LINKING DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION IN HEALTH: A CASE STUDY OF THE PHILIPPINES

By

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ABSTRACT

Climate change and climate-sensitive disasters pose significant risks to human health. As climate change continues to intensify, the frequency and severity of various climate-sensitive hazards is expected to increase. Increasing climate-sensitive hazards such as floods, typhoons and outbreaks of climate-sensitive diseases, present pertinent and growing risks that impact health. These rising health risks from climate change and climate-sensitive disasters are fast becoming a critical concern for global health. To address these risks, there is increasing need for health actors to engage in Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA).

DRR and CCA work towards common aims of reducing health impacts of climate change and climate-sensitive disasters. A large body of research recommends linking DRR and CCA to ensure coherent, effective, and efficient responses to current and future risks. Much remains to be gained from strengthening joint DRR and CCA action, and effectively linking the two approaches. Linking these approaches in health is particularly pertinent as health is a vital end-point of disasters and climate change, and important cross cutting issue in DRR and CCA.

Currently there is a significant knowledge gap surrounding how DRR and CCA can be linked in health. There is limited published research empirically examining how these approaches can be linked in real-world contexts. Furthermore, linking DRR and CCA in health has been identified as a key challenge in managing health risks in resource-constrained countries, such as the Philippines. Therefore, this research empirically investigated how DRR and CCA can be linked in health in the Philippines.

This research applied qualitative methods through a Case Study of the Philippines. Data collection methods used include: observations; policy analysis; 33 national, 13 regional and 10 local key informant interviews; and a national expert workshop. To supplement the Case Study seven global informant interviews were conducted.

To understand how DRR and CCA could be linked in health, the research first investigated the overarching priorities and gaps for these approaches in the Philippines. Strengthening community implementation was the priority for DRR in health. Comparatively, strengthening the national programme was the priority for CCA in health. Identified gaps in
DRR in health included inter- and intra-sectoral collaboration, and little involvement of the whole health sector in reducing disaster risk. Key gaps within CCA in health included limited governance and national leadership, and limited research to advocate for and inform CCA in health. These differing priorities present potential challenges for linking DRR and CCA in health. Additional challenges for linking these approaches highlighted in the Case Study included: the differing different status of implementation, and limited collaboration and coordination between DRR and CCA in health.

Resilience was explored as a conceptual synergy for strengthening joint DRR and CCA action in health. The concept represents a possible uniting goal for the two approaches. However, stakeholders noted significant challenges in using resilience as the basis for a shared framework. To strengthen DRR and CCA links in health, resilience needs greater clarity, a shared operational definition among stakeholders and measurable indicators.

Technical and operational synergies were identified as areas for linking DRR and CCA in health. These were categorised into no-regrets and climate-sensitive links. No-regrets links referred to those with net benefits for improving health, and reducing both disaster and climate change risks. These were particularly recognised as linked DRR and CCA by stakeholders at the local level. Climate-sensitive links represent specific activities which would require engagement of both DRR and CCA stakeholders; and explicit inclusion of both climate change and disaster risk data, as well as both DRR and CCA expertise.

Finally, to enhance DRR and CCA links in health key recommendations from this research include: (1) strengthen no-regrets options as a starting point for linked DRR and CCA in health; (2) develop guidelines and a formal mechanism for linking; (3) prioritise local-level linkages; and (4) strengthen the empirical evidence base of how DRR and CCA in health can be linked.

This research has contributed to the understanding of how DRR and CCA in health can be linked through examination of a country-level example. It provides concrete examples of application of, and challenges with, DRR and CCA links in health. Further, it lays the groundwork for future research and action towards linking these approaches.
STATEMENT OF ORIGINALITY

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Signed

Nicola Banwell

BPH (Hons.)
ACKNOWLEDGEMENTS

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Thank you to all of the participants in my study, thank you for your time and openness to sharing your wealth of experiences. I hope this thesis does justice to the experience and knowledge in addressing disaster and climate change risks which exists in the Philippines.

Thank you to Diarmid Campbell-Lendrum, Elena Villalobos Prats, and Marina Maiero at the World Health Organization for the privilege to work with you. Thank you for the trust and responsibility you placed in me as a young professional. The experience and knowledge I gained through the internship has been a vital foundation for this thesis and my professional development.

I would like to thank everyone who assisted in the publication of work contained in this thesis as co-authors who provided direction and critique, including: Jaime Montoya and Merlita Opeña (Philippine Council for Health Research and Development, Department of Science and Technology); Director Gloria J. Balboa and Dr. Ronald Law (Health Emergency Management Bureau); Carel IJsselmuiden (Council on Health Research for Development); Virginia Murray (Public Health England); Roger Street (UK Climate Impacts Programme, University of Oxford); and my three supervisors.
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The following papers have been published based on the work carried out for the degree of Doctor of Philosophy and contained in this thesis:


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<td>CCA</td>
<td>Climate Change Adaptation</td>
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<tr>
<td>CCAH</td>
<td>Climate Change Adaptation in Health</td>
</tr>
<tr>
<td>Climate Change Act</td>
<td>Philippine Climate Change Act of 2009 (RA 9729)</td>
</tr>
<tr>
<td>CRED</td>
<td>Centre for Research on the Epidemiology of Disasters</td>
</tr>
<tr>
<td>DOH</td>
<td>Department of Health</td>
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<tr>
<td>DPCB</td>
<td>Disease Prevention and Control Bureau</td>
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<tr>
<td>DRM</td>
<td>Disaster Risk Management</td>
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<td>DRR</td>
<td>Disaster Risk Reduction</td>
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<td>DRRH</td>
<td>Disaster Risk Reduction in Health</td>
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<tr>
<td>DRRM</td>
<td>Disaster Risk Reduction and Management</td>
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<tr>
<td>DRRM Act</td>
<td>Philippine Disaster Risk and Reduction Management Act of 2010 (RA10121)</td>
</tr>
<tr>
<td>DRRM-H</td>
<td>Disaster Risk Reduction and Management in Health</td>
</tr>
<tr>
<td>EDRM-H</td>
<td>Emergency and Disaster Risk Management in Health</td>
</tr>
<tr>
<td>EOHO</td>
<td>Environment and Occupational Health Office</td>
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<tr>
<td>EWS</td>
<td>Early Warning System</td>
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<tr>
<td>FQ</td>
<td>Focus Question</td>
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<tr>
<td>H-NAP</td>
<td>Health components of the National Adaptation Plans</td>
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<tr>
<td>HEM</td>
<td>Health Emergency Management</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>HEMB</td>
<td>Health Emergency Management Bureau</td>
</tr>
<tr>
<td>HEMS</td>
<td>Health Emergency Management Staff</td>
</tr>
<tr>
<td>HEMS Coordinator</td>
<td>Health Emergency Management Staff Coordinator</td>
</tr>
<tr>
<td>HFA</td>
<td>Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters</td>
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<tr>
<td>IDNDR</td>
<td>International Decade for Natural Disaster Reduction</td>
</tr>
<tr>
<td>IHR</td>
<td>International Health Regulations (2005)</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<tr>
<td>LCE</td>
<td>Local Chief Executive</td>
</tr>
<tr>
<td>LGU</td>
<td>Local Government Unit</td>
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<tr>
<td>MDGF Project</td>
<td>MDG Achievement Fund 1656: Strengthening the Philippines’ Institutional Capacity to Adapt to Climate Change</td>
</tr>
<tr>
<td>NAP</td>
<td>National Adaptation Process</td>
</tr>
<tr>
<td>NCCAP</td>
<td>National Climate Change Action Plan 2011-2028</td>
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<tr>
<td>NDRRMC</td>
<td>National Disaster Risk Reduction and Management Council</td>
</tr>
<tr>
<td>NDRRMF</td>
<td>National Disaster Risk Reduction and Management Framework</td>
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<tr>
<td>NDRRMP</td>
<td>National Disaster Risk Reduction and Management Plan 2011-2028</td>
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<tr>
<td>NFSCC</td>
<td>National Framework Strategy on Climate Change 2010-2022</td>
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<tr>
<td>NGO</td>
<td>Non-Government Organisation</td>
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<tr>
<td>NUHRA</td>
<td>National Unified Health Research Agenda</td>
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<tr>
<td>Term</td>
<td>Description</td>
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<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>Omnibus Policy</td>
<td>Integrated Policy for Disaster Risk Reduction and Management in Health</td>
</tr>
<tr>
<td>OpCen</td>
<td>Health Emergency Management Operations Centre</td>
</tr>
<tr>
<td>PAHO</td>
<td>Pan American Health Organisation</td>
</tr>
<tr>
<td>PCHRD-DOST</td>
<td>Philippine Council on Health Research and Development - Department of Science and Technology</td>
</tr>
<tr>
<td>PHC</td>
<td>Primary Health Care</td>
</tr>
<tr>
<td>PHEMAP</td>
<td>18th National Public Health and Emergency Management in Asia and the Pacific Training Course</td>
</tr>
<tr>
<td>PHEP</td>
<td>Public Health Emergency Preparedness</td>
</tr>
<tr>
<td>RDRRMC</td>
<td>Regional Disaster Risk Reduction and Management Council</td>
</tr>
<tr>
<td>rEBaP</td>
<td>Evidence Based Planning for Resilient Health Systems</td>
</tr>
<tr>
<td>RQ</td>
<td>Research Question</td>
</tr>
<tr>
<td>Sendai Framework</td>
<td>Sendai Framework for Disaster Risk Reduction 2015-2030</td>
</tr>
<tr>
<td>SREX</td>
<td>IPCC Special Report Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (2012)</td>
</tr>
<tr>
<td>UHC</td>
<td>Universal Health Care</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children's Fund</td>
</tr>
<tr>
<td>UNISDR</td>
<td>United Nations Office for Disaster Risk Reduction</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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WHO Operational Framework

WHO Operational framework for building climate resilient health systems
Part I
CHAPTER 1: INTRODUCTION TO THE RESEARCH

1.1 Introduction

Climate change and climate-sensitive disasters pose a significant threat to human health. Over the last two decades there has been a gradual increase in the loss of life resulting from disasters (Centre for Research on the Epidemiology of Disasters [CRED], 2015; United Nations Office for Disaster Risk Reduction [UNISDR], 2016). Disaster deaths from 2006-2015 have risen considerably compared to the previous decade (UNISDR & CRED, 2016). These figures do not reflect long-term health impacts, nor the increase in health impact of disasters as a result of climate change.

As climate change continues to progress, the frequency and severity of various climate-sensitive hazards is expected to increase (Intergovernmental Panel on Climate Change [IPCC], 2012, 2014b). Disaster risks are predicted to increase as populations become more vulnerable due to changes in spatial and demographic characteristics of populations, such as urbanisation and widening health inequities (Climate and Development Knowledge Network, 2012; Gupta, Nair, Bemmerlein-Lux, & Chatterji, 2013; IPCC, 2012; Watts et al., 2015; Watts et al., 2018). Climate change further exacerbates these physical, economic, social and environmental vulnerabilities (Watts et al., 2015), adding yet another level to the complexities of disaster risk.

There is limited global assessment of the health impact of climate change on climate-sensitive disasters. However, it has been determined that climate change is expected to increase mortality rates resulting from heatwaves and coastal flooding associated with storm surge (World Health Organization [WHO], 2014a). Furthermore, biological hazards such as climate-sensitive diarrheal and vector-borne diseases are expected to be associated with increased mortality (WHO, 2014a).

These increasing health risks from climate change and climate-sensitive disasters are fast becoming a central concern for global health. Extreme weather events and natural disasters have been identified as among the most likely events to pose social, economic and human risks to countries over the coming decades (World Economic Forum, 2016, 2017, 2018). Further to this, the failure to effectively mitigate and adapt to the risks of climate
change has been identified as a key global risk in the coming decades in terms of size and scale of impact, and likelihood of occurrence (World Economic Forum, 2018).

Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) have emerged as two necessary risk management approaches to address the current and future impacts of climate change and disasters. DRR refers to actions which are “aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development” (United Nations General Assembly, 2017b, p. 16). CCA refers to “the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities” (IPCC, 2014c, p. 1758).

1.2 Importance of linking DRR and CCA in health

DRR and CCA work towards common aims of reducing common impacts of climate change and climate-sensitive disasters. Linking DRR and CCA is important to ensure coherent, effective, and efficient responses to current and future disaster and climate change risks (United Nations Framework Convention on Climate Change [UNFCCC], Birkmann & von Teichman, 2010; IPCC, 2012; Kelman, 2017; Kelman, Gaillard, & Mercer, 2015; Klima & Jerollemann, 2017; Mercer, 2010; Schipper & Pelling, 2006; Schipper, Thomalla, Vulturius, Davis, & Johnson, 2016; Seidler et al., 2018; 2017b; UNISDR, 2015c). A large body of research has suggested that linking DRR and CCA strategies is also important to ensure a robust approach to dealing with long-term disaster risks associated with climate change (Birkmann & von Teichman, 2010; IPCC, 2012; Kelman, 2017; Kelman et al., 2015; Klima & Jerollemann, 2017; Mercer, 2010; Schipper & Pelling, 2006; Schipper et al., 2016; Seidler et al., 2018; UNFCCC, 2017b; UNISDR, 2015c). This has become increasingly important in the light of growing coherence between international policies including the Sendai Framework for Disaster Risk Reduction 2015-2030, the Paris Agreement on climate change, and the Sustainable Development Goals (Aitsi-Selmi, Egawa, Sasaki, Wannous, & Murray, 2015; Aitsi-Selmi & Murray, 2015a, 2015b; Aitsi-Selmi, Murray, & Wannous, 2017; Kelman, 2017; Kelman et al., 2015; Murray, Aitsi-Selmi, & Blanchard, 2015; Murray & Waite, 2018; Schipper et al., 2016; UNFCCC, 2017b). Much remains to be gained from strengthening joint DRR and CCA action, and effectively linking the two approaches.

Here the term ‘linking’ is used to refer to the connections between DRR and CCA, otherwise referred to as ‘coherence’, ‘synergy’, ‘integration’, ‘collaboration’, and
‘coordination’. This term is used to navigate contentions in the differing opinions and forms of DRR and CCA linkage; acknowledge that not all areas of work should be linked; and create an opportunity to explore more than the integration of policy in linking DRR and CCA. Linking these approaches in health is particularly pertinent as health is a vital end-point of disasters and climate change.

Climate change and climate-sensitive hazards which develop into disasters impact health simultaneously (Phalkey & Louis, 2016) and through common direct and indirect pathways. Health is becoming increasingly central and playing a greater role in addressing these risks through DRR and CCA (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015b; Aitsi-Selmi et al., 2017; Murray et al., 2015; Watts et al., 2015; Watts et al., 2018). Effective reduction of these risks requires deliberate combined DRR and CCA efforts in health. Health is used here to refer to government and non-government primary and public health actors on international, national, sub-national and local levels, as has been used in previous literature (e.g. Aitsi-Selmi & Murray, 2015a; Aitsi-Selmi & Murray, 2015b; Aitsi-Selmi et al., 2017; Maini, Clarke, Blanchard, & Murray, 2017; Murray, 2014). Linking these approaches in health is also important as health is a cross cutting issue in both DRR and CCA.

DRR in health (DRRH) and CCA in health (CCAH) work towards shared aims of reducing common health impacts of climate change and climate-sensitive disasters. Linking DRRH and CCAH can strengthen the effectiveness, efficiency and robustness of these two approaches, and ensure a long-term focus is adopted (Aitsi-Selmi et al., 2015; Maini et al., 2017; Mayhew, Van Belle, & Hammer, 2014; Sauerborn & Ebi, 2012; Watts et al., 2015). Furthermore, it is widely recognised in the literature that investment in reducing disaster and climate change risks is necessary to address economic and health inequalities, and achieve sustainable development within the context of climate change (UNISDR, 2015b; Watts et al., 2018). Further to this, the lack of linkage of DRRH and CCAH has been noted as a key challenge in addressing health risks in disaster and climate change prone countries such as the Philippines (Law, 2016). Therefore, linking DRRH and CCAH is both necessary and important, and calls for linking these two are increasing (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a, 2015b; Aitsi-Selmi et al., 2017; Few, 2007; Keim, 2008, 2011; Maini et al., 2017; Murray et al., 2015).
1.3 Current knowledge gaps in the literature

The extensive literature review completed for this thesis revealed that to date, published disaster and climate-related health research has primarily considered DRRH and CCAH separately, and has largely omitted the discussion of linking DRRH and CCAH. The limited literature which does consider linkage between DRRH and CCAH is scattered and restricted to theoretical discussion.

Based on the extensive literature presented in this thesis it is evident that limited published research empirically examines how DRRH and CCAH can be linked. Therefore, a significant knowledge gap exists regarding how these links can occur and be developed in real-world contexts (Aitsi-Selmi & Murray, 2015a; Dar, Buckley, Rokadiya, Huda, & Abrahams, 2014; Hancock, Spady, & Soskolne, 2015; Murray, 2014; Murray et al., 2015; Sauerborn & Ebi, 2012).

Efficiently and effectively reducing health risks from climate change and disasters requires combined DRRH and CCAH efforts. However, significant knowledge gaps exist surrounding the challenges for developing links; how these links could and do occur; and how to establish and strengthen them in real world contexts. This knowledge will be highly valuable for low- and middle-income countries due to the pervasive and cumulative disaster and climate change hazards and vulnerabilities, such as in the Philippines (Law, 2016). However, there is a distinct need for research empirically investigating how DRRH and CCAH can be linked in this setting.

Therefore, this PhD thesis aims to first draw together the current knowledge on why linking DRRH and CCAH is important. This forms a strong coherent rationale and theoretical foundation for the research. Following this, it aims to empirically investigate how DRRH and CCAH can be linked in a country-level Case Study of the Philippines.

1.4 Research questions and approach

The present thesis aims to investigate linkages between DRRH and CCAH. It does this by first drawing together the current published literature on why and how DRRH and CCAH can be linked. The research then empirically investigates existing and potential linkages through a Case Study of the Philippines. The over-arching Research Question (RQ) is:
How can Disaster Risk Reduction in health (DRRH) and Climate Change Adaptation in health (CCAH) be linked?

This question is answered through three Focus Questions (FQ):

**FQ1** What are the key priorities and gaps for DRRH in the Philippines?

**FQ2** What are the key priorities and gaps for CCAH in the Philippines?

**FQ3** How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links?

This research takes a qualitative approach grounded in a Case Study of the Philippines. This approach was used to allow in-depth exploration of the context-specific and complex social phenomena in a real decision-making context (Yin, 2014). Furthermore, case studies are suitable for health research (Merriam, 2009) and within organisational settings (Creswell, 2013). The Case Study data collection took place from May to December 2016 through the Health Emergency Management Bureau (HEMB) of the Philippine Department of Health (DOH) in Manila, Philippines. Data collection methods consisted of observations; policy analysis; key informant interviews at national, regional and local levels; and a national expert workshop. Interviews with global informants in DRRH and CCAH were conducted to supplement the Case Study. The purpose of these interviews was to provide greater context to the Case Study results and strengthen the external validity of the findings. These global informant interviews were undertaken during an internship from January to June 2017 with the Climate Change and Health Unit of the World Health Organisation (WHO) in Geneva, Switzerland.

1.5 Thesis logic and structure

This PhD thesis is separated into two parts. **Part I** provides the background, rationale, conceptual basis and methodology for the research. The extensive literature review in Chapters 2 to 4 provide the background and rationale to the research, including the RQ and FQs which were developed from this extensive review. **Chapter 2** explains key concepts within DRR and approaches in DRRH. **Chapter 3** provides essential background on CCA concepts and evolution, followed by an in-depth review of CCAH literature. **Chapter 4** provides a foundation for understanding linking DRRH and CCAH. Portions of Chapters 2 to
4 draw on two peer-reviewed publications which were published based on the literature review contained in this thesis. These publications include:


Following this, Chapter 5 explains the research methodology, including the Case Study setting.

**Part II** consists of the results of the research presented in three results chapters, followed by a discussion. Each results chapter corresponds to a FQ. Chapter 6 presents the results of FQ1 relating to the priorities and gaps of DRRH in the Philippines. Chapter 7 presents the findings in relation to FQ2 regarding the priorities and gaps of CCAH in the Philippines. Chapter 8 presents the results for FQ3 on how DRRH and CCAH can be linked and challenges for building these links in the Philippines. Responses from global informant interviews are used throughout these Chapters to provide broader context to the Case Study findings. Chapter 9 provides an in-depth discussion of the findings in relation to the overarching RQ. Key findings in relation to DRRH and CCAH approaches in the Philippines are discussed. This is followed by a discussion of conceptual, technical and operational links, and challenges for building these links. Following this the research recommendations and significance of the research are outlined.

Finally, Chapter 10 highlights key findings of the research, briefly discusses the research limitations, and provides concluding remarks for the thesis.

**1.6 Scope of the thesis**

This thesis explicitly examines links between DRRH and CCAH. Within this PhD thesis, sustainable development is considered as an overarching concept for linked DRRH and CCAH. It is recognised that there are also opportunities for linking the three approaches, that is DRRH, CCAH and sustainable development. However, to limit the scope of this PhD thesis, explicit links with sustainable development have not been considered in this thesis. It
is acknowledged that not all DRRH or CCAH is sustainable development, particularly maladaptive strategies. However, this research serves as an important foundation for future research examining links between DRRH, CCAH and sustainable development.

The literature review has identified three potential concepts for linking DRRH and CCAH – resilience, risk and vulnerability. Restricting the investigation to one of the three concepts was necessary to limit the scope of the thesis due to the in-depth nature of the investigation required to understand the utility of just one concept in linking DRRH and CCAH. This research explicitly examines the utility of resilience as the overarching concept for a framework to link DRRH and CCAH. Resilience was investigated as it has been used as the foundation for frameworks linking DRR and CCA outside of health. Additionally, the policy analysis identified resilience as the most commonly used of the three terms within the Case Study.

This thesis examines relevant links between approaches developed in both DRRH and CCAH to address health risks of climate-sensitive hazards. However, it is important to acknowledge that this does not assume that all areas of DRRH or CCAH should or can be linked, as not all risks are common or overlapping (discussed further in Chapter 4). Furthermore, to restrict the scope of this PhD thesis, it does not explicitly examine additional action required to address unique risks faced by vulnerable populations. However, this thesis potentially serves as a foundation for future research in this area.

1.7 Conclusion

This Chapter introduced the background of this thesis. It briefly explained the relationship between climate change and climate-sensitive disasters. It also provided some context for the study by briefly discussing disaster and climate change risks to health, and highlights the need to link two key approaches for addressing these risks – DRRH and CCAH. It presented the rationale for the study through highlighting key gaps in the literature relating to linking DRRH and CCAH. Following this the RQ and FQs, and research approach were briefly introduced. Finally, the logic of the thesis was outlined, as well as thesis scope and structure.
CHAPTER 2: DISASTER RISK REDUCTION IN HEALTH

2.1 Introduction

Disasters cause great disruption to societies in terms of physical, economic and social functioning, as well as human and economic losses (Saharan, 2015). Over the last two decades there has been a gradual increase in the loss of life resulting from disasters (CRED, 2015), with the number of climate-sensitive disasters doubling in the last forty years (UNISDR & CRED, 2016). Further to this, extreme weather events and major natural disasters have been identified as among the most likely events to pose risks to economies and industry over the coming decades (World Economic Forum, 2016, 2017, 2018). It is widely recognised that investment in reducing disaster risk is more effective than response-based approaches to disaster management (O'Brien, O'Keefe, Rose, & Wisner, 2006; Wisner, Blaikie, Cannon, & Davis, 2004). Furthermore, DRR is recognised as necessary to address economic and health inequalities, and achieve sustainable development in the context of climate change (Murray, 2014; UNISDR, 2015b; United Nations, 2014). Health is central to the impacts of disasters, and the recognition of the role of health, and the engagement of health actors in reducing disaster risks is increasing (Aitsi-Selmi & Murray, 2015a; Aitsi-Selmi, Murray, et al., 2016; Murray, 2014; Murray et al., 2015; United Nations, 2014).

This Chapter provides key theoretical background to this research through a literature review of DRR, as well as DRR in the context of health, referred to here as DRRH. The Chapter is structured in two sections. The first provides important background on the key concepts and definitions of DRR, followed by the evolution and current themes in DRR literature in order to provide context for DRRH. Section 2.3 provides a narrative review of the origins of health approaches to disasters, the evolution of Public Health Emergency Preparedness (PHEP) and Health Emergency Management (HEM), how health fits into broader DRR discourse on a global policy level, as well as the current themes in the field of DRRH.
2.2 Disaster Risk Reduction

2.2.1 Key concepts and definitions

A disaster is defined by the United Nations General Assembly (2017b, p. 13) to be any:

“serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.”

As illustrated by this definition the components of exposure, vulnerability and capacity are core to the risk of a disaster and its associated impacts. Disaster risk incorporates the complex interaction of hazard, exposure, vulnerability and capacity (United Nations General Assembly, 2017b). There are similarities and differences between these concepts and concepts in Climate Change Adaptation (CCA). This is discussed in further detail in Sections 3.2.1 and 4.6.1. Brief definitions of these key concepts from DRR literature are provided here:

- **A hazard** refers to “a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation” (United Nations General Assembly, 2017b, p.18). Current efforts to reduce the occurrence and impacts of disasters take an ‘all hazards’ approach, addressing all types of physical shock, whether natural, biological or manmade in origin (Aitsi-Selmi & Murray, 2015a, 2015b; Kelman, 2015; UNISDR, 2015d).

- **Exposure** refers to the elements of communities, infrastructure, organisations or systems that are located within the proximity of a hazard, thus potentially subject to damage and loss (United Nations General Assembly, 2017b).

- **Vulnerability** is seen as the “susceptibility of an individual, a community, assets or systems to the impacts of hazards” (United Nations General Assembly, 2017b, p.24), which is caused by economic, social, physical and environmental factors (Adger, 2006; Alwang, Siegel, & Jorgensen, 2001; McEntire, 2001; United Nations General Assembly, 2017b; Wisner et al., 2004).
• **Capacity** refers to the ability of individuals, communities, organisations and systems to access and use the strengths, skills, and resources available in order to reduce or manage disaster risk (United Nations General Assembly, 2017b).

The combination of hazard, exposure, vulnerability and capacity determine the level of disaster risk, which is primarily addressed through strategies such as **Disaster Risk Management (DRM)**, **Disaster Risk Reduction (DRR)** and **Disaster Management**. Within the context of this thesis DRR refers to and encompasses all DRR, DRM and Disaster Management. In the context of the current research, DRR is defined as those approaches (United Nations General Assembly, 2017b, p. 16):

“aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development.”

There have been recent notable developments in the understanding of the relationship between DRR and DRM initiatives, where DRM was previously seen to be a combination of DRR and Disaster Management (Begum, Sarkar, Jaafar, & Pereira, 2014; UNISDR, 2009; UNISDR, UNDP, & GFDRR, 2012). Figure 2.1 demonstrates how the relationship between DRR and DRM was conceptualised, where DRM was seen as the efforts focused primarily on disaster preparedness, response and initial recovery (United Nations General Assembly, 2017b). DRR is this conceptualisation was concerned with reduction of risk through prevention, mitigation and adaptation (Djalante & Thomalla, 2011; Hay, 2009; UNISDR, 2009; UNISDR et al., 2012).

![Figure 2.1](image_url)

**Figure 2.1** Previous relationship between Disaster Risk Management, Disaster Risk Reduction and Disaster Management (From: Hay, 2009; UNISDR et al., 2012)
The latest conceptualisation of DRM and DRR demonstrates a different relationship between the two approaches. DRR is the policy objective of DRM, and DRM is the implementation of these policy objectives through prospective, corrective and compensatory DRM (United Nations General Assembly, 2017b). **Prospective DRM** refers to preventing the creation of new, and increasing existing disaster risks and are typically focused on future risks, **corrective DRM** aims to reduce current pre-existing risks, and **compensatory DRM** aims to strengthen the resilience of communities to deal with remaining risk that cannot be reduced, and includes mechanisms such as preparedness, response and recovery, as well as financial support in the form of social safety nets and insurance (United Nations General Assembly, 2017b). However, these terms are just beginning to be used in DRR and DRM discourse, and the relationship between DRR, DRM and Disaster Management are not yet completely clear. Figure 2.2 clarifies the relationships between these concepts based on the revised terminology, as they are applied in this research.

![Diagram](image)

**Figure 2.2** Relationship between DRM, DRR, Disaster Management and the phases of the DRM cycle (developed based on definitions presented in: United Nations General Assembly, 2017b).

A longstanding concept within DRM is the breaking down into ‘phases’ that constitute the DRM cycle. These phases include: prevention/mitigation, preparedness, response and recovery (Figure 2.3; H. Khan, Vasilescu, & Khan, 2008; Wisner & Adams, 2002). The term ‘mitigation’ is often used interchangeably to refer to the prevention aspect of the DRM cycle. However, recently the distinction between disaster mitigation and prevention has become clearer. Mitigation refers to minimising impact, and prevention refers to avoiding existing
and new risks by reducing exposure and vulnerability (United Nations General Assembly, 2017b). This distinction is reflected in the DRM cycles illustrated in Figure 2.3.

![DRM Phases Diagram]

**Figure 2.3** DRM Phases (adapted from: H. Khan et al., 2008; based on revised DRR terminology from: United Nations General Assembly, 2017b).

### 2.2.2 Evolution and current themes in Disaster Risk Reduction literature

Understanding the current paradigm in DRRH requires an understanding of the evolution of previous approaches and paradigms within broader DRR. Approaches to address disaster risks have evolved significantly in the past decades. These paradigms are referred to here as: i) civil protection; ii) engineered solutions; iii) vulnerability; and iv) resilience (Figure 2.4).
DRR originates from a fatalistic approach towards disasters as ‘Acts of God’ and ‘Acts of Nature’ (Quarantelli, 2000). These early approaches did not consider the human element of disaster risk, resulting in a reactive approach based in civil protection where disaster relief and response were the sole focus and responsibility of the government (Jeggle, 2001; Quarantelli, 2000). This approach expanded to include aspects of preparedness such as warning systems, semi-trained personnel, evacuation shelters, and search and rescue based on lessons learnt in World War II and technological hazards through the industrial revolution (Gupta et al., 2013; Quarantelli, 2000). When the perception of disaster risk began to expand to recognise the role of decisions of human societies a change in management strategies occurred (Quarantelli, 2000).

Since the 1980s a significant gradual paradigm shift occurred from response-oriented approaches toward a risk management approach due to globalisation, technological development, and the resulting economic growth and interdependency (Boulter et al., 2013; Gupta et al., 2013; Jeggle, 2001; Quarantelli, 2000). Increasing visibility of disasters through international media, and growing economic loss from disasters in the private sector amplified political pressure and public demand for collective government efforts to combat the growing devastation and cost of disasters (Jeggle, 2001; Quarantelli, 2000). The International Decade for Natural Disaster Reduction (IDNDR) from 1990-1999 was the first collective global government initiative in managing disaster risk (Aitsi-Selmi et al., 2015; IDNDR, 1994; Jeggle, 2001). During this time, the Yokohama Declaration recognised that mitigation and preparedness are more effective and efficient than disaster response alone (IDNDR, 1994). The IDNDR was successful in raising collective awareness about disasters (Selby, 1998).
However, the cornerstone of disaster efforts in the 1990s was reducing exposure through engineering-based strategies and lacked consideration of broader determinants such as vulnerability and related factors, including poverty and marginalisation (Jeggle, 2001; Selby, 1998).

Vulnerability emerged within the literature as a key factor in disaster risk first in 1963 through the writings of sociologists Quarantelli and Dynes (Jeggle, 2001; Wisner et al., 2004). This gained momentum with pivotal contributions of several authors, including: Randolph Kent (1987); and Anderson and Woodrow (1989) who recognised the importance of underlying social, economic and political vulnerability in disaster risk (Jeggle, 2001; Quarantelli, 2000). However, despite awareness of the importance of underlying determinants of vulnerability in disaster risk, during the 1990s vulnerability was only seen as additional to the main cause of disasters, not as root cause (Jeggle, 2001; Selby, 1998). Vulnerability became part of collective disaster management efforts at the end of the IDNDR in 1999. At this time there was a recognised need to “shift from a culture of reaction to a culture of prevention” (United Nations, 1999, p.1). This brought about the establishment of the United Nations Office for Disaster Risk Reduction (UNISDR) in 1999 (Economic and Social Council, 1999) and the ‘Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters’ (HFA; Aitsi-Selmi et al., 2015; Jeggle, 2001).

The HFA was the first international framework which established a ten-year plan for a preventative approach to disasters (UNISDR, 2005). The HFA recognised the role of vulnerability in compounding disaster risk and aimed to reduce economic, social and human disaster losses by building resilience (Gupta et al., 2013; UNISDR, 2005). The Five Priorities for Action included: making DRR a priority, enhancing early warning, building a culture of risk reduction, reducing underlying risk factors, and strengthening preparedness for response (UNISDR, 2005).

Key contributions of the HFA included: advocating for mainstreaming in planning within sectors, raising public and institutional awareness, generating political commitment to reducing disaster risk, and initiating the collective action of stakeholders (Aitsi-Selmi & Murray, 2015b; Gupta et al., 2013; UNISDR, 2015d). Furthermore, the HFA has helped to encourage a clearer shift away from solely response-based approaches to reducing the impact of disasters on critical infrastructure and the economy (Aitsi-Selmi & Murray, 2015b). The fourth Priority for Action ‘reducing underlying risk factors’ targeted vulnerability directly,
however success in reducing vulnerability during the period of the HFA was limited (Aitsi-Selmi & Murray, 2015b; UNISDR, 2015d). Other gaps in international approaches to DRR highlighted by the HFA were surrounding formulation of goals and priorities, and ensuring adequate implementation, particularly around building resilience (Aitsi-Selmi & Murray, 2015b; UNISDR, 2015d).

Resilience was placed at the centre of international DRR initiatives initially through the HFA (Manyena, 2006; Matyas & Pelling, 2015) with a central aim to contribute to “strengthening of institutions, mechanisms and capacities…that can systematically contribute to building resilience to hazards” (Djalante, Holley, Thomalla, & Carnegie, 2013; UNISDR, 2005). Since the HFA, there has been a growing body of literature on resilience within the context of disasters (Bahadur, Ibrahim, & Tanner, 2013; Djalante & Thomalla, 2011). The adoption of resilience thinking and campaigns such as the ‘Making Cities Resilient Campaign’ lead by the UNISDR have seen a growing commitment to resilience building strategies (Bahadur et al., 2013; Cutter, 2016; UNISDR, 2013). Where initial efforts to build resilience focused on ‘bouncing back’ there is a growing focus on learning, innovation and transformation based on previous disaster experiences, reflecting the notion of ‘bouncing forward’ (Kelman et al., 2015). However, there are significant challenges and knowledge gaps in translating building resilience from theory into something that is implementable and measurable (Cutter, 2016; Djalante et al., 2013). Resilience is discussed further in the context of linking DRR and CCA in Section 4.4.1. Building resilience continues to remain the focus of the international DRR agenda through the successor framework to the HFA, the ‘Sendai Framework for Disaster Risk Reduction 2015-2030’ (Sendai Framework; Roberts, Andrei, Huq, & Flint, 2015; UNISDR, 2015d).

The Sendai Framework further emphasises a shift within disaster management toward a risk management approach (McCLean, 2015; UNISDR, 2015d). It illustrates greater dedication to reducing underlying vulnerabilities and building resilience based on an all hazards approach, including not only risks from natural hazards, but also man-made, technological and biological hazards and risks (McCLean, 2015; UNISDR, 2015d). It also expands DRR approaches to include slow-onset and small-scale hazards (Rovins, 2017) and takes an action-oriented and people-centred approach (UNISDR, 2015d). The seven quantifiable goals have ambitious indicators relating to reducing the mortality rate, number of people affected, economic losses, damage to critical infrastructure as a result of disasters, as well as increasing the number of national and local DRR strategies, enhancing international
collaboration, DRR investment, and increasing access to multi-hazard early warning systems (EWSs; UNISDR, 2015d; United Nations General Assembly, 2017b). The Sendai Framework reflects contemporary themes in DRR literature through its focus on understanding the complex and multidisciplinary nature of disaster risk; strengthening governance and collaboration; meaningful stakeholder participation; evidence-based approaches to DRR; and investment in building economic, social, cultural, educational and health resilience (Aitsi-Selmi et al., 2015; UNISDR, 2015d). Furthermore, it recognises two contemporary themes in recent DRR literature important to this research, including: the need for linking DRR with CCA, and the growing role of health in DRR.

Linking DRR with CCA and climate change science has been recognised as necessary for improving DRR strategies, understanding risk and dealing with uncertainties (Berkes & Ross, 2013; Djalante et al., 2013; Florano, 2015; Handmer et al., 2014; Howes, 2014; Howes et al., 2015; IPCC, 2012; Kelman, 2015; Paton & Johnston, 2006; Porfiriev, 2015; Serrao-Neumann, Crick, Harman, Schuch, & Choy, 2015; Sudmeier-Rieux, 2014; UNFCCC, 2017b; United Nations General Assembly, 2017a). The Sendai Framework has been created at a time of increasing coherence between international policies with 2015 being a pivotal year for global policies on development, with the 2030 Agenda for Sustainable Development and Sustainable Development Goals, as well as climate change with COP21 (Aitsi-Selmi et al., 2015; Murray et al., 2015; Roberts et al., 2015; Rovins, 2017; UNFCCC, 2015a; UNISDR, 2015d; United Nations General Assembly, 2017a). This increasing coherence between global policies emphasises the need to work towards linking DRR and CCA in practice (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015b; Aitsi-Selmi et al., 2017; IPCC, 2012, 2014b; UNFCCC, 2017b; United Nations General Assembly, 2017a). However, multiple challenges and barriers arise when attempting to integrate DRR and CCA (Birkmann & von Teichman, 2010; Forino, von Meding, Brewer, & Gajendran, 2014; Howes, 2014; Kelman, 2015; Nalau et al., 2016; Schipper & Pelling, 2006; Thomalla, Downing, Spanger-Siegfried, Han, & Rockstrom, 2006). There is a considerable knowledge gap surrounding when, where and how to link DRR and CCA, especially within vital sectors such as health.

Health has emerged as central to disaster impacts and reducing disaster risks with the release of the Sendai Framework (Aitsi-Selmi et al., 2015; Murray, 2014; Murray et al., 2015; UNISDR, 2015d; United Nations, 2014). With this push comes the need for elaboration of the roles of the health sector in DRR, strengthening synergies between public health and DRR, as well as inquiry into the implementation of DRR initiatives within the context of the
health sector in a changing climate (Murray, 2014; Murray et al., 2015; Sauerborn & Ebi, 2012). As health is a key focus of this research, the field of DRR as it pertains to health will be discussed in greater depth in the following sections.

2.3 Disaster Risk Reduction in Health (DRRH)

This sub-section provides a detailed description of DRRH. It elaborates on the health impacts of disasters, both direct and indirect. It discusses the evolution of approaches that have emerged to address these impacts. Finally, this section provides key theoretical background to the study by exploring current themes and gaps in DRR as it relates to health.

2.3.1 Impacts of disasters on health

Health impacts of disasters are a key consideration of disaster consequences (United Nations, 2014). Patterns of health impacts from disasters vary across different types and scales of disasters, and are compounded by various factors pre- and post-disaster (Aitsi-Selmi & Murray, 2015a; PAHO, 2000a; Schipper & Pelling, 2006). A report on disaster mortality by the UNISDR and CRED examined disaster deaths from 1996-2015, and found that the average annual mortality from disasters resulting from natural hazards between 2006-2015 was 69,800, which increased from 64,900 in the previous decade (UNISDR & CRED, 2016). Further to this, climate-related disasters accounted for the majority of deaths in 15 of the years between 1996 and 2015 (UNISDR & CRED, 2016). However, these figures only include deaths from disasters resulting from natural hazards, excluding epidemics, or disasters of human origin, thus they only show the tip of the iceberg in terms of true long-term health impacts of all types of disasters.

Health impacts of disasters have commonly been discussed in terms of two categories, direct and indirect impacts on health and health systems (Aitsi-Selmi & Murray, 2015a; Raich, Adler, Stühlinger, Lorenzoni, & Duschek; Shoaf & Rottman, 2000a). Direct impacts on health include death, injury, disease, mental health impacts, and other health issues such as toxic exposure (Climate and Development Knowledge Network, 2012; Dar et al., 2014; Keim, 2008; Keim & Abrahams, 2012; Phalkey & Louis, 2016; Raich et al.; Shoaf &

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1 Parts of the following section are an edited excerpt from an article published during the course of the PhD candidature (Banwell, Rutherford, Mackey, Street, & Chu, 2018). For the published manuscript, please refer to Appendix 2.
Rottman, 2000a; United Nations, 2014). The increase in deaths, injuries, disease and other health outcomes places direct pressure on health systems through changing service demand patterns and volumes (Shoaf & Rottman, 2000a). Other direct impacts on the health care system include: damage to infrastructure; damage to non-structural elements such as equipment and medical supplies; and factors relating to functional aspects of the health system such as losses of health personnel and medical records (Raich et al.; Shoaf & Rottman, 2000a).

Indirect health impacts can result from primary healthcare needs going unmet after a disaster. This can be due to the change in healthcare needs, and reduced capacity of the health system to meet these needs and baseline healthcare needs, for example: prenatal care, chronic disease management. Indirect health impacts can be caused by the loss of ‘normal living conditions’ such as adequate and appropriate shelter (Shoaf & Rottman, 2000a). They can also be the result of degradation of: ‘environmental health safeguards’ (Noji, 1996); and health-determining sectors and infrastructure that populations and health systems rely on, including clean water, sanitation, waste management, electricity (Climate and Development Knowledge Network, 2012; Dar et al., 2014; Keim, 2008; Raich et al., 2015; Shoaf & Rottman, 2000a; United Nations, 2014). For example, outbreaks of diarrhoeal diseases may occur after a disaster or complex emergency when affected populations are living in overcrowded evacuation centres and the water and sanitation infrastructure and practices are degraded (Waring & Brown, 2005). Or acute respiratory infections may occur in susceptible and malnourished populations living in overcrowded evacuation shelters with poor ventilation (Waring & Brown, 2005). Social and economic consequences of disasters also indirectly impact health, well-being and development (Climate and Development Knowledge Network, 2012; Dar et al., 2014). Examples of indirect health impacts include worsening of chronic health conditions due to the limited access to health care services, otherwise avoidable maternal deaths and declining nutritional status due to food shortage (Keim & Abrahams, 2012; Raich et al.; Shoaf & Rottman, 2000a).

Population health status may be further eroded and health impacts of disasters exacerbated through indirect impacts of disasters on health systems, where public health efforts to respond to ongoing or recurrent disasters result in the suspension of public health efforts (Lechat, 1976; Shoaf & Rottman, 2000a). For example, increases in vector borne disease may occur over the long term due to interruption of vector control programmes following a disaster (Noji, 2005b; PAHO, 2000a). Further, population health status and health
inequalities have been highlighted as crucial in exacerbating disaster impacts and post-disaster health outcomes (Songsore, 2017; United Nations, 2014). This is of increasing concern as climate-related extremes and hazards continue to increase in frequency and intensity due to climate change (IPCC, 2012).

Disasters are most often considered in terms of their direct health impacts as these are more easily measurable (Keim & Abrahams, 2012). Disaster epidemiology is an important tool to enable public health professionals to gain an understanding of health impacts of disasters (Keim & Abrahams, 2012). However, measures such as death statistics and the number affected have been criticised as crude measures that underrepresent the true extent of the health impact of disasters (Chan, 2017; Keim & Abrahams, 2012). These statistics often do not represent true direct health impact, let alone the indirect health or health system impacts. Indirect impacts on health are less visible and harder to attribute to the occurrence of a disaster because of the complex interaction of multiple factors within a system (Chan, 2017).

These direct and indirect health impacts emphasise the importance of the baseline strength of the health system prior to a disaster, as well as maintenance of the health status of the affected population, and the maintenance and quick restoration of public and primary health systems during and after a disaster (Shoaf & Rottman, 2000a). Their diversity and impact also emphasise the importance in developing strategies to reduce disaster impacts on health.

2.3.2 Evolution of Disaster Risk Reduction in Health (DRRH)

Public and primary health practitioners have responded to health needs in emergencies and disasters, such as disease outbreaks and epidemics including smallpox or Human Immunodeficiency Virus, natural disasters and human conflict, long before the establishment of health preparedness, response, risk reduction or risk management approaches (Murthy, Molinari, LeBlanc, Vagi, & Avchen, 2017). With research publications on disaster preparedness in health as early as 1930 (Nonkin Avchen, LeBlanc, & Kosmos, 2017),

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2 Parts of the following section are an edited excerpt from an article published during the course of the PhD candidature (Banwell, Rutherford, Mackey, Street, et al., 2018). For the published manuscript, please refer to Appendix 2.
Disaster risk approaches in health have undergone considerable transformation in the last two decades spurred on by several events of international concern that posed significant threats to health, such as the September 11 terrorist attacks, Anthrax, Severe Acute Respiratory Syndrome, H1N1 and Ebola (Arnold, 2005; Y. Khan et al., 2015; Moore, Mawji, Shiell, & Noseworthy, 2007; Nonkin Avchen et al., 2017; Tekeli-Yeşil, 2006). These experiences have led to the evolution of approaches and responsibilities of health sectors, practitioners and agencies in reducing disaster risk to health through: preventing epidemics and disease spread, protecting against natural and other types of hazards, preventing death and injury, supporting healthy behaviours, protecting mental health, responding to disasters, assisting in recovery, and ensuring the quality of and access to health services during and after a disaster (Noji, 1996; Shoaf & Rottman, 2000a). This section provides a brief insight into the early origins of health approaches to dealing with disaster risks, gives a brief history of more recent approaches. It then examines how, until quite recently, these approaches have developed largely in isolation of broader DRR and DRM approaches.

**2.3.2.1 Origins of public health approaches to disasters**

Public health approaches to emergencies and disasters originate from disaster medicine in the context of disaster response and humanitarian aid, and the evolution of epidemiology in disasters (Noji & Toole, 1997). Disaster medicine evolved from the necessary engagement of health personnel in addressing injury and illness in humanitarian assistance, and emergency and disaster relief in the context of disasters and warfare (Dara, Ashton, Farmer, & Carlton Jr, 2005). The development of disaster medicine is intertwined with disaster management, emergency preparedness, modern medicine, and military models of emergency health care (Dara et al., 2005; Suner, 2015).

Disaster medicine has emerged as a significant scientific field since the 1950s (Dara et al., 2005). However, its history and evolution can be traced back to as far as the times of Napoleon, with the development of early versions of the triage system in the 1790s, which saw soldiers medically treated based on the urgency of their condition as opposed to their rank (Dara et al., 2005; Suner, 2015). However, there was little coordinated response in this time (Dara et al., 2005). Since this time, key milestones in the development of the field of disaster medicine include the establishment of the Red Cross in 1863 in response to a war between Austria and the Franco-Sardinian alliance in Italy, which marks the establishment of organised responses in disaster medicine (Dara et al., 2005). The establishment of the St
Johns ambulance service in 1877 to provide emergency medical care in peace and war developed into first aid training which is a cornerstone for modern disaster medicine practices (Dara et al., 2005). The First and Second World Wars greatly influenced various aspects of disaster medicine, particularly the triage system, training of response personnel and emergency medical technicians, rapid evacuation, in-field emergency medical treatment, and trauma medicine, which have since been further refined during the Vietnam and Korean Wars (Dara et al., 2005; Suner, 2015). The introduction of the Incident Command System and establishment of national disaster systems in the 1970s led to more effective and coordinated efforts in disaster medicine (Dara et al., 2005; Suner, 2015). Effective medical response in disasters requires the understanding of health problems and needs in disasters, and linking this data and information with decision-making process to enable the delivery of appropriate and timely interventions (Noji, 2001). For this reason, epidemiology, as applied to disaster situations, plays an important role in determining health needs, and enhancing effective risk reduction and management policies, plans and approaches in health (Noji, 2001, 2005b; Tekeli-Yeşil, 2006).

Disaster epidemiology has been used to scientifically measure and describe health impacts of disasters, identify vulnerable or at-risk population groups, identify needs in disasters, and inform preparedness and contingency planning, and future risk reduction strategies in health (Noji, 2005a). Disaster epidemiology has supported many aspects of public health approaches to disasters, including: the development of improved early warning and evacuation, measures to reduce injury during post-disaster clean up, measurement of the effectiveness of prevention and preparedness programmes, and improving community emergency preparedness (Noji, 2005a). Disaster epidemiology originated from the understanding that disaster impacts on health can be studied through epidemiological methods, and that this data may be applied as forms of evaluation of success of various disaster relief efforts (Lechat, 1976). Disaster epidemiology lead to greater understanding of the impact of disasters on health, in terms of death, injury, and communicable disease post-disaster (Lechat, 1976). The development of tools such as post-disaster rapid needs assessment significantly aided this (Noji & Toole, 1997). Simultaneously, the understanding of roles of health actors in medical support, supplies and coordination in disaster and humanitarian response developed (Noji & Toole, 1997).

In the 1990s to early 2000s a deeper understanding of health risks of disasters came with the development of tools such as risk assessment, which involved hazard and
vulnerability assessment (Arnold, 2002; Tekeli-Yeşil, 2006). This demonstrated a clear movement from response and relief activities in health to a greater emphasis on preparedness and prevention measures (Noji & Toole, 1997), often termed mitigation in the context of health. With a greater understanding of the interaction of risk factors that lead to disasters and impacts on health came the increasing push for health agencies and actors to play a greater role in preparedness and prevention in health (Arnold, 2005).

### 2.3.2.2 Formalisation of public health approaches to disasters

At the end of the 1990s and the beginning of the 2000s, preparedness practices in health began to become formalised within government structures outside of the concepts of response and relief, such as Public Health Emergency Preparedness (PHEP), and Health Emergency Management (HEM). Several quantitative review articles of PHEP literature have found that the majority of PHEP literature is from the United States (Bayntun, 2012; Y. Khan et al., 2015; Yeager, Menachemi, McCormick, & Ginter, 2010), with smaller portions from the United Kingdom and Canada (Achour, Pascale, Soetanto, & Price, 2015; Boyd et al., 2014; Y. Khan et al., 2015; Redwood-Campbell & Abrahams, 2011).

PHEP in the United States started out as the ‘Preparedness and Response for Bioterrorism Program’ in 1999 (Murthy et al., 2017). Several key events after this time have been reported as the triggers for government investment in PHEP and the establishment of the programme in 2005 (Murthy et al., 2017). The September 11 terrorist attacks in 2001 are often named as a key catalyst for establishing and building PHEP capacity in the United States (Morrow, 2007; Murthy et al., 2017; Nelson, Lurie, & Wasserman, 2007; Noji, 2005a; Nonkin Avchen et al., 2017; Plough et al., 2013; Watson, Watson, & Sell, 2017), with substantial increases in capacity and funding for PHEP since then (Murthy et al., 2017; Watson et al., 2017). Other key events that contributed to the evolution of PHEP approaches in the United States include the anthrax attacks which followed the September 11 terrorist attacks, the Severe Acute Respiratory Syndrome outbreak in 2003, Hurricane Katrina in 2005, H1N1 outbreaks in 2009, and Hurricane Sandy in 2012 (Morrow, 2007; Nelson, Lurie, & Wasserman, 2007; Watson et al., 2017). Following these events, several laws relating to PHEP were enacted in the United States which expanded the focus of PHEP from bioterrorism to all hazards, and strengthened health preparedness and response (Murthy et al., 2017).
More recent global events, such as Zika Virus and Ebola have also tested PHEP systems and have shaped the current PHEP approaches within the United States (Nonkin Avchen et al., 2017) and globally. The global environment of public health threats, which have becoming increasingly apparent since the September 11 terrorist attacks, has influenced the development of national public health systems to focus on preparedness for response (Moore et al., 2007). This has led to globally significant shifts in strengthening public health systems and capacities for preparedness and response in health (Moore et al., 2007) and significant investment in emergency preparedness and response capacity for health over the last 15 years (Y. Khan et al., 2015).

Public health roles in disaster preparedness and response are becoming increasingly understood and clearly defined. For example, when discussing the objective of public health intervention in disasters Noji (2005b) states specific roles of health in the response and preparedness phases, including: assess and meet the needs of populations after a disaster in order to prevent further adverse health effects; as well as to evaluate response and plan for future disasters. The public health functions of preparedness and response include: disease surveillance systems; baseline, rapid needs and epidemiological assessments; among others (Noji, 2005b). Critical health interventions after disasters include the provision of: water, sanitation and hygiene; shelter; sexual and reproductive health services; control of communicable diseases; and food and nutrition services (Noji, 2005b). Often these roles are formalised within legislation and the roles of government under PHEP and HEM.

### 2.3.2.3 Public Health Emergency Preparedness and Health Emergency Management

As previously mentioned, DRRH has evolved under various terms, including PHEP (Y. Khan et al., 2015; Morrow, 2007; Murthy et al., 2017; Nelson, Lurie, & Wasserman, 2007; Nonkin Avchen et al., 2017; Yeager et al., 2010); Public Health Preparedness and Response (Keim, 2008); HEM (Arnold, 2005; Keim & Abrahams, 2012; Redwood-Campbell & Abrahams, 2011); Public Health Emergency Management (Rose, Murthy, Brooks, & Bryant, 2017), Health Disaster Management (PAHO, 2000a); Public Health Disaster Management (Noji, 2005b); health/public health in DRR (Aitsi-Selmi et al., 2017; Murray, 2014; Murray et al., 2015); and more recently Health Emergency and Disaster Risk Management known as ‘Health-EDRM’ (Chan, 2017; Lo et al., 2017). Often there is no clear distinction between these terms and they appear to be used interchangeably, referring to similar concepts.
Based on the findings of this literature review, PHEP and HEM appear to be two of the more commonly used terms within the literature. PHEP appears to be more often defined within the literature with relative consistency. PHEP is defined as the:

“capability of the public health and health care systems, communities, and individuals, to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those whose scale, timing, or unpredictability threatens to overwhelm routine capabilities. Preparedness involves a coordinated and continuous process of planning and implementation that relies on measuring performance and taking corrective action” (Nelson, Lurie, Wasserman, & Zakowski, 2007, p. S9).

There has been considerable work over the last decade to define the components of PHEP and HEM (Nelson, Lurie, Wasserman, et al., 2007). However, there are differences and crossovers in these components and concepts that are rarely discussed or clarified, furthermore, terms relating to PHEP and HEM are not always clear, nor defined in the literature when they are used (Redwood-Campbell & Abrahams, 2011). Take the following components of PHEP and HEM as an example. Nelson, Lurie, Wasserman, et al. (2007) suggest three broad categories for PHEP work, including:

- **Pre-planned and coordinated rapid-response capability:** this involves health risk assessment, supportive legal framework, clearly defined roles and responsibilities, Incident Command System, public engagement of the public as active participants in PHEP, epidemiological and laboratory functions, countermeasures and prevention strategies, mass health care, public information and communication, robust supply chain;
- **Expert and fully staffed workforce:** this includes workers and volunteers with response capacity that are operations ready, and leadership; and
- **Accountability and quality improvement:** this involves monitoring and evaluating operational capabilities through real events and drills, performance management and accountability systems, tracking and ensuring timely availability of financial resources.

However, the six domains of HEM suggested by Rose et al. (2017), differ considerably despite some conceptual overlaps. These domains include:
• Facilities, management and operations: emergency operations centre, operations personnel and processes;
• Policies, plans, procedures, and partnerships: including emergency operations plans and business continuity plans, policies, standard operating procedures, protocols that provide guidance on HEM;
• Internal communications and information technology: personnel, systems, and infrastructure to support internal communications;
• Crisis and emergency risk communication and public information and warning: synthesis and dissemination of accurate and timely information to the public relating to a disaster or emergency;
• Surveillance and control: systems that enable epidemiology, outbreak surveillance and control in the event of an emergency or disaster;
• Information collection, integration, and sharing: systems that collection, analyse, integrate and share public health information;
• Incident management and response: incident management system that enables the use of emergency management principles to facilitate public health emergency response;
• Coordination and logistical support of field operations: the support of in-field response operations through coordination and logistical support; and
• Training, exercising, and evaluation: programmes for training, drills and evaluation based on emergency management principles.

The clear classification and definition of these components is important and necessary for the measurement of overall progress towards PHEP and HEM, as well as monitoring and evaluation of particular approaches (Nelson, Lurie, & Wasserman, 2007). The development of tools for the measurement and assessment of both PHEP and HEM is a process that is ongoing (Murthy et al., 2017). The measurement of health approaches in disasters is inherently underscored with numerous challenges due to the unpredictable nature of disasters, the variation in scale and impact of disasters, as well as challenges in gathering and accessing reliable baseline and post-disaster health data (Nelson, Lurie, & Wasserman, 2007). The absence of clear definitions and metrics for the functions and responsibilities in PHEP and HEM poses significant challenges to the measurement of the effectiveness of PHEP and HEM (Nelson, Lurie, & Wasserman, 2007). Furthermore, the scattered and siloed nature of PHEP and HEM literature (Yeager et al., 2010), as well as the lack of clarity around the differences and similarities of these two approaches makes measurement difficult.
Bayntun, Rockenschaub, and Murray (2012) suggest that the inclusion of disaster prevention in definitions of PHEP is what distinguishes PHEP from the response-focused HEM, sometimes referred to as Public Health Emergency Management. However, when examining PHEP and HEM literature, this difference is not always apparent. For example, Rose et al. (2017), have defined the components of HEM according to the four aspects of the DRM cycle, suggesting that prevention and recovery are vital components of HEM. Despite this, the health sectors’ efforts in disasters have largely remained focused on response and been reactive in nature, with a parallel being drawn between PHEP/HEM approaches and DRM, as opposed to the more preventative focus of DRR (Keim & Abrahams, 2012).

Academics have been urging the PHEP/HEM approaches to take on a more proactive and preventative approach since the 1990s and 2000s (Chan, 2017; Keim & Abrahams, 2012; Lechat, 1990; Nelson, Lurie, Wasserman, et al., 2007; Shoaf & Rottman, 2000a). The importance of prevention in health approaches to emergencies and disasters has been reflected in a number of definitions of PHEP and descriptions of PHEP components (Bayntun et al., 2012; Boyd et al., 2014, p.84; Morrow, 2007; Nelson, Lurie, Wasserman, et al., 2007). Factors important for the reduction of morbidity and mortality in disasters include: baseline health status of a population prior to a disaster (Keim & Abrahams, 2012; Shoaf & Rottman, 2000a); the provision of primary health care services before, during and after a disaster (Keim & Abrahams, 2012; Shoaf & Rottman, 2000a); as well as the strength of the public health system, including factors such as routine public health surveillance, high immunisation coverage, strong management of environmental determinants of health (Keim & Abrahams, 2012; Morrow, 2007; Shoaf & Rottman, 2000a). Reducing the health vulnerability of populations, as well as strengthening health systems against the impacts of disasters have been central concepts in the drive for a more proactive and preventative approach to PHEP and HEM (Dar et al., 2014; Keim, 2011; Keim & Abrahams, 2012). Keim and Abrahams (2012, p. 530) urge that:

“priority should be given to a preventative approach over the more traditional curative approach in order to promote health and avoid the risk of death, injury, illness before health is threatened.”

Despite the recognition and push to incorporate prevention and recovery as important stages of PHEP the emphasis has been on preparedness and response (Keim & Abrahams, 2012). This is illustrated by several reviews of PHEP literature that have found that the
majority of research, primary or secondary, focuses on the preparedness and response phases (Boyd et al., 2014; Lo et al., 2017; Yeager et al., 2010), with considerably less literature focusing on either the prevention or recovery phase (Y. Khan et al., 2015; Yeager et al., 2010). In the 2000s, Shoaf and Rottman (2000a), recognised the importance of strong public health and medical systems in boosting the prevention aspect of health sector roles in disasters. However, the PHEP and HEM fields have historically been criticised for their separation from routine public health work and systems (Moore et al., 2007; Nelson, Lurie, & Wasserman, 2007).

2.3.2.4 Isolation of PHEP and HEM from public health

It has been recognised that PHEP and HEM need to build on existing public health and primary health systems (Moore et al., 2007; Nelson, Lurie, & Wasserman, 2007; Plough et al., 2013). The need to integrate PHEP with, and build upon, public and primary health systems and functions has seen a significant shift in the role of the health sector in disasters (Moore et al., 2007). This includes changes in organisational structure of health departments to incorporate PHEP/HEM programmes, capacity development for the health workforce in PHEP/HEM, structures and tools for rapid assessment and monitoring of health impacts of disasters, building community partnerships for PHEP/HEM, changing in funding structures for PHEP/HEM, the operational ability of health facilities to withstand disasters, as well as the development of a health systems approach for PHEP/HEM (Bayntun, 2012; Dar et al., 2014; Keim & Abrahams, 2012; Moore et al., 2007; Shoaf & Rottman, 2000a; Waring & Brown, 2005; Watson et al., 2017). For instance, commonly Primary Health Care (PHC) and disaster medicine, or medical assistance in disasters, have been described separately in the literature, as both emerged from different models of healthcare (Redwood-Campbell & Abrahams, 2011). However, it is now understood that both PHC and healthcare in disasters are essential for reducing the health impacts of disasters (Redwood-Campbell & Abrahams, 2011). Similarly, public health concepts have been used to bring PHEP/HEM and broader public health closer together.

Public health concepts and terminology have been used to draw parallels between PHEP/HEM and broader public health concepts, thus facilitate the further integration of PHEP/HEM in broader public health (Chan, 2017; Keim & Abrahams, 2012). The concept of prevention is better than cure has been drawn on to illustrate the spectrum of public and primary health actions that assist in reducing disaster risks. For example, both Keim and
Abrahams (2012), and more recently Chan (2017), use the hierarchy of prevention model of Leavell and Clark (1958) to explain functions in PHEP/HEM, and emphasise the need for greater preventative action in disasters and health, illustrated in Table 1.

Table 1. Hierarchy of prevention concepts in public health and PHEP/HEM (adapted from: Chan, 2017; Keim, 2018b; Keim & Abrahams, 2012; WHO EURO, 2017).

<table>
<thead>
<tr>
<th>Prevention strategy</th>
<th>Use in public health</th>
<th>Parallel drawn with PHEP/HEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tertiary prevention</td>
<td>Treatment and recovery to reduce mortality rates and ongoing effects from the disease, and improve quality of life if the disease cannot be cured.</td>
<td>Minimises health impacts and loss of life during the post-disaster phases.</td>
</tr>
<tr>
<td>Secondary prevention</td>
<td>Early detection and treatment of disease, in order to prevent the progression and spread of the disease.</td>
<td>Seeks to decrease or eliminate the effects of risk through vulnerability reduction, as well as increasing preparedness and capacity for response.</td>
</tr>
<tr>
<td>Primary prevention</td>
<td>Prevents the onset of disease by improving the health status of the population.</td>
<td>Prevents hazard exposure and seeks to avoid the occurrence of a disaster primarily through structural and non-structural measures such as locating communities and health facilities away from hazard zones.</td>
</tr>
</tbody>
</table>

Similarly, the socio-ecological approach to public health and the associated individual, biological, social, economic, and environmental determinants of health has been recently used to describe the range of complex interactions a disaster can have with the health of a community (Chan, 2017). They have also been used to describe what broader DRR means to public health professionals. For example, Murray et al. (2015) highlight that public health professionals have a stake in health outcomes of a disaster. They have a role in the management of broader health determinants which will affect health if impacted by a disaster, such as loss of livelihood, environmental damage, and disruption to socio-economic services (Murray et al., 2015).
Applying public health concepts and the approach of ‘prevention is better than cure’ to DRRH paints a broader picture of the spectrum of responsibilities health in reducing disaster risks. This novel conceptualisation involves a broader role of health than what is currently addressed by PHEP/HEM. By doing so, it attempts to bridge public health and preventative approaches with DRRH.

### 2.3.2.5 Health in broader DRR

PHEP/HEM and health historically did not have a strong collective voice in broader DRR, thus faced difficulties engaging with the broader DRR community on an international level (Shoaf & Rottman, 2000a). Recently these two fields have begun to work closer together, solidified through the recognition of health in the Sendai Framework.

The initial and considerable separation between PHEP/HEM and broader DRR was due to a lack of knowledge of the importance of health systems and professionals, and public health in the various phases of DRR and DRM (Shoaf & Rottman, 2000b). This is reflected in the HFA, where health was referred to just four times (Aitsi-Selmi et al., 2015; Murray, 2014; Murray et al., 2015). These references demonstrated a narrow interpretation and understanding of the role of health and public health professionals in DRR, limited to only hospitals and health facilities (Aitsi-Selmi et al., 2015; Iain, 2010; Murray, 2014; Murray et al., 2015). However, since this time, health has begun to be recognised as having a clear and crucial role in the health outcomes of disasters, and processes that impact the determinants of health and are thus linked to underlying risks of disasters (Aitsi-Selmi et al., 2015; Murray et al., 2015). As such, health is beginning to be recognised as an important benefactor of, and contributor, to DRR.

Since the HFA, several international processes have led to the increasing recognition of health in broader DRR and DRM. These include the development of the Health Cluster in the 2005 humanitarian reform, work towards the International Health Regulations (IHR, 2005), the international DRR campaign on hospitals safe from disasters, the expansion of the definition of hazards to include all hazards, and the solidification of the role of health in DRR through the Sendai Framework (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a, 2015b; Maini et al., 2017; Murray et al., 2015; United Nations, 2014). Since this time there is growing acknowledgement of the role of health within global DRR policy discourse (United Nations General Assembly, 2017a, 2018).
The cluster approach to international disaster response was implemented in 2005 as one of the four pillars of the international humanitarian reform (Keim & Abrahams, 2012; United Nations General Assembly, 2006). This reform saw international humanitarian response structured into clusters according to sectoral action in humanitarian response (United Nations General Assembly, 2006; WHO, 2007, 2017). Among these, four clusters were relevant to health, including Health, Food Security, Nutrition, and Sanitation, and Water and Hygiene clusters. The WHO was designated as the lead for the Global Health Cluster (Redwood-Campbell & Abrahams, 2011). Responsibilities within the clusters include, but are not limited to, joint response strategies and contingency plans, mapping of actors and services, and assessment of the needs of affected populations according to their cluster (Keim & Abrahams, 2012; WHO, 2011, 2017). The cluster approach was significant in increasing the recognition of health and public health professionals in disaster response, particularly in preventing further morbidity and mortality after a disaster through the provision of essential primary health services, as well as public and environmental health services such as clean water, sanitation, immunisation services, and food and nutrition. However, this recognition did not extend far outside of the response phase of disasters.

The growth of the recognition of the role of health outside of disaster response has grown significantly since the Hospitals Safe from Disasters initiative (Aitsi-Selmi et al., 2015). Organised by the UNISDR, WHO and World Bank as part of the World Disaster Reduction Campaign, this initiative originally ran from 2008 to 2009 (UNISDR, WHO, & World Bank, 2009). The initiative aimed to increase the structural, non-structural and functional aspects of hospitals in order to protect lives of the public, patients and health professionals (UNISDR et al., 2009). Structural aspects refer to the building strength and integrity of hospital structures in relation to the potential hazards it will face (WHO, 2015e). Non-structural aspects include the architectural and safety features of the building such as the safety and emergency systems, and equipment in the building (WHO, 2015e). Finally, the functional aspects include: the coordination of emergency and disaster management planning and activities (such as preparedness, response and recovery); human resource management; communication; information management; and logistics (WHO, 2015e). This campaign built on the existing work of the Pan American Health Organisation (PAHO) in increasing the resilience of hospitals to disasters (García Concheso, 2003; Krauskopf & Saavedra, 2004; PAHO, 2000b). Since this time, the One Million Safe Schools and Hospitals campaign was successful in gaining over 2000 pledges for increasing the resilience of schools and hospitals,
with national assessments of existing hospitals to disaster risk to be completed by 2011 (Aitsi-Selmi & Murray, 2015b). At the Global Platform for DRR 2009, it was agreed that concrete implementation plans for safer hospitals were to be developed by 2015 (Aitsi-Selmi et al., 2015). Since this time the Hospital Safety Index has been revised and updated to build on lessons learnt (WHO, 2015e) and hospital safety has become a key goal under the Sendai Framework (UNISDR, 2015d; United Nations General Assembly, 2017b).

Since the initiation of the Hospitals Safe from Disasters campaign, and the end of the HFA, there has been increasing advocacy for the recognition of the role of health in broader DRR (Aitsi-Selmi et al., 2015). The outcomes of the biennial Global Platform for DRR in 2009, 2011 and 2013, and several Regional Platforms for DRR were indicative of this. For example, the establishment of a thematic platform on DRRH and increased attendance by health professionals (Murray, 2014). At the Global Platform for DRR in 2013, key statements on health in broader DRR included emphasis on addressing underlying risk drivers for health, such as health services and infrastructure, baseline levels of disease, and key public health and environmental health services; the importance of multi-sectoral action and strengthening DRR in key sectors such as health; as well as key DRRH actions, including systematic implementation of the IHR and full reporting of the health burden of disasters (Aitsi-Selmi et al., 2015). Furthermore, instrumental support statements for the inclusion of health in the Sendai Framework came from five of the six Regional DRR Platforms in 2014, including Africa, the Americas, Asia, Europe, and the Arab States (Aitsi-Selmi et al., 2015). During this time there was increasing recognition of health status as a key factor in vulnerability to disasters, as well as for the need to mainstream disaster risk in health (United Nations, 2014). Further to this, the key public health functions have all been identified as important for DRR, including assessment and monitoring of the health of vulnerable populations; the provision of Universal Health Coverage (UHC), including public health services; and development and implementation of public health policies (Murray et al., 2015). Finally, significant parallels between contemporary public health and DRR and DRM approaches have been draw, including the similarities between underlying determinants of disaster and health risks, the focus on proactive approaches rather than reactive, and community-based approaches to addressing disaster and health risks (Phibbs, Kenney, Severinsen, Mitchell, & Hughes, 2016). With the recognition of these parallels and important public health functions for DRR, the DRRH community advocated strongly for increased recognition of health in the Sendai
The Sendai Framework was key in solidifying the role of health in broader DRR. It did so through several mechanisms. First of all, thirty direct references were made to health (Aitsi-Selmi & Murray, 2015b) and health was captured as a cross-cutting issue within five of its seven global targets (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a). Second, the Sendai Framework expanded the definition of a hazard to include biological hazards such as epidemics and pandemics to reflect an all hazards approach to DRR (Aitsi-Selmi et al., 2015; Maini et al.). While the definitions of PHEP have been said to be in line with an all hazards approach since about 2007 (Boyd et al., 2014; Moore et al., 2007; Murthy et al., 2017; Nelson, Lurie, Wasserman, et al., 2007), this has not been the case in mainstream DRR. PHEP/HEM developed from an early stage to deal with the health consequences of biological, natural, technological and human-made hazards (Y. Khan et al., 2015; Murthy et al., 2017). For example, while the term all hazards may not yet have been in use, early discussions of disaster epidemiology include complex humanitarian crises, biological hazards, natural hazards, bioterrorism and technological hazards among others (Noji, 1996, 2001; Noji & Toole, 1997). This has been reflected in quantitative literature reviews of PHEP literature, which illustrate that significant portions of the literature address all hazards (Achour et al., 2015; Bayntun, 2012; Yeager et al., 2010). However, until the Sendai Framework came about, the all hazards approach was not used uniformly in DRR. This limited the recognition of biological hazards in broader DRR approaches. Third, the Sendai Framework has solidified the role of health in DRR through explicit reference to the IHR and their importance in DRR (Aitsi-Selmi et al., 2015). This link to the IHR is significant because it is the international mechanism and collective regulatory framework for addressing public health emergencies of international concern that is binding to 194 countries (Bennett et al., 2017; Chan, 2017; United Nations, 2014). According to the IHR, countries are required to develop capacities to prevent, prepare for and respond to disease outbreaks, and report those that are of international concern (Moon et al., 2017). Recently there have been calls for stronger coordination between DRM and PHEP/HEM systems, particularly in the management of biological hazards, including through the application of the IHR (United Nations General Assembly, 2018). Finally, the Sendai Framework called for strengthening the resilience of health systems and integrating DRM into healthcare (Aitsi-Selmi et al., 2015).
After the creation of the Sendai Framework, health has continued to have growing recognition in DRR. In 2016 the ‘Bangkok Principles on the Implementation of the Health Aspects of the Sendai Framework for Disaster Risk Reduction’ (Bangkok Principles; UNISDR, 2016a) were developed. This was the first time that guidance was developed specifically for the health aspects of international DRR policy. They endorse seven measures for implementing the health aspects of the Sendai Framework at the country level (UNISDR, 2016a). Further, they have been recommended to be implemented alongside the Sendai Framework in the implementation of Safe Hospitals (UNISDR, 2017a). Recently the Bangkok Principles have been gaining recognition in global DRR processes (United Nations General Assembly, 2017a, 2018).

The indicators for monitoring the global targets of the Sendai Framework were developed after the Bangkok Principles in 2016. The indicators directly related to health, shown in Table 2, focus on direct impacts on human health and the health system (United Nations General Assembly, 2017b). However, other indicators serve to provide some measurement of the impact of disasters on various aspects of health determinants, such as the number of damaged or destroyed dwellings, disruption or destruction of livelihoods, and economic losses (United Nations General Assembly, 2017b). The health indicators of the Sendai Framework are ambitious, and will be a challenge to pursue in resource constrained settings where data collection and information management on the health impacts of disasters, particularly impacts on health facilities, are lacking.
Table 2. Health-related indicators for the Goals of the Sendai Framework for Disaster Risk Reduction (United Nations General Assembly, 2017b).

<table>
<thead>
<tr>
<th>Global Targets</th>
<th>Compound Indicator</th>
<th>Health-related Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global target A:</strong></td>
<td>A-1 Number of deaths and missing persons attributed to disasters, per 100,000 population.</td>
<td>A-2 Number of deaths attributed to disasters, per 100,000 population.</td>
</tr>
<tr>
<td>Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared with 2005-2015.</td>
<td>A-3 Number of missing persons attributed to disasters, per 100,000 population.</td>
<td></td>
</tr>
<tr>
<td><strong>Global target B:</strong></td>
<td>B-1 Number of directly affected people attributed to disasters, per 100,000 population.</td>
<td>B-2 Number of injured or ill people attributed to disasters, per 100,000 population.</td>
</tr>
<tr>
<td>Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared with 2005-2015.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Global target D:</strong></td>
<td>D-1 Damage to critical infrastructure attributed to disasters.</td>
<td>D-2 Number of destroyed or damaged health facilities attributed to disasters.</td>
</tr>
<tr>
<td>Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.</td>
<td>D-5 Number of disruptions to basic services attributed to disasters.</td>
<td>D-7 Number of disruptions to health services attributed to disasters.</td>
</tr>
</tbody>
</table>

The revised DRR terminology that are relevant to health expand the conceptualisation of how disasters impact health. For example, the definition for those ‘affected’ by a disaster has been expanded to not only include death and injury, but also illness and other health effects (United Nations General Assembly, 2017b). It also labels these effects as direct and
indirect impacts of disasters (United Nations General Assembly, 2017b), expanding the traditional understanding of death and injury as the impact of disasters on health. Health has also been prioritised in several pertinent definitions within the revised terminology, for example the restoration of health is important under the definition of recovery, and is now explicitly stated in the definitions of key DRR concepts, such as disaster, disaster risk assessment, disaster risk management, as well as DRR policies and strategies (United Nations General Assembly, 2017b). By expanding the conceptualisation of health impacts of disasters, and explicitly mentioning health in various aspects of DRR concepts, more space has been created for health professionals, and public and primary health services, to play a larger role in DRR.

The greater recognition of health in DRR is leading to greater inclusion and recognition of PHEP/HEM in international DRR. Disaster management is seen more and more as a priority within health systems, and the use of key DRR terminology such as preparedness and prevention are increasingly familiar to public health professionals (Noji, 2005a). Although these terms are not always clearly defined (Redwood-Campbell & Abrahams, 2011), the roles of PHEP/HEM in the DRM cycle continue to be increasingly clarified. Within these definitions, specific reference to the mitigation and prevention aspects of the DRM cycle (Nelson, Lurie, Wasserman, et al., 2007) in order to emphasise the role of health in reducing the underlying risks of disasters. For example, definitions refer to the reduction of vulnerability to prevent or lessen the impact of a disaster prior to the event (Moore et al., 2007), or prevention actions which can be carried out before, during or after a disaster aims to reduce losses, damage and risk (Rose et al., 2017).

Despite the growing recognition of health in all aspects of the DRM cycle, there remain criticisms of the separation of health professionals involved in DRR and broader health professionals (Bennett et al., 2017; Plough et al., 2013; Shoaf & Rottman, 2000a; Yeager et al., 2010). For example, this has been seen between IHR advocates and the health community involved in the SDGs, as well as the separation of health actors in DRR and DRM from the broader humanitarian relief and response system, as was the key criticism following the Ebola outbreak (Bennett et al., 2017). In an attempt to bridge this gap, new umbrella terminology ‘Health Emergency and Disaster Risk Management’ known as ‘Health-EDRM’ beginning to emerge (Chan, 2017; Chan & Shi, 2017; Lo et al., 2017). Alongside the emergence of this terminology comes calls for promoting systematic integration and involvement of health and health professionals into DRR policies and processes and for
greater engagement of the health community in broader DRR which is increasingly important in the context of sustainable development and climate change (Chan & Shi, 2017; Dar et al., 2014). Figure 2.5 presents a conceptual representation of how the fields of public health, PHEP/HEM and broader DRR have drawn closer over time.

Figure 2.5 Conceptual representation of the convergent relationships between public health, PHEP/HEM and DRR

### 2.3.3 Current themes in current DRRH literature

The recognition of health as central to disaster impacts, and as an important contributor to and benefactor of DRR has clearly emerged through the Sendai Framework (Aitsi-Selmi et al., 2015; Chan & Shi, 2017; Murray, 2014; Murray et al., 2015; UNISDR, 2015d; United Nations, 2014). Within this context, several key themes have emerged through the literature in terms of the state of the art of DRRH practices and approaches. Key themes in current DRRH literature include all hazards, health security, health systems, and resilience approaches, as well as the role of community, and the need for a systematic and comprehensive approach to reducing underlying risks of disasters.
While the all hazards approach is not a new approach and has been applied in emergency management and response since the 1990s (Federal Emergency Management Agency, 1996), embracing and encouraging an all hazards approach within the Sendai Framework is novel in global DRR policy (Aitsi-Selmi & Murray, 2015b; Maini et al.; UNISDR, 2005, 2015d). The all hazards approach intends to ensure nations, localities and communities are prepared for effective response to any hazard that may occur (Federal Emergency Management Agency, 1996) as opposed to developing preparedness for only specific hazards (Adini, Goldberg, Cohen, Laor, & Bar-Dayan, 2012). The all hazards approach draws on common building blocks of preparedness and response across all hazards as the core for developing plans, operating procedures, training, etc. (Adini et al., 2012; Levy, Rokusek, Bragg, & Howell, 2009). This has been increasingly recognised as an important trait of DRR and DRM if emergency managers are to be asked to respond to chemical, biological and mass-casualty emergencies and disasters (Adini et al., 2012; A. S. Khan, 2011). As previously discussed in Section 2.3.2.5, this has been an important step in the solidification of the role of health in broader DRR through the inclusion of biological hazards in the definition of a hazard.

The recognition of biological hazards, coupled with explicit reference to the IHR within the Sendai Framework, demonstrates increasing recognition of health security in international DRR discourse. The recognition of the importance of global health security has risen in recent years with international non-traditional security threats, including H1N1, Avian Influenza, the 2001 Anthrax attacks and the Ebola outbreak, among others (Heymann et al., 2015; A. S. Khan, 2011; Redd & Frieden, 2017). This has increased alongside the growing understanding that health emergencies of international concern undermine political and economic stability (Iain, 2010; Moon et al., 2017) and the capacity of health systems to provide necessary health services (Aitsi-Selmi & Murray, 2015a; Raich et al., 2015). The health security approach is reflected explicitly in regional DRM frameworks, such as in the guiding principles for the ‘Western Pacific Regional Framework for Action for Disaster Risk Management for Health’ (WHO WPRO, 2015). These emergencies are impacted by a broad range of factors that do not respect geographic borders such as pandemics, poverty, environmental hazards, conflict, climate change and migration (Iain, 2010). Some researchers label these factors as health emergencies in their own right, and state that these non-traditional security threats need to be reflected in the definition of health emergencies and threats to security (Cuthbertson, Archer, Robertson, & Rodruguez-Llanes, 2017). The 2014-
2015 Ebola outbreak in west Africa demonstrated multiple gaps in the international response system for threats to health security in terms of the speed and coordination of the response due to inadequate compliance with the IHR (Bennett et al., 2017; Moon et al., 2017), the siloed nature of the humanitarian and PHEP/HEM fields on a global level (Moon et al., 2017; WHO, 2015d), and the importance of health system strengthening in the context of increasing global health insecurity (Bennett et al., 2017; Raich et al., 2015).

Health systems strengthening has emerged within DRR and DRM for health on the basis that the whole of the health system needs to be resilient to both potential intensive and extensive risks (Ardalan, Mowafi, & Homa Yousefi, 2013). This is important to ensure effective, timely and coordinated response and recovery (Bayntun et al., 2012), protect health infrastructure, and improve health outcomes in disasters (Tekeli-Yeşil, 2006; United Nations, 2014). The WHO Resolution from the 64th World Health Assembly in May 2011 prioritised the strengthening of national health emergency and disaster management capacities and resilience of health systems (Murray et al., 2015; World Health Assembly, 2011). The health systems approach in DRRH is based on strengthening the Six Building Blocks of health systems, including financing, leadership and governance, health workforce, health information systems, essential medical products and technologies, and service delivery (Murray et al., 2015). Within the process of health systems strengthening, the mainstreaming of DRM in primary, secondary and tertiary health care is important (Lo et al., 2017), as well as the mainstreaming of health in broader DRR and DRM (Keim & Abrahams, 2012).

There are numerous gaps in the literature regarding health systems strengthening and resilience to disasters. These include the evaluation of a holistic approach to health systems strengthening in the context of disasters (Bayntun et al., 2012), and the impact of power outages on health systems during disaster events (Murray et al., 2015). Health system strengthening has been suggested as an overarching approach for developing health security, UHC, and resilience (Kutzin & Sparkes, 2016).

The importance of health systems resilience has been growing since the Ebola outbreak (Blanchet, Nam, Ramalingam, & Pozo-Martin, 2017), with the recognition that resilience is not a static construct, but requires iterative assessment and management of risks and vulnerabilities within health systems (Kruk, Myers, Varpilah, & Dahn, 2015). A health system is considered resilient if it prevents morbidity and mortality, and enables good health outcomes for all populations during and after a disaster (Kruk et al., 2015). It includes the
capacity of health professionals, actors and institutions to maintain core functions; make use of available health, hazard and epidemiological information; address all hazards; self-regulate the need for a surge in human and financial resources; facilitate communication and action between a diverse range of stakeholders; and adapt to new threats through monitoring, evaluation and iterative approaches to decision-making (Kruk et al., 2015; Lo et al., 2017). Community trust is an essential element of resilient health systems (Kruk et al., 2015).

The concept of resilience is used in reference to both communities and health systems (Castleden, McKee, Murray, & Leonardi, 2011). Community resilience refers to the “capability (or process) of a community adapting and functioning in the face of disturbance” and is influenced by the health status and determinants of health of a population (Castleden et al., 2011, p.371). The importance of the community in health systems resilience was highlighted by the Ebola outbreak (Bennett et al., 2017). Additionally, the resilience of the community itself is beginning to be seen as an important aspect of health systems resilience. Conceptualisations of resilience in the context of disasters and health are now beginning to recognize community engagement with, and trust of, the health system as key aspects of health systems resilience (Kruk et al., 2015) and acknowledge the link between the resilience of health systems and the resilience of communities (Wulff, Donato, & Lurie, 2015). As such, there has been a call for communities to be less dependent on external assistance during and after disasters in order to boost their resilience (Castleden et al., 2011). However, there still remains difficulties in clearly defining and measuring resilience, whether referring to the separate or combined resilience of health systems and the community (Castleden et al., 2011; Overseas Development Institute, 2017a).

The community is an important aspect of many DRRH approaches (Phibbs et al., 2016). The recognition of the importance of community started in the early days of PHEP/HEM where De Ville de Goyet and Lechat (1976) emphasised the importance of public health personnel in the response to natural disasters with regards to their proximity to the disaster, highlighting the important role of community health workers in response to disasters. Enhancing the health and resilience of communities is an important aspect of PHEP, with emphasis on the preparedness and response capacities of communities (Nelson, Lurie, Wasserman, et al., 2007; Nonkin Avchen et al., 2017; Plough et al., 2013; Toloo, FitzGerald, & Tong, 2014). There are three key aspects of community-based DRRH, including the understanding that community-based preparedness and health service provision are an essential aspect of resilience of health systems (Dar et al., 2014; Keim, 2011; Savoia et
al., 2017) community-engagement and trust are essential for the implementation of national health policies (Bennett et al., 2017), and equitable access to health services and information (Savoia et al., 2017). Community-based DRRH approaches are essential as the community is on the forefront of multiple health risks not only from disasters, but also from poverty, inequity and environmental changes such as climate change.

With the recognition of the multiple health risks faced by communities and nations, as well as the multitude of international policy streams aimed at addressing these risks, there has been a call for increased coherence and integration between DRR and CCA (Berkes & Ross, 2013; Djalante et al., 2013; Florano, 2015; Handmer et al., 2014; Howes, 2014; Howes et al., 2015; IPCC, 2012, 2014b; Kelman, 2015; Overseas Development Institute, 2017a; Paton & Johnston, 2006; Porfiriev, 2015; Roberts et al., 2015; Schipper & Pelling, 2006; Serrao-Neumann et al., 2015; Sudmeier-Rieux, 2014; Thomalla et al., 2006; UNFCCC, 2017b; United Nations General Assembly, 2017a), particularly under the umbrella of sustainable development (Bennett et al., 2017; Kelman, 2015; Kelman et al., 2015; UNFCCC, 2017b; United Nations General Assembly, 2017a). In this context there is a need to establish a greater understanding on the types of integration, coherence and links to be made between these initiatives; how to build and strengthen these links; and how to implement joint activities addressing public health, DRR and CCA needs within the context of sustainable development (Murray, 2014; Murray et al., 2015; Murray & Waite, 2018; Sauerborn & Ebi, 2012). The call for these increased linkages is clear within DRRH literature. This is a central concept of this research which will be discussed in Chapter 4.

2.4 Conclusion

This Chapter provided a background of key concepts and evolution of approaches in the field of DRR. The changing conceptualisation of the relationship between DRR and DRM was discussed, where DRM was previously understood as the combination of DRR and Disaster Management, DRR is now understood to be the policy objectives for DRM. The emergence of the concepts of prospective and corrective DRM, as well as the distinction from compensatory DRM, were noted as important for strengthening the reduction of underlying risks in DRR and DRM going forward.

The Chapter went on to discuss the importance of health in DRR outlining the health impacts of disasters, followed by a narrative review of the evolution of PHEP/HEM, and how health fits within the context of broader DRR. PHEP and HEM literature are scattered and
often disjointed from broader public health, creating challenges for health to actively engage in broader DRR with a singular voice that recognises the role and importance of strong public and primary health systems in prevention of disasters, and thus DRR. Finally, in summarising the current themes in DRRH literature, this review highlighted the all hazards, health security, health systems, resilience and community-based approaches of DRRH; as well as the call for building linkages between DRR and CCA.

The call for these increased linkages is clear within DRRH literature. As this is a central concept of this research, Chapter 3 is dedicated to understanding CCA and CCA as it applies to health. This is to provide a background for linking these approaches in health, as a conceptual basis for this research, the subject of Chapter 4.
CHAPTER 3: CLIMATE CHANGE ADAPTATION IN HEALTH

3.1 Introduction

Climate change is already believed to be impacting human health (Watts et al., 2018). Climate change impacts health directly through increased morbidity and mortality from extreme events (Haines, Kovats, Campbell-Lendrum, & Corvalán, 2006; IPCC, 2012, 2014a; McMichael, 1993; Overseas Development Institute, 2017a; Watts et al., 2015; Watts et al., 2018; WHO, 1992, 2014b, 2015c). Indirect impacts include those mediated by human and environmental systems (Haines et al., 2006; IPCC, 2014a; Watts et al., 2018; WHO, 2014b). These indirect impacts occur through increasingly complex pathways which limits their visibility (McMichael, Woodruff, & Hales, 2006). Much of the potential health burden resulting from climate change can be significantly reduced with appropriate CCAH action within the next two to three decades (WHO, 2014b). However, the current scale of response is not enough to achieve this (Watts et al., 2018; WHO, 2014b, 2015c). An increase in comprehensive multisectoral adaptation action which is effective, appropriate and iteratively managed is necessary over the short-, medium- and long-terms to address environmental and social determinants of ill-health and vulnerability, and thus reduce the health risks of climate change (Ebi, 2011a, 2011b; Ebi & Hess, 2017; Hess & Ebi, 2016; Hess, McDowell, & Luber, 2012; Huang et al., 2011; Watts et al., 2018; WHO, 2013, 2014b, 2015c).

This Chapter reviews literature central to Climate Change Adaptation in health (CCAH) and places it within the context of broader Climate Change Adaptation (CCA). To provide necessary theoretical background to this study Section 3.2 discusses key concepts and definitions of broader CCA, as well as the evolution and current themes in the field. Section 3.3 reviews CCAH, it discusses the origins of CCAH approaches, how health is discussed in the Intergovernmental Panel on Climate Change (IPCC) Reports over the decades, and the evolution of CCAH in global climate change policy.
3.2 Climate Change Adaptation

This section discusses the key concepts and definitions of CCA. It provides key background to the study by exploring the evolution of CCA, and key knowledge gaps in the current literature.

3.2.1 Key concepts and definitions

Climate change mitigation and adaptation are two responses necessary to reduce the impacts and risks posed by climate change (IPCC, 2007a; Klein et al., 2007). The present research focuses on adaptation. However, there are growing conceptual and practical links between mitigation and adaptation, as well as calls for integrated strategies, or strategies that create ‘co-benefits’ for both approaches (Klein et al., 2007; Watts et al., 2015).

**Climate change mitigation** aims to reduce the causal factors of climate change over the long-term by reducing the sources, or increasing the sinks, of greenhouse gases globally (IPCC, 2007a; Klein et al., 2007). Mitigation thus takes an upstream approach to reducing any impacts (positive or negative) of climate change (Klein et al., 2007) by avoiding “continued degradation of environmental determinants of health” (WHO, 2015c, p.2). Mitigation and adaptation, however, are fundamentally different in terms of aims and scale of application.

**Climate Change Adaptation** (CCA) is defined by the IPCC (2014c, p. 1758) as “the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities”. These adjustments can be designed to either reduce potential risks, by reducing vulnerability, sensitivity and exposure of a community or activity, offset these risks, or take advantage of opportunities presented by a changing climate (Adger, Arnell, & Tompkins, 2005; IPCC, 2001, 2007b; Klein et al., 2007).

CCA of human systems to environmental change finds its origins in anthropology and emerged as a central concept within climate change sciences (Schipper, 2006; Smit & Wandel, 2006). Mitigation was the first focus of international climate change response (Burton, Huq, Lim, Pilifosova, & Schipper, 2002; Schipper, 2006). However, the movement toward CCA began with the recognition that even with the best mitigation possible, CCA was still needed to avoid climate change risks (IPCC, 2007c; Klein et al., 2007; Schipper, 2006), particularly due to the long lag time of mitigation strategies (Schipper, 2006).
explicitly recognised in the Marakesh Accords, which established the Least Developed Countries Work Programme to develop national mechanisms and capacity for adaptation through National Adaptation Programmes of Action, and through the IPCC Third Assessment Report (IPCC, 2001; Schipper, 2006). Since this time several international policy processes and publications reinforced the importance of CCA (Berrang-Ford, Pearce, & Ford, 2015; IPCC, 2007b; Stern, 2007; UNFCCC, 2007a, 2015a; Yohe, 2015). Finally, CCA was given equal priority to mitigation with the Cancun Adaptation Framework in 2010 (UNFCCC, 2010). With the adoption of the Paris Agreement, CCA has taken a new level of importance in the world’s climate change response through the inclusion of an entire article dedicated to outlining future global CCA action (Levin et al., 2015; UNFCCC, 2015a, 2015b).

CCA can include social, ecological, infrastructure and technological responses; risk transfer mechanisms including novel insurance mechanisms; changes to institutions, policy and legislation; education and behavioural change; information to support early warning, proactive planning; and integrated, appropriate and sustainable management of natural resources (IPCC, 2014b; Smit, Burton, Klein, & Wandel, 2000; Smit & Wandel, 2006). CCA can be transformational, that is changes which adjust the fundamental structures of a system; or it can be incremental, referring to smaller adjustments which aim to maintain the fundamental structures of a system (IPCC, 2014a; Palutikof, Boulter, Barnett, & Rissik, 2015). CCA can occur in response to past, present, or predicted circumstances (Smit et al., 2000) thus can be reactive, concurrent or anticipatory in nature (Smit & Wandel, 2006). Furthermore, it can be undertaken autonomously, where communities or individuals take the lead in their own adaptations, or planned by governing institutions at various levels (Smit et al., 2000; Smit & Wandel, 2006). It can include community-based CCA which focuses on bottom-up approaches empowering vulnerable communities through developing partnerships, increasing awareness and improving capacity to adapt (Ebi & Semenza, 2008). It can also include eco-system based CCA where biodiversity and ecosystem services are used to support the adaptation of vulnerable communities (Gupta et al., 2013).

As mentioned, CCA strategies aim to reduce or offset risks from climate change. Risk in the context of climate change is the “potential for consequences where something of value is at stake and where the outcome is uncertain” (IPCC, 2014a, p. 1048). Risk results from the interaction of hazard, exposure and vulnerability in actual or potential adverse outcomes (IPCC, 2012, 2014b). Hazards refer to the “characteristics of climate change and its effects on geophysical systems, such as floods, droughts, deglaciation, sea level rise, increasing
temperature, and frequency of heatwaves” (IPCC, 2014a, p. 1049), which “may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources” (IPCC, 2014a, p. 5). Exposure refers to the position of elements of systems (people, infrastructure, assets, livelihoods, services, resources, etc.) in locations that could be negatively impacted by climate change (IPCC, 2014b). Vulnerability is the “propensity or predisposition to be adversely affected“ (IPCC, 2014b, p. 5), which is made up of the susceptibility or sensitivity of individuals, populations and systems to harm and their capacity to adapt and cope (IPCC, 2012, 2014b). Adaptive capacity refers to the individual, community, societal, or organizational strengths, attributes, and resources that enable responses to change (IPCC, 2012, 2014b). Adaptive capacity is typically seen as the positive ‘counterweight’ to exposure and sensitivity, thus as the ‘positive’ attribute influencing vulnerability (Eakin, 2015). Capacity development for CCA involves creating the information, understanding, as well as regulatory, institutional and managerial conditions necessary for successful implementation (Stern, 2007).

No-regrets, or zero regrets, CCA options are those which reduce vulnerability to risks from both current climate variability and future anticipated climate change (IPCC, 2012; Klein, 2003). They are considered to be “actions that generate net social benefits under all future scenarios of climate change and impacts” (Heltberg, Siegel, & Jorgensen, 2009, p. 89). They are based on the understanding that certain interventions or strategies are beneficial for the population or system involved regardless of anticipated climate change (IPCC, 2012). No-regrets CCA strengthens robustness of CCA strategies should climate change projections differ to the actual climate change that will be experienced (IPCC, 2012). Adopting these ‘robust decision making strategies’ is seen as a way in which to reduce the impact of uncertainties on adaptation decision-making (Dilling, Daly, Travis, Wilhelmi, & Klein, 2015).

### 3.2.2 Evolution and current themes in Climate Change Adaptation literature

Several distinct thematic approaches can be recognised in the evolution of CCA (Figure 3.1). These include: i) scenario-based approaches; ii) vulnerability; iii) mainstreaming; iv) climate risk; v) adaptive management; and iv) resilience (adapted from: Boulter et al., 2013). These stages in thinking are not always discrete, but may overlap and be used simultaneously depending on the context.
Figure 3.1 Evolution of thematic approaches in CCA adapted from Boulter et al. (2013)

Early approaches to CCA from the mid-1990s to mid-2000s focused on prediction of climate scenarios and adaptation options tailored to these scenarios (Boulter et al., 2013; Burton et al., 2002; Smit et al., 2000). However, implementation of CCA was scarce as these climate change scenarios were uncertain, location-specific, and removed from the decision-making context (Burton et al., 2002). A vulnerability-based approach became central in the early to mid-2000s with the search for a more effective and comprehensive approach to adaptation that could be applied to a variety of communities (Smit et al., 2000). At this time, vulnerability was defined as “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change” (IPCC, 2007a, p.658), and seen as a function of sensitivity and exposure of systems and activities at all levels, as well as capacity to adapt to climate change (Adger et al., 2005; IPCC, 2007a; Smit & Wandel, 2006; Spickett, Katscherian, & Brown, 2012; Stern, 2007). This approach recognised the wider social, cultural, political and economic determinants of vulnerability (Adger et al., 2005; Smit & Wandel, 2006).

A push to ‘institutionalise’ or ‘mainstream’ CCA came with the understanding that CCA rarely occurs in and of itself, and the recognition that climate change impacts are cross-cutting issues that need to be systematically addressed in all sectors (Adger et al., 2005; Burton et al., 2002; Smit & Wandel, 2006). The focus remained on reducing vulnerabilities of communities and activities to climate change with the intent to improve implementation. However, mainstreaming aimed to ensure CCA options were integrated across specific sectors and development initiatives. Nevertheless, in and of itself, it is not enough for successful CCA due to the limited feasibility of providing climate change expertise at all levels across all sectors, and restricted sharing of experience and expertise across sectors (WHO, 2015b).
As focus shifted to the effectiveness of implementation of CCA strategies, adaptive capacity and adaptive management approaches emerged, with supporting decision makers in undertaking implementing CCA being a key focus of the field in the last decade (Kwakkel, Haasnoot, & Walker, 2016). Adaptive management is an iterative decision-making and management process which emphasises reflexive decision making in the face of uncertainty and change (Hess et al., 2012; WHO, 2015b). This approach focuses on stakeholder involvement, and monitoring and evaluation as core features of institutional learning (Hess et al., 2012; WHO, 2015b). Adaptive management has been primarily considered in the context of resource management, with application in the context of climate change becoming more popular in the last decade (Plummer & Baird, 2013; Tompkins & Adger, 2004). The IPCC 5th Assessment Report recognized CCA as an iterative risk management process (IPCC, 2014a). In this time, there have been increasing calls for iterative decision-making in CCA, including in CCAH (Ebi, 2011a, 2011b; Ebi & Hess, 2017; Hess & Ebi, 2016; Hess et al., 2012).

As an iterative risk management process, the conceptualization of climate change impacts was risk-centric. As previously discussed, climate risk is the result of the interaction of hazard, exposure and vulnerability, including adaptive capacity (IPCC, 2014c; Jurgilevich, Räsänen, Groundstroem, & Juhola, 2017). Approaches to understanding climate change impacts were vulnerability-focused up until and including the IPCC Fourth Assessment Report (Jurgilevich et al., 2017). These approaches saw climate vulnerability as the sum of exposure, sensitivity and adaptive capacity (Jurgilevich et al., 2017). The climate risk centred approach to CCA began to emerge with the IPCC Special Report Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) in 2012 and Fifth Assessment Report in 2014 (IPCC, 2012, 2014a; Jurgilevich et al., 2017). This shift from a vulnerability-focused to a risk-based approach was significant in three ways: it broadened understanding of climate change impacts to include exposure; emphasised the importance of the interaction of vulnerability, hazard and exposure; and acted as a framework to bridge DRR and CCA concepts (Jurgilevich et al., 2017). Another concept within CCA literature which has developed in recent years is the concept of resilience.

Resilience, in the context of adaptation, was first promoted internationally in the Cancun Adaptation Framework (UNFCCC, 2010). Before this time resilience was often seen as the converse of vulnerability, where vulnerability and resilience were situated at opposite ends of a continuum. However, recently resilience has been understood as more than the opposite of vulnerability (WHO, 2015c) and has been noted as an essential element of CCA
and sustainable development (Palutikof et al., 2015; Putra & Han, 2014). Resilience within CCA literature has begun to take on a longer-term perspective, with attempts to understand long-term CCA impacts on other parts of a socio-ecological system (Adger et al., 2011), and with the emerging concept of ‘climate-resilient pathways’ (IPCC, 2014b). Incorporating both mitigation and CCA strategies in the context of sustainable development, climate-resilient pathways focus on reducing negative impacts of climate change and maximising positive opportunities, planning under uncertainty and building flexible policy (Denton et al., 2014; IPCC, 2014b; Kwakkel et al., 2016). Since this time, resilience has been recognised as a common goal for CCA and DRR in the context of sustainable development (UNFCCC, 2017b).

As previously discussed in Section 2.3.3 there is an increasing call for synergies between climate change mitigation and CCA, DRR and sustainable development (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a, 2015b; Howes, 2014; IPCC, 2012, 2014b; Maini et al., 2017; Murray, 2014; Pilli-Sihvola & Väätäinen-Chimpuku, 2016; Roberts et al., 2015; Schipper & Pelling, 2006; Thomalla et al., 2006; UNFCCC, 2017b; Watts et al., 2015). This has largely been driven by improved knowledge regarding the short- and long-term implications of climate change in the context of extreme weather events (Denton et al., 2014; IPCC, 2012). Health is a pivotal cross-cutting sector within the context of CCA and DRR (Aitsi-Selmi et al., 2017). As such, the following section discusses CCAH as a theoretical foundation for this research.

### 3.3 Climate Change Adaptation in health (CCAH)

Adaptation to the health impacts of climate change refers to the strategies and approaches that build resilience or reduce vulnerability (Watts et al., 2015). This section provides key background to this research by exploring the evolution of CCAH. Beginning with a discussion of the direct and indirect pathways of health impacts of climate change, it then goes on to discuss how CCAH has evolved. The section then provides context for the study through a discussion of contemporary themes in CCAH, and key knowledge gaps in the current literature.
3.3.1 Impacts of climate change on health

Climate change has significant implications for human health. These impacts are already being felt in some areas, and predicted to worsen over the coming decades (Watts et al., 2018). Climate change acts as a risk driver, multiplying pre-existing health risks (Bowen & Friel, 2012; Watts et al., 2018) and increasing the likelihood of concurrent risks (Watts et al., 2018). For example, the Lancet Countdown reported that exposure of vulnerable populations to heatwaves is estimated to have increased by 125 million adults from 2000 to 2016 (Watts et al., 2018). Similarly, the number of people affected by weather-related disasters is expected to increase (IPCC, 2012; Shi, Yang, Fang, Xu, & Han, 2016). For example, it was found that by 2100 weather-related disasters could impact two thirds of the population in Europe annually, compared to 5% of the population in the years between 1981-2010 (Forzieri, Cescatti, Silva, & Feyen, 2017). The potential health impacts of climate change have been discussed in terms of direct and indirect pathways throughout the development of the field since the early nineties (Bowen & Friel, 2012; Godlee & Walker, 1992; IPCC, 2012; McCally, 2002; McMichael, 1993, 2013; McMichael & Lindgren, 2011; McMichael et al., 2006; Watts et al., 2015; Watts et al., 2018; WHO, 1992).

Direct impacts of climate change on health include morbidity and mortality, primarily resulting from changes in weather extremes such as heat, drought, cold weather and rainfall (Climate and Development Knowledge Network, 2012; Godlee & Walker, 1992; Haines et al., 2006; IPCC, 2012, 2014a; McMichael, 1993; Overseas Development Institute, 2017a; Watts et al., 2015; Watts et al., 2018; WHO, 1992, 1997, 2014b, 2015c). For example, the frameworks of direct and indirect impacts of climate change and health of both McMichael (2013) and Watts et al. (2015) suggest that direct impacts of climate change on health originate from climate-related hazards such as storms, droughts, heatwaves and floods. Within the climate change and health literature, it is common that disasters are referred to as examples within the direct health impacts pathways. Some of this literature also acknowledges the indirect pathways for health impacts of disasters in the context of climate change (Watts et al., 2015). While health impacts from extreme events are the most obvious

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3 The text contained in the following section has been modified and published during the course of the PhD candidature (Banwell, Rutherford, Mackey, Street, et al., 2018). For the full publication, please refer to Appendix 2.
health impacts and are easier to predict (McMichael, 1993; McMichael & Lindgren, 2011), indirect health impacts have been said to possibly outweigh direct health impacts (McMichael & Lindgren, 2011).

Indirect health impacts occur through two processes mediated by ecosystems and/or human institutional systems (Haines et al., 2006; IPCC, 2014a; Watts et al., 2018; WHO, 2014b). Environmental systems mediate health impacts through characteristics of vegetation, soil, baseline air and water quality, as well as geography (IPCC, 2014a). Health impacts mediated by environmental systems primarily include changes in disease vector distribution and life cycle, water and food-borne diseases, and air quality and pollution (Haines et al., 2006; IPCC, 2014a; WHO, 2014b). Indirect health impacts mediated through human processes and systems can include: occupational heat stress, mental health impacts as a result of conflict triggered by climate change, food insecurity and undernutrition as a result of reduced agricultural production, and restricted access to adequate and necessary public and primary health care (Bowen & Friel, 2012; Climate and Development Knowledge Network, 2012; IPCC, 2014a; Watts et al., 2015).

Climate change also impacts public and primary health services by affecting functionality, most visibly as a result of extreme weather events. For example, it causes damage to infrastructure and non-structural elements of health services; and disruption of essential services such as electricity, water supply and communication (Curtis, Fair, Wistow, Val, & Oven, 2017; Watts et al., 2018). While the research on climate change impacts on health systems is thin (Phalkey & Louis, 2016), there is also potential for climate change to impact health facilities and systems not only through extremes in weather and climate events, but also through sea level rise, as well as increasing burden on the health system through climate-sensitive diseases, such as dengue, malaria, or non-communicable diseases (Ebi & Hess, 2017; Paterson, Berry, Ebi, & Varangu, 2014). These impacts on health and health systems are expected to coincide with socioeconomic changes such as population aging and rapid urbanisation (Paterson et al., 2014). As a result, these impacts of climate change on health systems can cause additional indirect health impacts, particularly as health status is itself a contributor to population vulnerability to the impacts of climate change (J. Tucker et al., 2015). As the recognition of the impacts of climate change on health and health systems becomes more apparent, the role of health in addressing these risks through CCA has been increasingly recognised in international policy. The next section provides an overview of the evolution and current approaches of CCAH.
3.3.2 Evolution of Climate Change Adaptation in Health (CCAH)\(^4\)

The following section provides a background to CCAH by exploring the origins of CCAH, and how it has evolved in IPCC Assessment Reports and global policies. By doing so it provides the necessary theoretical background to this research.

3.3.2.1 Origins of climate change and health approaches

Health was excluded at the outset of global enquiry into climate change (Ebi & Hess, 2017). This is illustrated by the exclusion of health and health determining sectors from the objectives of the UNFCCC when it was established in 1992, and resonates today in the smaller knowledge base of climate change as it applies to health compared to other sectors (Ebi & Hess, 2017). Interest in climate change and health started at an international symposium on climate and human health lead by the World Health Organisation, World Meteorological Organisation and United Nations Environment Programme in 1986 (Kalkstein, 1990). Following this forum the Government of the United States commissioned an inquiry into the potential impact of climate change on the United States, the report from which included a section on health (Kalkstein, 1990). The findings of this report formed the basis for health-related action and enquiries in climate change in the United States (Kalkstein, 1990), and appear to be the foundation for the stronger areas of CCAH research today, including heatwaves and vector-borne diseases that are sensitive to climate change.

In the early 1990s interest grew further within the context of growing understanding of how global environmental change, including ‘global warming’, affect earth systems and increasing awareness of the potential impacts of these changes on human health (Godlee & Walker, 1992; McMichael, 1993; WHO, 1992). The CCAH literature of this time was dominated by advocacy for the recognition of climate change risks to health, as well as discussion and exploration of the potential impact pathways (e.g. Godlee & Walker, 1992; Graham, 1992; Haines & Fuchs, 1991; Kalkstein, 1990; McMichael, 1993; WHO, 1992). McMichael (1993) has been foundational for current approaches in climate change and health research, including multidisciplinary and systems focuses, and the interaction and

\(^4\) Parts of the following section are an edited excerpt from an article published during the course of the PhD candidature (Banwell, Rutherford, Mackey, Street, et al., 2018). For the published manuscript, please refer to Appendix 2.
management of complex risks across numerous scales (Ebi & Hess, 2017). At this time it was believed that it was not possible (WHO, 1992), or at least incredibly difficult (McMichael, 1993), to determine the amount of risk that climate change poses to health due to the uncertainties of the amount and distribution of change in climate. However, despite this assertion early and crude risk models for health impacts such as malaria and heat-stress were beginning to emerge in the late 1980s and early 1990s (Kalkstein, 1990). The understanding of climate change impacts on health and confidence in the models and quantification of risks has grown considerably since this time, shown and spurred on by health sections and chapters in the IPCC Assessment Reports (Ebi & Hess, 2017).

3.3.2.2 Health in IPCC Reports

It is visible through the IPCC Assessment Reports and the SREX that health is of growing importance in the context of climate change literature. The Reports also demonstrate a clear increase in understanding of the health impacts of climate change. The following section summarises how understanding of health risks and CCAH has evolved in the five IPCC Assessment Reports and the SREX (Figure 3.2).
Figure 3.2 Key points on the evolution of health within the IPCC Reports (Ebi & Hess, 2017; IPCC, 1990, 2012)

The First Assessment Report (1990) of the IPCC included a section focusing on human health (IPCC, 1990). It discussed the likely impacts of climate change on health relating to heat stress, air pollution, chemical pollution, water quality and quantity, vector-borne disease, as well as exposure to ultra violet light (IPCC, 1990). However, the data presented in relation to these health impacts do not include projections relating to increasing and changing risk due to climate change. The Report provides indication that individual sensitivities to climate change risks were beginning to be considered, as well as population sensitivities to heat stress. However, outside of the population sensitivities to heat stress, the vulnerability of populations to climate change risks is not discussed. The majority of recommendations from this Report revolve around the quantification and modelling of health risks with minor reference to CCA actions restricted to existing environmental health strategies such as how to
reduce the incidence of heat stress or reduce vector breeding (IPCC, 1990). Subsequent Assessment Reports have included a chapter dedicated to health.

IPCC Assessment Reports have featured a designated chapter on health since the Second Assessment Report in 1995 (Ebi & Hess, 2017). Ebi and Hess (2017) provided a comprehensive review of the Assessment Reports Two through Five, summarised in Figure 3.2. Thus, a full review of health in these Assessment Reports has not been included here. Ebi and Hess (2017) concluded that the reports demonstrate progress and increased confidence in quantifying and understanding climate change and health risks and patterns. Ebi and Hess (2017) state that there are challenges with confidently projecting the health impacts of extreme weather and climate events due to the difficulty experienced in assessing the complex pathways leading to health impacts of these extreme events. However, the IPCC Fifth Assessment Report (2014) and the SREX (2012) have illustrated that hazards such as heatwaves, floods, storms, and extreme cold, are likely to increase with the potential for greater health impacts (IPCC, 2012, 2014a).

The IPCC SREX collated health impacts from climate-sensitive extreme events and disasters. While the report did not dedicate a whole chapter to health, the report examined the health impacts of changes in climate extremes and their associated impacts on human health (IPCC, 2012). The SREX stated that amplified health impacts can be expected from increases in: average daily temperatures; intensity, frequency and length of heatwaves; intensity of droughts; frequency of heavy rainfall; wind speed of tropical cyclones in some regions; height extremes of coastal water; as well as flood (Climate and Development Knowledge Network, 2012; IPCC, 2012). The SREX also discussed the health dimension of vulnerability, which pertains to the variation of health effects of climate-sensitive extreme events between social groups and regions (IPCC, 2012). Vulnerability in the context of health is influenced by individual and social susceptibilities and disadvantage, such as pregnant women, children, persons living with disabilities, persons with lower socio-economic status (IPCC, 2012). Furthermore, it can depend on institutional factors such as the functionality of, and access to, health services and social safety nets and assistance, which can be further impeded by disasters (IPCC, 2012). The SREX argues that both DRR and CCA are concerned with resisting shocks under the umbrella of sustainable development, and building a bridge between these two fields is important to address current and future climate vulnerabilities (IPCC, 2012). The SREX was a key publication building clear linkages between disasters and climate change. Similarly, within the Fifth Assessment Report there
was robust evidence and high agreement on the need for building synergy with development and DRR by integrating CCA into planning, policy and decision-making (IPCC, 2014b).

The IPCC Assessment Reports reflect that climate change and health research has largely focused on quantifying potential health impacts (Ebi & Hess, 2017). However, there is an increasing call in the literature to strengthen CCAH research, particularly research, monitoring, public health surveillance, effectiveness of CCAH and understanding limits to CCAH (Watts et al., 2015; Watts et al., 2018). In recent years there has been increasing recognition of the need to build adaptive capacity in health focused on sustainable, long-term, no-regrets strategies (Climate and Development Knowledge Network, 2012; IPCC, 2014b; Watts et al., 2015). This call stems from the recognition that current mitigation and adaptation efforts are not sufficient to avoid health impacts and adaptation in climate change and health is crucial (IPCC, 2014b; Watts et al., 2018).

### 3.3.2.3 Evolution of CCAH in global policy

Initial climate change research was focused on understanding and quantifying potential health impacts (Ebi & Hess, 2017). Adaptation to these impacts has become increasingly important with the recognition that they are being felt around the world (Watts et al., 2015). International policy processes have been important in promoting the importance of both health and adaptation in climate change action, illustrated by the Nairobi Work Plan, initiation of the National Adaptation Plans (NAPs), Paris Agreement, Sustainable Development Goals, as well as the Lancet Countdown on Climate Change and Health. However, there has been limited progress toward CCAH and current CCAH actions are not sufficient to address projected health risks (Watts et al., 2018).

Early research attempted to incorporate some crude measures of acclimatisation to heatwaves (Kalkstein, 1990), and make small reference to some types of CCAH options, such as EWSs, and preventing future spread of vectors carrying climate-sensitive diseases (Kalkstein, 1990; McMichael, 1993; WHO, 1992). This illustrates early consideration of how populations will adapt to climate change risks to health, however this did not include societal

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5 Parts of the following section have been adapted and published during the course of the PhD candidature (Banwell, Rutherford, Mackey, & Chu, 2018). For the full publication, please refer to Appendix 1.
responses, and was not the focus of climate change and health research at this time. In line with similar approaches in broader climate change action, mitigation was the focus of recommendations, including reducing greenhouse gas emissions, increasing energy efficiency, and reducing population growth (McMichael, 1993; WHO, 1992). This illustrates that comprehensive CCAH to the wide array of climate change risks to health had not yet begun to be considered. CCAH research and action has gained increasing momentum since the mid-2000s (Ebi & Hess, 2017; Verner, Schütte, Knop, Sankoh, & Sauerborn, 2016; Watts et al., 2018).

Calls for CCAH emerged from the recognition that mitigation action alone is not sufficient to prevent health impacts of climate change (Schipper & Pelling, 2006). The Kyoto Protocol (1997) often provided a platform to discuss the need for both mitigation and CCAH action in health (e.g. Kovats & Haines, 2005). While it was recognised that the Kyoto Protocol did not provide sufficient mitigation commitments to address climate change, it was an important foundation for future climate change action (Kovats & Haines, 2005). The importance of mitigation and CCAH action continues to be recognised in more recent literature (e.g. McMichael, 2013; Watts et al., 2015; Watts et al., 2018). However, health and especially CCAH was on the periphery of global climate change policy with initial recognition only growing under the Nairobi Work Plan (UNFCCC, 2007b).

Implementation of CCAH has largely been driven by the WHO and member states, with the National Adaptation Plan (NAP) process playing a big role in this in low- and middle-income countries (UNFCCC, 2007b). The NAP process implemented under the Cancun Adaptation Framework (UNFCCC, 2010) has been, and will continue to be, critical in strengthening concrete implementation of CCAH (UNFCCC, 2017a; WHO, 2014c). Furthermore, Health components of the NAPs (H-NAP) have been identified by Least Developed Countries as key strategies for assessing vulnerability and risks, and identifying adaptation needs and priorities at a national level (Ebi & Villalobos Prats, 2015).

Central to the H-NAP is the consideration of the determinants of health and upstream risk drivers in the context of climate change, and how to address these factors (Ebi & Villalobos Prats, 2015). A resolution from the 2008 World Health Assembly encouraged Member States to address health impacts from climate change, including through strengthening health systems as no-regrets CCAH, and conducting vulnerability and adaptation assessments (Bowen & Friel, 2012). A comprehensive vulnerability and
adaptation assessment often forms the basis of H-NAPs (Ebi & Villalobos Prats, 2015). Vulnerability and adaptation assessments place climate change impact assessments within their broader social context (Füssel, 2008), consider numerous determinants of climate-sensitive health outcomes, and identify adaptation priorities and options for implementation under H-NAPs (WHO, 2013). The integration of health into the broader NAP process, as well as the iterative management of health risks are critical for the success of the H-NAP (WHO, 2014c) and as such is an important indicator of progress towards CCAH (Watts et al., 2018). A review by the WHO in 2010 identified that the majority of plans acknowledged the health sector as susceptible to climate change impacts (Manga, Bagayoko, Meredith, & Neira, 2010). However, the CCAH actions and allocated budget were deemed as insufficient to address climate change risks to health (Bowen & Friel, 2012; Manga et al., 2010). Current status of the suitability and effectiveness of CCAH in H-NAPs is unknown (UNFCCC, 2017a). However, the number of countries assessing vulnerabilities and developing H-NAPs is increasing (Watts et al, 2017). The H-NAPs aim to strengthen health systems in order to reduce climate change impacts on health (Ebi & Villalobos Prats, 2015).

Resilience of the health system to external shocks has been an important focus of CCAH (Bowen & Ebi, 2017; Curtis et al., 2017; Hess et al., 2012; Mayhew et al., 2014; Paterson et al., 2014; Watts et al., 2018; WHO, 2014b, 2015c). This includes translation into the WHO Operational framework for building climate resilient health systems (WHO Operational Framework; WHO, 2015c). The WHO Operational Framework (Figure 3.3) is based on the WHO Six Building Blocks of health systems model. The ten core climate resilience functions identified in the WHO Operational Framework aims to guide understanding and preparation for health risks associated with climate change (WHO, 2015c).
Figure 3.3 Ten components of the WHO Operational framework for building climate resilient health systems (WHO, 2015c, p.12)

Resilience in the context of climate change and health is seen as “the capacity of a system to absorb disturbance and reorganise...to retain function, structure, identity, and feedbacks” (Watts et al., 2015, p.6). Resilience frameworks drawn on in CCAH typically come from natural resource management or DRM (Bowen et al., 2012). They increasingly refer to human, social and community dimensions, and can be framed at individual, community and systems levels (Bowen et al., 2012; Overseas Development Institute, 2017a). Health system and population resilience are important indicators for progress in CCAH (Watts et al., 2018). Indicators for tracking the progress and outcomes in CCAH are under development for use by the Lancet Countdown for Climate Change and Health (Watts et al., 2018).
Tracking the progress made towards CCAH began with the Lancet Commission on Climate Change and Health in 2015 which highlighted the need for health to play a bigger role in CCAH (Watts et al., 2015). The Commission recognized climate change as “the greatest global health opportunity of the 21st century” (Watts et al., 2015, p.1). However, realising this would take significantly more engagement from the health sector (Watts et al., 2015). In order to increase the engagement and role of the health sector the Lancet Commission suggested that intergovernmental collaboration across health would be necessary, as well as strong health sector support for climate change mitigation action. To support the increasing role of health, the Commission committed to establishing the Lancet Countdown on Climate Change and Health, an annual report on implementation of the health aspects of the Paris Agreement (Watts et al., 2015). Adaptation planning and resilience for health is the third pillar of the Lancet Countdown and includes indicators on: H-NAPs; city-level climate change risk assessments; detection and early warning of, preparedness for, and response to health emergencies; climate information services for health; national assessment of vulnerability, impacts, and adaptation for health; and climate-resilient health infrastructure (Watts et al., 2018). The first report recognizes the limitations in terms of indicators and measurement, and the ongoing and iterative nature of improving the measurement of progress in climate change and health (Watts et al., 2018). A key finding of the first edition of the Lancet Countdown clearly established that the recognition of health within climate change has increased considerably in the last decade (Watts et al., 2018).

The engagement of the health sector and health actors is important for driving progress on climate change (Watts et al., 2015; Watts et al., 2018). There have been increasing calls by leading academics in climate change and health for greater involvement of health professionals in broader CCA processes (Bowen & Friel, 2012; Haines & Fuchs, 1991; Manga et al., 2010; Watts et al., 2015; Watts et al., 2018). Furthermore, there have been numerous calls for increased availability and access to financing for CCAH and developing climate resilient health systems (Bowen & Friel, 2012; Manga et al., 2010; Watts et al., 2015; Watts et al., 2018). Recognition of the importance of both health and CCA has grown further with the adoption of the Paris Agreement (Levin et al., 2015; UNFCCC, 2015a).

The Paris Agreement emphasises the importance of CCA and explicitly recognises the right to health in the context of climate change (UNFCCC, 2015a) and is a significant step towards protecting health over the long- and short-term (Watts et al., 2018). In some cases, countries have also used the Intended Nationally Determined Contribution under the Paris
Agreement to outline adaptation actions and targets (Levin et al., 2015; UNFCCC, 2015b). However, current climate change action in health has been recognized as insufficient (Dietzel, 2017) with greater ambition needed (Watts et al., 2018). International priorities have been set for strengthening CCAH. These priorities include (UNFCCC, 2017a):

(a) Enhancing research and health information systems;

(b) Adopting a comprehensive approach to integrating health into CCA plans, projects and programmes and to combine climate change with other determinants and drivers of health-care systems;

(c) Developing the capacity of the health-care workforce and educational institutions in order to develop climate-resilient health-care systems;

(d) Strengthening intersectoral action and multilevel governance;

(e) Promoting climate-resilient and sustainable health infrastructure and technology; and

(f) Scaling up financial investments for CCAH plans and action.

3.3.3 Current themes in CCAH literature

This section provides a brief discussion of these themes as they pertain to this research to contribute to the theoretical foundations of this research. Current research gaps in understanding and adapting to climate change risks to health are discussed, as well as complexities in research. Key themes in CCAH literature are also discussed, including: the increasing role of the health sector in CCA; and the need to link CCAH with DRRH.

The understanding of how and to what extent climate change will impact health has grown significantly since the early 1990s. Research in CCAH is still dominated largely by the quantification of risks, identifying vulnerabilities within populations, and projecting changes to health risks (Ebi & Hess, 2017). The growing understanding of health impacts is particularly illustrated in the case of heatwaves, and climate-sensitive diseases such as malaria (Ebi & Hess, 2017). However, there are still significant knowledge gaps on the extent to which climate change will impact health (Curtis et al., 2017; IPCC, 2012), particularly within low- and middle-income countries (IPCC, 2012). There remain calls for strengthening research on health impacts under different climate change scenarios (Curtis et al., 2017). Furthermore, there is still a need for these data and information to be useable and used by
policy and decision-makers (UNFCCC, 2017a). Finally, there are still significant knowledge gaps surrounding CCAH (Curtis et al., 2017; Ebi & Hess, 2017; Phalkey & Louis, 2016; UNFCCC, 2017a; Watts et al., 2015; Watts et al., 2018).

With the growing recognition of the importance of CCAH there have been increasing calls in the literature to strengthen CCAH research, particularly with relation to the effectiveness of CCAH action (Ebi & Del Barrio, 2017; Ebi & Hess, 2017; Watts et al., 2015; Watts et al., 2018). Research has shown that there are significant barriers to CCAH, including financial challenges, technological limits, institutional arrangements, and political will (Füssel, 2008; Huang et al., 2011). However, there is little research examining how to overcome these barriers. For example, there is very little financial support dedicated to addressing health impacts of climate change (Bowen & Friel, 2012; Manga et al., 2010; Watts et al., 2018). It has been suggested that overreliance on the NAP process has limited accessing funding for CCAH (Bowen & Friel, 2012). However, alternative mechanisms for strengthening access to funding have not yet been explored. Furthermore, there remain numerous knowledge gaps within CCAH.

Key research gaps around CCAH include the range and extent of risks climate change poses to health systems (Ebi & Hess, 2017; Phalkey & Louis, 2016), and the public health interventions for most effectively managing these changing risks (Austin et al., 2016; Bouzid, Hooper, & Hunter, 2013; Ebi & Del Barrio, 2017; Ebi & Hess, 2017). Similarly, there is a call for research to address knowledge gaps surrounding the efficiency, coverage and effectiveness of CCAH; limits to CCAH; cost-savings associated with co-benefits; as well as impacts of differing CCA scenarios (Bouzid et al., 2013; Curtis et al., 2017; Ebi & Del Barrio, 2017; Eidson, Clancy, & Birkhead, 2016; Huang et al., 2011; Watts et al., 2015; Watts et al., 2018). Finally, there are significant research gaps surrounding the implementation of CCAH (Ebi & Del Barrio, 2017; Ebi & Hess, 2017). The literature calls for comprehensive multisectoral action, which is effective; appropriate in time, scale and coverage; and managed iteratively (Austin et al., 2016; Ebi, 2011a; Ebi & Hess, 2017; Hess & Ebi, 2016; Hess et al., 2012; Huang et al., 2011; Watts et al., 2018).

The complexity of the pathways through which climate change impacts health is a challenge for assessing risks (Bowen & Friel, 2012; Ebi, Ogden, Semenza, & Woodward, 2017; UNFCCC, 2017a). According to Phalkey and Louis (2016) there are three key challenges with understanding health risks to climate change. These include: quantifying
health risks, assessing causality, and attributing health impacts to climate change (Phalkey & Louis, 2016). Ebi et al. (2017) demonstrate that a proportion of the current climate-sensitive disease burden may be attributed to climate change given sufficient health data, greater knowledge of the complexities of health impact pathways, and sophisticated analysis methods. As a risk multiplier, climate change has the potential to compound risks and health issues already occurring, making them occur simultaneously (Watts et al., 2018). The simultaneous impact of these health risks has yet to be assessed. Furthermore, only using climate change projections in CCAH decision making assumes that vulnerability of systems and populations remains static, however this is not the case (Ebi, Hess, & Isaksen, 2016). Therefore it is essential to consider changes in vulnerability in CCAH scenarios and decision making, as well as ensure iterative assessments of risk and CCAH action (Ebi et al., 2016).

There has been an increasing drive for health to play a greater role in addressing climate change risks (Ebi & Hess, 2017; Huang et al., 2011; Jancloes et al., 2014; McMichael & Lindgren, 2011; Watts et al., 2015; Watts et al., 2018). This comes as a result of the ever-growing understanding of the importance of CCAH in addressing risks of climate change and the recognition that appropriate adaptation can greatly reduce the health burden resulting from climate change (Hancock et al., 2015; IPCC, 2014b; Keim, 2011; Watts et al., 2015; Watts et al., 2018; WHO, 2015c). However, the health sector has been slow to recognise and initiate action addressing health risks of climate change (McMichael & Lindgren, 2011; Watts et al., 2018). The involvement of health in climate change also plays a considerable role in preventing losses to development gains, as well as reducing disaster risks.

CCAH is increasingly recognised as an important contributor to other global processes, such as sustainable development and DRR. As such, CCAH has often been referred to as important for sustainable development pathways (Bowen & Friel, 2012; Ebi & Hess, 2017; Keim, 2008, 2011; UNFCCC, 2017a). Within this context reducing disaster risks and building resilience are also important (Murray & Waite, 2018). For example, prevention, preparedness, response and recovery in DRR and DRM inside and outside of health have been recognised as increasing climate change resilience in health (Keim, 2008, 2011; Paterson et al., 2014). Similarly, health system strengthening approaches have been highlighted as mechanisms by which CCAH is supported through development and DRR initiatives (Paterson et al., 2014; Phalkey & Louis, 2016). As such, climate change literature appears to increasingly place CCAH within the broader context of sustainable development recognising climate change is not a standalone driver of risk (Ebi & Hess, 2017; UNFCCC,
Similarly, DRRH is increasingly framed as a complimentary strategy to CCAH, and integrating health into national DRRH strategies has been recognised as a way to build capacity to responding to climate change impacts on health (UNFCCC, 2017a). As such, there has been increasing calls for comprehensive strategies which build on synergies across sectors (Ebi & Villalobos Prats, 2015; Murray & Waite, 2018; UNFCCC, 2017a).

3.4 Conclusion

This Chapter presented the key concepts and state of the art of the literature relating to CCAH. It clarified the concept of climate change risk as a function of hazard, exposure and vulnerability (including susceptibility and adaptive capacity). The growing international recognition of the importance of CCA was noted. The Chapter briefly described the evolution of CCA from a focus on predicting climate scenarios and assuming that identified adaptation options would be implemented to incorporate concepts of vulnerability, adaptive management and resilience.

Following this, the Chapter provided background of the health impacts of climate change, and the evolution of CCAH. Historically, emphasis has been on climate change and health impact research. However, there is growing focus on the implementation of CCAH. Global processes such as the H-NAP and the increasing inclusion of health within the IPCC Assessment Reports, have driven progress in CCAH in recent decades. Recently, building the climate-resilience of health systems and tracking global progress have become focuses in CCAH. Research gaps in CCAH literature identified here include: understanding of climate change risks to health; the effectiveness of CCAH action; and implementation of CCAH. This review highlighted that the role of health in CCA is growing, and CCAH contributes to other global processes including DRRH and sustainable development.

There is increasing recognition that DRRH strategies are complementary to CCAH and build resilience to extreme events worsened by climate change. This was demonstrated in both Chapters 2 and 3. The following Chapter (Chapter 4) discusses the links between DRRH and CCAH in greater detail as important background for this research.
CHAPTER 4:  LINKING DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION IN HEALTH

4.1 Introduction

Health impacts of climate change and climate-related disasters are of increasing global importance (Aitsi-Selmi & Murray, 2015a; Climate and Development Knowledge Network, 2012; Maini et al., 2017; Murray et al., 2015; UNISDR, 2016b; Vogel, 2017; Watts et al., 2018). Linking DRR and CCA has been explicitly recognised by academics and international actors as essential for addressing disaster and climate change risks (IPCC, 2012; Turnbull, Sterrett, & Hilleboe, 2013; UNFCCC, 2015a; UNISDR, 2015d). Chapters 2 and 3 laid the foundation for understanding DRRH and CCAH approaches. Building on this foundation, this Chapter examines the current state of the literature in linking DRRH and CCAH. It first provides a background on linking DRR and CCA broadly, followed by linking within health. It discusses the reasons why linking DRRH and CCAH is particularly important, including: the growing role of health actors in DRR and CCA; commonalities in health impact pathways; and positioning of public health actors to build these links. Following this conceptual analysis, key messages from the literature on how these links could potentially be formed are discussed in terms of conceptual, and operational and technical synergies. Finally, key research gaps are summarized as a foundation for this research. Significant portions of this Chapter draw on work previously published as part of this research (Appendices 1 and 2).

4.2 Terminology for linking DRR and CCA

Here the term ‘linking’ is used to describe the bridges and connections between DRR and CCA in policy and implementation that have been commonly referred to with terms such as ‘coherence’ (Aitsi-Selmi & Murray, 2015a; UNFCCC, 2017b), ‘synergy’ (Serrao-Neumann et al., 2015; UNFCCC, 2017b), ‘integration’ (Handmer et al., 2014; IPCC, 2012; UNFCCC, 2017b).

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6 The following section is a direct excerpt from an article published during the course of the PhD candidature (Banwell, Rutherford, Mackey, & Chu, 2018). For the published manuscript, please refer to Appendix 1.
UNFCCC, 2017b), ‘collaboration’ (Begum et al., 2014; Howes et al., 2015), and ‘coordination’ (Begum et al., 2014). The term linking is used in order to:

- Avoid challenges and contentions in the differing opinions on how these links take shape, such as those surrounding the suggested absorption of one strategy by the other through integration (Birkmann & von Teichman, 2010; Forino, von Meding, & Brewer, 2015; Kelman, 2015, 2017; Kelman, Gaillard, Lewis, & Mercer, 2016; Kelman et al., 2015; Klein, Nicholls, & Thomalla, 2003; Mercer, 2010; Serra-Neumann et al., 2015);
- Recognize that the links between DRR and CCA may occur differently between, and within, specific contexts such as partial integration on an international level (UNFCCC, 2017b), or mainstreaming on a national level (Nalau et al., 2016);
- Acknowledge that not all areas of work in DRR and CCA overlap, or should be linked; and
- Provide an opportunity to explore more than the integration of policy or institutions, such as the exploration of technical, operational and conceptual links.

4.3 Why link DRRH and CCAH?\(^7\)

Well-planned, effective and appropriate DRRH and CCAH is essential for addressing the ever-present and increasing health risks associated with climate change and climate-sensitive disasters (Watts et al., 2018; WHO, 2013, 2014b, 2015c). Linking these two approaches is said to increase the coherency, efficiency and effectiveness of efforts in this area (UNFCCC, 2017b). It is particularly important to:

- Ensure a robust approach to dealing with climate-sensitive disasters and their associated risks (Birkmann & von Teichman, 2010; IPCC, 2012, 2014b; Mercer, 2010; Schipper & Pelling, 2006; Thomalla et al., 2006). For example, linking DRR with CCA and climate change science has been recognized as necessary for

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improving DRR strategies, understanding risk, dealing with uncertainties, addressing increasing vulnerability as a result of climate change, and reducing the potential for maladaptation (Berkes & Ross, 2013; Djalante et al., 2013; Florano, 2015; Handmer et al., 2014; Howes, 2014; Howes et al., 2015; IPCC, 2012; Kelman, 2015; Paton & Johnston, 2006; Porfiriev, 2015; Serrao-Neumann et al., 2015; Sudmeier-Rieux, 2014; UNFCCC, 2017b).

- Enable sharing of expertise, knowledge, lessons and tools between the two fields, thus increasing the efficiency and effectiveness of DRR and CCA particularly through the consideration of long-term risk and adoption of long-term adaptation options (Howes, 2014; IPCC, 2012, 2014b; Roberts et al., 2015; Schipper & Pelling, 2006; Thomalla et al., 2006; UNFCCC, 2017b).

- Enhance efficiency in terms of the human, technical and financial resources used to reach common goals, thus reducing the use of resources in duplicated institutional structures and implementation (Howes, 2014; IPCC, 2012, 2014b; Overseas Development Institute, 2017a; Roberts et al., 2015; Schipper & Pelling, 2006; Thomalla et al., 2006; UNFCCC, 2017b).

- Answer the growing global call for linking DRR and CCA in the context of sustainable development (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a, 2015b; Howes, 2014; IPCC, 2012, 2014b; Kelman et al., 2015; Maini et al., 2017; Murray, 2014; Pilli-Sihvola & Vääätäinen-Chimpuku, 2016; Roberts et al., 2015; Schipper & Pelling, 2006; Schipper et al., 2016; Thomalla et al., 2006). This includes the call for linkage in international policies and publications from the last decade, particularly the international landmark agreements such as the Sendai Framework, Paris Agreement, and Sustainable Development Goals (Murray & Waite, 2018).

Linking in health is particularly important for a number of reasons. Health is a crucial end point for both climate change and disasters (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a, 2015b; Dietzel, 2017; Murray et al., 2015; UNFCCC, 2015a; UNISDR, 2015d, 2016b). Thus health is a cross-cutting issue in DRR and CCA in the context of sustainable development (Aitsi-Selmi et al., 2017; Murray & Waite, 2018). Linking DRRH and CCAH is vital to address the similarities of health risks associated with climate change and climate-sensitive disasters, especially as these risks occur simultaneously (Phalkey & Louis, 2016). Furthermore, public health professionals are well positioned to make these links. As the recognition of the role of health increases in DRR and CCA, the potential for...
greater overlaps and potential synergies will grow. Building links between DRRH and CCAH has the potential to strengthen the robustness of DRR and CCA approaches, thus creating more effective means of reducing risks to health over the long-term.

4.4 Linking DRR and CCA outside of health

Despite the global call for increased links between DRR and CCA these fields have largely stayed separate because they originated from different disciplines, have different methodologies and commonly have separate funding and implementing bodies (Forino et al., 2015; Mercer, 2010; Serrao-Neumann et al., 2015). The possible synergies between these two areas have not yet been fully realized (IPCC, 2014b; UNFCCC, 2017b). However, the calls for maximising links between DRR and CCA are becoming prominent in global DRR and CCA policy discourse (UNFCCC, 2017b; United Nations General Assembly, 2018). Suggested approaches include the consideration of disaster risks in long-term sustainable development that incorporates increasing risks from climate change (IPCC, 2012; UNFCCC, 2016), as well as mainstreaming climate change risk and CCA strategies into multi-hazard risk management approaches (IPCC, 2014a; UNFCCC, 2016). Furthermore, national policy processes, such as National Adaptation Plans (NAPs) have been identified as important for identifying vulnerabilities and adaptation options and priorities, as illustrated through the joint NAPs of several countries in the Pacific (UNFCCC, 2016, 2017b). Numerous examples for successful linkage have been identified, including in the South-West Pacific, particularly the Solomon Islands and Vanuatu (Nalau et al., 2016). The links between DRR and CCA with national policy have since been reflected at the regional level. This is illustrated by the replacement of the Pacific DRR and Disaster Management Framework for Action 2005–2015 and Pacific Islands Framework for Action on Climate Change 2006–2015 (Nalau et al., 2016) with the Framework for Resilient Development in the Pacific An Integrated Approach to Address Climate Change and Disaster Risk Management 2017 – 2030, and the development of the Pacific Platform for Disaster Risk Management and Climate Change (Pacific Resilience Partnership, 2016).

The following section draws on an excerpt from an article published during the course of the PhD candidature (Banwell, Rutherford, Mackey, & Chu, 2018). The excerpt has been edited to allow better flow in the thesis. For the published manuscript, please refer to Appendix 1.
The integration of DRR and CCA in national institutions and policies has been discussed in the literature (Bhamra, Dani, & Burnard, 2011; Djalante et al., 2013; Djalante & Thomalla, 2011; Howes et al., 2015; Nalau et al., 2016; Serrao-Neumann et al., 2015). Appropriate capacity, tools, decision-making support and governance structures (IPCC, 2014b), effective interagency communication and collaboration, shared learning within institutions, and establishing common goals (Howes, 2014) have been highlighted as necessary for supporting effective linkage of DRR and CCA. However, multiple operational and institutional barriers to the integration of DRR and CCA have been identified. Operational barriers include differences in terminology, methodological approaches, and administrative bodies (Birkmann & von Teichman, 2010; Forino et al., 2014; Howes, 2014; Kelman, 2015; Schipper & Pelling, 2006; Thomalla et al., 2006). Institutional barriers to integration often relate to bureaucracy, political territorialism and institutionalised silos (Forino et al., 2014; Howes, 2014; Howes et al., 2015; Kelman, 2015; Schipper & Pelling, 2006). Recently, this literature has expanded to investigating ways in which links between DRR and CCA can be built across national government actors and in several specific sectors including agriculture, water and forestry (Pacific Resilience Partnership, 2016; Pilli-Sihvola & Väätäinen-Chimpuku, 2016; UN Economic and Social Commission for Asia and the Pacific, 2017). Within this process health has been identified as an important sector for linking DRR and CCA (Pacific Resilience Partnership, 2016).

Since this time, there have been efforts through international platforms to build an understanding about how these links can be developed at various levels. For example, there was an explicit focus on linking at the 2017 Global Platform for DRR (UNISDR, 2017a) and the UNFCCC technical expert meetings on CCA (UNFCCC, 2017b). The UNFCCC technical paper produced from this meeting highlight that the scope of both approaches is cross-sectoral and across multiple scales; and both approaches have the common objectives of addressing impacts on communities and vulnerable populations (UNFCCC, 2017b). It also states that both DRR and CCA address a common theme of “reducing vulnerability and enhancing resilience” (UNFCCC, 2017b, p.4).

### 4.4.1 Resilience as a possible framework for linking DRR and CCA

Meaningful engagement with resilience is important to ensure the development of a cross-disciplinary and well-linked approach to DRR and CCA (Djalante & Thomalla, 2011; Sudmeier-Rieux, 2014). Strengthening resilience has been promoted as a potential option for
strengthening long-term approaches to DRR, particularly if it is paired with the more proactive and long-term approach of resilience adopted in the context of adaptation to climate change (D. Alexander, 2013; Djalante et al., 2013; Heazle et al., 2013; Sudmeier-Rieux, 2014; Wulff et al., 2015). Furthermore, failing to consider increasing intensity and frequency of disasters as a result of climate change has the potential to lead to maladaptation (Batabyal, 1998; Ford, Berrang-Ford, & Paterson, 2011; Mitchell & van Aalst, 2008; Palutikof et al., 2015; Serrao-Neumann et al., 2015).

Resilience is a multifaceted concept used across numerous fields such as ecology, economics, developmental and trauma psychology, engineering, development science, disaster management, and climate change (D. Alexander, 2013; Bahadur et al., 2013; Klein et al., 2003; Manyena, 2006; Sudmeier-Rieux, 2014). Thus, resilience has multiple definitions that are specific to context and purpose (D. Alexander, 2013; Baggio, Brown, & Hellebrandt, 2015; Bahadur et al., 2013; Cutter, 2016; Manyena, 2006; Matyas & Pelling, 2015; Sudmeier-Rieux, 2014).

A broad definition of disaster resilience incorporates the ability to prepare for, absorb and recover from adverse events (Adger et al., 2011; D. Alexander, 2013; Berkes & Ross, 2013; Cutter, 2016; Folke, 2006; Folke et al., 2010; Sudmeier-Rieux, 2014; Walker, Holling, Carpenter, & Kinzig, 2004; Watts et al., 2015). Resilience is a key underlying factor for dealing with gradual and sudden change (Berkes & Ross, 2013; Blanchet et al., 2017). The Lancet Commission definition of resilience is used here as it encompasses most facets of resilience in its contemporary conceptualization in the context of DRR and CCA, can be applied to multiple scales (local, national and regional), and is relevant to health. Therefore, resilience is defined here as the

“capacity of a system to absorb disturbance and reorganise while undergoing change...includes the capacity...to not only absorb a disturbance, but to innovate and transform” (Watts et al., 2015, p.15).

Numerous resilience frameworks have been developed in both DRR and CCA (Djalante et al., 2013; Overseas Development Institute, 2017a) with an increasing focus on operationalising and measuring resilience (Cutter, 2016). Furthermore, there is a recognised need for a comprehensive resilience framework linking DRR and CCA which suggests concrete actions and steps for building resilience through linking DRR and CCA (Djalante & Thomalla, 2011). However, just as there is no singular definition for resilience, there is no
‘one-size fits all’ framework (Cutter, 2016). For this reason the utility of resilience as a bridging concept between stakeholder groups has been questioned as the term is most often used within siloed fields rather than as an interdisciplinary concept (Baggio et al., 2015). It is believed that interdisciplinary engagement with resilience will be vital if the concept is to develop into an operational paradigm (Davidson et al., 2016).

The knowledge around why and how to build links between DRR and CCA is growing conceptually, and at international and national policy levels. However, the development of links between DRR and CCA is still in its infancy (UNFCCC, 2017b). Further context specific exploration into how these links are developed in different contexts at various scales is needed, particularly in health.

4.5 State of the literature on linking DRRH and CCAH

The following section provides an extensive review of the current state of the literature on linking DRRH and CCAH. Four key themes emerged from the literature review. First, there are increasing calls within the literature to link DRRH and CCAH. Second, public health actors have been identified as an important bridge for linking DRRH and CCAH. Third, climate change and climate-sensitive hazards that evolve into emergencies or disasters impact health through common pathways. Fourth, numerous conceptual, technical and operational synergies can be maximised by linking DRRH and CCAH.

4.5.1 Increasing call for linking DRRH and CCAH

The push for greater health involvement in DRR and CCA is highlighted in both areas of global policy and research literature (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a; Murray et al., 2015; Murray & Waite, 2018; UNFCCC, 2015a; UNISDR, 2015d, 2016b) as previously discussed in Sections 2.3.2 and 3.3.3. The need for linking DRRH and CCAH will increase as the role of health in DRR and CCA continues to grow. As the Sendai Framework has broadened the definition of hazards to include epidemics and pandemics as part of an all hazard approach to DRR (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray,

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9 The following section has been published during the course of the PhD candidature (Banwell, Rutherford, Mackey, & Chu, 2018). This section is a direct excerpt and has not been edited from the original article (Appendix 1).
2015a, 2015b; Murray et al., 2015; UNISDR, 2016b; WHO, 2015c), climate-sensitive diseases emerge as a potential area for overlap between DRRH and CCAH. Furthermore, some categories of climate change impacts, such as heatwaves, are not often classified as hazards associated with disasters within the climate change discourse (Åström, Åström, Andersson, Ebi, & Forsberg, 2017; Hess & Ebi, 2016; Hoy et al., 2014; Kovats & Hajat, 2008; D. Lowe, Ebi, & Forsberg, 2011). As DRR has expanded the definition of disasters to now incorporate slow-onset stressors such as drought there will also be increasing overlap in the implementation of DRR and CCA (Rovins, 2017). These potential areas for additional overlap between DRRH and CCAH have not previously been considered in the literature (Rovins, 2017). These overlaps have the potential to increase as DRR continues to move toward an approach which aims to address underlying risks, just as CCA seeks to address underlying vulnerabilities.

### 4.5.2 Public Health Actors: Critical in Bridging DRRH and CCAH

Practitioners and policy makers play an important role in bridging DRR and CCA (Kelman, 2015) and are vital contributors to effective implementation of DRRH and CCAH strategies (Keim, 2008). Public health professionals are experienced in dealing with risk, as well as vulnerability (created by the social determinants of health) in their day to day work functions. Therefore, public health professionals should be readily familiar with concepts and approaches that are commonly used in DRR and CCA (Ebi, Kovats, & Menne, 2006; Keim, 2008; Lindsay, 2003; Phibbs et al., 2016; Plough et al., 2013). Commonalities have been drawn between the concept of vulnerability and the determinants of health in disaster and climate change literature (Ebi et al., 2006; Lindsay, 2003; Phibbs et al., 2016; Plough et al., 2013). Public health professionals are experienced in dealing with long-term risks (Ebi & Villalobos Prats, 2015) fraught with uncertainty such as those that exist in models of climate change impacts on health (Ebi, 2011b; Ebi et al., 2016; Ebi & Villalobos Prats, 2015), as well as health issues which require multi-sectoral action (Hunter & Perkins, 2012; Phibbs et al., 2016; Signal et al., 2013). Addressing the complex risks of climate change and disasters will require public health professionals and administrators to draw on their experience addressing

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10 The following section is the summary of an excerpt which has been published during the course of the PhD candidature (Banwell, Rutherford, Mackey, Street, et al., 2018). For the published manuscript, please refer to Appendix 2.
complex public health challenges, such as when addressing obesity or tobacco control (Hunter, 2009; Signal et al., 2013). The unique positioning of the health sector within the community has the potential to improve implementation of adaptation and risk reduction strategies in health, as local-level CCA is important within a complex multi-level CCA response (Keim, 2008), and often local-level public health actors are tasked with DRRH (Keim, 2011). While recognizing the strengths of health professionals to potentially build these links, it is also important to acknowledge the silos which occur between groups working on DRRH and CCAH (Kelman, 2017; Moore et al., 2007; Nelson, Lurie, & Wasserman, 2007; Plough et al., 2013). Therefore, greater collaboration and coordination will be necessary between pertinent groups working on DRRH and CCAH (Aitsi-Selmi et al., 2015; UNFCCC, 2017b). The commonalities in health risk pathways of climate change and climate-sensitive disasters offer a starting point for building this collaboration.

4.5.3 Commonalities in health risk pathways

Health impacts of the disasters have commonly been discussed in terms of two categories, direct and indirect impacts on health and health systems (Aitsi-Selmi & Murray, 2015a; Overseas Development Institute, 2017a; Raich et al.; Shoaf & Rottman, 2000a). Similarly, the potential health impacts of climate change have been discussed in terms of direct and indirect pathways since the early nineties (IPCC, 2012; McMichael, 1993, 2013; McMichael et al., 2006; Morris et al., 2017; Watts et al., 2015; Watts et al., 2018; WHO, 1992). These were discussed in greater detail in Sections 2.3.1 and 3.3.1 respectively, and Appendix 2. Direct health impacts are unmediated impacts of climate-sensitive hazards on health (Haines et al., 2006; IPCC, 2012, 2014a; Keim, 2008; Keim & Abrahams, 2012; Overseas Development Institute, 2017a; Raich et al.; Shoaf & Rottman, 2000a; United Nations, 2014; Watts et al., 2015; Watts et al., 2018; WHO, 2015c). Indirect health impacts are mediated through ecosystems and human systems (Climate and Development Knowledge Network, 2012; Dar et al., 2014; Haines et al., 2006; IPCC, 2014a; Keim, 2008; Raich et al.; Shoaf & Rottman, 2000a; Watts et al., 2018; WHO, 2014b). Although not all disaster-related health impacts are the result of climate-sensitive hazards or influenced by climate change,

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11 The following section has been published during the course of the PhD candidature (Banwell, Rutherford, Mackey, Street, et al., 2018). This excerpt has been edited to allow better flow within the thesis. For the published manuscript, please refer to Appendix 2.
and not all climate change impacts are related to disasters, the impacts on human health and health systems have “considerable overlap” (Phalkey & Louis, 2016, p.455). Figure 4.1 provides a novel framework for identifying the commonalities in direct and indirect pathways of climate change and climate-sensitive disaster impacts on health, where previously these impact pathways have been considered separately. The framework was developed based on existing frameworks (contained in: McMichael, 2013; McMichael & Lindgren, 2011; McMichael et al., 2006; Phalkey & Louis, 2016; Watts et al., 2015).
Figure 4.1 Direct and indirect health impact pathways of climate change and climate-sensitive disasters
The commonalities between health impact pathways of climate change and climate-sensitive disasters can be understood when climate-sensitive disasters are considered as the interaction of hazard, exposure, vulnerability and capacity (IPCC, 2012, 2014b; United Nations General Assembly, 2017b). It is important to clearly understand that climate change is a driver for climate-sensitive health hazards. Here hazards are classified as climate-sensitive events that pose risks to human health. Climate-sensitive hazards include hydrological (e.g. flood and rainfall-triggered landslide); climatological (e.g. drought and wildfire); biological (e.g. relevant climate-sensitive diseases such as dengue, cholera, malaria, etc.) and meteorological hazards (e.g. temperature extremes, severe storms). This distinction is made based on the EM-DAT hazard classification (CRED, 2009) to ensure a holistic approach to climate-sensitive health hazards, similar to the all hazards in DRR. Understanding commonalities in health risks through this holistic approach:

- Enables the inclusion of hazards that have emerged as potentially climate-sensitive, such as weather and climate extremes, and some biological hazards. For example, relevant climate-sensitive infectious diseases such as dengue are classed as hazards, where traditionally these were not.
- Illustrates the extensive range of commonalities in health impact pathways due to the broad range of climate-sensitive health hazards. For example, this ensures meteorological hazards such as heatwaves are understood as health hazards from both a climate change and disaster perspective, even if the classification of heatwaves as a disaster or emergency occurs in a small portion of experienced heatwaves (Kovats & Hajat, 2008).
- Includes climate change-related morbidity and mortality that results from hazards not classified as extreme events or disasters. For example, heat-related health impacts are expected to increase as a result of anomalous changes in temperature which are not classed as extreme events (Scovronick et al., 2018; Vardoulakis et al., 2014), or outbreaks of climate-sensitive diseases such as dengue fever.
- Considers both acute hazards (e.g. outbreaks with potential for rapid proliferation and development into a health emergency or disaster) and slow-onset hazards (e.g. droughts or increasing dengue prevalence). The incorporation of slow-onset hazards broadens the conventional frame of hazards and enables the consideration of those which have conventionally not been considered as potentially leading to disasters.
These slow-onset hazards impact health through similar direct and indirect pathways, however this occurs at a different temporal scale to acute hazards.

In understanding these commonalities, the distinction between disaster and emergency is important. It is recognized that the term emergency is at times seen as synonymous with the term disaster (United Nations General Assembly, 2017b). However, in the context of this thesis, emergencies are events that “do not result in the serious disruption of the functioning of a community or society” (United Nations General Assembly, 2017b, p. 13). The key distinction here is the level of disruption and if it exceeds capacity to respond. Climate-sensitive disasters and emergencies are again distinguished from climate-sensitive health hazards which do not evolve into emergencies or disasters, but still impact health.

In this framework, climate change has potential impacts on health both as a driver of climate-sensitive disaster and emergency risk, as well as through climate-sensitive hazards that do not evolve into disasters. This distinction demonstrates the commonalities in health impact pathways of climate-sensitive hazards. It also considers both the variation in severity of the disruption and whether coping capacity is exceeded. In doing so, the framework recognises that not all climate-sensitive hazards result in disasters or even emergencies.

Finally, this framework incorporates an innovative interpretation of the potential hazard–disaster–impact relationship to allow for the inclusion of escalating health impacts. This is included through a cyclic component where climate-sensitive hazards may have impacts on health but these do not necessarily evolve into disasters until after they are mediated by ecosystems or human systems. For example, the initial outbreak of Ebola in 2014 impacted human health but was not seen as an emergency or disaster until after interacting with complex human systems. In this instance approaches for combating transmission of Ebola were not culturally or religiously accepted (Manguvo & Mafuvadze, 2015). This increased the health risk and impact, and thus the outbreak evolved into a health emergency (Manguvo & Mafuvadze, 2015).

While attributing any singular disease outbreak to climate change is not possible, the Ebola outbreak is given as an example of the complex feedback loop which can result in health impacts from climate-sensitive hazards escalating to emergencies and disasters. In this context, Ebola is considered to be a potential climate-sensitive hazard as the proliferation of the virus is potentially influenced by climate-sensitive factors such as climatological and meteorological conditions including periods of unusual drought and rain (K. Alexander et al.,
This draws attention to the consideration of a sub-group of infectious diseases which are potentially climate-sensitive but have not yet been identified as such due to current spatial and temporal limitations in meteorological and baseline health data (K. Alexander et al., 2015).

In addition to the commonalities identified here between the indirect and direct health impact pathways, there are of course important differences in these pathways not represented here. These include differences in time scales (IPCC, 2012) and spatial scales (IPCC, 2014a; Phalkey & Louis, 2016). Furthermore, not all disasters are climate change related, just as not all climate change impacts on health are the result of disasters. These different pathways are not captured in this framework as these considerations are outside its intended scope.

The health impacts pathways of both climate-sensitive disasters and climate change have numerous commonalities (Climate and Development Knowledge Network, 2012; Dar et al., 2014; Haines et al., 2006; IPCC, 2014a; Keim, 2008; Keim & Abrahams, 2012; Noji, 1996; Raich et al.; Shoaf & Rottman, 2000a; United Nations, 1992, 2014; Watts et al., 2018; WHO, 2014b). With this knowledge, it is reasonable to assume that the strategies in place, or being developed, to reduce these risks must also have numerous commonalities. By identifying common health risks, this framework takes the first step in developing a common language for identifying and addressing health risks in both the DRRH and CCAH spaces. It is important to build on this to develop links between DRRH and CCAH to address common health risks. To this end, the next section examines relevant literature to present the state of the art in linking DRRH and CCAH and establish a coherent foundation for this research.

4.6 Current state of the literature on linking DRRH and CCAH

Literature referred to in this section was primarily sourced from Scopus, Web of Science, PubMed, and Google Scholar using ‘disaster risk reduction’, ‘climate change adaptation’ and ‘health’ as search terms. Literature considered relevant to this review needed to explicitly refer to building integration, links, synergies or coherence between DRRH and

12 The following section has been published during the course of the PhD candidature (Banwell, Rutherford, Mackey, & Chu, 2018). This section is a direct excerpt and has not been edited from the original article (Appendix 1).
CCAH in the body of the text. It also draws on literature linking DRR and CCA not specific to health to inform this research with the latest knowledge.

Of the identified literature, four articles refer directly to how DRRH and CCAH could possibly link (e.g. Few, 2007; Keim, 2008, 2011; Sauerborn & Ebi, 2012). Three of these articles present theoretical concepts for developing linkages, including public health preparedness and response as adaptation to climate change, examination of health impact pathways, and the concept of vulnerability reduction (e.g. Few, 2007; Keim, 2008, 2011). The other advocates for greater collaboration around data collection to attribute climate change to disaster-related health impacts (e.g. Sauerborn & Ebi, 2012). None of these draw on primary empirical data to examine these suggestions in practice. Nor is there any subsequent work building on these suggestions, thus the ideas presented in these articles remain theoretical.

Since 2015, there has been an increase in explicit calls for building the coherence between DRRH and CCAH (e.g. Aitsi-Selmi et al., 2015; Aitsi-Selmi et al., 2017; Hashim & Hashim, 2016; Maini et al., 2017; Phalkey & Louis, 2016). However, the majority of articles are discussion pieces. Only two articles and the book chapter draw on case studies from secondary literature as examples to illustrate points for linkage (including: Aitsi-Selmi et al., 2017; Filho et al., 2018; Phalkey & Louis, 2016). This review revealed no articles which draw on empirical methods to explore how the links between DRRH and CCAH do or could occur. The key messages drawn from the articles above are discussed in the following sections.

4.6.1 Maximising conceptual synergy

Broader DRR and CCA literature indicates that there are potential areas for building synergies between DRR and CCA strategies (Begum et al., 2014; Djalante et al., 2013; Howes et al., 2015; Lei & Wang, 2014; Paton & Johnston, 2006; UNFCCC, 2016, 2017b; United Nations General Assembly, 2017a). Opportunities for synergy also exist between DRRH and CCAH approaches which address common health impact pathways of climate

13 The following section has been published during the course of the PhD candidature (Banwell, Rutherford, Mackey, & Chu, 2018). This section is a direct excerpt and has not been edited from the original article (Appendix 1).
change and climate-sensitive disasters (Section 4.5.3). Anchoring DRR and CCA on conceptual synergies will be important in reaching shared goals of reducing long-term risks (Roberts et al., 2015; UNFCCC, 2017b). Furthermore, maximising conceptual synergies will significantly reduce duplication, and improve the effectiveness and efficiency of implemented strategies (Howes, 2014; IPCC, 2012, 2014b; Roberts et al., 2015; Schipper & Pelling, 2006; Thomalla et al., 2006; UNFCCC, 2017b). Conceptual synergies are the concepts prevalent in both DRRH and CCAH which can provide foundations for joint action. Potential conceptual synergies in health identified through this extensive literature review include resilience, vulnerability and risk (Aitsi-Selmi et al., 2017; Few, 2007; IPCC, 2012; Keim, 2008, 2011; UNFCCC, 2017b).

Resilience inevitably forms part of DRR and CCA discourse in the context of development and humanitarian aid (Bahadur et al., 2013; Matyas & Pelling, 2015; Sudmeier-Rieux, 2014). Both approaches work towards resilience as a common aim, therefore meaningful and systematic engagement with resilience is necessary (Djalante et al., 2013; Djalante & Thomalla, 2011; Howes, 2014; Porfiriev, 2015; Roberts et al., 2015; Schipper & Pelling, 2006; Sudmeier-Rieux, 2014; UNFCCC, 2017b). This has also been recognized in the literature on linking DRRH and CCAH (Keim, 2008). However, as previously discussed in Section 4.4.1, resilience is known to have many definitions (D. Alexander, 2013; Blanchet et al., 2017; Castleden et al., 2011; Dahlberg, Johannessen-Henry, Raju, & Tulsiani, 2015; Manyena, 2014) and the utility of resilience as an interdisciplinary bridging concept has been contested (Baggio et al., 2015; Beichler, Hasibovic, Davidse, & Deppisch, 2014; Van de Pas, Ashour, Kapilashrami, & Fustukian, 2017).

Similarly, meaningful engagement with the concepts of risk and vulnerability occur in both DRRH and CCAH (Begum et al., 2014; Climate and Development Knowledge Network, 2012; Kelman et al., 2015; Yuan, Wei, Wang, & Mi, 2017). Reducing vulnerability is important in addressing the health impacts of both disasters and climate change, as discussed in Sections 2.3.2 and 3.3.2. Risk and vulnerability reduction are cross-cutting issues in both DRRH and CCAH (Aitsi-Selmi et al., 2017; Few, 2007; Keim, 2008, 2011). The concepts of vulnerability and risk link DRR, CCA and public health practice in multiple ways. First, PHEP/HEM has been discussed as reducing climate change vulnerability and disaster risk (Few, 2007; Keim, 2008, 2011). Second, health status has been highlighted as a contributor to disaster and climate change vulnerability and risk (Climate and Development Knowledge Network, 2012; J. Tucker et al., 2015; United Nations, 2014; Watts et al., 2015; WHO,
Finally, the determinants of vulnerability to disasters and climate change are similar to the determinants of the health approach commonly used in public health (Phibbs et al., 2016). Incorporation of the social determinants of health has been suggested as a potential opportunity to strengthen both DRRH (Phibbs et al., 2016) and CCAH, particularly if used in conjunction with an iterative approach to decision-making (Ebi, 2011b; Ebi et al., 2016). Therefore, conceptual synergies in addressing underlying risks and vulnerabilities are potential motivators for linkage. Further to this, anchoring DRRH and CCAH on the social determinants of ill-health and vulnerability has been suggested as a potential strategy for building synergy in addressing climate change risk over the long-term (WHO, 2013, 2014b, 2015c). This is particularly important for addressing indirect health impacts, such as those resulting from food and water insecurity (Talukder et al., 2017; Wheeler & Von Braun, 2013).

As DRR and CCA continue to become more concerned with building resilience, and reducing underlying risks and vulnerabilities, DRR and CCA will have greater conceptual overlaps (IPCC, 2012; Porfiriev, 2015; Rovins, 2017). Resilience, risk and vulnerability concepts present potential opportunities for building conceptual synergies between DRRH and CCAH. Further exploration is needed to understand how these concepts serve as potential joint pathways for linking DRRH and CCAH and thus reducing health impacts. However, the utility of these concepts to link DRRH and CCAH is still unknown.

### 4.6.2 Maximising technical and operational synergies

Linking DRRH and CCAH is important to build on existing technical expertise and tools, as well as implementation of both approaches, in order to maximise technical and operational synergies. Technical and operational synergies are those areas of work which offer potential for joint strategies to reduce duplication and strengthen tools, expertise and implementation of DRRH and CCAH. This shared learning will strengthen the rigor, robustness, effectiveness and efficiency in addressing climate change and disaster risks long-term.

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14 The following section has been published during the course of the PhD candidature (Banwell, Rutherford, Mackey, & Chu, 2018). This excerpt has been edited, with the majority of the content reduced to a table to allow better flow within the thesis. For the published manuscript, please refer to Appendix 1.
term (Dar et al., 2014; Few, 2007; Keim & Abrahams, 2012; Kelman et al., 2016; Lechat, 1990; Murray et al., 2015). Informing disaster risk with the latest climate knowledge and adaptation expertise has been suggested in broader DRR and CCA strategies and is also applicable in health (Hoy et al., 2014; Kruk et al., 2015; Mayhew et al., 2014; WHO, 2014b). This is particularly pertinent as DRR needs to shift to a long-term risk prevention approach to address the short- and long-term risks associated with climate change (Dar et al., 2014; Few, 2007; Keim & Abrahams, 2012; Lechat, 1990; Murray et al., 2015; WHO, 2014b, 2015c).

Similarly, linking DRRH and CCAH can maximise operational synergies by reducing the burden of implementing DRRH and CCAH separately, including duplicated human and financial resources, particularly in resource-constrained contexts (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a; Howes, 2014; Mayhew et al., 2014; Sauerborn & Ebi, 2012; Serrao-Neumann et al., 2015; UNFCCC, 2017b; Watts et al., 2015). Technical and operational synergies are presented together (Table 3) as often the implementation of DRRH and CCAH (the operational aspect) cannot be separated from the tools and expertise behind DRRH and CCAH action (the technical aspect).

Potential operational synergies exist in the commitment and maintenance of human and financial resources dedicated to the implementation of joint DRRH and CCAH action. There has been wide recognition of the operational needs to link DRRH and CCAH (Aitsi-Selmi et al., 2015; Mayhew et al., 2014; Sauerborn & Ebi, 2012; UNFCCC, 2017b; Watts et al., 2015). Increased synergies across DRRH and CCAH are suggested to improve funding opportunities (Aitsi-Selmi et al., 2015), as well as the potential for joint policy and capacity development with cross-sectoral engagement (Aitsi-Selmi & Murray, 2015b). The seven areas of potential technical synergies identified through the literature review include: national policies; joint risk assessments; consideration of health impact pathways; health systems strengthening; health infrastructure resilience; Early Warning Systems (EWS); and disaster preparedness and response (Table 3). These technical synergies are also opportunities for potential operational synergies.
<table>
<thead>
<tr>
<th>Synergy</th>
<th>Explanation and examples</th>
<th>Knowledge gaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>National policies</td>
<td>• Essential for working towards shared goals limiting conflicting or maladaptive strategies.</td>
<td>• There is no research on links between DRR and CCA through policy processes in health.</td>
</tr>
<tr>
<td></td>
<td>• Can potentially facilitate further technical and operational synergies in implementation.</td>
<td></td>
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<td></td>
<td>• National policy processes, such as the Joint NAPs of several countries in the Pacific important in developing joint priorities (UNFCCC, 2016, 2017b), e.g. Solomon Islands and Vanuatu (Nalau et al., 2016); and Framework for Resilient Development in the Pacific An Integrated Approach to Address Climate Change and Disaster Risk Management 2017-2030 (Nalau et al., 2016; Pacific Resilience Partnership, 2016).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The H-NAP process or similar disaster policy and planning processes in health may also offer opportunities for building technical and operational synergies.</td>
<td></td>
</tr>
<tr>
<td>Joint risk assessments</td>
<td>• Joint risk and vulnerability assessments are important in assessing disaster and climate change risks to the health system and health of populations, and linking DRRH and CCAH (Few, 2007; Murray et al., 2015; Phalkey &amp; Louis, 2016).</td>
<td>• Challenges due to uncertainty and a lack of comprehensive climate change data; and little research of climate change on health systems (Phalkey &amp; Louis, 2016).</td>
</tr>
<tr>
<td></td>
<td>• Considering long-term climate change risk and vulnerability is essential in understanding long-term risks to health and reduce maladaptation (Batabyal, 1998; Ford et al., 2011; Mitchell &amp; van Aalst, 2008; Serrao-Neumann et al., 2015).</td>
<td></td>
</tr>
<tr>
<td>Consideration of health impact</td>
<td>• Presents a potential method for simultaneously identifying common disaster and climate change vulnerabilities and risks related to health, as well as technical and operation synergies in DRRH and CCAH strategies along the health impact pathway (Few, 2007).</td>
<td>• Examining health impact pathways and identifying points for joint intervention</td>
</tr>
</tbody>
</table>
| Pathways | Joint interventions seen on a continuum, e.g. incorporating climate change mitigation into the reconstruction of health facilities post-disaster, and the consideration in long-term changes in hazard characteristics resulting from climate change (Few, 2007).  
Could facilitate the consideration of the full spectrum of upstream to downstream DRRH and CCAH actions; and thus potentially create greater opportunities for identifying strategies for long-term proactive risk reduction and adaptation (D. Alexander, 2013; Djalante et al., 2013; Heazle et al., 2013; Sudmeier-Rieux, 2014; Wulff et al., 2015). | Joint action and research needed to identifying long-term risks and priorities for the health system in the face of climate change.  
Remains theoretical and its utility has not yet been examined in practice. |
| --- | --- | --- |
| Health systems strengthening | Potential no-regrets strategy for linking DRRH and CCAH (Phalkey & Louis, 2016).  
Important approach in DRRH, particularly health systems resilience since the Ebola outbreak (Bennett et al., 2017; Gostin & Friedman, 2015; Kieny, Evans, Schmets, & Kadandale, 2014; Kruk et al., 2015; Kutzin & Sparkes, 2016; Moon et al., 2017).  
Important approach in CCAH in H-NAPs (Ebi & Villalobos Prats, 2015), and the WHO’s Operational framework (WHO, 2015c). | The extent of use of linked DRRH and CCAH initiatives in building health infrastructure resilience is currently unknown, and is particularly underexplored in middle and low-income countries. |
| Health infrastructure resilience | Technical guidance and knowledge in DRRH on health facility and infrastructure resilience dates back to the 2000s (European Commission, UNISDR, & WHO WPRO, 2010; PAHO, 2000b; UNISDR, WHO, & World Bank, 2008; WHO, 2015a). A lot of these have not previously incorporated CCAH.  
Climate change literature often refers to ‘climate-proofing’ health infrastructure (Ebi & Hess, 2017; UNFCCC, 2017a); little mention of how this fits with existing DRRH efforts.  
Some approaches to building resilience of health facilities beginning to emerge that | |
incorporate both DRRH and CCAH, and sometimes climate change mitigation, e.g.: consideration of climate change risks in the reconstruction of New York city hospitals following hurricane Sandy (Kinney et al., 2015; New York City, 2013, 2014; Rosenzweig & Solecki, 2014); SMART hospital initiative (PAHO & WHO, 2017); Safe Hospitals Initiative specifically names climate change as a key consideration (WHO, 2015a).

- It is important to build on the technical expertise developed in both DRRH and CCAH to maximise synergies in implementation.

<table>
<thead>
<tr>
<th>EWS</th>
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<tbody>
<tr>
<td>• Both DRRH and CCAH promote EWS as essential tools for preparing for and preventing poor health outcomes from hazards and climate-sensitive diseases (Ebi &amp; Schmier, 2005; IPCC, 2014a; Thomalla et al., 2006).</td>
</tr>
<tr>
<td>• It is important to draw together the separate DRRH and CCAH approaches to ensure they are informed by the most recent climate change science, and early warning and risk communication expertise; and avoid unnecessary technical and operational duplication (e.g. heatwave EWS and risk communication).</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Disaster preparedness and response</th>
</tr>
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<tbody>
<tr>
<td>• Disaster preparedness and response in health have been recognized as adaptation action for climate change by reducing the potential immediate health risks posed by these events (Keim, 2008, 2011).</td>
</tr>
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</table>

- Limited research examining how to link the separate initiatives to draw on potential synergies.

- Use of climate change data in preparedness and response is under explored.
4.7 Rationale and Research Questions

The extensive literature review in Chapters 2 to 4 has highlighted the importance of linking DRRH and CCAH. Linking these approaches is important to address common direct and indirect health impacts of climate change and climate-sensitive hazards which evolve into emergencies or disasters (Section 4.5.3). Furthermore, it was identified through this review that linking DRRH and CCAH is important to ensure effective, efficient and robust strategies for addressing health risks of disasters and climate change (Section 4.3). With the increasingly central role of health as a key stakeholder in both DRR and CCA, it is necessary to explore how DRRH and CCAH can be linked.

The review synthesised current published research and highlighted key knowledge gaps. It presented potential areas for linking DRRH and CCAH, classified into conceptual, technical and operational synergies. However, despite the importance of linking DRRH and CCAH established by this review, literature on how to link DRRH and CCAH is largely restricted to discussion pieces. Therefore, a significant knowledge gap still exists regarding how these links can occur and be developed in the context of health (Aitsi-Selmi & Murray, 2015a; Dar et al., 2014; Hancock et al., 2015; Murray, 2014; Murray et al., 2015; Sauerborn & Ebi, 2012).

There is a distinct need to develop an in-depth understanding of how to link DRRH and CCAH, including: challenges and opportunities for developing links; how these links could and do occur; and how to establish and strengthen them in real world contexts. This will be a crucial step in identifying opportunities for links, as well as establishing and sustaining these links. This is particularly pertinent in resource constrained settings and countries experiencing pervasive and cumulative disaster and climate change risks (UNFCCC, 2017b). Among these countries, linking DRRH and CCAH has been identified as a key challenge in the management of health risks in the Philippines (Law, 2016). However, there is a need for research exploring how these links can be established, strengthened and simultaneously managed in health.
Therefore, empirical research was undertaken to investigate the actual and potential linkages between DRRH and CCAH through a Case Study of the Philippines. This research will aim to address the over-arching Research Question (RQ):

*How can Disaster Risk Reduction in health (DRRH) and Climate Change Adaptation in health (CCAH) be linked?*

As explained in Chapter 5, a case study approach is used focused on the Philippines. Three Focus Questions (FQ) were identified to address key aspects of this overall RQ:

- **FQ1** What are the key priorities and gaps for DRRH in the Philippines?
- **FQ2** What are the key priorities and gaps for CCAH in the Philippines?
- **FQ3** How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links?

FQ1 and FQ2 provide necessary in-depth understanding of approaches taken in DRRH and CCAH in the Philippines. The comparison of these findings offers greater understanding of challenges for linking DRRH and CCAH, thus also contributes to findings relating to FQ3. Finally, FQ3 examines areas for linkage between DRRH and CCAH in the Philippines. This will be based on areas of potential linkages identified through the literature review and built on by the Case Study of the Philippines.

### 4.8 Conclusion

The extensive literature review presented in Chapters 2 to 4 provide the background, rationale, and theoretical foundation for the research. In doing so it highlights the importance of linking DRRH and CCAH, as well as key knowledge gaps and rationale leading to the research questions. Chapter 4 presented the state of the art on linking DRRH and CCAH. Linking DRRH and CCAH is important because the role of health actors in both DRR and CCA is increasing; climate change and climate-sensitive disasters impact health through common pathways; and public health actors are well positioned to build these links. Links in health could potentially be formed by maximising conceptual, and operational and technical synergies, discussed in Section 4.6. However, there are considerable knowledge gaps surrounding how DRRH and CCAH can be linked. Therefore, this research aims to build knowledge in this area through empirical investigation. The following Chapter presents the research methodology adopted in this research.
CHAPTER 5: RESEARCH METHODOLOGY

5.1 Introduction

The previous three Chapters of this thesis presented the literature review, rationale, and research questions to be addressed in this research. This Chapter outlines the methodology to address the three focal research questions. The Chapter includes: the conceptual framework and how it relates to the research questions; the research approach and Case Study setting; the methods of data collection and analysis; as well as research rigour and ethics.

5.2 Conceptual and methodological underpinnings

This section provides background of the conceptual framework guiding this research and the methodological approach. It provides detail on the epistemological grounding, qualitative study design, and case study approach that was adopted.

5.2.1 Conceptual Framework and Research Questions

The conceptual framework for this research (Figure 5.1) assists to organize key concepts and results presented in the thesis, and has been initially developed through the extensive literature review and refined during the research process. It was developed based on review of three contextual fields: (1) DRRH (Chapter 2), (2) CCAH (Chapter 3), and (3) the linkage of DRRH and CCAH (Chapter 4). This conceptual framework shows how these three contextual fields relate to each other, and indicate how each FQ fits into the conceptual framework to answer the overarching RQ: How can DRRH and CCAH be linked? As such, the conceptual framework is used as the basis for summarising the findings for the RQ and FQs (Chapter 9).

The framework acknowledges that both DRR and CCA sit under the broader umbrella of sustainable development. However, it is important to note that this research only focuses on the central part of the conceptual framework. As such this does not examine sustainable development in depth. Rather, it places linking DRRH and CCAH under the broader umbrella of sustainable development.
5.2.2 Epistemology and ontology

This research has taken a constructivist approach, as has been seen in other case study research (Crowe et al., 2011; DeVries, 2005; Merriam, 2009; Yin, 2014). I used inductive reasoning and qualitative data collection methods with the aim of understanding how DRRH and CCAH are, and could be, linked. In doing so, I recognise that striving for objectivity is critical in the research process and I therefore incorporated a number of measures to strengthen validity and reliability (Yin, 2014) such as triangulation and prolonged data collection. My research approach aimed to strengthen the reliability of the findings through triangulation of multiple data sources and data collection techniques (Yin, 2013, 2014). Reducing potential sources of bias was a major consideration, including through prolonged data collection undertaken over one year working with organisations involved in DRRH and CCAH and incorporation of member checking into the data collection methods. These aspects of reliability, validity and bias reduction are discussed in greater detail in Sections 5.5.1 and 5.5.2.
5.2.3 Qualitative study design

Qualitative research methods were employed in this study. Qualitative methods were deemed appropriate to facilitate the in-depth exploration required to understand policy, governance and implementation processes, which are tightly bound to the context in which they are created (Babbie, 2014; Bryman, 2012; Yin, 2016). Multiple data sources were used within the research to ensure exploration through multiple lenses and improve the data credibility of research. Only qualitative data analysis techniques are used for this research, in line with the type of data collected.

5.2.4 Case Study Approach

A case study approach was used for this research to examine the policy, governance and implementation of DRRH and CCAH in the Republic of the Philippines. The Case Study was supplemented by global informant interviews, discussed further in Sections 5.4.3 and 5.5.1.

A case study approach is a method of empirical enquiry that involves intensive investigation of a phenomena within its real-life context through the study of a bounded system (Creswell, 2013; Denzin & Lincoln, 2011; Yin, 2014). It involves the development of in-depth and rich understanding built on triangulating data from multiple sources of evidence (Creswell, 2013; Yin, 2014). The case study approach in this research is primarily instrumental (Creswell, 2013; Yin, 2014), seeking to understand a specific issue – the linking of DRRH and CCAH strategies.

A case study approach was deemed appropriate for this research due to the qualitative and context-specific nature of the issue being investigated (Yin, 2014). Additionally, a case study approach allowed in-depth exploration of the complex topic in a real decision-making context (Yin, 2014). Furthermore, case studies have commonly and successfully been employed in organisational settings (Creswell, 2013), and identified as a useful approach in exploring issues in health (Merriam, 2009). This research therefore uses a case study of the Philippines, discussed in detail in the following section.
**5.2.4.1 Rationale and approach to the Philippine Case Study**

The Philippines is a highly relevant setting for the Case Study for five reasons. First, the country faces significant disaster and climate change-related health risks. Second, significant efforts have been made to address these risks through DRR and CCA. Third, health stakeholders are engaged in both of these processes. Fourth, the Philippine DRRH system is mature and experienced so as to enable the discussion of how DRRH and CCAH can potentially link. Finally, linking DRRH and CCAH has been identified as a key challenge in the management of health risks in the Philippines (Law, 2016).

The Case Study focused on policy and implementation of DRRH and CCAH on a national level. Due to the decentralised nature of the Philippine health system, interviews and observations also took place at regional and local levels to explore the implementation of technical and operational synergies, and highlight regional and local experiences. Of the 18 administrative regions in the Philippines, interviewees came from the National Capital Region, Bicol Region, Eastern Visayas and Northern Mindanao. These regions were recommended through key focal points of the DOH, and had good practices and unique valuable experiences which were identified by key stakeholders as holding potential value for the study. The rationale for selecting each region was:

- **National Capital Region**: disaster and climate risk associated with high population density, and long standing good practices in managing health-related disaster risks within some local governments within the National Capital Region.
- **Bicol Region**: Significant disaster and climate risks; long standing good practices in managing both climate and disaster risk, inside and outside health.
- **Eastern Visayas**: Experience with category 5 Super Typhoon Yolanda (Haiyan) in 2013 and the considerable recovery initiatives in health preparedness for response, and health governance relating to disaster risks; and highest proportion of poorest provinces.
- **Northern Mindanao**: Experience with category 5 Super Typhoon Pablo, strong leadership in DRRH.
5.3 Background to the Case Study Setting – The Philippines

This section provides the background to the research Case Study including the risk landscape; health system; and relevant policies and structures in DRR, DRRH, CCA and CCAH.

5.3.1 Climate-related hazards

The Philippines is one of the most at risk countries to both disasters and climate change in the world. The Philippines was ranked as having the third highest disaster risk from 2012-2016 (Kirch et al., 2017). In 2017 the country was ranked 6th most affected by all types of disasters with 4.87 million people affected (CRED & USAid, 2017). The Philippines was identified as the fifth most affected country between 1997 to 2016 due to long-term risk from weather-related disasters (Eckstein, Künzel, & Schäfer, 2018). However, calculation of this risk did not include climatological hazards (such as droughts) or biological hazards (such as infectious disease outbreaks). Furthermore, the Philippines was identified as having the highest expected annual mortality, affected population and Gross Domestic Product loss as a result of climate-related hazards. However, this study did not account for additional risks associated with climate change, or include biological hazards (Shi et al., 2016).

The Philippines faces such significant disaster and climate change risk due to high exposure to natural hazards, as a result of geographic location, and the high proportion of the population that is vulnerable to these hazards (Birkmann et al., 2014; Pullin, Tapia, & Perez, 2010; UNISDR, 2015a; Yumul, Cruz, Servando, & Dimalanta, 2011). An average of 19.4 typhoons enter the Philippine Area of Responsibility each year, of which approximately 9 make landfall (Cinco et al., 2016). Of the disasters between 1900 and 2018, climate-sensitive disasters (resulting from: drought, epidemics, flood, landslides related to precipitation events, storms, and wildfire) caused 70% (total = 56,623) of deaths (Guha-Sapir, Below, & Hoyois, 2018). Climate-sensitive disasters affected close to 206 million people in this time period (Guha-Sapir et al., 2018). Of the deaths caused by climate-sensitive hazards during this time, storms (including typhoons and tropical depressions) caused the greatest number of deaths and affected the most people, over 67 million people (Guha-Sapir et al., 2018). Some key typhoons in the Philippines include: Typhoon Reming (2006), Typhoon Ondoy (2009), and Super Typhoon Yolanda (internationally known as Haiyan; 2013; HEMB, 2010; HEMB, 2014, 2016a). Typhoon Yolanda was one of the strongest typhoons to hit the Philippines killing over 6,300 people, with 1,061 missing and 28,689 injuries (Lagmay et al., 2015).
Climate change is expected to impact the Philippines primarily through increased temperatures, decreased precipitation during dry months, as well as increased intensity of extreme precipitation events and typhoons (PAGASA, 2011; Villarin et al., 2016). Under the A1B emissions scenario (rapid economic and population growth with increase in innovative technologies across carbon intensive and sustainable sources (IPCC, 2000)), the Philippines is expected to experience increases in minimum and maximum daily temperatures by 2020 and 2050, with an increase in mean average temperature of up to 2.2°C by 2050 (Cinco, Hilario, de Guzman, & Ares, 2013; PAGASA, 2011; Villarin et al., 2016). As climate change progresses it is expected that dry seasons will become drier and wet seasons will see an increase in extreme precipitation and risk of flooding (Cinco et al., 2013; PAGASA, 2011). Furthermore, maximum wind velocity of tropical cyclones is projected to increase by 9% in the coastal regions of the Philippines (World Bank, 2013), with an increased risk of super typhoons in coming decades (Comiso, Perez, & Stock, 2015; World Bank, 2013). Sea-level rise has also been highlighted as a key climate change risk as the majority of the population lives on the coastline, though there is a paucity of country-level data on expected rises in sea-level (Villarin et al., 2016). There is currently limited data in the Philippines on the expected increase of climate-sensitive biological hazards as a result of climate change.

5.3.2 Health system

The Philippine health system has been decentralised since 1991 as a result of the Local Government Code (Government of the Philippines, 1991b). Through the devolution Local Government Units (LGUs) were given autonomy over health services (Government of the Philippines, 1991b; Romualdez et al., 2011). LGUs include Provincial government, in charge of secondary health services, as well as Municipal and City governments in charge of primary health services (Romualdez et al., 2011). The DOH serves as the national governing agency in charge of developing national plans, policies, guidelines and standards, as well as enforcing regulatory standards (Romualdez et al., 2011). The organisational structure of the DOH is available in Appendix 3. The DOH provides technical assistance and direction to LGUs through the regional Centres for Health Development (Romualdez et al., 2011). It also takes responsibility for tertiary health service provision through retained and specialist hospitals (Romualdez et al., 2011). Public health services are delivered by the LGUs, with the DOH coordinating with LGUs for targeted priority programmes such as tuberculosis (Romualdez et al., 2011). Due to decentralisation and privatisation significant challenges persist with inequitable access to health services (Romualdez et al., 2011). This problem is
worsened further by fragmentation between the national and local governance levels (Romualdez et al., 2011).

Significant efforts in recent decades have focused on improving access, quality and efficiency of health services, most recently through the pursuit of UHC, known as ‘Kalusugan Pangkalahatan’ (DOH, 2010a; Romualdez et al., 2011). UHC was introduced by the Aquino Administration in 2010 (DOH, 2010a) and strengthened by the National Objectives for Health 2011-2016 (DOH, 2011b; Romualdez et al., 2011). Since this time commitment to UHC has been continued by the current Duterte Administration via the Philippine Health Agenda 2016-2022 through one of the three pillars of strengthening health delivery networks (DOH, 2016a).

5.3.3 DRR policies and structures

This section presents the DRR policies and structures on a national level, and briefly discusses the corresponding regional and local structures. To provide further necessary background to this research, the following subsection introduces DRRH in the Philippines.

DRR is often referred to as Disaster Risk Reduction and Management (DRRM) in the Philippines. DRR began with the National Disaster Coordination Council, established in 1978 as the first peak national body for coordinating disaster response (Benson, 2009; Department of National Defense, 2011; IFRC, 2012; Pulhin et al., 2010). Since the adoption of the HFA in 2005 and the Philippine Disaster Risk and Reduction Management Act of 2010 (DRRM Act; RA 10121) DRR has become less reactive with risk reduction taking a more central focus (Government of the Philippines, 2010; IFRC, 2012; IFRC & UNDP, 2014). The DRRM Act aimed to ensure a holistic, integrated, and proactive DRRM approach, involving engagement of all stakeholders at all levels including the local community (Government of the Philippines, 2010).

The DRRM Act together with its implementing rules and regulations rebranded the National Disaster Coordination Council as the National Disaster Risk Reduction and Management Council (NDRRMC) to serve as a multi-sectoral coordinating body across all four DRM phases (Government of the Philippines, 2010). Different Sectors are appointed as leads for each DRM phase with membership including all sectors (Government of the Philippines, 2010):

- **Chairperson:** Secretary of the Department of National Defense
• **Vice Chairs:**
  - *Disaster Preparedness:* Secretary of the Department of the Interior and Local Government
  - *Disaster Response:* Secretary of the Department of Social Welfare and Development
  - *Disaster prevention:* Secretary of the Department of Science and Technology
  - *Recovery and Rehabilitation:* Director-General of the National Economic and Development Authority

The DRRM Act also institutionalised corresponding regional and local structures, known as Regional DRRM Councils (RDRRMC) and Local DRRM Councils (Government of the Philippines, 2010). These structures have similar leadership and multi-sectoral composition as the NDRRMC (Government of the Philippines, 2010).

The NDRRMC was tasked with developing the National DRRM Framework (NDRRMF), and National DRRM Plan 2011-2028 (NDRRMP; Government of the Philippines, 2010). The NDRRMF presents the foundational principles for the DRRM approach in the Philippines including the vision of “safer, adaptive and disaster resilient Filipino communities toward sustainable development” (Department of National Defense, 2011, p.16). It vocalises the need for continuing the paradigm shift from Disaster Management to a proactive and preventive approach to DRR and addressing underlying vulnerabilities (Department of National Defense, 2011). The NDRRMP outlines the outcomes, outputs and activities, as well as stakeholders and timelines for implementation according to the long-term goals associated with each of the four DRM phases (NDRRMC, 2011). Following the creation of the NDRRMF and NDRRMP, the National Disaster Response Plan and National Disaster Preparedness Plan were created (NDRRMC, 2014, 2015). These plans outline roles and responsibilities of national agencies in preparedness and response in the country (NDRRMC, 2014, 2015). The role of health in these plans and policies will be discussed in the following section.

### 5.3.3.1 Development and approach of DRRH

Health is clearly recognised in national DRR policies in the Philippines. The health sector has a significant role in disaster response particularly as head of the ‘Health Cluster’ for disaster response (DOH, 2016c; NDRRMC, 2014). Health has a more limited role in
prevention, and recovery and rehabilitation, as can be seen in the NDRRMF and NDRRMP (NDRRMC, 2014, 2015). However, as a member of the NDRRMC it is also expected to participate in prevention and preparedness (DOH, 2016c). Appendix 4 presents a summary of how health is represented in current national DRR policies.

The role of the health sector in DRR is supported by numerous DRRH policies from the DOH (College of Public Health, 2016). At the time of data collection HEMB were working to consolidate these policies into what was named the “Integrated Policy for Disaster Risk Reduction and Management in Health” (DOH, 2016c), referred to in this thesis as the ‘Omnibus Policy’. Appendix 4 summarises the key points of the most relevant overarching policies and plans on DRRH.

The DOH was mandated as the lead agency in health emergency preparedness and response in 1991 (DOH, 1999, 2016c) with the Disaster Management Unit of the DOH created under the Office of the Secretary in 1992 (Health Emergency Management Staff & WHO WPRO, 2005). In 1994 a concurrent program was created called the Strategic Tactical Options for the Prevention of Disasters, Epidemics, Accidents and Trauma, known as STOP DEATH (Health Emergency Management Staff & WHO WPRO, 2005). These two programmes were later merged, and DRRH institutionalised in the DOH (DOH, 1999; Health Emergency Management Staff & WHO WPRO, 2005). The integrated DRRH program was initially known as the Health Emergency Management Staff (HEMS) under the Office of the Secretary (Health Emergency Management Staff & WHO WPRO, 2005), and later became ‘HEMB’ (Health Emergency Management Bureau; DOH, 2016c; Health Emergency Management Staff & WHO WPRO, 2005). HEMB carries out these functions through two Divisions, Preparedness and Response, and the national Health Emergency Management Operations Centre (OpCen; DOH & WHO WPRO, 2012; HEMB, 2012).

The Preparedness Division of HEMB leads the emergency and disaster preparedness of the health sector to ensure effective response thus decreasing mortality and morbidity (HEMB, 2014). Its functions include (College of Public Health & HEMB, 2016; DOH & WHO WPRO, 2012):

1. Developing prevention and preparedness policies, plans, programmes and standards;

2. Lead and coordinate the health sector in preparedness efforts;
3. Provide capacity building, as well as technical, consultative and advisory services to implementing agencies; and

4. Carry out and coordinate research in DRRM in health.

The health preparedness approach in the Philippines is based on a concept referred to as the ‘10 Ps of Preparedness’ (College of Public Health & HEMB, 2016; DOH, 2010b; HEMB, 2012, 2014). These ten points guide the implementation and priorities of health emergency and disaster preparedness in the country, and form the basis for DRRH plans (DOH & WHO WPRO, 2012). They include: ‘Policy formulation and development’; ‘Plan development’; ‘People’ (staffing and capacity); ‘Partnership building’; ‘Program development’ (development of technical operations and programs); ‘Physical infrastructure development’; ‘Practices’ (documentation and monitoring and evaluation); ‘Peso and logistics’ (funding and prepositioning of supplies); ‘Promotion and advocacy’; and Packages of services (specific services to address health needs in emergencies and disasters; DOH & WHO WPRO, 2012; HEMB, 2014).

The Response Division of HEMB is responsible for implementing, coordinating and leading the health response to emergencies and disasters (College of Public Health & HEMB, 2016; DOH & WHO WPRO, 2012). Its functions include (College of Public Health & HEMB, 2016; DOH & WHO WPRO, 2012):

1. Run the OpCen as the alert and monitoring system for health emergencies;

2. Lead and coordinate health team deployment in disaster and emergency response;

3. Coordinate and integrate health sector emergency response.

The health emergency and disaster response approach in the Philippines is centred on providing “a well-organized and effective response” (HEMB, 2015, p.14). The approach is designed to address all hazards and reach across multiple levels and sectors, in the recognition of the importance of stakeholders across various levels and sectors in effective response (HEMB, 2015). Five components of the Health Emergency and Response Management Framework are the management of event/incident, service providers, non-human resources, victims, and the information system (HEMB, 2015). In the context of the high risk of climate-sensitive disasters in the Philippines, the national government works to
address the increasing risks associated with climate change, outlined in the subsequent section.

5.3.4 CCA policies and structures

To provide further necessary background to the Case Study, this section presents the climate change policies and structures of the Philippines and the next subsection presents CCAH in the Philippines.

The Philippines became a signatory of the United Nations Framework Convention on Climate Change in 1992 and a signatory to the Kyoto Protocol in the late 1990s (Department of National Defense, 2011; DOH, 2013a). After this began a process of National Communication on Climate Change meetings, which began the development of the Climate Change Act of 2009 (Climate Change Act; RA 9729; Climate Change Commission, 2011; Climate Change Commission, 2015; Government of the Philippines, 2009).

The Climate Change Act acknowledged the vulnerability of the Philippines to climate change and thus the importance of preventing and reducing negative impacts (Government of the Philippines, 2009). It aimed to systematically address climate risks through mainstreaming CCA and mitigation into policies, development plans and poverty reduction strategies (Climate Change Commission, 2011, 2015; Government of the Philippines, 2009; MDG Achievement Fund, 2012).

The Climate Change Act created the Climate Change Commission to create policy; and coordinate, monitor and evaluate climate change action in the Philippines (Government of the Philippines, 2009). Other tasks include: formulate a climate change strategy and program, mainstream CCA into development plans and actions, make recommendations regarding climate-sensitive sectors, assess vulnerability, and facilitate capacity building (Climate Change Commission, 2011; Government of the Philippines, 2009). The Climate Change Commission is positioned under the Office of the President (Government of the Philippines, 2009). It has cross-sectoral membership represented by corresponding Secretaries of each sector, including the Secretary of Health (Government of the Philippines, 2009). Unlike the DRRM structures, this structure is not replicated at regional and local levels. However, the Climate Change Act identifies LGUs as frontline agencies for community-based climate change action, and mandates the creation and mainstreaming of local climate change action plans into development plans (Department of Budget and Management, Climate Change
Following the Climate Change Act the National Framework Strategy on Climate Change 2010-2022 (NFSCC) was developed (Climate Change Commission, 2010). The NFSCC outlines the vision of the Philippines’ Government for a “climate risk-resilient Philippines with healthy, safe, prosperous and self-reliant communities, and thriving and productive ecosystems” (Climate Change Commission, 2010, p.5). As such, it provides the basis for national action on climate change and defines Key Result Areas for mitigation and CCA to be addressed in key climate-sensitive sectors (Climate Change Commission, 2010). DRR is recognised as a key climate-sensitive sector within the NFSCC (Climate Change Commission, 2010).

From the NFSCC, and National Climate Change Action Plan 2011-2028 (NCCAP; Climate Change Commission, 2011). The NCCAP outlined the country’s strategic direction for comprehensively dealing with current and projected climate risks by prioritizing climate strategies and action relating to food security, water sufficiency, ecosystem and environmental stability, human security, climate-smart industries and services, sustainable energy, and capacity development (Climate Change Commission, 2011). The key aims of the plan are to enhance adaptive capacity and resilience of communities and ecosystems, as well as balance economic value and competitive advantage of natural resources with biodiversity conservation for long-term sustainable development (Climate Change Commission, 2011). The role of health in these policies will be discussed in the next section.

**5.3.4.1 Development and approach of CCAH**

Philippine national climate change policy clearly recognises health as an end-point for climate change (Appendix 5). Furthermore, the health sector is recognised as climate-sensitive and a key stakeholder in addressing impacts of climate change. Health-specific policies and plans were needed to further CCAH implementation. These were developed through the project titled ‘MDG-Fund 1656: Strengthening the Philippines’ Institutional Capacity to Adapt to Climate Change’ (MDGF Project; MDG Achievement Fund, 2012).

The MDGF Project was initiated to facilitate the development of climate change capacity in climate-sensitive sectors in the Philippines (MDG Achievement Fund, 2012). The
project ran from 2008 until 2012 and included health as one of the climate-sensitive sectors (MDG Achievement Fund, 2012). The key objectives of the MDGF Project and the health component included: conduct vulnerability and adaptation assessment; strengthening emergency preparedness and response; enhance capacity of health workforce in climate-sensitive diseases and CCA; document existing CCAH actions; strengthen the surveillance of climate-sensitive diseases during disasters; and increase public awareness of climate-sensitive diseases (MDG Achievement Fund, 2012).

Outputs from the MDGF Project included health sector policies and plans for CCA (MDG Achievement Fund, 2012). The National Policy on Climate Change Adaptation for the Health Sector outlines four overall strategies for CCAH (Appendix 5; DOH, 2012b). Key functions and implementable actions for CCAH according to the four overall strategies in the overarching policy are outlined in the Operational Guidelines of Administrative Order No. 2012-0005, “National Policy on Climate Change Adaptation for the Health Sector” (DOH, 2012a) and 2014-2016 National Climate Change Adaptation in Health Strategic Plan (DOH, 2013a). The key points from the climate change in health policies and plans are summarised in Appendix 5.

Within the DOH organisational structures have been developed to facilitate the implementation of CCAH. The relationship and function of these elements are summarised in Appendix 6. The Technical Committee for Climate Change and Health was initially created to implement the National Framework Strategy on Climate Change 2010-2022 (DOH, 2010c). It was then superseded by the DOH Climate Change Executive Committee in 2015 (DOH, 2015).

The Climate Change Unit has also been established under the Environmental and Occupational Health Office (EOHO) of what is now known as the Disease Prevention and Control Bureau (DPCB; DOH, 2011a). The Climate Change Unit provides technical coordination with climate change focal points designated within DOH national offices, as well as DOH regional offices (DOH, 2012a). The Climate Change Unit is tasked to provide secretariat support to the multi-sectoral coordination mechanism for climate change and health (DOH, 2012b).

Additionally, the Inter-Agency Committee on Environmental Health serves as the multi-sectoral coordination mechanism for climate change and health (DOH, 2012b). It is chaired by the Secretary of Health (DOH, 2012b) and required to have three subcommittees
for climate change, including: policy, plans and partnerships; service provision, capacity and infrastructure enhancement; and health promotion, research, surveillance and monitoring (DOH, 2012a). However, the National Policy makes no mention on the Technical Committee for Climate Change and Health and its role in relation to continued implementation of climate change policy, or relationship with the Inter-Agency Committee on Environmental Health.

5.4 Research process and methods for data collection and analysis

The extensive literature review presented in Chapters 2–4 provided the background, rationale and research questions of this thesis. Following this, data collection was conducted in two phases:

- Phase I – Philippine Case Study; and
- Phase II – Global informant interviews.

Using a case study approach, as discussed previously in Section 5.2.4, this research employed the following qualitative data collection techniques: policy analysis; key informant interviews; observation of relevant meetings and events related to DRRH and CCAH; and an expert workshop. Figure 5.2 outlines the process that was taken in this research.
5.4.1 Literature review

A literature review (previously presented in Chapters 2–4) was conducted to provide the background and theoretical foundation for this study. The extensive literature review was used to scope the appropriate research gap to be addressed in the research, develop the RQ and FQs, and inform the development of the methodology.

An extensive review of academic literature and grey literature was conducted within the three contextual fields of this study: (1) DRRH; (2) CCAH; and (3) linkage between DRRH and CCAH. Literature sources used included available academic articles and books, grey literature, government documents, reports, guidelines, training materials and training guides, project reports, conference papers, web pages, as well as workshop materials and outcome documents. These were sourced from offline and online databases. Offline databases accessed include the Griffith University Library, WHO headquarters library, as well as the private libraries of some key stakeholders contacted for this research. The key online academic databases used for searching academic literature include Google Scholar, Scopus.
and the Griffith University Library Database. In addition to these databases I used several websites belonging to relevant organisations to search grey literature. Full versions of literature in English from a reliable source were included. Numerous combinations of key words used for retrieving literature from electronic databases included:

Disaster, disaster risk reduction, emergency, emergency management, climate change, climate change adaptation, climate change response, resilience, vulnerability, risk, health, health sector, public health, department of health, Philippines, Western Pacific, South-East Asia.

5.4.2 Data Collection Phase I – Case Study of the Philippines

The Case Study was undertaken as the first phase of data collection, as it was used to inform the line of inquiry and questioning in the second phase. The Case Study consisted of seven months fieldwork where the researcher was based with HEMB within the Philippine DOH, in Manila from 16th May 2016 to 11th December 2016. This was supported by the Endeavour Postgraduate Scholarship provided by the Australian Department of Foreign Affairs and Trade. Four key data collection methods were used within the Philippines Case Study including policy analysis, key informant interviews, observation and an expert workshop. The details of these data collection methods are discussed in detail below.

5.4.2.1 Policy Analysis

An analysis of relevant Philippine policies was conducted as part of the Case Study. The policy analysis was conducted surrounding the FQs of the research. The analysis thus centred on key priorities and gaps in DRRH and CCAH, and how these fields do and could link. Content analysis was conducted to understand what the policies indicated about each of the three FQs. The analysis included key national policies in DRR and CCA, both inside and outside health. These included laws and regulations, administrative orders, frameworks, long-term plans, and strategic plans. Seventeen policies were included in the analysis. Seven climate change policies were included, of these four were specific to health. Ten DRR policies were analysed, of these, four were specific to health. Policies were provided by the DOH during the Case Study data collection.

5.4.2.2 Key informant interviews

Semi-structured interviews were conducted with key informants on national, regional and local levels. Participants were selected for interviewing using purposeful sampling,
followed by snowball sampling (Bryman, 2012). Interviewing continued until the data saturation was reached (Yin, 2016). All interviews were conducted in English.

Interviewees included key decision and policy makers in the Philippines Government in DRR, CCA and health were interviewed. Other interviewees outside of the DOH who were well positioned to discuss the role of health in DRR and CCA, and the linking of DRR and CCA, were also interviewed to serve as an alternate point of view. Interviews were conducted at the national level, regional, and local government levels (through provincial, municipal and city level LGUs). Regional and local levels were included in the data collection in order to capture data from key stakeholders responsible for implementation (Eidson et al., 2016), as previously discussed in Sections 5.3.3 and 5.3.4.

The number of informants interviewed was dependent on availability during data collection in the Philippines. Key Informant Interviews were conducted with the following:

- 33 national interviews from national level organisations including: DOH, Office of Civil Defense and the NDRRMC, the Philippines Red Cross, National Economic Development Authority, Department of Environment and Natural Resources, University of the Philippines, United Nations Children’s Fund (UNICEF), Zuellig Family Foundation, WHO.
- 23 regional and local interviews from the following:
  - Eastern Visayas: 4 Regional, 5 LGU;
  - Northern Mindanao: 1 Regional;
  - Bicol Region: 6 Regional, 4 LGU; and
  - National Capital Region: 2 Regional, 1 LGU.

The interview protocol was designed with open questions based on the literature review findings of the research. The questions were developed in discussion with the supervisory team, key focal points within the DOH, as well as piloting with a previous DOH employee without an academic background in this topic. Separate interview protocols were developed for both national, and regional and local interviews (Appendix 7). Through these processes the researcher aimed to ensure the questions were not too theoretical and could be easily understood by all participants at different levels.
5.4.2.3 Observation

Observation of various meetings, training and events was undertaken when the opportunity arose (Appendix 8). Observation was used in the Case Study to deepen the researcher’s understanding of the context (Mack, Woodsong, MacQueen, Guest, & Namey, 2005); the role of the health sector in DRR and CCA; how active the DOH is in each of these areas; capacity building and training approaches of the DOH; and relationship dynamics which may impact the role of health in DRR and CCA. Any observation of formal meetings was subject to approval by all partners and meeting participants. Observation of the expert workshop was also an important part of data collection in the Case Study. Any reflections from observations were recorded in a field journal, after which the observations were verified through the interview process to strengthen the convergence of different lines of inquiry through triangulation (Bryman, 2012).

5.4.2.4 Preliminary data analysis

After the completion of the policy analysis, interviews and observations a preliminary data analysis was conducted. Data collected from interviews and the expert workshop was recorded with a handheld digital recording device. To strengthen the validity of the findings, familiarity with the data was developed through the transcription, reviewing and re-reading of the transcripts, as well as summarising interviews into ‘case sheets’ (Harding, 2013). These summaries also helped to reduce the data by removing detail and repetition, and aid the comparison of data across interviewees (Harding, 2013).

Using these summaries and the constant comparative method the preliminary analysis was undertaken to facilitate the generation of insights and produce themes in key areas (Harding, 2013). These key areas included strengths, challenges and needs in DRRH and CCAH, as well as opportunities for linking these two fields. Themes were developed through a combination of deductive and inductive thinking, where the FQs were initially used to guide themes emerging under these key areas of interest. Areas of potential linkage identified through the literature review (Section 4.6.2) were used to guide the analysis of data relating to FQ3. The summaries and constant comparative method were undertaken simultaneously with the assistance of Microsoft Excel.

The preliminary findings of the Case Study are summarised here. This includes both the strengths and challenges in DRRH and CCAH (Table 4Table 5), needs in DRRH and CCAH,
and the potential areas for linking DRRH and CCAH. These preliminary findings were used to inform the expert workshop. The final results of the research are presented in Chapters 6, 7 and 8.

Table 4. Strengths and challenges in DRRH identified in preliminary analysis

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well recognised and respected for its work in disaster response</td>
<td>Use of purely historical data in risk assessment</td>
</tr>
<tr>
<td>Gradual shift to prevention and mitigation</td>
<td>Still DRM focused, the full prevention and mitigation potential within the health sector is yet to be realised</td>
</tr>
<tr>
<td>A lot of upstream DRR work in health is already in place in the form of existing programmes</td>
<td>Garnering local level support for investment in DRRH</td>
</tr>
<tr>
<td>Growing community focus</td>
<td>Implementation on the community level due to decentralisation</td>
</tr>
</tbody>
</table>

Needs in DRRH in the Philippines emerging from preliminary analysis of Key Informant Interviews were grouped into three categories for ease of understanding. The ten preliminary needs identified include:

- *Strengthen disaster prevention and mitigation in health*
  1. Strengthen coordination collaboration within the health sector on DRR prevention mitigation and early warning.
  2. Improve mainstreaming of DRRH programmes to strengthen prevention and mitigation.
  3. Strengthen understanding of the role of health in disasters outside response.
  4. Strengthen cross-sectoral coordination and collaboration with health affecting sectors in prevention and mitigation.

- *Strengthen local capacity and implementation*
  5. Local budget/improving access to DRRM funding for health.
  6. Strengthen documentation and measurement of implementation.
  7. Increase human resource support and permanent positions for DRRH in Regions and LGUs.
• **Strengthen institutional memory and capacity**
  (8) Strengthen documentation.
  (9) Strengthen staff continuity.
  (10) Build research capacity.

**Table 5.** Strengths and challenges in CCAH identified in preliminary analysis

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of climate change funding from international donors</td>
<td>CCAH is “new”</td>
</tr>
<tr>
<td>CCA action is already there in health programmes, incorporated as fundamental public health principles</td>
<td>Technical and not easily understood by policy makers</td>
</tr>
<tr>
<td>Existing policy framework in CCAH, needs operationalisation</td>
<td>Continuity of funding and resources due to the donor-driven nature of CCA</td>
</tr>
<tr>
<td></td>
<td>Requires a long-term planning approach</td>
</tr>
<tr>
<td></td>
<td>Data not translatable to the local level</td>
</tr>
</tbody>
</table>

Eleven needs in CCAH in the Philippines emerged from preliminary analysis of Key Informant Interviews. These were grouped into four categories for ease of understanding, as follows:

• **Develop an anticipatory and proactive approach**
  (1) Increase emphasis on proactive management of CC through pathways
  (2) Greater understanding of how CCA is operationalised in the health sector.

• **Strengthen leadership**
  (3) Strengthen leadership in climate change within health.
  (4) Strengthen leadership and coordination of CCA among sectors and actors.
  (5) Strengthen understanding and recognition of the health impacts and the role of health sector in climate change

• **Governance of health adaptation**
  (6) Identify the most appropriate organisational structure for CCAH.
  (7) Strengthen existing systems and structures through mainstreaming.
  (8) Ensure sustainability of CCAH (e.g. structures and resources).
• **Improve evidence base for CCAH**
  
  (9) Strengthen research capacity.
  (10) Need evidence to inform policy and implementation of CCAH at all levels.
  (11) Develop understanding of how much more needs to be done in key health programs for CCA.

The opportunities for linking DRRH and CCAH identified and presented at the expert workshop include:

• **Policy and Planning**
  
  (1) Coherent DRR and CCA policies
  (2) Inclusion of both parties in planning processes
  (3) Joint mainstreaming

• **Climate and disaster-risk informed DRRH and CCAH**
  
  (4) Integrated risk assessment incorporating climate change risk, vulnerability and adaptive capacity
  (5) Probabilistic hazard assessment applied to all aspects of the health sector
  (6) Improved climate services for health

• **Implementable initiatives**
  
  (7) Joint public education
  (8) Joint training of health professionals in DRR and CCA
  (9) Advocating for improving environmental adaptation and determinants of health
  (10) Heatwave early warning, preparedness, advocacy, etc.
  (11) Early warning systems for Climate Sensitive Diseases and creeping health impacts
  (12) Research harnessing climate data, disease surveillance and disaster epidemiology

5.4.2.5 **Expert workshop**

Expert workshops are intended to facilitate joint brainstorming, and draw on the expertise of experts from different sectors and organisations, and have been identified as useful in bridging policy research and practice (Oreszczyn & Carr, 2008). One expert workshop was conducted as part of the Case Study of the Philippines at the end of the fieldwork in Manila. This workshop brought together previously interviewed participants at
the national level to discuss the preliminary results. This was a form of validation and feedback. It was also intended to further the initial findings through interactive discussions and exercises, and allow for further observations of interactions between DRRH and CCAH stakeholders.

The expert workshop titled “Research Study on Linking Disaster Risk Reduction to Climate Change Adaptation in the Health Sector: A Case Study” was hosted and funded by the HEMB of the DOH on the 10th November 2016 at the Richville Hotel, Mandaluyong, Metro Manila. The workshop was restricted to one day to increase participation rates. Twenty-six previous interviewees were invited to attend the workshop based on the content of their previous interview and the relevance of their knowledge to the expert workshop. Of those invited, twenty participants attended representing the DOH (nine participants), other national government organisations (four participants), academic institutions (one participant), and non-government and international organisations (six participants). The researcher designed and facilitated the workshop. Two staff of the DOH provided logistical, administrative and note taking assistance.

The expert workshop had three main sessions. The first two sessions presented the preliminary findings on DRRH and CCAH, and were each followed by a workshop activity prioritising key gaps and needs in each field. These breakout sessions aimed to validate and prioritise needs in DRRH and CCAH. The exercises were conducted by splitting the workshop participants into two groups with similar stakeholder representation. Each group was requested to first go through the list of needs provided and state if they agree or disagree, give an explanation for any needs they disagreed with, and list other identified needs not included in the list provided. Following each validation exercise, I asked both groups to identify three priority needs and provide an explanation and brief exploration of what would be necessary to address these needs. Splitting the workshop into two groups was intended to check validity of the workshop responses. As such, the results of these groups are presented together as there was little difference in responses between the two groups.

The final session included a presentation of preliminary findings of linking DRRH and CCAH (Section 5.4.2.4) followed by a discussion on challenges and opportunities for linking. The activity for this session was conducted as an open discussion. All participants were asked to provide feedback on the suggested areas for linkage that were presented in the session.
They were also asked to share their opinion on the challenges and opportunities for strengthening these potential areas for linkage.

5.4.3 Data Collection Phase II – Global informant interviews

At the global level, expert interviews were conducted with international policy experts from international organisations and non-government organisations. The purpose of these interviews was to develop a deep understanding of: the global context of the Case Study; the role of health in DRR and CCA; and how DRRH and CCAH can potentially be linked. Experts were identified based on their knowledge in DRRH, CCAH; as well as their positioning to provide insight on DRRH and CCAH through experiences in these fields.

Seven global informants were interviewed including four global informants in DRRH; two in CCAH; and one working across both DRRH and CCAH. Of the seven global informants interviewed, three had specific experience working with the DOH in the Philippines on DRRH. These interviews were conducted face-to-face where possible, with one of the seven interviews being conducted remotely via Skype. A core set of questions was used across all experts with additional questions tailored to their area of expertise (Appendix 7).

This phase of data collection commenced after the Case Study data collection. During this phase, a full-time internship was undertaken with the Climate Change and Health Unit of the Department of Public Health, Social and Environmental Determinants of Health at the WHO headquarters in Geneva, Switzerland from January to June 2017. This was supported by the Endeavour Postgraduate Scholarship. Work responsibilities included climate change and health project implementation, and drafting and refining technical documents in the area of climate and disaster risk in health. This internship facilitated access to global informants for interview, and provided me with a more in-depth understanding of CCAH.

5.4.4 Final data analysis

The inductive nature of this research leant itself well to thematic analysis (Harding, 2013). The final analysis was structured based on the three key aims of thematic analysis: to examine commonalities, differences and relationships within the data (Harding, 2013). The final analysis was broken down into three key steps which included data reduction, data display, and conclusion drawing and verification (Harding, 2013).
Data reduction was continued from the preliminary analysis by building on the case sheets from the Case Study interviews (Section 5.4.2.4), and creating additional case sheets for the global informant interviews and the expert workshop. Furthermore, following the preliminary analysis and expert workshop, the interview and workshop transcripts, and associated recordings, were combined and systematically coded using NVivo 11 qualitative analysis software (QSR International Pty Ltd, 2016). This computer assisted qualitative analysis software was used as a tool to assist the analysis due to the size of the data set, and to assist the researcher to clearly organise themes and their relationships. Coding was carried out in two cycles.

The first cycle of coding reduced the data to a manageable size by grouping the data in chunks which are most relevant to the research through a heuristic approach to detect reoccurring patterns (Creswell, 2014; Harding, 2013; Miles, Huberman, & Saldana, 2014). Open coding was done following the themes initially identified from the preliminary analysis. However, the inductive nature of the analysis was maintained with no restriction to the number of codes to ensure a potentially important theme was not overlooked (Harding, 2013). This step enabled continued reflection on the themes from the preliminary analysis and the data, and ensured that the themes were solidly grounded in the context of the data.

The second cycle of coding refined the coding and themes in the data. This was done by sub-categorising codes, grouping codes into larger thematic areas, as well as identifying and removing duplicate codes or codes where the data was not supported by a sufficient number of participants (Harding, 2013). Through this step, the consistency of the coding was also checked.

Domain and taxonomy analysis were used to further group the codes and display the data in themes through hierarchical network display (Miles et al., 2014). This analysis technique was used as it was suitable to the type of data and research. Furthermore, while having origins in ethnographic research this approach has been shown to be useful in the analysis of public health research (Atkinson & Hap, 1996; Spradley & McCurdy, 1972). FreeMind (Version 1.1.0; Müller, Polansky, Novak, Foltin, & Polivaev, 2014) cognitive mapping software was used to assist in the organisation of domains and taxonomy arising in the themes of the analysis.

Domains and taxonomy analysis was the focus of the interpretation of the qualitative data and the primary method for drawing and verifying conclusions (Miles et al., 2014).
Secondary data, in the form of grey literature and documents collected during fieldwork, as well as field notes and observation were used to support and further verify conclusions. The use of matrices enabled charting of the data to compare themes, taxonomy or subthemes to verify conclusions relating to specific findings (Miles et al., 2014). For example, a matrix was used to compare the conceptualisation and use of resilience across different participants at different types of organisations and levels of government. Finally, careful consideration of alternative interpretations was an important process for the verification of conclusions (Yin, 2014).

5.5 Research rigour and ethical issues

5.5.1 Validity, reliability and triangulation

Measures to address reliability and validity in this research included: triangulation, member checking; spending a prolonged time conducting field work; peer debriefing; clarification of researcher bias; and reading and re-reading transcripts and coding (Creswell, 2009, 2014; Harding, 2013; Yin, 2016).

Triangulation of data types and sources was used to improve the validity of the research, reduce bias and improve the consistency of results through converging lines of inquiry (Creswell, 2009, 2014; Yin, 2016). Strategies which were employed included: verifying understanding and interpretation of observations through interviews; interviewing national policy experts and stakeholders from outside the DOH to offer a different perspective to participants within the DOH; secondary documents, grey literature and resources; the expert workshop attended by national interviewees; and interviews at different levels (sub-national, national and global).

This research was restricted to a singular case study to limit the scope of the research and time required for data collection. Furthermore, conducting a valid case study requires thorough understanding of both the context and phenomena, thus case studies are commonly limited to a singular case due to the time this takes (Yin, 2013). Due to the singular case study method applied, comparison across settings is not possible. However, the expert interviews were incorporated into the research design to strengthen the external validity of the findings of the Case Study and provide some external context for comparison (Merriam, 2009; Yin, 2014). Data collection took 12 months, compared to the usual three to six months more typically allocated for a PhD project. Prolonged data collection was necessary to
increase my depth of understanding relating to the Case Study and the cultural and political context, thus improve validity (Babbie, 2014; Creswell, 2009; Yin, 2016). Furthermore, as an early career researcher, it was necessary for me to better understand both DRRH and CCAH in order to provide greater insight to the results. I gained greater understanding of the different approaches by collecting the Case Study data through a DRRH organisation (HEMB) and working with a leading entity in CCAH (the Climate Change Unit of the WHO).

The credibility of the findings were strengthened through the expert workshop which served as a form of interviewee feedback and member checking (Bryman, 2012; Creswell, 2009; Yin, 2016). Reliability checks were conducted during transcription and coding to minimise mistakes and drifts in coding (Creswell, 2009). Detailed records of all stages of the research were kept to improve transparency and reliability (Bryman, 2012; Creswell, 2009).

5.5.2 Researcher context and limitation of biases

Especially in the case of qualitative case study research, the researcher context is part of the method of enquiry, and thus the findings are related to the context of the researcher and their skills (Merriam, 2009). While there is no specified way to guarantee the systematic removal of researcher bias (Maxwell, 1992), the researcher needs to illustrate that they have reduced potential bias to the best of their knowledge and ability (Bryman, 2012).

As an early career researcher with limited practical experience in a political context, I was highly aware that at the time of data collection I did not yet having a full understanding of the political context of the Philippines. Furthermore, I was aware of the potential for my assumptions and biases to influence my interpretation of the data.

To reduce bias, I used several strategies including: self-reflection; reflection in the analysis process; and strategies incorporated in the research design. The self-reflective strategies I drew on included: journaling; discussing my potential biases and assumptions with mentors, supervisors and colleagues within HEMB and the WHO; and considering the frame from which I as a researcher view the world (Babbie, 2014; Creswell, 2009; Maxwell, 1992). The strategies I applied to the analysis were: review of the analysis by my supervisory panel; discussion and exploration of interpretations of the findings with critical peers and colleagues both informally and formally through the expert workshop; and consideration of alternative interpretations and explanations in an open-minded manner (Creswell, 2014;
Maxwell, 1992). Aspects of the research design which reduced researcher bias included: prolonged fieldwork (seven months Case Study, and five months internship and global interviews) compared to the usual three months fieldwork of many PhD programmes; making observations on multiple occasions; and the expert workshop, which highlighted concepts that I had perhaps not considered in my preliminary analysis (Bryman, 2012; Creswell, 2014; Yin, 2016).

5.5.3 Ethical issues

This research complied with the Griffith University Ethics Manual and ethical requirements of the Philippines Department of Health. Ethical clearance was obtained through the Griffith University Human Research Ethics Council (Reference Number 2016/282; Appendix 9) granted on the 3rd May 2016. Approval was also obtained on the from the University of Manila Philippines Research Ethics Board on the 23rd June 2016 (Reference Number UPMREB 2016-235-01; Appendix 10).

Informed consent was collected from all participants and confidentiality was maintained throughout all stages of this study. All participants were made aware of the voluntary nature of their participation, as well as their right to withdraw from the study at any time without repercussions. As per ethics requirements, this research involved aspects of confidentiality and anonymity to address potential ethical concerns. The identity of any participants was not disclosed at any point except to those researchers directly involved with data collection or analysis. All data obtained via interviews and the expert workshop was de-identified to protect the participant’s privacy and anonymity. Further to this, any publications produced from the findings of this research were and will be carefully examined to ensure that the participants cannot be identified and thus remain completely anonymous.

5.5.4 Research dissemination and follow up

Research dissemination and follow up with key facilitators of the research was considered an important part of the research cycle. As such the results of the research were disseminated through several avenues. The expert workshop was considered to be one avenue of dissemination of the preliminary findings to national stakeholders and interviewees. The preliminary results of the research were also presented at the end of data collection in Manila at the National Convention on Health Emergency Management hosted by HEMB from the 7th to 9th December 2016. As the annual national DRRH conference, the audience of over 200
participants included the majority of interviewees on national, regional and local levels. Final results were presented in July 2018 prior to the submission of the thesis through two separate forums in Manila in July 2018, the ‘DRRM in Health Research Forum’ hosted by HEMB and workshop titled ‘Strengthening Research in Global Health in Disaster Risk Reduction and Climate Change in the ASEAN Region’ hosted by the Philippine Council for Health Research and Development. To facilitate the dissemination of findings an Executive Summary was provided to attendees of these two workshops, and provided to key stakeholders and interviewees. Additional communication tools for decision makers are currently being developed in partnership with key stakeholders at the DOH. Publication of the research in peer reviewed journals is an important part of this process. Publication of the literature review has already been complete, and publication of the results is underway in partnership with key stakeholders.

5.6 Conclusion

This Chapter presented the methodology applied in this research. This research used an exploratory approach with the aim of building theory through inductive reasoning, using qualitative data collection methods. A Case Study of the Philippines was conducted and complemented by interviews with global policy experts. There were two phases of data collection and analysis, including: Phase I) Case Study data collection (policy analysis, key informant interviews, observation) followed by preliminary analysis and expert workshop; and Phase II) global informant interviews conducted during an internship with the Climate Change and Health Unit of the WHO. Following this the final analysis was conducted. This Chapter also described issues relating to research rigour and ethics. Part II of this thesis presents the results of the research and discussion. Drawing on the findings from the Case Study, Chapters 6 to 8 of this thesis discuss the results relating to key priorities and gaps in DRRH; key priorities and gaps in CCAH; and links between DRRH and CCAH in the Philippines. These Case Study results are supplemented by global interviews.
Part II
CHAPTER 6: KEY PRIORITY AND GAPS FOR DRRH IN THE PHILIPPINES

6.1 Introduction

As the first of three results Chapters, this Chapter presents the overarching priority and the key gaps in DRRH in the Philippines. These results relate to FQ1: What are the key priorities and gaps for DRRH in the Philippines? As previously noted, DRRH is known as ‘Disaster Risk Reduction and Management for Health’ (DRRM-H) within the DOH. However, for consistency within this thesis, DRRH has been used to refer to DRRM-H in relation to the Case Study findings. The priorities and key gaps in DRRH were initially assessed through policy, literature, observations, and KIIs at all three levels. To provide a detailed picture of the current overarching priority and key gaps in DRRH in the Philippines the strengths, challenges and needs were initially identified through the preliminary thematic analysis (Section 5.4.2.4), and subsequently presented at the expert workshop. Following the expert workshop, further thematic analysis grouped these into key themes to provide insight into current approaches and needs of DRRH in the Philippines. Aspects of these themes relating to DRRH in the Philippines are discussed below. It is important to acknowledge that these separate themes and subthemes are interrelated in terms of strengthening the implementation of DRRH. As such these results provide insight into DRRH in the Philippines and into the development of links with CCAH.

6.2 Priority: Strengthening community-level implementation of DRRH

The overarching key priority identified for DRRH in the Philippines was to strengthen community-level implementation of DRRH. The themes identified within this priority included: (i) strengthening community-level capacity building initiatives for DRRH; (ii) the need to strengthen local governance and leadership support for DRRH; and (iii) human resources for DRRH.
6.2.1 Strengthening community-level capacity building efforts for DRRH

There has been a gradual recognition of the importance of the community in addressing health risks of disasters in the Philippines, particularly preparedness and response. This is visible through key DRRH policies:

"The response must thrive on the empowerment and resilience of the community members as they are the driving force and primary actors of the response. Local partnerships, therefore, must be forged among local governments, non-government organisations, private sector, and other stakeholders on the ground." (HEMB, 2015, p.14)

This is also communicated in the draft DRRH Omnibus Policy as part of the DOH mandate in DRRM, which includes to:

“Build a resilient health system across all levels, especially at the community level.” (DOH, 2016c, p. 2)

As such, there is increasing prioritisation of community-based capacity building initiatives in national DRRH approaches. The shift toward a community-based approach was acknowledged by interviewees:

“Now we are so focused on the community, so that we are planning to have specific activities already at that level. So before we were waiting for our system to go down, but now we are intent on being there. Doing our activities there and targeting LGUs, from there.” (National Interviewee)\(^\text{15}\)

This was observed through the adoption of the ‘5K’ approach to DRRH which was launched in Tacloban, in Eastern Visayas on the 19\(^{th}\) July 2016. ‘5K’ stands for ‘Kaligtasang pangKalusugan sa Kalamidad sa Kamay ng Komunidad’ (Figure 6.1). Translated from Tagalog this slogan means ‘Health disaster safety in the hands of the community’, as verified

\(^{15}\) In order to protect the identity of the informants, it is important that the researcher does not reveal the specific details of the interviewees, thus interviewee labels have been restricted to the level of the interviewee.
by interviewees. Since the time of the fieldwork, the 5K strategy has also been launched by HEMB in Marikina (DOH, 2017a; Marikina Public Information Office, 2017).

**Figure 6.1. 5K logo - HEMB community DRRH strategy**

Following the launch of the 5K strategy in Tacloban, a training pilot for local level leadership and management in DRRH took place. It was the first local level training to be implemented by the national level from HEMB (20th to 23rd July; Tacloban, Eastern Visayas). The trainees are intended to be community leaders in strengthening community disaster preparedness (Sunstar Tacloban, 2016), referres to by interviewees as the ‘Kadre’.

The recognition of the importance of the community in DRRH is shared across national, regional and local levels. This is illustrated by the Evidence Based Planning for Resilient Health Systems (rEBaP) project, from which the concept for Kadre training was developed. Led by UNICEF in close partnership with the DOH, the project was implemented with eight other partners (UNICEF, 2015). The project was implemented in 50 LGUs from six provinces within three regions that were affected by Typhoon Yolanda (UNICEF, 2015).

The need for the project was recognised after Yolanda, where it was identified that the affected LGUs commonly did not have designated coordinators for DRRH, known as ‘HEMS Coordinators’, or DRRH plans known as ‘Health Emergency Preparedness Response and Recovery Plans’. The project incorporates the approach to strengthening health governance used by the Zuellig Family Foundation and aims to institutionalise DRRH on the local level. It utilised the WHO building blocks of the health system as the basis of health systems resilience. Within this context, the participating LGUs and Regional DOH within Eastern
Visayas recognised that community is an important element of health system resilience, and thus added ‘community’ as an additional seventh building block. An interviewee involved in the project shared:

“For us, if you are looking at local assistance, the community plays a very critical role. So in the Six Building Blocks, community is important and defined there. That’s why we all agreed it would be the seventh block.” (National Interviewee)

Interviewees at all levels discussed the importance of the community in DRRH. One national government interviewee said:

“DRR work is not really limited to us only in government, because we need to do that, but we want also the people in the communities to play their role. They have to own it, they have to be self-sufficient. So that’s the big consideration to us.” (National Interviewee)

It was observed through the PHEMAP training course that the community focus of the Sendai Framework has influenced the community focus of HEMB. Furthermore, the pertinence of the community in disaster preparedness and response for health was learnt through the experiences of those regions heavily affected by Typhoon Yolanda:

“The direction is towards helping families and Barangays, you know the Barangay is a small unit of our society. So it’s about helping Barangays to be resilient because, the concept that when disaster strikes, it strikes at the Barangay, and the very people that are effected could be the first responders also. Because some of them may not be effected, so they will bank on their own people, and the next responder will be the next adjacent not affected Barangay or Municipality until response will go to the higher level. Why, because time is of the essence, if we will wait for the furthest, just like Yolanda, we had to wait for the farthest help, it took 3 days, 2 to 3 days before arrival of help.” (Regional Interviewee)

Building capacity and capability at the local level was a clear priority identified by both groups in the expert workshop, including institutionalising DRRH at regional and local levels. It was suggested to address this need by strengthening local documentation and data related to health, using this data and others for evidence-based planning for each LGU, and ensuring the plans are all hazards with emphasis on the particular hazards and needs of each
LGU. Within this context, engagement of local health actors in DRRH planning was identified as vital for strengthening implementation.

6.2.2 Need to strengthen local governance and leadership support for DRRH

Although community-based approaches of the DOH in DRRH are currently the focus of HEMB, the implementation of community or LGU level DRRH has been limited. Several interviewees at all levels attributed this to the devolution of the health system:

"We have devolution for the health sector, so the health sector is fragmented, we have the national and regional level and then it stops there. And then followed by the province and the LGUs and the health sectors in the provinces, barangay is part of the municipal, and the municipal and the provincial health sector have no connection at all." (Regional Interviewee)

As a result of the devolution of the health system, the Local Chief Executive (LCE) is responsible for the implementation of DRRH initiatives. LCEs include Barangay Captains, Municipal and City Mayors, and Provincial Governors (Government of the Philippines, 1991b). However, the challenge of local level implementation is not restricted to the health sector alone:

"We are one of the countries that have very good laws in everything, climate change, DRR, name it, we have it. Unfortunately, if you go down to the last mile, the community, which we usually work with, they don't have actually some, even some small knowledge on these policies...You can really see the disconnect between having a really good law and implementing it on the ground." (National Interviewee)

Local level governance and LCE support for DRRH was one of the greatest barriers to local level implementation. This was particularly highlighted through the rEBaP project. This was also recognised through the needs prioritisation exercise by both groups. Furthermore, it was observed as being discussed at length during the Kadre training, and HEMB internal consultations relating to the development of the Omnibus Policy.

Strengthening implementation of DRRH on a community level requires addressing local level governance. In particular, garnering support from LCEs to ensure the financial resources and prioritisation of DRRH, and ensuring the human resource support for implementation. Where DRRH or even health is not prioritised by the LCE, there is often
limited investment, personnel, and capacity for implementing DRRH. The DOH and HEMB have clearly recognised this and are working to directly address the challenges of implementing DRRH at the community level within the context of the devolved health system. For example, the Kadre programme, rEBaP and the 5K’s are designed to build the capacity of the community, and endorse the importance of DRRH to LCEs. Local level governance and political support was often discussed as essential for strengthening local implementation:

“Even if you are hardworking and dedicated Municipal Health Officer that is not an assurance if the Mayor is not supportive, because you have to compete with the other components of the municipal operations.” (National Interviewee)

Local level interviews revealed that a key success factor in the implementation and institutionalisation of DRRH at the local level was the support from the LCE. There are some good practice examples within the Philippines where strong local governance for DRRH has facilitated implementation (Boxes 1, 2 and 3).

**Box 1. Local governance and support for DRRH in Marikina as a Healthy City**

Marikina is often referred to as a good practice example in DRRH due to the local government commitment to health and DRRH. As stated by one of the regional interviewees:

“One of the model city is really Marikina...The mayor attends the local health board compare to others [where]...there is no decision making or fast action, since they would still need the approval of the mayor.” (Regional Interviewee)

Marikina is a model Health City for the Philippines and the Western Pacific Region. Within this context there is a history of strong leadership and prioritisation of health. As a result, Marikina has strong DRRH planning and capacity.
Box 2. Local governance and support for DRRH in Albay

Albay is famous for its successful implementation of DRRH and ‘zero casualty’ approach. This has been attributed to the drive, commitment and accountability demonstrated by the LCE. The leadership of Albay was often referred to by interviewees as a good practices example for DRRH and broader DRR:

“In Albay, which is usually very prone to disaster, all types typhoon, and eruption, and flooding. You name it, they have it. So the LGUs there, the leader was very good...He did a lot on the preparedness site for the communities even before disasters struck...for some LGUs, they’re kinda advanced when it comes to preparedness so it depends on the leader of course.” (National Interviewee)

There are also examples of local-level DRRH implementation being strengthened through national capacity building in DRRH and health governance (Box 3). This example has been attached to projects funded by international donors. Pilot projects and adhoc donor-funded projects such as this are challenging to scale up and implement across all LGUs.

Box 3. Local governance and support for DRRH in Salcedo

Since Typhoon Yolanda, local governance and leadership for DRRH in Salcedo has increased in part due to rEBaP and the local health governance training assisted by UNICEF and the Zuellig Family Foundation. As a result of LCE support, the DRRH programme is able to access the necessary funding and human resources to implement Barangay Level Health Emergency Management Training. As one interviewee discussed in relation to funding from the LGU:

“That's why, when it comes to financial support, there is no problem with the LCE... He is even pushing us to implement the things we have identified in our plans.” (Local Interviewee)

6.2.3 Human resources for DRRH

Ensuring sufficient human resources for DRRH was also raised as a potential strategy for strengthening local level implementation. Numerous interviewees on sub-national levels expressed the need for permanent positions for HEMS Coordinators to reduce the burden and multitasking of those designated the position as an additional task to their daily work:
“I am in charge of the health programmes in the inter-local health zones I am handling them, coordinating them, and then also with the PhilHealth. Well I’m multitasking. We are only eight programme coordinators, and we multi-task… the nurses have already been overworked… we do not have that much personnel, and we don’t have that much support from the local government.” (Local Interviewee)

This contrasts with the results from the expert workshop. Participants agreed that there is a need for more human resource support for DRRH on the local level. However, permanent civil service positions for HEMS Coordinators at Regional and LGU levels were regarded as not necessary. It was expressed that permanent HEMS Coordinators are not essential. Furthermore, the administrative process for obtaining a dedicated permanent position for HEMS Coordinators were seen as a significant barrier by both expert workshop participants and national interviewees. Participants suggested that the better solution would be to have champions for DRRH without permanent positions as these have been sufficient to drive action in some LGUs:

“Even though we don’t have permanent positions at the local level, but you have champions to do it, like in Davao, you don’t have to see people with permanent positions in there… what we will do is just to identify champions, we will be meaning that we will have all the [Department of Budget and Management] requirements for the permanent positions. But for the meantime, tap the local champions.” (Expert Workshop Participant)

The concept of having champions to drive the implementation of a programme was also supported in a global informant interview:

“But one of the things about progress is having champions to drive a programme forward over many years, because one of the challenges is obviously a lot of movement of personnel, and if that happens, then you can’t really develop systems.” (Global Interviewee)

During the expert workshop discussion, several participants recognised that identifying champions for DRRH needs to be coupled with strong LCE support and governance for DRRH. Local level examples demonstrated that champions with support from LCEs are important drivers of successful local DRRH implementation. These results suggest that while there may be a place for permanent positions for regional and local HEMS Coordinators in
the future, this is not what is needed or feasible at this point in time. These results highlighted that increasing human resources for DRRH will potentially assist with strengthening community level implementation of DRRH as the overarching priority for DRRH in the Philippines.

6.3 Role of the health sector in disaster prevention

The first gap identified in DRRH in the Philippines revolved around the role of health in the prevention phase of DRR. This was discussed at length by interviewees, and validated by expert workshop participants. In relation to this gap three sub-themes were identified: (i) respected role of the health sector in disaster preparedness and response; (ii) the growing role of health in disaster prevention; and (iii) the need to strengthen mainstreaming of disaster prevention with the health sector.

6.3.1 Respected role of health in disaster preparedness and response

It was evident that health is well respected within disaster response and preparedness in the Philippines, particularly as the lead of the health cluster. This authority is shown clearly in national DRRM policies, where health is designated a clear role in response (Appendix 4). Furthermore, the role of health in emergency and disaster response was discussed with ease by participants across all groups and levels. A key leader in DRRH described the role of the DOH in disaster response:

“When it comes to DRR, we do the consequence management, bottom line. The main work that we have is related to responding to the consequences of every type of emergency or disaster that will come our way.” (National Interviewee)

Similar accounts of the role of the DOH and HEMB in disaster response were given by interviewees across levels. Roles in disaster response were central to the interviewees understanding of DRRH:

“The role of DOH in DRR, of course ours is for the injuries, especially for the patients to provide drugs and medicines, to ensure safety as well of the responders, and also for the mental health aspect…organizing the incident command system…we also organize clusters.” (Regional Interviewee)
The cluster approach for disaster response in the Philippines, as well as the role of the DOH as health cluster lead was often discussed by interviewees. A member of a national non-government organisation and response stakeholder affirmed the strong respect of the DOH as health cluster lead:

“They [the DOH] are the lead, especially for health response, and we really respect that...they are the lead for all the response, we are supporting them and if there’s a need...that’s the only time that we come in.” (National Interviewee)

Furthermore, it was evident that the engagement of health in the NDRRMC and RDRRMCs was important and valued in the Philippine approach to DRRM. This was set out through the DRRM Act, which named the DOH as a member of the NDRRMC and RDRRMCs (Government of the Philippines, 2010). The involvement of health in developing the Philippines as a global hub for DRR reinforces the central and vital role of health in DRRM in the Philippines (Appendix 11). This message was further endorsed by regional interviewees:

“We really talk, and I really encourage the participation of the bosses, the heads. And you know even if the DOH is not a committee chair among the four thematic areas of DRR, they are still an integral, one of the major, agencies of Government that we really can’t do without.” (Regional Interviewee)

Interviewees commonly acknowledged that effective disaster response requires strong engagement of, and partnership with, health actors. This was also observed through the Bicol Region quarterly multisectoral preparedness drill (29th September 2016; Figure 6.2).


16 The observations of the 10th Philippine National Health Research System Week Celebration were published during the Case Study data collection (Banwell et al., 2016). The joint publication was written with key stakeholders in DRRH research in the Philippines, please refer to Appendix 11.
Furthermore, the findings indicating the strength of health in disaster response in the Philippines was confirmed through a key interview with a global informant in DRRH:

“There is actually quite a deal of confidence that exists within the Philippines and their ability to manage the health aspects of emergencies…some of the things that we say about what represent key success factors to effective DRR in countries is somewhat aligned to some of the positive things to which the Philippines can espouse. I mean, for example, well respected within the national disaster management arrangements, being able to stand up for itself when it comes to matters of public health, track record, good coordination with the regional offices, and so forth.” (Global Interviewee)

6.3.2 Growing role of health in disaster prevention

In addition to the recognition of the DOH in response and preparedness, it was evident that there is growing recognition inside HEMB that the health sector has a significant role in prevention. This is illustrated through a clear paradigm shift from a HEM to a ‘DRRM-H’ approach exhibited by HEMB goals (HEMB, 2012, 2015). The former is focused on preparedness and response, and primarily oriented toward stopping emergencies from evolving into disasters. Comparatively, the ‘DRRM-H’ approach expands this to also include prevention and recovery as a key aspect of reducing health risks.

The increasing focus on the preventative aspects of DRRH was further illustrated in the revised structure that was proposed and under consideration in the new Omnibus Policy that was being developed at the time of data collection. During the meetings on the development of the Omnibus Policy it was suggested that HEMB expand from the preparedness and response division to include two additional divisions with a prevention/mitigation focus, and
recovery/rehabilitation focus (DOH, 2016c). No decision was reached at this time as to whether this change should be implemented. There was significant disagreement among DRRH stakeholders of the DOH as the lines demarking prevention, preparedness, and rehabilitation activities are not clear and the existing Divisions are working in these spaces already. However, the organisational structure has since been updated. Prevention and mitigation are incorporated within the Preparedness Division. Similarly, recovery and rehabilitation within the Response Division (DOH, 2017b).

The changing approach to DRRH was also evident in the 18th National Public Health and Emergency Management in Asia and the Pacific Training Course (PHEMAP). This training of regional HEMS Coordinators was attended as observation for this research on 18th to 27th May 2016. This PHEMAP was the first time the concept of prevention in DRRH was introduced into the training curriculum.

6.3.3 Need to strengthen mainstreaming of disaster prevention within the health sector

Despite the shift toward a more preventative focus within HEMB, the role of the health sector is still regarded as primarily preparedness and response. National interviewees acknowledge that the role of health is limited to preparedness and response by the current DRRM mandate. This is supported by the policy analysis which revealed that national DRRM policies designate health roles focusing on preparedness, response and immediate recovery (Appendix 4). However, national policies in DRRM do not give any indication about the potential role of the health sector in prevention. This was acknowledged by several interviewees at national and regional levels as an ongoing challenge:

“Even the present structure right now, they need to be giving more emphasis on the prevention and mitigation side. Because if you give importance to this...then you have less problems...because if you just concentrate particularly on response its very reactive and very expensive...That's one of our challenges still...Because that's where basically where your existence is really felt and really needed...but the prevention and mitigation side is kind of a bit academic really, there are not much of tangible deliverables there.” (Regional Interviewee)

In light of this, several interviewees discussed what expanding the prevention aspect of DRRH would really mean for implementation of DRRH and the work of the DOH:
“[We] have been discussing about how do we really prevent and reduce risk. One of the ways by which we can do that is perhaps we can intensify more our regular programs like the immunization, the health services...[Or] one of the vulnerabilities of the population is when they are in poor nutritional status. So if only all Filipinos, the entire community, would be in optimum nutrition prior to the calamity then they may be affected less by the impact of the calamity... so that’s my concept of risk reduction. We are supposed to put people into a healthier condition.” (National Interviewee)

This understanding was also echoed at a local level by a few interviewees:

"Other mitigating factors, health related? Basically, what we are doing right now. Immunisation, vaccination, it’s all part of the mitigating strategies. Public health, surveillance, that's also part of our mitigating approach. Disease surveillance. Warning systems, but it is not part of the health but we are connected.” (Local Interviewee)

The limited recognition and engagement of the health sector outside of preparedness and response presents a challenge for the health sector to participate in preventative aspects of DRR which are essential for reducing underlying risks. It was clearly recognised that there is a strong need to strengthen the understanding and value of the whole of the health sector in DRR outside of response amongst internal and external stakeholders.

Similarly, it was openly acknowledged within interviews and validated through the expert workshop that other health programmes within the DOH do not understand or recognise their role in preventative DRRH. The need to strengthen the understanding of the role of health in disasters outside response was among the top priorities in the expert workshop. Some strategies to address this gap centred on creating a common language and understanding of DRRH as an integral cross cutting issue across all national agencies and health programmes within the DOH. This strategy was also discussed by a global informant:

“We need to use language that health systems people or anybody that works in the health system or other sectors don’t feel alienated from their contribution to managing these risks.” (Global Interviewee)

Interviewees acknowledged that often disaster and emergency management for health is considered separate to the regular health programmes of the DOH. Furthermore, the role of
regular health programmes in preventative DRRH are not widely understood. An interviewee working with the DOH aptly summarised how Typhoon Yolanda began to change this:

“Until Haiyan I think, where everybody saw that in fact a disaster of such magnitude affects the entire health system for quite a prolonged amount of time...that's where everybody felt 'oh, okay I have a role here'. So when the news started with mothers and pregnant women, not accessing care, because of in the aftermath of Haiyan, then suddenly the MMCH [maternal and childhood health] people thought ‘ok we actually have a stake in the boarder discussion of DRRM and CCA’, so also the immunization people, also the NCD [non-communicable disease] people, also the mental health people...Everybody started to consider, how is there access to health services in the aftermath of a disaster...it allows people to reflect – ‘[DRR is] not just a HEMB thing, we actually also have a stake in that’. The problem I feel is that for the longest time is that people are in this DRR frame...when they talk about DRRM, it means response, preparedness and response, that's it. And that's what drives this whole notion that it's a HEMB thing, because it's preparedness and response.” (National Interviewee)

6.4 Inter- and intra-sectoral collaboration

The relationships and coordination that HEMB has with inter-sectoral actors (actors outside the health sector) as well as intra-sectoral actors (i.e., actors within the health sector, particularly the DOH) arose as an important theme influencing the current DRRH approach. Key subthemes which arose included: (i) openness to inter- and intra-sectoral collaboration; and (ii) the need to strengthen collaboration on DRRH with inter- and intra-sectoral stakeholders.

6.4.1 Openness to inter- and intra-sectoral collaboration

Strong relationships between HEMB and key sectors in disaster response were evident through the cluster approach. Coordination between HEMB and Regional Offices of the DOH was noted by global informants as a strength of DRRH in the Philippines. At the national level there was clear recognition of the importance of inter- and intra-sectoral relationships to strengthen DRRH. Several interviewees discussed the growing openness of HEMB to partner with other programmes within the DOH and other agencies outside of health:
“The nice thing is that the current HEMB is open, you feel that when working with them and it's nice and they're just open and there're coming from a history of very strong leaders...but now, much of the responsibility is given to them.” (National Interviewee)

Similarly, HEMB have demonstrated clear recognition of the need to strengthen their work on DRRH within the DOH. Strengthening these intra-sectoral relationships is also discussed as an opportunity to strengthen preventative DRRH:

“We should have better engagement with other stakeholders as well, even in, especially inside, the DOH...The across things should be really improved, across with other offices and other sectors. So most of the time we’re looking down from national and regional.” (National Interviewee)

In recognition and support of this, at the time of data collection it was observed that HEMB are trying to address this challenge by proposing a shift in organisational structure which could possibly facilitate the strengthening of these relationships. The DOH was under the Office for Technical Services at the time of the Case Study fieldwork, and has since moved to the Office for Field Implementation and Management (DOH, 2017b). During the drafting process of the new DRRH Omnibus Policy it was observed that under the current structure, HEMB is limited in its capacity to work with other programmes in the DOH to build a whole of health sector approach to DRRH. At this time, it was proposed that HEMB be moved under the Office of the Secretary and Under Secretary in order to reduce fragmentation within the DOH, mainstream DRRH and build a whole of health sector approach. As such, the draft Omnibus Policy states that HEMB:

“Shall serve as the focal point in coordinating the development and implementation of the DOH’s policies, plans, programs and projects on DRRM-H [DRRH]. Nevertheless, it is the responsibility of each and every unit in the DOH organization, including attached agencies, to fulfil these mandates.” (DOH, 2016c, p. 2)

Furthermore, during the expert workshop, it was recognised by participants that strengthening the understanding of the role of health outside of preparedness and response was necessary for increasing inter- and intra-sectoral collaboration on DRRH (as already described in Section 6.3). Global informant interviewees also discussed the need for a whole of health sector approach to managing disaster and climate risks.
6.4.2 Need to strengthen collaboration on DRRH with inter- and intra-sectoral stakeholders

The challenge in strengthening inter- and intra-sectoral collaboration on DRRH was often attributed to the lack of understanding of the role of the health sector in DRRH outside of preparedness and response. As a product of this, HEMB is often considered in silo from the broader public health programmes of the DOH. Interviewees often noted that HEMB is sometimes referred to as the ‘small DOH’ referring to the fact that HEMB would previously work in silo to the broader DOH across all issues. Furthermore, siloed approaches with programmes internal to the DOH were often discussed by interviewees at the national level. This interviewee discussed limitations of key DOH programmes in relation to engagement with HEMB and DRRH:

“The DPCB. They are supposed to be the climate change unit of the DOH. But if you look at the response plan, it's very silent about their role, you cannot really see... But in responding to biological events or hazards the role of other offices are also very important. Because here the infectious disease office, the DPCB, they have the technical expertise there. By default they are expected to have a big role. But we want them to know about that, that what they are doing is already prevention, and that its part of our framework also. So what I’ve said, our functions right now, based on our mandate, the functions are really limited to preparedness and response.” (National Interviewee)

It was observed that there was rarely direct engagement of the Epidemiology Bureau or Infectious Disease Office in discussions relating to disaster prevention or preparedness. Similarly, it was often discussed during field work that the epidemiology information system is separated from the national health emergency OpCen within the DOH, with significant disconnect in terms of which groups should be forecasting, monitoring and providing warnings for, and reporting on hazards and their health impacts. Furthermore, it was discussed that often HEMB were not informed of outbreaks until they had developed into disasters. The disconnect between health programmes and HEMB was discussed by a global informant interviewee who had spent several years working in disaster preparedness in health in Asia, and was familiar with DRRH in the Philippines:

“Sometimes you end up with pockets of activity, let’s say on reproductive health and gender issues, or epidemiology, but if these are not part of the entire system and there
Strengthening coordination and collaboration with stakeholders within and outside the health sector was prioritised by participants in the expert workshop and suggested as essential for strengthening DRRH (Figure 6.3). Three levels of action for collaboration were suggested by expert workshop participants. These levels highlight the importance of strengthening DRRH within the national DOH before moving outwards to the whole health sector, and across health-affecting sectors. As highlighted during the discussion of strategies to address DRRH needs:

“You cannot do a lot of things, go to the other sectors right away, without thinking how we are doing things inside.” (Expert Workshop Participant)

![Figure 6.3. Levels of intervention for strengthening collaboration for DRRH proposed in the expert workshop](image)

This was supported by a global informant during discussion about the importance of the whole of the health system in managing disaster and climate risks to health:

“The whole idea is to try to reduce the barriers to those that contribute to managing the risks wherever they are and to acknowledge as much as possible their contribution to the management of these risks, so you find a space and a forum where by their individual contributions can be enabled, scaled up and connected to the rest of the system.” (Global Interviewee)
Interviewees also identified the importance of working with health-determining sectors to reduce disaster risks in health:

“What even the way we should work with other sectors. Just like now, we are faced with lots of outbreak events in most parts of the country. So, it's related to the water infrastructure, because after big disasters sometimes the infrastructure doesn't get fixed. So maybe we have to work that out with the infrastructure sector, public works, water administration, and things like that.” (National Interviewee)

Multi-sectoral drills and exercises were suggested during the expert workshop as a tool for strengthening inter-sectoral collaboration. Similarly, the engagement of other sectors in the development of DRRH plans was noted as a useful strategy for strengthening the engagement of other sectors in DRRH. The value of multi-sectoral engagement during the DRRH planning process was discussed by one national interviewee:

“The MPDO [Municipal Planning and Development Office] officer said, ‘Now that I understand what is happening, I am part of the plan. I can help allocate funds and shares that go to the Barangay Captain, and make sure you have an allocation for health in your budget’. So that's very powerful because it's not only coming let's say from the Municipal Health Officer but from the planning officer...when we did the planning, the non-health officials who were with the team, that's when they said, oh, health needs more than just than an emergency plan when it comes to disaster.” (National Interviewee)

6.5 Summary of findings

The findings presented in this Chapter sought to answer FQ1: What are the key priorities and gaps for DRRH in the Philippines? The themes and subthemes relating to FQ1 are summarised in Figure 6.4. The overarching priority identified in DRRH was strengthening community-level implementation. Key subthemes within this priority included (i) strengthening community-level capacity building efforts for DRRH; (ii) need to strengthen local governance and leadership support for DRRH; and (iii) human resources for DRRH.

Two dominant gaps were identified in DRRH. The first related to the role of health in the preventative phase of DRR. The subthemes related to this gap included the: (i) respected role of health in disaster preparedness and response; (ii) growing role of health in disaster prevention; and (iii) the need to strengthen mainstreaming of disaster prevention within the
health sector. The second gap identified related to inter- and intra-sectoral collaboration. Subthemes identified within this gap included the: (i) openness to inter- and intra-sectoral collaboration for DRRH; and (ii) need to strengthen DRRH collaboration with inter- and intra-sectoral stakeholders.

**Figure 6.4.** Summary of findings of the research in answer to FQ1 – Priority and gaps of DRRH in the Philippines
This Chapter presented the findings that aimed to answer FQ1 by identifying the key priorities and gaps in DRRH in the Philippines. Strengthening community-level implementation of DRRH was identified as the overarching priority for DRRH in the Philippines. Two key gaps were identified, these included the role of the health sector in disaster prevention, and inter- and intra-sectoral collaboration. Chapter 7 presents the results in relation to FQ2 on key priority and gaps of CCAH in the Philippines.
CHAPTER 7: KEY PRIORITY AND GAPS FOR CCAH IN THE PHILIPPINES

7.1 Introduction

The previous Chapter presented the current state of DRRH in the Philippines. This Chapter presents the results of this research relating to FQ2: What are the key priorities and gaps for CCAH in the Philippines? Similarly to the previous Chapter, the results presented here were initially identified through the preliminary analysis of Case Study interviews (Section 5.4.2.3), and refined through the expert workshop. Following this, further analysis identified the key priority and two gaps in CCAH, as well as subthemes relating to these overarching themes. While these emerged as separate themes, it is important to note that they are all related to each other in terms of their relevance to driving implementation of CCAH. The findings presented here allow understanding of the current approaches to CCAH in the Philippines, as such they also provide insight into the linkage of DRRH and CCAH.

7.2 Priority: strengthen national organisational structure and governance

The priority in the current approach to CCAH in the Philippines was to strengthen national governance and organisational structures for CCAH. Within this priority three subthemes were identified: (i) the need to strengthen CCAH implementation across all levels; (ii) the opportunity for strengthening CCAH structures due to existing policy mandate; and (iii) the need to establish and sustain an appropriate governance mechanism.

7.2.1 Implementation of CCAH needs strengthening across all levels

CCAH was observed to have limited implementation on a national level, with weaker implementation on regional and local levels. National and regional interviewees often acknowledged that the challenges in national implementation of CCAH limited regional and local implementation:

“I don't think there is much on the LGU level because the program is not that active, at the national level it's not active so how can you expect that it could be rolled out to the regional even to the local level.” (National Interviewee)
This reality was further confirmed by a national interviewee working in health projects at the LGU level:

“The question for me is, fine you have all the coordination at national and provincial level, fine you have all these implementing rules, laws. But then, how is it felt at the barangay level, and this is the question for myself. If you ask them ‘what is climate change?’ Do they even know how to define this?” (National Interviewee)

It was observed that implementation at the regional and local levels are largely restricted to those LGUs and Regions involved in the MDGF Project on building CCAH capacity. However, some other regional and local stakeholders do recognise the potential health risks of climate change. This understanding was found to be typically the result of individual pursuit of the topic or exposure through the MDGF Project, and was largely restricted to general understanding of potential pathways, with limited understanding of the extent to which these risks are increasing within their own localities or regions. Low awareness of climate change and health issues at a local level was often discussed by interviewees as a key reason for limited implementation of CCAH at this level:

“More often climate change is seen as something that effects their crops, something that effects their livelihood, but they don't see that – ‘I don't have something to eat right now, that is a health problem’.” (National Interviewee)

Several interviewees spoke about the important role of the DOH central office in working with LGUs to strengthen their understanding and implementation of CCAH. This was illustrated by a national interviewee in the context of LGU access to CCAH funding:

“In terms of funding, we have available in CCA we have the People’s Survival Fund, this fund is available to LGUs and community organisations...We notice that there are no proposals related to the health sector. We think that this is maybe something that the DOH should be looking into to target and coordinate with the LGUs. But maybe the LGUs don’t look at or see clearly the link between health and climate change, and maybe that is why it’s not a priority.” (National Interviewee)

7.2.2 Existing policy mandate for CCAH structures

The policy analysis undertaken for this research revealed numerous strengths in relation to the development of the organisational and governance structure for CCAH (Appendix 6).
First, the structures have already begun to be implemented under the existing policy mandate, and were identified as a priority area for strengthening in the CCAH national guidelines and most recent strategic plan (DOH, 2013a). Second, the existing policies recognise the need for CCAH to be mainstreamed in relevant health programmes, and designates responsibilities for implementing CCAH to this effect. Finally, the development of the appropriate structure reflects an iterative learning process. This is illustrated by the evolution of climate change and health structures in DOH policies:

- The Technical Committee for Climate Change and Health, created in 2010 (DOH, 2010c), was bound to the period of the MDGF Project (Section 5.3.4.1) thus ceased to function after the project finished (DOH, 2013a).
- The Climate Change Unit under the DPCB, created in 2011 (DOH, 2011a) with designated staff and resources outlined in the most recent Strategic Plan (DOH, 2013a);
- The Inter-Agency Committee on Environmental Health designated as the multi-sectoral coordinating mechanism in 2012 (DOH, 2012b).
- Designated roles and responsibilities in CCAH were provided in 2012 through the Operational Guidelines of the DOH on CCAH (DOH, 2012a).
- The need for a coordinating mechanism was clearly recognised within the DOH after the Technical Committee for Climate Change and Health ceased functioning (DOH, 2013a). Thus the DOH Climate Change Executive Committee was created in 2015 (DOH, 2015). The initial Department Personal Order creating the Climate Change Executive Committee excluded key stakeholders (DOH, 2015), this was later amended to include essential stakeholders from the Epidemiology Bureau and the Health Promotion and Communication Service (DOH, 2016b).

Additionally, the effectiveness of these structures has been evaluated in the 2014-2016 strategic planning process, and identified as a priority for further strengthening, in line with the National Climate Change Policy (DOH, 2013a). The policies, guidelines and strategic framework all recognise the need to mainstream CCAH across relevant work of the DOH. As such, the roles and responsibilities for the implementation of CCAH are designated in CCAH policy (DOH, 2012a). The agencies include the EOHO of the DPCB, the Climate Change Unit, Health Promotion and Communication Service; Bureau of International Health Cooperation; Health Human Resource Development Bureau; Health Facilities Development
7.2.3 Need to establish and sustain an appropriate governance mechanism

Despite the policy mandate to support the governance structure for CCAH, and initiation of these structures in the DOH, there are significant challenges around establishing and sustaining appropriate governance structures for CCAH. There was a clearly recognised need to determine the most appropriate organisation and governance structure for the implementation of CCAH among national interviewees and all expert workshop participants. Numerous interviewees questioned the appropriateness and authority of the Climate Change Unit to mainstream CCAH in the DOH, and the sustainability of CCAH funding to support CCAH:

“We need to look at the effectiveness of having a separate unit for climate change, because the intention is actually to mainstream. While, yes, it is good to have an office dedicated to that. But that should be across the whole DOH, it’s just not in a single office. Because I think even some of the officials, they are saying, ‘we have been doing this in our basic programmes, so we just really need to organise ourselves’...but the solution is not having a separate unit to have that oversight because that wouldn’t translate into having an effective implementation.” (National Interviewee)

Considering that CCAH needs to be mainstreamed to strengthen existing public health efforts, a lot of interviewees demonstrated that they were aware that CCAH was already existing to some extent in the DOH. However, the extent to which climate change science or knowledge were used to inform programme planning within the DOH was unclear. It was observed that climate change was acknowledged as a health risk driver within specific programmes, including the Omnibus Policy process of HEMB (DOH San Lazaro Compound, Manila, 22nd August 2016) and Consultation on the Development of the Food and Waterborne Disease Program Strategic Plan 2017-2022 (Manila, 14th to 15th September 2016). However, other programmes remain unknown. Several interviewees commented that CCAH in the DOH is unsystematic and requires coordination:
“We have identified several offices within the DOH who are working on climate change...there is a need to coordinate these activities. But what is the most appropriate organisational structure? Should there be an office? Or a mechanism to oversee? Where will it be positioned? Under the Office of the Secretary? Or should it be one of the major units, just like HEMB? We think this needs to be further looked into.” (Expert Workshop Participant)

National interviewees identified that establishing and sustaining a mechanism for coordinating the mainstreaming of CCAH is a challenge. It was evident that this was not only a challenge when the Technical Committee for Climate Change and Health ceased to function when the MDGF Project finished, as previously mentioned. This was also an evident challenge with the current Climate Change Executive Committee. Interviewees often expressed that sustaining the mechanism remains a challenge despite the supporting policy. Key issues raised for sustaining these mechanisms raised by national interviewees included the uncertainty of support from leaders, the work load of staff tasked with driving CCAH, and most commonly the authority of the Climate Change Unit to implement CCAH across the DOH. The position of the Climate Change Unit under the EOHO of the DPCB was often noted as limiting the Unit’s authority to coordinate CCAH across the DOH, as discussed by this interviewee:

“If there is no steering committee higher than this one or there is no committee at the level of the Secretary, the other programs will not be moved by the present secretariat, this is the EOHO.” (National Interviewee)

The need for a cross cutting structure that brings together all of the actors within the DOH was a commonly held opinion among many national interviewees. Interviewees also recognised the need for the coordinating mechanism for CCAH to have adequate authority to work across the agencies of the DOH. When reflecting on how the governance structure could be revised, interviewees would often say that a coordinating programme needed to be positioned under the Office of the Secretary for effective mainstreaming across programmes. For example, one national interviewee from the DOH discussed the following:

“[The Climate Change Unit] cannot mobilise or tell the offices that it should be implemented. It should be at Undersecretary level or the Executive Committee level....It is either Undersecretary or Office of the Secretary, so that everybody will really understand or really recognise that all of the offices should have a program on
climate change so that it will be intertwined or integrated in all the offices.”  
(National Interviewee)

Global informants also emphasised the importance of authority in CCAH governance. A legal mandate and appropriate authority were seen to support CCAH implementers to work closely with focal points of climate-sensitive health programmes, the environmental sector and community stakeholders. In these countries, local agencies of the national health system with clear accountability from the national level enabled community-level implementation:

“It’s their dynamics within the government, they receive orders and they are able to implement it because they have the structures in place that reaches everywhere, from the top to down at the community...They’re also at this stage of development where there is a lot of funding coming in...it is quite an autocratic government, but it does function quite well, and people more or less have confidence in the system and expect it to work.”  (Global Interviewee)

Finally, interviewees also discussed the need for this mechanism to be sustained to implement CCAH:

“The concept of technical working group will be there only for temporary solution for let us say starting a work. Once it is there already, once it is compiled then it should be a longer-term solution like permanent staff really of that office or whatever.”  
(National Interviewee)

CCAH in the DOH was often criticised by interviewees as being project-based in terms of funding models. Expert workshop participants specifically raised concerns relating to the sustainability of financing of the CCAH programme and how this has limited the capacity of the Climate Change Unit to drive implementation. Similarly, a national stakeholder working closely with the DOH on health systems resilience discussed the need for a longer-term view of CCAH funding within the DOH:

“Imagine yourself as a program manager you have to think long term, and broad. So, it takes a while for people to do that kind of reflection. It’s fairly new that there are resources, so now there’s an opportunity to do that. But obviously there are, what I call institutional inertias...because it has been in a scarcity, it has lived on scarce resources for a very long time, so you can just imagine how much institutional inertia there is.”  (National Interviewee)
Global informants similarly criticised CCAH implementation for often taking a project-based approach. It was also acknowledged by global informants that cross-cutting governance mechanisms are needed on all levels if CCAH is to be mainstreamed.

7.3 Research and evidence

The significant need for climate change and health research was highlighted as a considerable gap in driving CCAH action. Two subthemes emerged under this theme. The first subtheme was the limited availability of country-level climate change and health research and evidence. This was highlighted in interviewees across all levels, the expert workshop and national policies. The second subtheme related to the specific research needs, including to strengthen: (1) baseline health data for linking health impacts to climate change; (2) evidence of health risks associated with climate change (including for climate-sensitive diseases); and (3) research on CCAH options and actions.

7.3.1 Limited research and evidence relating to climate change and health

Limited climate change and health research was noted as a significant barrier to CCAH among national and regional interviewees, as well as in the expert workshop. The paucity of climate change and health data was also observed through interactions with interviewees. Often, following interview, interviewees would ask if the researcher was aware of any climate change and health data available specifically for the Philippines. One interviewee did elude to the presence of climate change and health studies linking climate change to dengue. However, it was said that these studies have not been published, and upon discussions with other interviewees that were aware of these research efforts, it was said that these studies were believed to be of questionable quality, and had limited uptake and use by the DOH. National interviewees strongly recognised the challenges in garnering support for climate change and health planning and programmes with a lack of supporting data:

“There is a lack of the study correlating Dengue and other biological things to climate change...myself I am longing and looking for such, because when we develop that plan...in that meeting that is one question...‘Why Dengue?’ “Why Malaria?” These vectors and these diseases are related, and can be correlated to climate change. But when they ask us we cannot see any study that could back up our claim.”

(National Interviewee)
The lack of climate change and health data which could be used to inform planning was a clear challenge acknowledged by interviewees. Furthermore, this was highlighted as an important barrier to CCAH action:

“I’m not sure if DOH has released any statistics on the changes in the mortality and morbidity cases because of changes in climate, because that would be really helpful. There are those figures globally, but I find it very hard not to have the local statistics, like if there’s a spike of dengue cases in La Nina and there’s a spike of dengue cases in typical El Nino...we don’t see a lot of evidences especially from my understanding, when I’m trying to have an evidence-based link on climate change and health, this is very difficult." (National Interviewee)

Intent to develop the research agenda on climate change and health within the DOH was explicitly expressed by a number of interviewees. However, management support for climate change and health research was not strong. At the time of data collection climate change was not identified as a priority research area in health, as set out in the National Unified Health Research Agenda (NUHRA) 2011-2016 (Philippine Council on Health Research and Development - Department of Science and Technology [PCHRD-DOST], 2011). Furthermore, it was observed that there were no plans for renewing the expired climate change and health strategic plan, thus the future for climate change and health research was, at that time, unknown. Expert workshop participants, interviewees on the national level, as well as some regional interviewees recognised the need for CCAH research to drive action in the sector.

The need for research and evidence to inform and drive CCAH arose as a top priority. This was indicated by the expert workshop, as well as national and regional interviews. As explained by a presenter during the needs prioritisation exercise:

“In order for CCA to be mainstreamed operationally into aspects of the DOH, we need to start with research...Before we are able to determine the appropriate governance structure, the appropriate approaches, we need to start with research.” (Expert Workshop Participant)

This was particularly evident with interviewees from within the DOH and stakeholders working closely with the DOH on issues related to climate change and health. For example, a national stakeholder stated:
“So, they need to have really good data, well researched data, to say it is really happening and how does it impact on programmes so that they will have the basis for planning. As long as this data are not available, they are not going to get the management support.” (National Interviewee)

The importance of data in informing evidence-based policy for CCAH was emphasised by interviewees. A key leader in climate change and health from the DOH stated:

“How would you adapt? You need to have data...The results of the research will guide them [programme managers in the DOH] on how to do the intervention, specifically on infectious diseases, particularly on vector borne diseases. The results of the research should be the basis of crafting of interventions on their programs how to adapt or to reduce the effect climate change.” (National Interviewee)

The need for evidence-based adaptation and climate change research was strongly recognised through national climate change policy, and CCAH policies (Appendix 12). National CCA policies recognise research as an essential component of CCA across all sectors (Climate Change Commission, 2010, 2011). Despite climate change not being identified as a research priority in the NUHRA 2011-2016 (PCHRD-DOST, 2011) at the time of data collection, the inclusion of CCAH in the NUHRA was a priority. The ‘Philippine Strategy on Climate Change Adaptation: Health Sector’ calls for the climate change and health research to be “coursed through the NUHRA” (DOH, 2010d, p.16). All national climate change and health policies, administrative orders and plans identify climate change and health research as a priority (Appendix 12). Similarly, national interviewees and expert workshop participants also recognised the importance of climate change and health research, and including CCAH in the NUHRA:

“The DOH could now allocate more in this line of work, and use this as input for their policy and planning...and that’s the thing, climate change is not in the research agenda. So they should put it there.” (National Interviewee)

Since the time of data collection, the NUHRA has been revised. The NUHRA 2017-2022 now includes CCAH research (PCHRD-DOST, 2017a, 2017b). This is an important step in securing future funding for CCAH research. Furthermore, there has also been a national call for CCAH research (PCHRD-DOST, 2017c). Both DRRH and CCAH research needs are recognised in the latest NUHRA, this is discussed as an opportunity for linkages in
health in Section 8.3.8. Despite the inclusion of CCAH in the NUHRA, there remains a significant gap in both health impacts and adaptation research for climate change.

Despite the recognition of the importance of climate change research in policies and plans, a key challenge identified in the implementation of CCAH was the lack of research and data to inform adaptation action. It was evident through discussions with interviewees and expert workshop participants that the specific climate change and health research goals outlined in the 2014-2016 National CCAH Strategic Plan were not met (Appendix 12; DOH, 2013a). This was also recognised on regional levels. Box 4 illustrates that climate change is being linked with specific health impacts in Eastern Visayas, and research is needed to inform environmental and health action in the region.

**Box 4.** The recognised need for climate change and health data in Eastern Visayas

<table>
<thead>
<tr>
<th>The impact of climate change was recognised on local and regional levels in Eastern Visayas:</th>
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<tr>
<td>“The consequences of climate change...in the Region, its commonly occurring and recurring, it's the red tide infestation of our bays...There is temperature change, then the proliferation of this algae...it actually affects the bay...it affects health as well.” (Regional Interviewee)</td>
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Regional interviewees also recognised the need for climate change data to inform evidence-based environmental initiatives to safeguard health. For example, when talking about climate change, an interviewee discussed mangrove planting to protecting coastal communities for worsening storm surge and coastal flooding:

“In terms of what are the preventive factors we still have to grow. I remember all these things were being done when we were still kids, plant five seedlings of this and that, but what happens, we were not told to take care of it...Looking back, had we been told about that, but it was just for compliance...Had we really done our tree planting, reforestation...can do so much if we had planted them in the right areas.” (Regional Interviewee)

Global informants also noted challenges with implementing CCAH projects without sufficient climate change and health data. It was often discussed that national health baseline data in low- and middle-income countries was insufficient for developing climate change and health risk projections. Heatwave data in high-income countries was noted as the most
climate-sensitive hazard with the most advanced health outcome data which could be used with climate change projections:

“Sometimes there is not the data to support local vulnerability and adaptation assessments. That’s what we are finding when we are trying to implement, we are having to go back and strengthen climate and health data in order to get a useable assessment.” (Global Interviewee)

However, when discussed with national interviewees, heatwaves were not considered as a concern within the Philippines, with no designated lead in the national DOH to address heat health concerns.

7.3.2 Specific research needs to drive CCAH action

Specific research needs were discussed during interviews, these included the need to: (1) strengthen baseline health data for linking health impacts to climate change; (2) evidence of health risks associated with climate change (including for climate-sensitive diseases); and (3) research on adaptation actions. Example quotes demonstrating these needs are provided in Table 6.
<table>
<thead>
<tr>
<th>Research Need</th>
<th>Example quotes from primary data</th>
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<td><strong>Strengthen baseline health data for linking health impacts to climate change</strong></td>
<td>“In terms of health, of course you have to look at the incidences of morbidity for airborne, vector borne, and water borne diseases. The problem that they have is that can you actually attribute it to climate change? It is about having the baseline so you can actually attribute it...I think in terms of health you can start with the burden of diseases, it boils down to the indicators and the baselines in health.” (National Interviewee)</td>
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<td>“No, we actually during the MDGF Project, we started to do that, five diseases. Together with the epidemiology bureau. We tried to develop software to capture it [the link between climate change and health], unfortunately no data can be found. Only I think dengue was there with good data. But others like malaria, we have difficulty getting it...We tried to do that, but as I mentioned data are not available for other diseases. For dengue there is, but for others none.” (National Interviewee)</td>
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<td></td>
<td>“Because the other thing in disaster risk...you understand the hazard, you understand the vulnerability. Those are the DRM thing. So we are doing it in the hospitals, we are doing this in our offices. So the other thing is the hazard is the climate change or something about weather. So what will be the changes to the vulnerable population and the capability that you will have to develop, what kind? But until now she cannot answer me. So how can I...?” (National Interviewee)</td>
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<td>“One of the priorities for research and development should be the link between climate change and diseases that actually arise in terms of increases in temperature.” (National Interviewee)</td>
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<tr>
<td><strong>Evidence of health risks associated with climate change</strong></td>
<td>“They don't understand the other layer of risk that the climate change is bringing in the health, and not just in the DOH...In all agencies there is another layer of risk because of climate change and it’s not well appreciated in the sense that it should be in their regular programming.” (National Interviewee)</td>
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<td>(including for climate-sensitive diseases)</td>
<td>“First we need to know how climate change is related to health, then climate change plus disasters on health.” (Expert Workshop Participant)</td>
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<td></td>
<td>“More local researches are needed to establish health impacts of climate change” (DOH, 2013a, p. 39).</td>
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<td>“We should have proceeded with that [climate change and health research] because people are asking information...when you say dengue, malaria and others are due to climate change, do we have proof? And then what should we do, if it is really climate change related?” (National Interviewee)</td>
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<td></td>
<td>“We want to go into research on what kind of diseases will occur or will change because of climate change? Because from there we would know also what kind of prevention or what kind of things we should do during disaster. Because before we are looking at leptospirosis, we are looking at dengue, what other things should change? So that’s the way I was looking at it, for the future.” (National Interviewee)</td>
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<tr>
<td>Research on adaptation actions</td>
<td>“So, we need to provide information in terms of quantity or formula, that they [the DOH] can use in planning. But, if you just say climate change next year, more typhoons how more is that typhoon? If we have 20 typhoons in a year, would it be 25 or 30? They say more stronger typhoons, or a stronger typhoon. How strong is that? Is it 300 km per hour, it is just like Yolanda? Or what? More flooding, more rain, how? We need quantities. To be used in planning. How many volume of rain? Is it different from before? The climate change group cannot come up with the data then nobody will believe the climate change group. They just say increasing temperature. So what? So what? What is the impact of that on my programme? Will I do differently or the same? If it is the same well..so, I have to do nothing but programme my activities as planned. As usual. Business as usual.” (National Interviewee)</td>
</tr>
<tr>
<td></td>
<td>“More local researches are needed to...measure cost-effectiveness and efficiency of different CCAH interventions.” (DOH, 2013a, p. 39)</td>
</tr>
<tr>
<td></td>
<td>“I don’t know what the budget is of the Department of Health on research, by maybe they could now do a lot more on this research as inputs for guiding their policies, and particularly planning.” (National Interviewee)</td>
</tr>
</tbody>
</table>
This illustrates that climate change and health research is needed to advocate for investment in CCAH. The evidence base is particularly needed to garner the political commitment and leadership to drive CCAH. Furthermore, it was widely recognised within interviews and the expert workshop that CCAH research is important to inform programme and planning decisions, priorities and specific CCAH actions; and inform the governance structure for CCAH. An important step in developing climate change and health research is strengthening baseline health data, as is occurring in the Bicol Region (Box 5).

**Box 5.** Strengthening baseline health data for climate change research in Bicol

Bicol Region was one of the regions chosen for piloting the MDGF project (Section 5.3.4.1). As part of this project it was identified that the Region does not yet have strong enough health baseline data for climate-sensitive diseases to develop climate change projections for these diseases. As one regional interviewee discussed:

“Research is one of the things they really need, especially in our region, if we can make some research around that and develop such research, and maybe we can link the climate change data to the epidemiological data. This is one of the promising areas that this could happen.” (Regional Interviewee)

As a result of this baseline health data is currently being strengthened in the Region:

“Presently we are concentrating on gathering data and analysing it for future use for future material for research. That’s what we’ve been telling the group that came for the climate change work. Furnish all the data, collect all the data, make a system for collecting all the data, and then probably in the future we can use them for your research.” (Regional Interviewee)

### 7.4 National leadership for CCAH

Two subthemes emerged in relation to leadership for CCAH. First, significant challenges were acknowledged in sustaining leadership and political commitment for CCAH. Second, champions for driving CCAH were identified as important and necessary if CCAH was going to progress in the Philippines.
7.4.1 Difficulty sustaining leadership and political commitment for CCAH

Political commitment and prioritisation, and limited and unstable leadership arose as key barriers to implementation of CCAH in the DOH. This was discussed by numerous national interviewees and during the expert workshop. The lack of political commitment and prioritisation of CCAH was often attributed to limited acknowledgement of climate change and health risks. Climate change was even at times contested by some who were tasked to lead the implementation of CCAH in the DOH. Political commitment was also limited due to the lack of prioritisation and advocacy for CCAH within the DOH:

“Because climate change will fall under the environmental disease [DPCB] division...it's not their priority and they will be the one to champion it with the Secretary of Health and with the Director of the DPCB. So there is a disconnect...I mean it's not a priority, I think that's the main reason” (National Interviewee)

Finally, political commitment was low due to broader debates around climate justice. A number of national leaders inside and outside health questioned the responsibility of the Philippines to fund their own adaptation if the country is not a major contributor to anthropogenic climate change. This was largely because at the time of data collection President Rodrigo Duterte had not yet ratified the Paris Agreement and it was believed he would refuse to commit to the Agreement. This was discussed by in the expert workshop in relation to CCAH needs and funding:

“Remember the argument of the President, why he refused to ratify the Paris Agreement. It is precisely because of the concept of climate justice...What it means is that the Philippines is a vulnerable country and a country that emits not very much in terms of greenhouse gas emissions. And it should not be burdened, financially burdened when it comes to climate change. That is why it is so hard to finance climate change work in this country, because of the concept of climate justice.” (Expert Workshop Participant)

Within this context, national leadership in climate change in the Philippines was uncertain at the time of field work. Global interviewees noted the importance of collective influence of strong leaders in CCA on a national level. Through the use of examples of national CCA agendas, such as the United Kingdom, they noted the valuable role of national scientific advisors in driving the national CCA agenda and implementation in all sectors.
Leadership within the DOH was discussed by interviewees more often compared to limited leadership from the national government and Climate Change Commission. Leadership and higher level political commitment within the DOH were key barriers to implementation. This was discussed by national interviewees who worked closely with DOH stakeholders on CCAH. Limited acceptance of climate change and health risks was often discussed as a barrier for leaders of the DOH driving CCAH:

“Who could lead this?...PersonX is the ideal one because he has a passion on climate change. Unfortunately, he was out...Executive Committee members, the high-level officials, at the DOH only very few are interested...even some of them are questioning, is this true? Is this really happening? Shall we provide budget for this, this is not a waste of time and money?...It needs to be led by an Executive Committee member...under the Secretary of Health or Assistant Secretary of Health, with the authority, not just a program manager.” (National Interviewee)

However, not all interviewees believed a leader from higher level management was needed, due to the greater turnover of upper management when compared to technical staff. This is illustrated by a national level interviewee who works within the DOH:

“We need, clear leadership. Because, you know, our administration...it's short-term...And then it changes to another. But we technical staff, we are permanent and we are not coterminous with the Administration...it's only somebody who will rise among us and who will be supported in doing that...they need to come from middle management.” (National Interviewee)

Interviewees often discussed both the lack of leadership and political support hand in hand as the key reasons for limited implementation of CCAH:

“The budget, the leader and staff, and then it could work. For climate change, if I can see strong leader, I can see strong office...the point person is complaining, no management support, no money, all the proposals are turned down, that sort of problems. So, it should be from the top I should say. But if there is a political will to create an office for climate change and that office should have staff.” (National Interviewee)

This problem was heightened by high leadership turnover in CCAH. This was particularly pertinent at the time of field work due to the recent change in President and thus
Secretary and Undersecretaries of Health. At the time of data collection recent changes recent leadership changes had occurred within the DOH Executive Committee, with the loss of a political advocate for CCAH. It was observed that the Climate Change Unit of the DOH had also experienced a recent leadership change. Leadership change was discussed by interviewees as also being a key barrier for developing and sustaining technical capacity for CCA in the DOH.

Not only was a lack of CCAH leadership visible within the DOH on a national level, these leadership challenges also extended to regional and local level implementation of CCAH. See Box 6 and 7 for examples of these challenges.

**Box 6. Eastern Visayas - Regional and local leadership in CCAH**

Within Eastern Visayas no LGU interviewees reported CCAH action or climate change as a priority for health in their LGU. This was often reported by local and regional interviewees as being the result of lack of political commitment to health:

“*The former mayor was very supportive of the health programmes, no problem, but some of the mayors, most, the other ones, they are not giving priority. Also, although they will give funding, they will give you fund for this year, or the next year, that’s it…For us down at the Municipal level, funding for health is not immediate.*” (Local Interviewee)

In the context of the devolved health system of the Philippines, local level leadership was also highlighted as important for implementation. CCAH action was limited at the local level. However, the political commitment and leadership in health in the National Capital Region has facilitated the first steps of implementing CCAH in the Region (Box 7).
Box 7. National Capital Region – Regional and local political commitment to CCAH

During the interviews in the National Capital Region it became apparent that climate change in health is a priority, with a regional CCAH plan under development. LGUs are also being encouraged to develop local CCAH plans. During the discussion of local CCAH plans, the issue of LCE commitment and prioritisation of CCAH was raised:

“That's one of the challenges actually. Even with the Regional plan...asking the local coordinators to create their own local plan, it would take sometimes years, before the LCE would sign.” (Regional Interviewee)

Marikina is often held up as a model of good leadership and governance in health, particularly for winning many awards for being a Healthy City. Through the political support and leadership in the Healthy Cities approach, and as a part of the MDGF Project on climate change, the city developed some climate change estimates for health. These climate change and health projections have been said to be used in health programme planning. However, this was acknowledged by interviewees as a starting point and in great need of strengthening.

7.4.2 Champions for driving CCAH

Leadership of CCAH was a common recurrent theme in national and regional interviews and in the expert workshop. The need to strengthen leadership and political commitment for CCAH was supported by interviewees on all levels and the expert workshop. Identifying a champion for CCAH emerged as a key theme in strengthening this leadership. Participants of the expert workshop expressed that there was a need for a champion in CCAH:

“We recognise that strengthening leadership is important...We need increased advocacy on the part of our leaders, because when we talk about climate change we need a high degree of appreciation, and we expect the same of our top-level officials...We need a champion, it might be hard to identify this person on the top level. But it would be good if we could find someone who could really push for climate change.” (Expert Workshop Participant)

The authority to act and implement CCAH action was recognised as core to successful leadership. As discussed by a manager with over 20 years of experience working in the DOH:
“So as far as we're talking in climate and health, first of all it will always be the person who is going to implement the programmes should be the one who knows what to do and given the full authority to do it, that should be first and foremost.”
(National Interviewee)

During the expert workshop, participants indicated that there are some health professionals within the DOH who are willing and able to become champions for CCAH if supported to do so. Similarly, the presence of a few individual health professionals ‘championing’ CCAH in their own work was identified through interviews and observations. During the data collection, it was observed that a number of individuals working in health on the national level push for the inclusion of climate change in their own work. This was observed during the Consultation on the Development of the Food and Waterborne Disease Program Strategic Plan 2017-2022 (Manila, 14th to 15th September 2016). During the Consultation, the need to consider increasing risks from climate change as a threat to the success of the Food and Waterborne Disease Program was discussed. Furthermore, one national interviewee from academia stressed the importance of health professionals understanding climate change risks to health in a discussion of how they incorporate climate change into the curriculum they teach to nurses and doctors:

“Medical students need to be taught about how to deal with the health impacts of climate change. Me, in my courses, I do this. It is so important. Really, I believe that climate change needs to be part of the curriculum for medical professionals.”
(National Interviewee)

This illustrates that there is the willingness to drive CCAH on an individual level among some national health professionals. However, this action was ad hoc and the result of individual commitment with no driving organisational strategy or commitment. It was more commonly recognised among interviewees and during the expert workshop that there is limited political commitment and leadership to support CCAH.

7.5 Summary of key findings and conclusion

The findings presented in this Chapter sought to answer FQ2: What are the key priorities and gaps for CCAH in the Philippines? The key points of these findings are summarised in Figure 7.1. Summary of findings of the research in answer to FQ2 – Priority and gaps of CCAH in the Philippines. The key priority in the Philippines was to strengthen
the national governance and organisational structure for the implementation of CCAH. Key subthemes emerging under this priority were: (i) the need to strengthen CCAH implementation across all levels; (ii) policy mandate for CCAH structures is existing, however is not being implemented; and (iii) the need to establish and sustain an appropriate governance mechanism.

Two key gaps were identified in CCAH, including: (1) research and evidence for climate change and health; and (2) national leadership for CCAH. Within the research and evidence theme, key subthemes included: (i) limited research and evidence relating to climate change and health; and (ii) three specific research needs to drive CCAH action – strengthen baseline health data for linking climate change impacts with health, evidence of health risks associated with climate change; and research on adaptation actions. Within the second key gap – national leadership for CCAH – the two subthemes were: (i) difficulty sustaining leadership and political commitment for CCAH; and (ii) champions for driving CCAH.
Figure 7.1. Summary of findings of the research in answer to FQ2 – Priority and gaps of CCAH in the Philippines

These findings were identified through Case Study interviews and expert workshop. Challenges with climate change and health data were echoed by global interviewees. Governance for CCAH was a key issue discussed by global informants. They, however, noted the importance of accountability in national CCAH governance mechanisms. This Chapter together with Chapter 6 form the foundation for understanding links between DRRH and CCAH in the Philippines presented in Chapter 8.
CHAPTER 8: STRENGTHENING LINKS BETWEEN DRRH AND CCAH IN THE PHILIPPINES

8.1 Introduction

Chapters 6 and 7 presented the findings in relation to the priorities and gaps for both DRRH and CCAH in the Philippines. They set the scene for understanding these two approaches within the Case Study and provide additional insight into how these approaches can link. This Chapter presents findings from the Case Study supplemented by the global informant interviews to identify what linkages exist, and what are the challenges in strengthening these linkages. In doing so it answers FQ3: How is DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links? This Chapter draws on the potential areas for linkage identified in the literature review of this thesis (Chapter 4). As such it discusses linkages in the Philippine context in terms of conceptual linkages, as well as technical and operational linkages.

8.2 Maximising conceptual synergies – the utility of resilience

There are three potential areas for conceptual synergy that were identified through the literature review: resilience, risk and vulnerability (Section 4.6.1). This section presents the research findings in relation to conceptual synergies for linking DRRH and CCAH in the Philippines. For delineation of scope, this research intended to only investigate the utility of resilience in promoting conceptual synergies. Resilience was examined as it has been investigated to some extent as the foundation for frameworks linking DRR and CCA outside of health. Further, the policy analysis identified resilience as the most commonly used of the three terms within the Case Study. The section draws on Case Study data, including national, regional and local interviews, the expert workshop, and relevant policies. These results are complimented by global informant interviews. First, the results from a policy analysis on resilience in DRR and CCA policy inside and outside of health are presented, these are followed by the perceptions of interviewees regarding the utility of resilience as a uniting framework.
8.2.1 Use of resilience in relevant policy in the Philippines

‘Resilience’ is commonly used in DRR and CCA policies and plans on a national level both inside and outside of health in the Philippines. The details of the use of resilience in each policy is outlined in Appendix 13. This section provides an overview of the findings in relation to the use of resilience in these policies and plans.

The term resilience is commonly used in the three national climate change policies and plans analysed (Appendix 13). These policies discuss resilience in terms of environmental systems. The National Climate Change Action Plan 2011-2028 (NCCAP) is the only national plan using resilience in a health-related application through the ‘human security’ priority. Outcomes of this priority include: a health system resilient to climate change; and DRR and CCA to be jointly implemented in all sectors. However, the term resilience only appears in the goal summary in the appendix. No direct reference is made to resilience in a health context within the main text of the NCCAP, including in discussion of the human security priority.

Resilience is commonly used in an overarching manner in CCAH policies and plans (Appendix 13). Building community resilience is one of the six activities in one of the five pillars of the Philippine Strategy on Climate Change Adaptation: Health Sector (DOH, 2010d). Furthermore, the National Policy on Climate Change Adaptation for the Health Sector (Administrative Order 2012-0005) acknowledges the need to develop specific activities for strengthening community resilience (DOH, 2012b). For example, the term has been used in the vision of the strategic plan (DOH, 2013a), and in the definition of CCAH (DOH, 2012a, 2012b). However, community resilience is not referred to in the 2014-2016 National CCAH Strategic Plan (DOH, 2013a).

Compared to the national CCA policies, the national DRR policies and plans use resilience more often and with an explicitly stated definition (Appendix 13). In these, resilience is used primarily in reference to communities. Health is acknowledged as an important issue within DRRM policies and plans. Direct references to resilience in relation to health within national DRR policies and plans include: the resilience of health facilities; and community resilience to psychosocial impacts of disasters (for which the DOH plays a lead role in disaster response).
DRRH policy indicates an increasing use of resilience in relation to health infrastructure and community resilience. The National Policy on Health Emergencies and Disasters (Administrative Order 168s.2004) makes no mention of resilience. However, it is important to note that this was created before major milestones which brought resilience into DRR discourse, including the HFA (2005), and the Philippine DRRM Act (2010). Resilience is increasingly used in more recent policies and plans. These policies also illustrate a paradigm shift from a focus on infrastructure resilience to community resilience. This is particularly evident in the draft HEMB DRRM in Health Strategic Plan 2017-2022 (HEMB, 2016a).

This analysis of resilience indicates that it is commonly used as a national policy goal in DRR and CCA both inside and outside health. However, nowhere is resilience explicitly discussed as a common conceptual goal for linking DRR and CCA either inside or outside of health.

8.2.2 Perception of resilience as a uniting concept for DRRH and CCAH

When prompted, a number of national interviewees expressed that resilience is a potentially useful concept in bridging DRRH and CCAH. In part, this was because it is used by both DRR and CCA stakeholders, particularly in national policy. Furthermore, the concept presents an opportunity to illustrate to stakeholders in both fields that they have shared interest in building resilience. As one national interviewee expressed when discussing the role of health programme managers in DRRH:

“If I am an epidemiology manager, what do I care about CCA or DRRM?...It's interesting for me this idea of resilience, because for the health sector, I think it's a potential bridge for others within the health sector to understand like the broader implications of CCA, because they already think that DRRM is just preparedness and response and therefore ‘I don't have a stake there’ and CCA seems to be broader. The problem is the observations of how people use the terms.” (National Interviewee)

However, interviewees on the most part expressed challenges with using resilience as a uniting concept. The first key theme arising in relation to resilience was the need for resilience to be better defined and operationalised in DRRH and CCAH. The majority of interviewees in the Philippines expressed that a clear operational definition was necessary if resilience were to be useful as a framework for bringing DRRH and CCAH together. This
view is supported by the policy analysis which showed that there were no resilience definitions specific to health (Appendix 13). The definitions provided in the national DRR policies and plans are somewhat inconsistent, with two differing definitions. However, the definition used in the DRRM Act is most commonly used, which defines resilience as:

“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.” (Government of the Philippines, 2010, p. 9)

Definitions are not often given within the national DRRH policies and plans. However, the Omnibus Policy provides the same definition as the DRRM Act (DOH, 2016c). Comparatively, the climate change policies and plans both inside and outside of health provide no definition or guidance as to what resilience means for people or communities.

Interviewees on a national level within the Philippines often expressed difficulties in understanding resilience as it applied to their programmes. As one interviewee working in health outside of the DOH stated:

“With resilience the most important thing is indicators, how do we measure it? Because resilience is really at the outcome level, we need to clarify the indicators so we can see if resilience is being built and how to operationalise it.” (National Interviewee)

The need to clearly define and operationalise resilience in order for it to be a useful concept for implementing DRRH and CCAH was discussed by numerous interviewees. The understanding of resilience by LGU and community stakeholders was also highlighted as important:

“Unless the people working on the ground have very a clear concept of resilience, they won't able to do much...we have to ensure that those in the trenches actually know what they are doing.” (National Interviewee)

Global informants supported the idea that resilience could be a good overarching concept for linking DRRH and CCAH. However, they offered caution on its usefulness as more than a point for conceptual synergy due to the challenges in making resilience operational:
“Resilience speaks to a positivity around managing risks, and I think it is useful in corraling the different actors towards a common goal. I think it is an attribute of sustainable development. But I think it needs to be pitched at a higher level, because it is full of confusion and obfuscation and at the end of the day you still have to do things. I am hesitant to suggest that you have resilience programmes, I don’t know what that would be – I mean it’s just too big a concept, it needs to be brought down to far more digestible chunks.” (Global Interviewee)

These thoughts were also shared by another global informant:

“People struggle with the term resilience, but they are moving it from undefined to something that is actionable. But the UNISDR definition is a useful one, it is getting closer to being used in practice.” (Global Interviewee)

While some interviewees acknowledged the need to clearly define and operationalise resilience, other interviewees delved further into the concept and expressed that resilience was often used in different ways by DRRH and CCAH groups. This difference in the conceptualisation of resilience arose as the second subtheme. One national level interviewee experienced within the health system expressed this particularly well:

“Linking DRR and the CAA policy, you know the biggest challenges is that they use a different terminology...Climate Change Resilience is different from Disaster Resilience and that's the challenge...Resilience from the perspective of the climate change people it's more of a long-term resilience rather than the acute hazard impact from disaster risk, but we talked about disaster risk resilient so that's where some of the misunderstanding happens and that's the major one that I think is the challenge. The other thing is sometimes they are like the six blind men and the Elephant, the CAA and the DRR people sometimes are like the six blind men, one is talking about the trunk and the other is talking about the legs and they don’t know it but they are both talking about an elephant.” (National Interviewee)

This was also reflected in global informant interviews. For example, one global informant stated:

“There is a need for communities to better understand what resilience to climate change means, rather than just resilience to shocks [disasters], they need to
understand the difference between stressors – resilience over the long term; and shocks – short term resilience” (Global Interviewee)

It was observed that local level interviewees were more able to readily speak about resilience in relation to disasters than climate change. When discussing what resilience meant the majority of interviewees would discuss disaster resilience. Few were able to discuss climate change resilience. For example, an interviewee from Eastern Visayas defined community resilience in relation to disasters in the following way:

“A resilient community is one, to me, that is first of all prepared, before the disaster happens they are prepared. And even if they are, if they experience a disaster and they will be out of proportion from their preparedness, meaning that even if they have prepared but still the disaster was too much for their preparedness, and they are destroyed or damaged they can still bounce back, they are able to bounce back...to a better situation.” (Regional Interviewee)

The dominance of disaster resilience definitions was corroborated by national interviewees who worked closely with LGU counterparts implementing DRRH. The dominance of disaster resilience concepts among interviewees was further demonstrated by the word frequency analysis of the resilience theme (Figure 8.1). It illustrates that the terms ‘health’, ‘community’, ‘prepared’ and ‘disaster’ were most commonly used when discussing resilience.

Figure 8.1. Word frequency analysis of resilience definitions among Case Study interviewees at the national, regional and local levels
8.3 Technical and operational synergies in health in the Philippines

This section discusses the findings relating to links between DRRH and CCAH in the Philippines Case Study. Results presented here are drawn from key informant interviews, the expert workshop, relevant policies and other written primary sources. Global informant interviews are presented alongside each area of technical synergy to provide further insight. The analysis was partly guided by areas of work for linkage identified in the literature review. This includes: national policies, joint risk assessment, consideration of health impact pathways, health systems strengthening, health infrastructure resilience, Early Warning Systems (EWS), and disaster preparedness and response. In addition to the areas for technical and operational synergy identified through the literature review, joint research and capacity building emerged from the Case Study as additional areas of potential synergy.

Existing technical and operational synergies in health are limited in the Philippines. This was discussed in the expert workshop and acknowledged by interviewees at all levels:

“Linking DRR and CCA. It’s a work in progress in the Philippines.” (National Interviewee)

Less interviewees were able to converse about the linkage between DRRH and CCAH than those able to discuss each individual field.

Among those conversant on links between DRRH and CCAH, the majority expressed that linking is important. This was echoed in the expert workshop, with participants noting that there is an urgency for this. Reducing duplication in implementation was identified as a key reason for linking DRR and CCA by interviewees. This was seen as particularly important to reduce pressure of implementation and make use of limited human resources on the local level:

“I have been clamouring for integration of programs here at the central office because at the regional office we have no choice but to integrate it because of lack of resources and there is actually funnelling, like here at the central office one person handles one program and a lot of bureaus here, but when you go to the region one person handle two or more programs, and then the more if you go to the local level one person would handle all so of course that health worker can only do so much you know he cannot do everything.” (National Interviewee)
The following subsections discuss the current and potential technical and operational synergies between DRRH and CCAH in the Philippines.

### 8.3.1 National policies

Strong links are made between DRR and CCA throughout national DRR and CCA policies and plans. All national DRR and CCA policies and plans make a link between these two approaches, with the exception of the National Disaster Response Plan (Appendix 14). These links include key areas for joint action, including but not limited to: EWS, capacity building, risk and vulnerability assessment, and a joint national plan. Currently there are separate DRR and CCA frameworks, including the NFSCC (Climate Change Commission, 2010) and NDRRMF (Department of National Defense, 2011).

The implementing rules and regulations and the NDRRMP call for a joint DRR and CCA work plan, and the National Disaster Preparedness Plan makes reference to a joint work plan. However, a copy of the joint framework/work plan or the equivalent was not made available at the time of data collection. Furthermore, all interviewees who were able to comment because of their knowledge of existing policies were unsure of the status of the joint work plan:

“The [DRR and CCA] plans have targets to 2028. So, in terms of policy we have the Climate Change Act and DRRM Act and, and I know there are some efforts to combine the two.” (National Interviewee)

Others stated that the joint work plan had not been developed, and that any joint action plan had only got as far as the development of a Memorandum of Understanding between the NDRRMC and Climate Change Commission:

“Right now, the Climate Change Commission and NDRMMC are trying to revive the Memorandum of Understanding...it was signed in 2011. Actually, it expired this year. The only problem with that is that it was never operationalised. That was meant to be the MOU for the Climate Change Commission and NDRRMC to come up with a joint work programme on DRR and CCA which covered all the sectors.” (Expert Workshop Participant)

No explicit reference to health is made with regards to linking DRR and CCA in the national policies and plans (Appendix 14). However, both the NCCAP and NDRRMP make
reference to implementing or mainstreaming DRR and CCA in sectors as an outcome of both of the plans. Under the Human Security priority, the NCCAP states:

“CCA and DRR implemented in all sectors at the national and local levels” (Climate Change Commission, 2011, p. 17).

Similarly, one of the six disaster prevention priorities of the NDRRMP states:

“DRRM and CCA mainstreamed and integrated in national, sectoral, regional and local development policies, plans and budget” (Government of the Philippines, 2010, p. 3).

While the NDRRMP outcome for mainstreaming is specifically related to the sectoral development plans, this includes the sectoral development plan for health. The National Objectives for Health 2011-2016 make direct reference to both disasters and climate change under two separate goals. The DRRH goal relates to reduced disaster-related morbidity and mortality, whereas the CCAH goal relates to increasing health system capacity to manage climate change at national and local levels (DOH, 2011b). However, no mention is made of the link between extreme weather, disasters, and climate change; nor between DRRH and CCAH.

With regards to health within national policies, the NFSCC makes specific reference to both DRRH and CCAH under the one of the seven Key Result Areas, ‘Climate-Responsive Health Sector’, the objective of which is to manage health risks associated with climate change (Appendix 14). Under this priority there are three strategic priorities, all of which are relevant to linked DRRH and CCAH, these include (Climate Change Commission, 2010, p. 31):

a) Assessment of the vulnerability of the health sector to climate change;

b) Improvement of climate-sensitivity and increase in responsiveness of public health systems and service delivery mechanisms to climate change; and

c) Establishment of mechanisms to identify, monitor and control diseases brought about by climate change; and improve surveillance and emergency response to communicable diseases, especially climate-sensitive water-borne and vector diseases.
CCAH and DDRH policies and plans exhibit significantly less linkages compared to national policies (Appendix 14). The Philippine Strategy on CCA: Health Sector does make reference to DRRH as the first line of defence. However, this only recognises the preparedness and response aspects of DRRH. No health policies in climate change reflect the overlaps between DRRH and CCAH through aspects of DRR outside of preparedness and response. This is unsurprising in light of the finding that DRRH is commonly understood as preparedness and response previously presented in Section 6.3. The subsequent policies and plans under the framework make increasingly less direct reference to DRRH. The national CCAH policy does make direct reference to HEMB and the roles they are required to undertake as part of CCAH, however, these are limited to advocating for building the resilience of health facilities to disasters (discussed further in Section 8.3.5).

Compared to CCAH policies and plans, DDRH policies and plans make very little reference to climate change and CCAH (Appendix 14). Earlier DRRH policies and plans make no reference to climate change or CCAH. Only the recent draft policies and plans from 2016 make reference to CCAH. First, they recognise climate change as a driver of disaster risks (HEMB, 2016a). Second, they call for LGUs to integrate their respective DRRM in Health Plan into the Local CCA Plan (DOH, 2016c). Third, the draft policy recognises the responsibility of the DOH to ensure resilience of the health system to climate change-related disasters (DOH, 2016c). No national level action in relation to climate change is specified in DRRH policies and plans.

National interviewees indicated that there was a need for clearer link between national DRR and CCA structures and policies:

“There are two bodies, two policies. So, there should just be one. But that might not be possible with the current structures. We will have to deal with that problem. But at least the policies should clarify the coordinating mechanisms.” (National Interviewee)

During the expert workshop the need for a specific and actionable policy mandate for linking DRRH and CCAH was also discussed. Participants expressed differing views on if a stronger policy mandate was needed for linking DRR and CCA inside and outside of health. One expert workshop participant stated:
“The LGUs are demanding that it is integrated, so we don’t want to see a scenario that two offices from the same agency are doing the same thing, like we are already starting to see with the offices of the Climate Change Commission and the NDRRMC...this is because of the absence of a joint framework for integrating these two very important works” (Expert Workshop Participant)

In contrast, another workshop participant did not agree that is necessary to have more of a policy mandate before action is taken on linking DRRH and CCAH, stating the following:

“I don’t think we have to wait for that, the signing of a DRR and CCA action plan...the policy mandate for integration is there already, it is there in the RA.10121 [DRRM Act], and Climate Change Act. I believe we should be integrating early so as we are not complicating things.” (Expert Workshop Participant)

The national CCA planning processes, and the health components of these plans, were identified as an opportunity for linking DRR and CCA by global interviewees. For example, one global informant expressed:

“The NAP programme has been a big driver in many countries for links between DRR and CCA, and most of these have an element of health. It is a useful measure for considering how do the national policies link with DRR and CCA. This is a good starting point and this process has been a good opportunity for building this link in many countries.” (Global Interviewee)

8.3.2 Joint risk Assessment

Limited links between DRRH and CCAH were found through joint risk assessment for health in the Philippines. However, probabilistic disaster risk assessment incorporating climate change risks was identified as a potential opportunity for strengthening links between DRRH and CCAH. This was discussed by national interviewees and expert workshop participants. During the final session of the workshop, participants were asked to identify potential areas for strengthening links between DRRH and CCAH based on the preliminary findings of the study. Workshop participants identified probabilistic risk assessment incorporating climate change as a feasible short-term opportunity for linking DRRH and CCAH. During this discussion, a national stakeholder in DRR stated:
"In order for us to have a really meaningful integration of DRR and CCA, you have to conduct an integrated risk assessment. Without this it will be very difficult...We were talking about the Sendai Framework, if you follow the same it's the same thing, you understand risk, but this time you include climate change information." (Expert Workshop Participant)

However, the use of climate change projections in health and disaster risk assessments within health was observed as being limited. This was supported by national interviewees. One DRR interviewee working in a well-respected national NGO said:

"The use of climate forecasting is very much limited to the DRR persons, where in fact it could also be used by the health volunteers...They could use it to anticipate the amount of dengue we will have in the futures, or the new areas the disease will appear in." (National Interviewee)

Climate change projections were also identified as potentially useful in mapping the risks faced by health facilities. This was being pushed quite strongly by some key national stakeholders in DRRH in the Philippines. One national expert in hazard mapping stated:

“We are pushing for a national standardised programme using probabilistic maps, which incorporate the likelihood, frequency and probability of hazards, which includes of course the scenarios of the future, like climate change.” (National Interviewee)

This was further reinforced by observations during a workshop which aimed to modify the Hospital Safety Index indicators to the Philippine setting (From the Safe Hospital Philippine Indicators to a Hospital Safety Index Tool, Hotel Jen, Manila, 31st August 2016). Probabilistic risk assessment incorporating climate change was identified as an important tool for understanding future health risks from extreme events. As another national interviewee working in DRRH explained:

“We should start from the understanding of the risks. Which, by the way, is the first stream of work with the Sendai framework...Climate change is a contributing factor that exacerbates existing risks...climate change increases the likelihood and increases the intensity of some hazards...the understanding of the hazards, and the mapping of the health facilities according to these hazards, this needs to be done.” (National Interviewee)
However, local interviewees often expressed technical capacity challenges with carrying out disaster risk assessments, even without the incorporation of climate change risk or vulnerability in these processes. One local interviewee from Eastern Visayas expressed:

“When we were instructed to come up with a DRR plan for health, I couldn’t really do it by myself…it was really difficult…there is a need for interagency collaboration because in the hazards assessment I have limited knowledge, for the biological hazards I could do it, but for the other hazards, especially natural… I cannot even understand the map myself, how much more for the people at the Barangay?” (Local Interviewee)

Though local capacity has been supported through technical assistance from the national level through the rEBaP project (previously discussed in section 6.2.1) this is not consistent across all LGUs. It was observed that climate change was not included in LGU DRRH plans which were examined as part of the Case Study, and hazard risk assessments were limited to historical data. This need for integrated risks assessment as a starting point for linking DRRH and CCAH was supported by a global informant in DRRH:

“You need to do a rigorous analysis, a rigorous assessment of risk, so you can understand the connections in relation to vulnerability, hazards, exposures and other things. Then you can start to look at where do you find the common ground around how to deal with these risks.” (Global Interviewee)

8.3.3 Consideration of health impact pathways

When discussing links between health impacts of disaster and climate change, interviewees did not directly use terminology like ‘health impact pathways’. Rather, they would commonly speak about disasters and climate change impacting health through environmental determinants. Most commonly this would include: limited access to clean water, and poor sanitation conditions. This was visible across all levels of interviewees, including at the local level. This discussion was facilitated by knowledge surrounding an ongoing diarrheal outbreak in a few of the localities where interviews took place:

“With climate change, in fact you might probably know of the diarrheal outbreak, one of the causes of that that was identified, was actually the long drought that affected the source of potable water for the communities…DRRM and CCA are definitely interrelated. So the extremes become the problem, and also it has an effect on the
whole DRRM spectrum, you can mitigate the effects of one then you also lower the effects of the other.” (Regional Interviewee)

One national interviewee in DRRH who was assisting with the response to the outbreak demonstrated acknowledgement of links:

“There's no disaster to speak of, but there is an ongoing outbreak, so what's the reason? The vulnerabilities there are a problem, the water infrastructure system, and hygiene practices in the community...that’s a big problem because the vulnerabilities are there but there are no disasters really, even the normal systems are challenged.” (National Interviewee)

Interviewees could often see that both climate change and disasters impacted health through influences on environmental determinants. Within this context interviewees would often say that DRRH and CCAH are related through management of the environmental determinants of health. This particularly highlights the importance of addressing the adaptation deficit and reducing existing vulnerability. Stakeholders also acknowledged the importance of reducing social determinants and vulnerabilities:

“For me it boils down to the basic health principles, like keeping the air clean, keeping the water clean, so that when disasters strike the morbidity and mortality is less. That's practically the essence. Even in the evacuation centres, you want to guard the most vulnerable groups, women, children, so what do you promote? You give them a clean place to live, good food to eat, promote breastfeeding.” (National Interviewee)

Similarly, another national interviewee working in both DRRH and CCAH stated:

“The climate change factors both affect and are affected by the ecological factors and environmental factors...will actually affect vulnerabilities of population...and this is where CCA and DRR will actually hold hands because if you identify who the vulnerable people are and where they are then you can do what we called targeted interventions.” (National Interviewee)

In managing health impacts associated with climate change and disasters, interviewees discussed both DRRH and CCAH as being part of one spectrum of responses and protective measures for health:
“HEMB’s work is here, on the response end of the spectrum, to respond to emergency and disaster because of climate change. The others are here, where there is no disaster yet...They are preparing the environment preventing the environment from causing disasters and risks. The Epidemiology Bureau and environmental health that should have a bigger role in to reduce the environmental threats to health, they have a big role.” (National Interviewee)

A regional interviewee from the Bicol Region working in DRRH communicated a similar point of view, that DRRH and CCAH are on a spectrum:

“Like for water, for water sanitation and water sanitation it varies a situation of change in temperature...adaptation would mean a kind of design and application of water system and all the support for the water purity programme...but at the moment there is a drying up of water supply from the source...so what we are doing then? We start an adaptation, but it DRR because they are providing emergency supply of water in order to prevent an epidemic.” (Local Interviewee)

Interviewees often discussed local-level initiatives to manage the environmental and social determinants of health impacts from disasters and climate change, examples are indicated in Table 7. This was seen across all regions in various interviews, and numerous interviews on the local level.
Table 7. Local strategies for managing environmental and social determinants of health coming from national, regional and local interviews

<table>
<thead>
<tr>
<th>Local level strategy</th>
<th>Example quote</th>
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<tbody>
<tr>
<td>Role of health professionals in health promotion</td>
<td>“In the Municipalities with high diarrheal cases we encourage water sampling and then disinfection. And then we deployed our nurses, we have DOH nurses deployment, we have over 200 nurses in the province, we deployed them to the Barangays. And we give them supplies of oresol, hyposol, and aquatabs...They teach them hygiene promotion.” (Local Interviewee)</td>
</tr>
<tr>
<td>Managing environmental determinants to minimise dengue outbreaks</td>
<td>“When it comes to climate change, we organize for dengue, we have this so-called dengue brigade...their job is not only finding out stagnant water and looking for the lava, it is also their job to destroy, to search and destroy, in stagnant water containers and stagnant water.” (Local Interviewee)</td>
</tr>
<tr>
<td>LCE support for sanitation education in the barangays</td>
<td>“The premise here is you train the leaders to look also at health determinants and then they become more empowered to improve their areas, their communities. So that’s like a training course for Mayors, Governors, and the Municipal Health Officers.” (National Interviewee)</td>
</tr>
<tr>
<td>Implementation of the Healthy Cities programme</td>
<td>&quot;Healthy cities programme is a simple way to address other programmes, the health could point out that it should be done for the safety of the people for health purposes...if you have a clean environment then you can control the spread of possible infection, you can ensure there is good drainage in your city so there is not flood and people don’t get leptospirosis...you can base that on the healthy cities programme, so that other programmes even not directly for health, like the market, the drainage, the infrastructure, its included in there.&quot; (Local Interviewee)</td>
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</table>
Contrastingly, global informants spoke less about the environmental determinants of health in managing health risks of climate change and disasters. However, one global informant discussed elements relevant to both the environmental and social determinants of health when addressing risk factors:

“One shouldn’t confuse climate change with just climate and climate risk, because climate change is just one dimension of climate risk, and it tends to be the medium and long term dimensions... We need to be able to get a handle on those issues to deal with different dimensions of climate, as well as climate change specifically, which might be more in terms of the longer term developments of water infrastructure or sighting of health facilities, but also looking at the way which climate change impacts other risk factors for public health and try to paint this picture of the primary, secondary and tertiary risk factors for public health.” (Global Interviewee)

8.3.4 Health system strengthening

The link between DRRH and CCAH through health systems strengthening was not clear through the Case Study. Health systems strengthening was not as commonly used in CCAH policies or interviews. The NFSCC did mention the responsiveness of the health sector to climate change (Climate Change Commission, 2010). However, this was relating specifically to climate-sensitive disease and responses of public health service delivery, with no mention of disasters or DRRH. Contrastingly, DRRH policies and stakeholders often referred to the health system in recent plans and in interviews. For example, the recent draft HEMB DRRM in Health Strategic Plan 2017-2022 states:

“Many general health system strengthening measures can be most effective for DRRM-H [DRRH]. High baseline coverage rates for essential health services, for example, will improve overall health status, contribute to the prevention of outbreaks, and mitigate the health impact of emergencies, thereby building the resilience of communities.” (HEMB, 2016a, p. 33)

The Strategic Plan then goes on to break down the five objectives into Key Results Areas across the Six Building Blocks of Health (HEMB, 2016a). This was supported in numerous interviews where interviewees linked both primary and public health services to improving baseline health status and thus reducing disaster and climate change risks. Example quotes are provided in Table 8.
Table 8. Example quotes relating to primary and public health service improvement, baseline health status and reducing health risks of disasters and climate change.

<table>
<thead>
<tr>
<th>Contribution of health service delivery to reducing health risks</th>
<th>Example quote</th>
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<tr>
<td>Health service delivery and UHC reduces health risks.</td>
<td>“Before I transferred to the region, I was the municipal health officer, I worked in the community, and that’s what I tried to build…I didn’t know about disaster or emergency before, but we were talking about how they [the community] can be protected from diseases, and...have a healthy life...especially through UHC, and that is part of being resilient to all these things.” (Regional Interviewee)</td>
</tr>
<tr>
<td>Maintaining baseline health status</td>
<td>“The health system is important to keep us healthy so that in times of disasters we would be more able to address and keep ourselves safe, our families safe and our communities safe.” (Regional Interviewee)</td>
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<tr>
<td>Intensification of public health programmes to improve baseline health status</td>
<td>“How do we really prevent and reduce risk? One of the ways by which we can do that is perhaps we can intensify more our regular programs like immunization, health services, and nutrition...So if only all Philipippinos, the entire community, would be in optimum nutrition prior to the calamity then they may be affected less by the impact of the calamity.” (National Interviewee)</td>
</tr>
<tr>
<td>Protective effect of high vaccination coverage against health risks post-disaster</td>
<td>“When there’s a group of people in this one evacuation center and most of them are not vaccinated for measles and other antigens disease easily spreads to others...making the communities more healthy so that you know when these diseases come they’re more, they have better immunity and protection...this is a contribution to preparing for disasters in a way.” (National Interviewee)</td>
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Similarly, a global informant specified the role of health service access to reducing underlying disaster risks:

“The challenge is that we are not doing enough and we are not promoting enough the capacities of the different sectors to jointly plan risk mitigation and risk prevention measures and we are still focusing too much on preparedness and response... you have to try to address the huge health inequities in the society if you want a society with better coping capacities for any disaster of any type. If you have sections of the society that are excluded by the health services, you need to give them access, otherwise they will be even more vulnerable during a disaster.” (Global Interviewee)

Some interviewees recognised the potential value of the Six Building Blocks of Health in relation to planning for DRRH and CCAH. This was restricted to those interviewees familiar with the Six Building Blocks through the rEBaP project (previously discussed in Section 6.2.1). Through the rEBaP project the Building Blocks were used as the basis for developing local DRRH plans:

“The WHO has kind of described the health system in terms of the Six Building Blocks...It’s good that we stick with the Six Building Blocks, because there is quite a lot of investment on it, at the global level, and also at the country level and subnational level... Just, obviously the family and the community is an important part of the health system. That’s why those LGUs chose to include the community as a seventh building block.” (National Interviewee)

One interviewee from Eastern Visayas who had been involved in developing local DRRM plans according to the Six Building Blocks stated:

“I think, for me, climate change should have all of these building blocks also. Just like DRRM has these Six building blocks, CCA should also have these Six building blocks in health.” (Regional Interviewee)

When discussing the WHO Operational Framework (previously discussed in Section 3.3.2.3) with global informants in CCAH, they acknowledged that the exclusion of the community element is a challenge in using the framework. However, the link of the WHO Operational Framework to the Six Building Blocks is valuable in its application:
“It is important that the climate resilience framework is attached to the health systems building blocks, as this is something that national ministries recognise and understand. However, the community doesn’t line up with those. But you can see that community can be addressed within each of the elements. I understand that there has been a lot of discussion about making the health system building blocks more community based. If the health systems people revise that and gave it a stronger and clear focus on the community then it would be easier to tie to the community.”

(Global Interviewee)

8.3.5 Health facilities resilience

The potential for strengthening links between DRRH and CCAH in building health facilities resilience was recognised in policies and interviews. The Philippines has made significant progress in increasing the resilience of health facilities. However, limited progress has been made in mainstreaming climate change considerations into the retrofitting of hospitals and health facilities. This is an example where clear duplication could develop between DRRH and CCAH in the Case Study. As one global informant with experience in the Philippines expressed:

“They are quite active on some DRR measures...For example, Safe Hospitals...the Philippines has been one of the most active countries in Asia for sure, and even in the world...There is a program which is called Green Hospitals. And we try to link the two [DRR and CCA], but in reality, we have not done much progress. And, in the Philippines, we have not yet really moved very far from this. It's what we call ‘Smart Hospitals’ which is safe and green.” (Global Interviewee)

Interviewees often acknowledged the importance of health facilities resilience to disasters and climate change-related disasters. This was particularly the case in relation to previous experiences with floods and typhoons, including Typhoons Ondoy (2009) and Yolanda (2013). One national stakeholder heavily involved in the development and implementation of the Hospitals Safe from Disasters Programme and Hospital Safety Index in the Philippines stated:

“It's overlapping yeah...if you build a new hospital and you set the standard and they follow the standard...If you construct it in a safe place in a safe area following those standards, that’s prevention and adaptation. But we also teach them how to do the
“drills, the planning, training so they can be part of preparedness. It's both CCA and DRR.” (National Interviewee)

Policies and plans in both DRRH and CCAH highlighted the importance of health facilities resilience to either disasters or climate change. However, the link between DRRH and CCAH initiatives in this area is unclear. DRRH policies relating to health facilities resilience make no reference to climate change (DOH, 2004, 2013b, 2016c; HEMB, 2014, 2016a). Furthermore, the current version of the Hospital Safety Index which has been modified to suit the Philippine context makes no reference to climate change risks or CCAH (HEMB, 2016b).

Early CCAH policies make a strong and clear link to existing health facility strengthening efforts within DRRH in the DOH. The Philippine Strategy on Climate Change Adaptation: Health Sector makes direct reference to the existing health facilities resilience program which HEMB has a major role in delivering (DOH, 2010d). Furthermore, it suggests that CCAH can be mainstreamed in this existing programme. However, the link in subsequent policies and plans is unclear. Some CCAH policies use term ‘climate change proof’ and make little reference to existing facilities strengthening efforts in DRRH. For example, the National Policy on Climate Change Adaptation for the Health Sector (ao2012-005) and the accompanying Operational Guidelines (ao2012-0018) both use the terms ‘climate change proof’ and ‘climate-proofing’ (DOH, 2012a, 2012b) defined as:

“A process of identifying and reducing health risks as a consequence of climate change, and ensuring those risks are reduced to acceptable levels through long-lasting and environmentally sound, economically viable, and socially acceptable modifications” (DOH, 2012b, p. 2).

The National Policy on CCA for the Health Sector makes no reference to existing health facilities strengthening efforts in DRRH. However, the Operational Guidelines requires CCAH to be mainstreamed into existing structural, non-structural and functional criteria for hospitals (DOH, 2012a). These are the same categories of criteria used in strengthening hospital resilience to disasters in the DOH. While no direct reference to disasters is made, this could be considered an indirect reference to DRRH.

It is not clear in these policies how DRRH and CCAH actors in the DOH should engage with each other in order to mainstream climate change risk and adaptation in the current
Hospital Safety Index and program on strengthening hospitals against disasters. This is particularly highlighted by the designation of roles within Administrative Order 2012-0018. The roles of HEMB, according to this policy, is to merely assist with the promotion of the Safe Hospitals campaign (DOH, 2012a). This policy does not acknowledge HEMB as a key stakeholder in the development of hospital disaster resilience standards, indicators and capacity (DOH, 2013a, 2013b). Similarly, the DRRH policies make no reference to how climate change risk or adaptation can be considered in strengthening health facilities against climate change. Some interviewees noted the lack of involvement of CCAH stakeholders in this process:

“The Hospital Safe from Disasters programme, we know that because of the effects of climate change the disasters that we are experiencing right now are becoming stronger…but that has an overlap…HEMB are coming up with this tool [Hospital Safety Index] but if you will really look at it it's more supposed to be a function of those two Bureaus [DPCB and Health Facilities Development Bureau], the climate change part...So, there is already an overlap there.” (National Interviewee)

Some interviewees discussed how climate change can be considered in the resilience and functionality of health services during disasters. One national interviewee discussed the use of climate-smart technology in Eastern Visayas to increase the resilience of the vaccine cold chain:

“When Yolanda struck everything was stopped. Facilities were heavily damaged and of course power was out. So, in terms of like I'm looking at immunization we made changes to the equipment that we have provided, even if there isn’t a disaster we have the solar features that will really just go on, even without power...Even if a disaster strikes, there's no power it can still work for ten days without power.” (National Interviewee)

Interviewees shared that significant lessons were learnt about health facility resilience during Typhoon Yolanda. One key lesson included the need to consider longer-term climate risks in health facilities resilience, particularly when determining the location of the health facilities. One way to do so was overlaying health facilities with probabilistic hazard assessments which includes risks of increasing hazard frequency and intensity developed from climate change scenarios, as discussed previously in Section 8.3.2.
8.3.6 Early Warning Systems and disease surveillance

The link between DRRH and CCAH in relation to Early Warning Systems (EWS) is unclear. EWS for DRRH and CCAH occur through two systems within the DOH. This is demonstrated by DRRH and CCAH policies and corroborated by national interviewees. For example, the Philippine Strategy on CCA: Health Sector states that the DOH has a responsibility to:

“Provide EWS to reduce the current and projected burden of climate-sensitive diseases. Hence, access to national and regional climate forecasting information, including climate change projections should be facilitated.” (DOH, 2010d, p. 2)

The EWS for disasters in health is operated by a separate system managed by HEMB and the national DRRH OpCen within HEMB. However, inputs from these are provided by key stakeholders working in CCAH. As one national interviewee working in DRRH explained:

“We have our OpCen that participates in the dissemination of information to the public...the technical input there is coming from the DPCB and then the Epidemiology Bureau okay and then they package it into an advisory, they gave it to us and then to up-send so that is the message that we provide the public.” (National Interviewee)

In relation to the ongoing diarrheal outbreak, some interviewees expressed the potential value of having an EWS for climate-sensitive disease which accounted for both climate variability, such as El Nino, and climate change. It was believed these systems would add value to disaster preparedness and response through greater understanding of regional climate patterns and how they may impact health emergencies. For example, needs for EWS and disease projections informed by climate change scenarios were expressed by some interviewees on a national level:

“The possibility of what mosquito-borne diseases will come in the future, how people will be affected with different types of weather, like increases in temperatures...because this talks about the future, this is something that DRRM cannot fund...it should be funded by climate change funds, but the public health surveillance system that's DRRM and it's tracking what's happening now...but I don’t see anyone tracking what is going to happen in the future.” (National Interviewee)
It was observed that there was a disconnect between the disease surveillance system and the disaster preparedness and EWS. Interviewees often discussed limited communication on rising disease cases prior to the declaration of an emergency. A key leader in DRRH expressed the importance of working closely with CCAH stakeholders on this:

“HEMB cannot handle it alone right okay so like for example, the emerging diseases...We now have Zika in the country okay so we can also relate this to climate change you know...it's the DPCB that's taking the lead with strong support from the Epidemiology Bureau but I really make it a point that HEMB are on board, even if HEMB are not the lead there.” (National Interviewee)

Taking this one step further, one global informant acknowledged the importance of shared terminology and collaboration between disease surveillance and those responsible for EWS for disasters:

“One of the challenges straight off the bat is the terminology that we use...the term ‘disaster’ has a connotation of natural events, which isn’t all that we’re dealing with, especially in health. So you end up with a dichotomy between outbreaks and other types, so you end up with parallel systems within ministries [of health].” (Global Interviewee)

### 8.3.7 Disaster preparedness and response

Health emergency preparedness and response was often identified as CCAH action within the Case Study. This was strongly illustrated throughout the research by policies and interviews at all levels. National climate change policies recognise DRR, particularly preparedness and response, as on the forefront of managing climate change risks. For example, the NFSCC states:

“In the overall effort of combating the effects of climate change, DRR shall be the first line of defense.” (Climate Change Commission, 2010, p. 32)

Towards this end, CCAH policies recognise the need to strengthen health emergency preparedness and response, and include health emergency preparedness and response as indicators for progress in CCAH (DOH, 2010d, 2012b). This concept was reflected by numerous DRRH and CCAH stakeholders at all levels (Table 9).
Table 9. Example quotes across national, regional and local interviews discussing disaster preparedness and response as CCAH

<table>
<thead>
<tr>
<th>Interviewee level</th>
<th>Example quote</th>
</tr>
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</table>
| National         | “You see, prevention and preparedness for DRR are actually adaptation measures for climatic hazards. But DRR also includes geological hazards, not just climate hazards.” (National Interviewee)  
“Practically all of our programs really address both...CCA also talks about preparedness...Both will have to be geared towards preparedness and response and building of resilience that system.” (National Interviewee)  
“Well, we have to focus on the health aspect of climate change...I think, basically the things that we are doing with DRRM-H is the way forward to deal with climate change.” (National Interviewee) |
| Regional         | “But climate change mitigation is also disaster mitigation. Climate change is more of theory at the moment. It is important to think about it though because at least you are prepared, and something can be done about how you prepare and respond. This will lessen the effect of disasters.” (Regional Interviewee) |
| Local            | “Through their former experiences, the Sorsogonans they have learnt how to adapt, even if the climate change affects the environment, or the disasters. I think based on my observation, they are experienced with disasters...We are prepared. No matter what happens with climate change we are prepared.” (Local) |

One global informant expressed a similar opinion to the Regional interviewee in Table 9, stating that strengthening preparedness and response is a tangible and achievable strategy for addressing climate change risks in health:
“We know the health risks of climate change are very real, but because they are very slow and they effect lots of different health outcomes and they are dissipated throughout the world, it can be a challenge to health actors to know what to do about it. And one of the most obvious ways that climate change manifests is through more frequent and extreme events, so therefore one of the best ways to adapt to climate change is to strengthen your resilience to potential disasters through preparedness and response.” (Global Interviewee)

Expanding on this, another global informant expressed that when compared to CCAH, disaster preparedness is more clearly understood in terms of implementation within a community and health sector:

“It is easier for countries to understand short term disaster risk because they see it immediately and they have been seeing it for a long time. But if you talk about increasing water temperature or salination, or other risks that will come later, it is much harder for countries to understand.” (Global Interviewee)

The majority of global informants held the opinion that disaster preparedness and response is an important starting point for CCAH. One global interviewee highlighted the importance of distinguishing between DRR, DRM and CCA, so as to ensure that DRR is not just understood as preparedness and response. However, global informants also express concerns that it is important that this is not where CCAH action ends, and to ensure long-term risks are incorporated to DRRH action. One global informant discussed disaster preparedness and response as a starting point for implementing CCA, they then went on to talk about how this could be implemented as a ‘no-regrets’ CCAH strategy:

“DRR is a starting point within the climate change sphere...it is a kind of no-regret solutions, a good first step, if you will. But it is important to ask when it is being implemented, are these strategies still valid under other scenarios? This is why it is important that CCA is an iterative process. Where short term DRR measures end up being there for a long time they need to be reassessed. Then we need to look at if these strategies are sensitive or still robust under a number of different scenarios.” (Global Interviewee)

Global informants also expressed numerous concerns that it is important not to equate CCAH with DRRH, or vice versa, as there are numerous disasters that are not climate-related
and numerous climate change impacts on health that are not disaster-related. As a global informant in DRRH said:

“I think it is also important to not see DRR and climate change, or even climate risk as two sides of the same coin. It is a major driver in the Pacific Island countries where there is a lot of connection made between climate and DRR, which is understandable, but at the same time it shouldn’t be at the expense of other sources of risk, such as geophysical risks or technological events, or conflict and violence or mass gatherings and those sorts of things.” (Global Interviewee)

Within this Case Study, national interviewees expressed the need to move away from purely a disaster preparedness and response approach (previously discussed in Section 6.3.3). Similarly, CCAH policy recognises preparedness and response as only a small component of the range of CCAH options.

**8.3.8 Other potential areas for linkage identified in the Case Study**

An additional two areas for potential linkage, beyond those identified in the literature, were recognised through national interviews and the expert workshop. They include joint research and joint capacity building.

Joint research in DRRH and CCAH was an important topic of discussion during the expert workshop. During the CCAH needs prioritisation exercise participants made it clear that two facets of research needs for CCAH exist. The first was climate change and health; the second was climate change, disasters and health:

“In terms of needs, it is important to strengthen our understanding particularly on this programme, climate change as it is related to health. Second to this is how it relates to DRR. First, we need to know how climate change is related to health, then climate change plus DRR on health.” (Expert Workshop Participant)

DRRH and CCAH policies both mandate that each respective unit responsible for DRRH (HEMB) and CCAH (DPCB) have research processes (DOH, 2004, 2010d, 2013a). Thus, these research processes have potential overlaps and common points of interest. As briefly mentioned in Section 7.3.1, since the time of data collection both DRRH and CCAH were included in the new NUHRA (PCHRHDOST, 2017b). This is the first time DRRH and
CCAH have been formally recognised as having common research aims in the Philippines. However, outside of the present research, linked research has not yet been undertaken.

Joint capacity building was suggested by several interviewees as a potential linkage between DRRH and CCAH. One national interviewee discussed the importance of strengthening the capacity of the health workforce to plan for current and future risks to health services; with both short term and long-term considerations:

“Having already adequate work force on normal times, is a challenge...But so far, we have only talked about really just disaster, but we haven't really talked about the creeping effects of climate change and the impact that also has on the health systems and human resources for health. Will you have more vector borne illnesses? Because there’s climate change...it's something that the immunization people should also be able to consider this when planning their primary health care facilities network for the next forty years.” (National Interviewee)

Some interviewees believed joint capacity building should be undertaken at the local level:

“DOH have to train the Barangay health workers because these are their front liners of their health programmes...They need to understand that climate change exacerbates health problems, pre-disaster and post-disaster events.” (National Interviewee)

Other interviewees expressed that for building capacity both DRRH and CCAH should be mainstreamed into university and other education curriculum for health care service providers, particularly medical professionals.

8.4 Challenges in linking DRRH and CCAH

Key challenges and needs in linking DRRH and CCAH in the Philippines were discussed by interviewees, primarily at the national level, and during the expert workshop. Two key overarching themes were identified relating to the challenges and needs in DRRH and CCAH. The first theme was collaboration in DRRH and CCAH. This related to the relationships within the DOH and between sectors. The second theme was coordination of DRRH and CCAH in the DOH. This related to the roles of each of the actors within the DOH and mechanisms for them to work together.
8.4.1 Collaboration between DRRH and CCAH

Collaboration on DRRH and CCAH was discussed by interviewees and expert workshop participants as a significant barrier to strengthening links between DRRH and CCAH. As illustrated by the word frequency analysis of this theme (Figure 8.2), health, climate change and disasters are the central point of this theme. Key terms within this theme included: ‘office’, ‘managers’, ‘programs’, and ‘sector’. This illustrates that this theme is largely centred around the elements which need to collaborate on DRRH and CCAH.

Figure 8.2. Word frequency analysis of ‘Collaboration between DRRH and CCAH’ theme

There were three pertinent subthemes within this theme (Table 10). First, limited collaboration between the key focal points for DRRH (HEMB) and CCAH (DPCB) within the DOH was identified as a barrier for joint action. Second, it was highlighted that there is limited collaboration and mainstreaming across other relevant health programmes within the DOH. Finally, the need for stronger multisectoral collaboration with health-affecting sectors on managing the health risks of climate change and disasters was a key subtheme on collaboration for DRRH and CCAH.
### Table 10. ‘Collaboration between DRRH and CCAH’ subthemes and example quotes

<table>
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<tr>
<th>Subthemes</th>
<th>Example quotes</th>
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| Limited collaboration between key focal points for DRRH and CCAH in the DOH. | “At times they [DPCB] would think that we are stepping on them, that we are doing more than what we should be working on... and if you have that sort of interaction with someone who thinks 'ohh you're going outside your mandate', that creates a lot of tension.” (National Interviewee)  
“[HEMB] are not much involved just because the climate change programme was launched under the DPCB...But prior to this period... [HEMB] supervisors are already attending meetings and planning sessions relative to climate change” (National Interviewee)  
“The link between DRR and CCA should be in concept and drawing on the information generated by climate change scientists to inform DRR. There should be more and better communication between the two fields to enable this.” (Regional Interviewee) |
| Limited collaboration and mainstreaming across all programmes within the DOH. | “We were telling the programs that they could have made prevention strategies so that these [diarrhea] cases would not come up...we are saying that if we are just better in terms of prevention in this situation would not have happened. So we were talking to the programs that was the point. So it's trying to mainstream disaster preparedness and DRR, and CCA also.” (National Interviewee)  
“Historically at the DOH its really just HEMB involved in DRRM and I think even CCA discussions. It's just them, the others are not included. Because both these spaces are only thought as important for disasters. So, I think the challenge to move it beyond HEMB is there. Mainly because DRRM and CCA, everybody thinks, ‘oh it's HEMB's job’...Nutrition, water issues, health promotion and prevention services, and NCDs, I'm not sure to what extent they are considering climate effects in their programming and then their links to HEMB in terms of preparedness and response is also not so strong.” (National Interviewee)  
“Everybody will take the lead before disaster. Every stakeholder. Because
in every office, every sector, there is now a window for climate change program. Everybody should now be involved in pre-disaster period....No, there is not a window for predisaster period, there are programs which need to have a window for climate change so when disasters come, there will be easier for adapt during disasters.” (National Interviewee)

<table>
<thead>
<tr>
<th>Need for multisectoral collaboration between DOH and other agencies within health-affecting sectors.</th>
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<tbody>
<tr>
<td>“It's a cross sectoral thing, therefore there has to be close coordination with all the other actors in the playing field, not just within the health sector.” (National Interviewee)</td>
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<tr>
<td>“What is needed at the moment is for all the stakeholders to be aware and converge so that together they can plan and pool resources. It shouldn’t be just the DOH, we need the Bureau of Fisheries and Aquatic Resources or the Department of Agriculture, or the local government. All should be involved. Even the Department of Education, because they can teach the children to use toilets, to manage the garbage.” (National Interviewee)</td>
</tr>
<tr>
<td>“When we do risk reduction it's going to be the effects of climate change…it's very difficult to talk to the health sector are always on the downside...when we talk about climate change sensitive diseases it means that everybody else, the other sectors, have failed, like the potable water was not enough, and we have water borne diseases because the potable water supply and the quality of water was not taken care of. For leptospirosis flooding has not been dealt with, and that’s the role of the Public Works sector.” (National Interviewee)</td>
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The need for stronger collaboration both within the health sector and across sectors was supported by a global informant in DRRH who stated:

“We need to take an inclusive approach...more often than not we’re all really talking about the same thing, as long as we are talking about how do we reduce the risk of these types of events to public health, then I think we need to be inclusive and actually use a whole of health approach, and whole of society approach to the way we do it...we need to go about it in a similar way in which we tackled other health problems, such as road safety, or NCDs, or what have you...we need to be much more risk
focused than event focused, and use inclusive language so anyone working in the health system or in other sectors, doesn’t feel alienated from their contribution to managing these risks.” (Global Interviewee)

The need for multisectoral involvement in managing disaster and climate change risks was reiterated by another global informant. They also acknowledged the importance of working with health-affecting sectors to reduce underlying risk drivers.

8.4.2 Coordination of DRRH and CCAH

The word frequency analysis of this theme revealed that health was the central element of the discussion on the coordination of DRRH and CCAH (Figure 8.3). Climate change was discussed slightly more often than disasters. It was common in interviews and the expert workshop for participants to dedicate more time to discussing the coordination of CCAH. Furthermore, coordination was considered a function of disaster response activities. However, it was observed that interviewees were less able to discuss coordination and shared roles in reference to the preparedness, prevention, and recovery phases of DRRH. The key terms around these central elements include the terms ‘response’ and ‘adaptation’ (Figure 8.3). Key terms relating to other DRM phases (‘preparedness’ and ‘prevention’) were less prevalent, or not discussed (e.g. ‘recovery’).

Figure 8.3. Word frequency analysis of 'Coordination between DRRH and CCAH' theme

Two subthemes under the coordination of DRRH and CCAH (Table 11). These included the need for clarification of DRR and CCA roles in the DOH; and a formal mechanism for linking within the DOH.
**Table 11. ‘Coordination of DRRH and CCAH’ subthemes and example quotes**

<table>
<thead>
<tr>
<th>Subthemes</th>
<th>Example quotes</th>
</tr>
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</table>
| Clarification of DRR and CCA roles in the DOH | “We are really trying to clarifying the roles of all of those involved, because it's an inter-bureau collaboration, it's not just HEMB...we need to be clarifying the roles and responsibilities, and then we are really pushing for the mainstreaming of DRR and climate change in all the different programs.” (National Interviewee)  

“HEMB needs to work with the DPCB...the question will be how much of the work will HEMB do and how much of the work will DPCB do...in terms of Climate Change Adaptation it's actually the other bureaus that will be dealing with that because as they deal with the malaria control programs and the dengue control programs the leptospirosis control programs all of these are usually you know disparate, they call this the programs in silos that they don't even talk to each other which is a shame because like Malaria and Dengue are both caused by mosquitoes.” (National Interviewee)  

“It's only a matter of identifying what are those programs and projects that are done by the DOH falls under preparedness, response recovery, adaptation, mitigation it's only a matter of identifying but they haven’t. But most of them are taken from the regular operations, because they are components in the regular programs.” (Local Interviewee) |
| Need a mechanism for linking DRR and CCA in the DOH | “Let me start with the three circles, this is the Epidemiology Bureau, the HEMB, and environmental health, these are all related to climate change and disaster...They have some work of their own and they have some overlaps. So, the question is who will be doing the central part that will integrate them...they have some common thing, how to manage that?” (National Interviewee)  

“Everything is entwined...Because typhoons are related to climate, and almost every disaster I think is related to climate, so I think there should be a link to that. And maybe somebody should be looking on that, the two,
HEMB and the climate change should be, become, one.” (Local Interviewee)

“Linking of Climate Change Unit with sub-national and local counterparts is not clear vis-à-vis coordination already existing between [HEMB] with regional and local counterparts.” (DOH, 2013a, p. 30)

“Maybe because it needs a higher official really to push it because if it will just be the Directors, you know, there are two separate Directors. Somebody should be integrating the two and I would really think it should be at the level of the Executive Committee, the Cluster Heads specifically.” (National Interviewee)

The first subtheme included the need to clarify roles and responsibilities in DRRH and CCAH. As previously mentioned in Section 8.3.1, both the National Policy for CCA in the Health Sector and CCAH strategic plan make direct reference to the roles and responsibilities of HEMB in CCAH. However, these roles fail to acknowledge the inclusion of climate change risk in disaster risk assessment, ongoing health surveillance, and development and implementation of the Hospital Safety Index (as discussed in Section 8.3.5).

The second subtheme highlighted that a clear mechanism is needed for stakeholders in DRRH and CCAH in the DOH to work together. During the expert workshop, participants discussed challenges and opportunities for strengthening the coordination of DRRH and CCAH in the DOH. The need for strengthening the CCAH programme was seen as a critical step in improved collaboration:

“What sort of linkage do we expect to see when DRR is so advanced?...HEMB is already institutionalised, it has a budget, it has people, it has a functioning structure...the climate change programme, is still evolving, and there is a change of leadership...How can HEMB coordinate on climate change when the programme is not established?” (Expert Workshop Participant)

Expert workshop participants highlighted that coordination and collaboration was possible because, at the time of the workshop, the key stakeholders in DRRH and CCAH in
the DOH were under the same cluster within the DOH, the Office of Technical Services. Thus, these stakeholders were being led by the same Under Secretary of Health.

### 8.5 Summary of findings and conclusion

Linking DRRH and CCAH was identified by interviewees and expert workshop participants as important and timely in the Philippines. This section summarises the key findings presented in this Chapter, corresponding with FQ3: *How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links?* These findings are summarised in Figure 8.4.

**Figure 8.4.** Summary of findings of the research in answer to FQ3 – Links between DRRH and CCAH in the Philippines, and challenges for strengthening these links

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**Conceptual synergy**
- Resilience
  - Possible conceptual goal
  - Lacking clear definition and measurable indicators
  - Differing definitions between stakeholders

**Technical and operational synergy**
- Current links
  - National DRR and CCA policies
  - Consideration of health impact pathways through the determinants of health
  - Disaster preparedness and Response
  - Research
  - Health systems strengthening: Improving baseline health status by strengthening health services

**Potential future links**
- DRRH and CCAH policies
- Health systems strengthening: Building blocks
- Integrated risk assessment
- Integrated EWS and surveillance
- Resilience of health infrastructure
- Joint capacity building

**Collaboration**
- Needed on three levels: Focal points within the DOH; whole of DOH; and health-affecting sectors

**Coordination**
- Lack of clear role designation and formal coordination mechanism
Resilience was examined as a potential conceptual synergy between DRRH and CCAH in the Philippines. It was found that resilience is used in numerous national and health policies both in DRR and CCA. Though resilience is not explicitly established as a common goal between DRR and CCA within or outside of health, resilience was suggested as a potential goal for drawing together key stakeholders by some national and global informants. However, the dominant message emerging from the Case Study was that resilience lacks clarity, measurable indicators have yet to be developed, and the term is defined differently by different stakeholders. Considering these challenges, the utility of resilience as the basis of a conceptual framework for linkages is discussed in detail in Chapter 9.

This Chapter presented the links between DRRH and CCAH in the Philippines. Existing synergies were found in: national DRR and CCA policies; consideration of the health impact pathways, specifically through examination of the social and environmental determinants of health; disaster preparedness and response as no-regrets CCAH; joint research for DRRH and CCAH; and health systems strengthening in relation to improving health services and strengthening baseline health status. Opportunities for developing linkages which were identified through the Case Study included: DRR and CCA policies in health; health systems strengthening through the building blocks of health; integrated EWS and disease surveillance; resilience of health infrastructure; and joint capacity building. The following Chapter discusses these technical and operation links in relation to existing literature.

In general, the current technical and operational linkages between DRRH and CCAH in the Philippines need strengthening. Collaboration and coordination were identified as the key challenges for strengthening these linkages. Collaboration was related to the relationships within the DOH and between sectors. Collaboration was identified as necessary on three levels: 1) key DRRH and CCAH stakeholders within the DOH; 2) whole of health sector; 3) health-affecting sectors. Coordination challenges were related to the need for clarity around the roles of DRRH and CCAH actors within the DOH and a formal mechanism for them to work together.

This Chapter highlighted key findings in relation to linking DRRH and CCAH in this Case Study. The Case Study identified that linking DRRH and CCAH is both timely and important. Current conceptual, technical and operational links need considerable strengthening. Resilience poses challenges in terms of its utility beyond an overarching
conceptual goal for DRRH and CCAH. Technical and operational links between DRRH and CCAH were the strongest in policies, though these could stand to be strengthened, as well as in the recognition of disaster preparedness and response as no-regrets adaptation. The overarching challenge identified in linking was how health stakeholders collaborate and coordinate on DRRH and CCAH. The following Chapter draws together the key findings from this Chapter and Chapters 6 and 7 to discuss the findings of this research in relation to the overarching RQ and in the context of the literature.
CHAPTER 9: DISCUSSION AND RECOMMENDATIONS

9.1 Introduction

This research sought to answer the RQ: How can DRRH and CCAH be linked? This Chapter discusses the research findings in the context of related research findings. It draws on DRRH and CCAH literature, as well as literature from broader, cognate fields, including DRR and CCA literature outside of health. First the importance of linking DRRH and CCAH is summarised in Section 9.2.1. Following this, the discussion is organised according to the FQs of the research. Findings relating to the priorities and key gaps of DRRH and CCAH in the Philippines (FQ1 and FQ2) are discussed in Sections 9.2.2 and 9.2.3, respectively. Findings from FQ1 and FQ2 are also drawn together and compared to provide further insight into the challenges for linking DRRH and CCAH. This provides greater depth to the findings relating to FQ3 (presented in Section 9.2.4). The summary of findings relating how DRRH and CCAH are linked in the Philippines (FQ3) are discussed in Sections 9.2.5 and 9.2.6. Subsequently, recommendations for future research and practice are given. Finally, the significance and contribution of the research is highlighted.

9.2 Summary of main findings

Through the use of the conceptual framework for this research (originally presented in Section 5.2.1) Figure 9.1 condenses the key findings in relation to the RQ: How can DRRH and CCAH be linked? This presents a summary of existing and potential links between DRRH and CCAH in the Philippines. The foundation of this framework was drawn from the extensive literature review. However, it is important to note that the refinement of this framework is based on findings specific to the Philippines. Thus, the generalisability of these findings is potentially limited due to the singular case study methodology of the research. Some elements may be transferable to other settings. However, this would require further investigation in other settings to ascertain their broader applicability. The main findings in relation to the RQ and FQs are visually summarised in Figure 9.1.
Figure 9.1. Summary of findings of the research in relation to the overarching RQ – How DRRH and CCAH can be linked

Chapters 2, 3 and 4 drew together published literature on why linking DRRH and CCAH is important, and the current knowledge about how DRRH and CCAH can be linked. Through the extensive literature review it was identified that linking DRRH and CCAH was important to reduce the concurrent health risks of climate-sensitive health hazards, as well as
maximise conceptual and technical/operational synergies. This is briefly summarised in the top arrow linking from DRRH to CCAH.

The DRRH component on the left summarises findings relating to FQ1: *What are the key priorities and gaps for DRRH in the Philippines?* The corresponding CCAH component on the right presents findings relating to FQ2: *What are the key priorities and gaps for CCAH in the Philippines?* Finally, the central component labelled ‘Linked DRRH and CCAH’ summarises key points relating to FQ3: *How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links?* These findings are separated into three parts in correspondence with how they are discussed in this Chapter: (1) resilience as a conceptual synergy; (2) technical and operational synergies (divided into no-regrets and climate-sensitive options); and (3) challenges for linking DRRH and CCAH.

### 9.2.1 The importance of linking DRRH and CCAH

As previously mentioned, the extensive literature review in Chapters 2, 3 and 4 highlighted the importance of linking DRRH and CCAH. Two key reasons for linking DRRH and CCAH were highlighted, including the need to address commonalities in health risks from climate-sensitive disasters and climate change; and maximise conceptual, technical and operational synergies. The Case Study supported the need to maximise synergies in implementation, discussed below.

#### 9.2.1.1 Addressing common health risks

The literature review established that climate-sensitive disasters and climate change impact health through common direct and indirect pathways. Climate-sensitive health hazards (hydrological, climatological, biological and meteorological) interact with vulnerability and exposure to impact health directly, or indirectly when mediated by ecosystems and/or human systems. Section 9.2 presented a novel framework for considering the commonalities between disaster and climate change impacts on health. Highlighting these common health risks is the first step in developing a common language to for addressing them through both DRRH and CCAH.

#### 9.2.1.2 Maximising synergies

Linking DRRH and CCAH is important to maximise conceptual, technical and operational synergies between the two approaches. Opportunities for conceptual, technical and operational synergies for linking DRRH and CCAH were identified through the literature
Conceptual synergies referred to those concepts prevalent in DRRH and CCAH which can potentially provide foundations for joint action. Those potential conceptual synergies identified through the literature review included resilience, vulnerability and risk. Technical and operational synergies referred to areas of work which create opportunities for joint strategies to reduce duplication and strengthen tools, expertise, and implementation of DRRH and CCAH. Technical and operational synergies were classified together as commonly the operational side of DRRH and CCAH (implementation) is inseparable from the technical side (tools and expertise behind development of DRRH and CCAH strategies). Areas for technical and operational synergies identified through the literature included: national policies; health systems strengthening; joint risk and vulnerability assessment; consideration of health impact pathways; integrated EWS; resilience of health infrastructure; and disaster preparedness and response.

The Case Study of the Philippines highlighted that linking DRRH and CCAH was important and timely (Section 8.3). Furthermore, maximising operational synergies on the local level were identified as important for effective and efficient implementation. These findings are further supported by literature from the Philippine context (Law, 2016), and on a global level (Aitsi-Selmi et al., 2015; Aitsi-Selmi & Murray, 2015a, 2015b; Aitsi-Selmi et al., 2017; IPCC, 2012; Murray & Waite, 2018; UNFCCC, 2017b).

There are numerous discussions in the literature regarding the forms links should take (Section 4.2). For example, Kelman (2017) advocates for integration, stating that CCA should not exist as a separate field as this can be mainstreamed into DRR and sustainable development. While the author makes some valid arguments, the application of this would be dependent on the context and system within which it is being implemented. Comparatively, Murray and Waite (2018) highlight that numerous policy areas contribute to addressing health risks of climate change, and increasing coherence between these approaches including DRR and CCA is necessary to adequately address these risks. This Case Study indicated that it is well recognised that climate change is aggravating important disaster and health risks, thus a concerted effort on CCAH is needed in the Philippines. Furthermore, it illustrates that in order for CCAH to gain traction and be mainstreamed in broader health programmes, it is necessary for a group to drive it. In this case this would be those with the appropriate authority, leadership and technical skills within the DOH.
9.2.2 Priorities and gaps of DRRH in the Philippines

This research sought to identify the priorities and gaps of DRRH through FQ1. The overarching priority in DRRH in the Philippines was to strengthen community level implementation. Key gaps identified included: strengthening intra- and inter-sectoral collaboration for DRRH and increasing the role of the whole of the health sector in disaster prevention. The following subsections discuss these priorities and gaps in relation to the current literature. The implications of these priorities and gaps for linking DRRH and CCAH are discussed later in Sections 9.2.4.1 and 9.2.4.2.

9.2.2.1 Community-level implementation for DRRH

Strengthening community implementation was the overarching priority of DRRH in the Philippines. Outside of the present Case Study, local governments and communities are commonly recognised as key in disaster preparedness and response (Sheehan, Fox, Kaye, & Resnick, 2017) particularly in health (Plough et al., 2013). Both public health and DRR emphasise the importance of community-based approaches to compliment policies and national initiatives (Phibbs et al., 2016). The need for community-based DRRH is also supported by both the HFA and subsequently the Sendai Framework (Briceño, 2015; Phibbs et al., 2016). Furthermore, the Bangkok Principles emphasise the need to strengthen sub-national DRRH with communities at the centre (UNISDR, 2016a).

Similarly to the present Case Study, DRRH is becoming increasingly community focused in other settings. For example, community involvement in all DRM phases is vital to manage health risks from extreme events and slow-onset hazards, such as droughts in Brazil (Sena, Barcellos, Freitas, & Corvalan, 2014). Community-based DRRH is also an important focus in the United States (Bromley et al., 2017; Eisenman et al., 2014; Nicholls, Picou, Curtis, & Lowman, 2015; Nicholls, Picou, & McCord, 2017; Plough et al., 2013; Schoch-Spana, Selck, & Goldberg, 2015), and the Pacific Islands (Mahany & Keim, 2012). However, implementation of community level disaster preparedness and response remains a challenge in other settings, such as Myanmar (Smith & Chan, 2017).

Common challenges identified for implementing DRRH at the local level in the Philippines included the decentralisation of the health system, and limited dedication of LCEs and resources to support local DRRH. Similarly, resource constraints within the decentralised health system of the Philippines were highlighted as a challenge in DRRH literature relating
to Typhoon Yolanda (Salenga, Robles, Loquias, Capule, & Guerrero, 2015). Implementation of community-based DRRH has also been noted as challenging in decentralised contexts where funding is stretched across competing priorities and insufficient to meet DRRH needs (Grieb & Clark, 2008).

### 9.2.2.2 Role of the health sector in disaster prevention

The Case Study highlighted that initial efforts in DRRH in the Philippines focused on strengthening national response capacity and coordination, and policy framework supporting DRRH (DOH, 2004; Health Emergency Management Staff & WHO WPRO, 2005). Since this time, there has been greater focus on preparedness including: health service continuity during emergencies; prepositioning of response supplies; and preparedness and response planning at national, regional and local levels (DOH, 2016c). Furthermore, in recent years, draft policies and plans are beginning to focus more on local level implementation and community-based DRRH (DOH, 2016c; HEMB, 2016a). These strategic shifts have occurred largely as a result of the lessons learnt from Super Typhoon Yolanda, and the understanding that this is the ‘new normal’ that the Philippines faces in terms of disaster risks to health (DOH, 2016c; HEMB, 2014, 2016a).

There is growing recognition among key DRRH stakeholders in the DOH that health also has a role in the preventative phase of DRM. The increasing focus on the preventative aspects of the DRM cycle has also been identified in DRRH literature (Arnold, 2005; Moore et al., 2007; Rose et al., 2017). For example, the Sendai Framework has a greater focus on the determinants of vulnerability and risk. An upstream public health approach focusing on addressing determinants of health and inequalities is an important component of addressing these risks (Phibbs et al., 2016). However, despite these efforts DRRH has largely remained focused on preparedness and response both within the Philippines (DOH & WHO, 2012) and globally (Keim & Abrahams, 2012; Lo et al., 2017).

Suggested disaster prevention activities within the Case Study included strengthening current disease prevention efforts and health services. The literature identifies that public health roles, such as disease prevention, health promotion and strengthening health service delivery and the health system, are important for preventative DRRH action (Bayntun et al., 2012; Murray et al., 2015; Simkhada, van Teijlingen, Pant, Sathian, & Tuladhar, 2015). Global informants particularly emphasised the important contribution of all health services and public health actors in reducing disaster risks. Similarly, some literature stresses the
importance of focusing at a population level, such as in public health, in order to reduce disaster risks (Phibbs et al., 2016). DRRH strategies can be classified into primary, secondary and tertiary preventative strategies to draw parallels with public health (Section 2.3.2.4). When referring to the prevention phase of the DRM cycle, specific DRRH and public health actions could be classed as secondary and tertiary prevention strategies. These include vulnerability and exposure reduction efforts, such as addressing the determinants of health, health promotion and increasing access to health care. For example, public health services focusing on disease prevention have been suggested as a preventative DRM strategy for managing health risks of disasters (Keim, 2018b). There is, however, limited research examining preventative DRRH through secondary and tertiary prevention strategies, particularly in low- and middle-income countries.

9.2.2.3 Inter- and intra-sectoral coordination

This research identified gaps in coordination of DRRH within health and across sectors. The Philippines exhibited significant strengths in coordinating relationships between HEMB and key sectors in disaster response through the cluster approach. However, coordination between HEMB and other actors within the DOH, as well as health-affecting sectors outside of response were highlighted as gaps in DRRH. Furthermore, this research indicates that the Philippines has good national and regional coordination in disaster response, with particular challenges in coordination at the local level. Strengths in coordination and opportunities for further improving health response were highlighted by Typhoon Yolanda (McPherson, Counahan, & Hall, 2015). Coordination between national DRRH and subnational focal points has been identified as a challenge in other settings, such as Japan (Egawa, Suda, Jones-Konneh, Murakami, & Sasaki, 2017), as well as coordination between the health system and public health agencies such as in the United States (Murthy et al., 2017).

Coordination within and across sectors has been identified as vital for effective DRRH (Lo et al., 2017; Wilson, McKenzie, McLeod, Darsey, & Craig, 2017). The Bangkok Principles emphasise multi-sectoral policies and planning, as well as greater engagement of health in cross sectoral initiatives for DRR for strengthening DRRH coordination (UNISDR, 2016a). Similarly, multi-sectoral approaches to disaster response have been highlighted as essential for successful DRRH in Africa (Olu et al., 2016).

There is a growing body of literature examining effective coordination of disaster response in health. For example, the Ebola outbreak in 2015 emphasised the importance of a
coordinated response and the IHR in responding to health emergencies (Kruk et al., 2015). Research has also examined the cluster approach for coordinating disaster response, such as was used in response to the Nepal earthquake in 2015 (Subedi, Sharma, Dahal, Banjara, & Pandey, 2018); and local level coordination (Peters, Hipper, & Chernak, 2018), such as illustrated by Zika preparedness efforts in New York (Madad et al., 2018). However, there remains limited research exploring successful inter- and intra-sectoral collaboration for preventative aspects of DRRH.

9.2.3 Priorities and gaps of CCAH in the Philippines

This section discusses findings relating to FQ2: *What are the key priorities and gaps of CCAH in the Philippines?* The overarching priority for CCAH in the Philippines was to strengthen national governance and organisational structures for implementation. The two key gaps identified in CCAH were: limited research and evidence for climate change impacts on health and adaptation strategies; and the need to strengthen national leadership and political will.

9.2.3.1 Strengthening national implementation and governance of CCAH

CCAH in the Philippines takes a mainstreaming approach (DOH, 2012a, 2012b). Despite established policies and some established structure, mainstreaming of CCAH in the Philippines is limited at national, regional and local levels. Therefore, strengthening national implementation is the current overarching priority of CCAH in the Philippines.

It was commonly reflected in interviews and the expert workshop that the governance mechanism for CCAH needed to be focused on mainstreaming CCAH in existing health programmes. This was largely due to the understanding that CCAH action is present in pre-existing public health initiatives. Literature supports this commonly reflected view that it does not necessarily require ‘new’ action, rather needs the strengthening of current public health efforts to consider climate change risks (Bowen & Friel, 2012; Ebi & Del Barrio, 2017). Furthermore, adopting a mainstreaming approach has been said to be more successful than the development of parallel structures, and ensures that climate change is considered alongside other risk drivers (WHO, 2015b). However, CCAH in the Case Study primarily takes a project-based approach. This appears to be a common approach in low- and middle-income countries, as reflected by the literature (Ebi & Del Barrio, 2017).
There is emerging literature evaluating the success of the implementation of CCAH (Austin et al., 2016; Ebi & Del Barrio, 2017). It highlights that governance and institutional support are key challenges in implementing CCAH (Austin et al., 2016; Ebi & Del Barrio, 2017). This is similar to the identified gaps in the implementation of CCAH in the Philippines. Currently there is limited literature examining the implementation of national CCAH policies. However, indicators for measuring progress on CCAH are beginning to be developed, such as those recommended for the Government of Canada which include process and outcome indicators for CCAH progress (Expert Panel on Climate Change Adaptation and Resilience Results, 2018). Internationally the presence of national CCAH policies is used as the indicator for implementation of CCAH by the Lancet Countdown (Watts et al., 2018). However, this research highlights that the presence of national policy is not an accurate indication of the implementation of CCAH. It was indicated by global informant interviews that this finding is relevant in settings outside of the Philippines.

The Philippine Case Study highlighted the need for a cross-cutting CCAH governance mechanism within the health sector. To be successful this mechanism requires the appropriate authority and leadership support. Further to this, administrative turnover due to changes in political leadership appeared as a key barrier to sustaining a coordinating mechanism for CCAH in the DOH. Global informant interviewees suggest that this is not restricted to the Case Study context. Global informants also highlighted the importance of accountability in governance of CCAH, this is also supported by the literature (WHO, 2015c). CCA literature also highlights the importance of authority in the governance of CCA to strengthen coordination between programmes and thus implementation of CCA (Ampaire et al., 2017; Homsy, Liu, & Warner, 2018; Nightingale, 2017). The effectiveness of the current governance structure (institutional mechanism) for mainstreaming CCAH in the DOH was questioned by interviewees and expert workshop participants. Within this context it is important to note the difficulty reported in upscaling CCAH projects to institutionalised programmes (Ebi & Del Barrio, 2017), as is evident in CCAH in the Philippines.

Governance is central to adaptive capacity and greatly influences implementation of CCAH (Bowen et al., 2012). However, limited research exists on governance within the context of CCAH (Bowen et al., 2012), with even less literature relating to success factors and challenges of governance mechanisms in mainstreaming CCAH. It has been noted that limited awareness of health risks of climate change limits the institutionalisation of CCAH (Bowen, Miller, Dany, McMichael, & Friel, 2013; Ebi & Del Barrio, 2017). Furthermore, the
lack of a coordination mechanism has been identified as a barrier to CCAH in other countries (Bowen et al., 2013). In this Case Study the lack of CCAH knowledge among health programme managers was a secondary concern when compared to establishing a coordinating mechanism with the appropriate authority.

Strong governance, including coordination between health programmes, is a foundation for successful CCAH policy and implementation (Bowen et al., 2012; WHO, 2015c). Cross-sectoral governance for CCAH is highlighted as a priority within the literature (Austin et al., 2016; Bowen et al., 2012; Ebi & Del Barrio, 2017; WHO, 2015c). However, intra-sectoral governance was highlighted as the first concern within the Philippines. Challenges regarding inter-sectoral collaboration were seen as more distal, though these may emerge as more pressing issues in the future. The agency (influence and power) of individuals and groups, and architecture of institutions (institutional configuration) have been identified as potential lenses for evaluating governance in climate change in health (Bowen et al., 2012). However, these concepts have not yet been applied in empirical research. While these suggested lenses were intended to facilitate analysis of governance beyond “single-layered decision-making structures and processes” (Bowen et al., 2012, p.67) these lenses remain valid in application to intra-sectoral national governance within the DOH. It is suggested that there is a strong need for an intra-sectoral national governance mechanism which has the authority and mandate to drive the mainstreaming of CCA in national health programmes of the DOH.

There is the potential for the focus on governance of CCAH to grow as the Lancet Countdown on Climate Change on Health drives global reporting CCAH progress.

9.2.3.2 Research for CCAH

Research was identified as a critical need for strengthening implementation of CCAH. Expert workshop participants identified research as the foundation for understanding climate change and health risks, implementation of CCAH actions and the necessary governance structure. Lack of research and information on CCAH has previously been identified in the literature as a barrier to CCAH (Bowen et al., 2013; Curtis et al., 2017; Ebi & Del Barrio, 2017). Significant gaps remain in understanding health impacts of climate change in low- and middle-income countries (Bouzid et al., 2013). Particularly lacking is climate change and health projections at a useable scale for developing and implementing CCAH strategies (Ebi & Del Barrio, 2017; UNFCCC, 2017a; WHO, 2015b). This remains true in the Philippines. However, there are documented challenges surrounding the development of these projections
including: uncertainty of climate change data; limited baseline surveillance of climate-sensitive health outcomes; complexity of pathways of health impacts and the range of spatial scales at which these can occur; and uncoordinated and unsystematic collection of health data (Curtis et al., 2017; Ebi & Del Barrio, 2017; Hallegatte, 2009; Hashim & Hashim, 2016; Turner, Alderman, Connell, & Tong, 2013). Several of these challenges were highlighted through this Case Study, including: limited baseline data, complexity within the risk pathways, and scale and uncertainty of climate change projections.

Research on disasters, climate change and health was identified as an important priority in the Philippines. This is also supported by the literature (Curtis et al., 2017; Filho et al., 2018; Hashim & Hashim, 2016). Weather and climate extremes have been identified as important mechanisms for better understanding health impacts and adaptation to climate change (Filho et al., 2018). Since the time of data collection, both CCAH and DRRH have been included in the national agenda for health research, the NURHA. This is an important step towards strengthening joint research for DRRH and CCAH (discussed further in Section 9.2.6.2).

There is a need for greater research on implementation of CCAH (Curtis et al., 2017; Ebi & Hess, 2017), and health policy implementation in low- and middle-income countries (Erasmus, Orgill, Schneider, & Gilson, 2014; Mugwagwa, Edwards, & de Haan, 2015). This is particularly important as the effectiveness of CCAH policies in low- and middle-income countries varies considerably (Ebi & Del Barrio, 2017). Research investigating the policy-implementation gap in CCAH in the Philippines will go a long way to strengthening implementation. However, while research is an important part of the implementation process, caution needs to be used in the assumption that strengthening research will guarantee implementation (Haines, Kuruvilla, & Borchert, 2004). Therefore, there is a need to ensure research is ‘useful, usable and used’ particularly through close collaboration between researchers and end-users of research (Aitsi-Selmi, Blanchard, & Murray, 2016; UNFCCC, 2017a).

**9.2.3.3 Leadership for CCAH**

Political commitment and leadership in CCAH was identified as a significant gap in implementation. Limited political buy in and commitment to CCAH resulted in CCAH being seen as a lower order priority, or not being prioritised at all. A champion among the upper management of the DOH was identified as necessary for strengthening leadership and
political commitment. However, it has been found in the broader CCA literature that champions do not guarantee successful implementation (IPCC, 2012). Leadership within the health sector was particularly pertinent within the Case Study. However, national leadership in CCA was also highlighted as important, particularly among global informants.

Effective advocacy from influential stakeholders is key to strengthening national leadership (Bowen et al., 2012). This includes advocacy from communities and non-government organisations, the pressure from which can be key for building political commitment to protecting health (De Ceukelaire, De Vos, & Criel, 2011). Political commitment has been identified as imperative to the implementation of CCA more broadly (Eakin, 2015; Ford et al., 2011; IPCC, 2012; Mendizabal, Heidrich, Feliu, García-Blanco, & Mendizabal, 2018). Similarly, these factors have been found to greatly influence the governance and success of the implementation of CCAH (Bowen et al., 2012; Bowen et al., 2013; WHO, 2015b, 2015c).

9.2.4 Challenges for linking DRRH and CCAH

This section discusses the challenges for linking DRRH and CCAH in relation to the second half of FQ3: How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links? The challenges for linking DRRH and CCAH were identified in Section 8.4, as well as through comparison of priorities and gaps in DRRH and CCAH in the Philippines. The identified challenges include: (1) differing priorities and scale of operation of DRRH and CCAH; (2) differing implementation status of DRRH and CCAH; and (3) challenges in collaboration and coordination. Sections 9.2.4.1 and 9.2.4.2 discuss the implications of the differing DRRH and CCAH priorities and gaps for linking. Finally, coordination and collaboration challenges are discussed in Section 9.2.4.3.

9.2.4.1 Differing priorities and scale of operation between DRRH and CCAH

The findings presented in Chapters 6 and 7 indicate key differences in priorities and level of operation between DRRH and CCAH in the Philippines. DRRH is primarily community focused, aiming to strengthen community implementation and mainstreaming through existing health programmes. CCAH is primarily nationally focused, aiming to develop research to strengthen the establishment of the national programme.
Challenges associated with differing approaches have been highlighted in broader DRR and CCA literature. For example, differing scales, knowledge and norms have been identified as barriers for linking broader DRR and CCA (Birkmann & von Teichman, 2010). Differences in the scales knowledge and norms were previously identified in Philippine national policies on DRR and CCA (De Leon & Pittock, 2017). It is believed that this research highlighted differing spatial scales of current operation where DRRH aims to work at the community level, compared to CCAH which is currently nationally focused. This presents a significant challenge for identifying current joint initiatives which can be implemented. To the best of my knowledge these challenges have not previously been discussed in relation to health. However, similarly to the broader DRR and CCA literature, the findings of this research suggest that differences in approaches between DRRH and CCAH create challenges for linking the two initiatives. Further research is necessary to ascertain how this challenge can be overcome to strengthen links between DRRH and CCAH.

9.2.4.2 Difference in implementation status

The findings presented in Chapters 6 and 7 indicate key differences in level of implementation of DRRH and CCAH in the Philippines. DRRH is more advanced in implementation when compared to CCAH. The difference in implementation status is understandable considering the differing maturities of both programmes and levels of political will behind each approach. It was commonly highlighted that the limited implementation of CCAH presented a challenge for linking DRRH and CCAH work. This was also sometimes acknowledged as an opportunity to promote linked DRRH and CCAH before duplication develops. There is limited investigation of differing implementation status as a challenge for linking DRR and CCA both inside and outside of health. However, broader DRR and CCA literature has suggested that as CCA is newer, climate change priorities should be mainstreamed within DRR policies and efforts (Pilli-Sihvola & Väätäinen-Chimpuku, 2016) and sustainable development (Kelman, 2017). However, there is a need to develop greater understanding of how links between DRRH and CCAH can be strengthened considering CCAH is in the early stages of implementation.

9.2.4.3 Coordination and collaboration

As explicitly highlighted in Section 8.4, coordination and collaboration present significant barriers for linking DRRH and CCAH. Collaboration was used to denote the relationships within the DOH and between sectors. It was identified that collaboration is
necessary across three levels: (1) key stakeholders in DOH; (2) whole of health sector; and (3) health-affecting sectors. Coordination related to the roles of each of the actors within the DOH and mechanism for them to work together. This research identified the need to designate responsibilities and develop a formal mechanism through which key stakeholders can work together to link DRRH and CCAH.

It is important to note that inter- and intra-sectoral coordination was highlighted as a challenge within DRRH (Section 6.4.2). This is largely limited due to the perception of DRRH solely as preparedness and response, and the responsibility of HEMB. Similarly, the need for a strong CCAH governance mechanism to coordinate and collaborate relevant stakeholders across the DOH identified (Section 7.2.3). Therefore, both of these programmes face general coordination challenges within the DOH and health sector, including challenges coordinating and collaborating with each other. Strengthening this coordination and collaboration within the DOH potentially presents an opportunity for strengthening both DRRH and CCAH, as well as joint work.

To the best of my knowledge, this is the first research to examine collaboration and coordination as a challenge for linking DRRH and CCAH. Previous research has examined this challenge in broader DRR and CCA literature. It identified coordination between DRR and CCA agencies as a barrier to the progress of linking DRR and CCA (Schipper et al., 2016; Seidler et al., 2018). Furthermore, cross-sectoral collaboration has been highlighted as particularly important and a significant challenge in achieving the Sustainable Development Goals and thus reduce health risks from disasters and climate change (Bowen et al., 2017). It has been suggested that individual and political agendas often present a significant barrier to coordination and collaboration on DRR and CCA (Kelman et al., 2015). Thus, individual DRR and CCA practitioners cognizant of the value of linking DRR and CCA become essential bridges for these two approaches (Kelman, 2015). Within this context, collaborative governance has been identified as a potential framework to facilitate linkages between DRR and CCA outside of health (Dwirahmadi, 2016). The findings of the present research indicate that there is a need for empirical real-world exploration of methods for overcoming barriers to coordination and collaboration to link DRRH and CCAH.
9.2.5 Utility of resilience as a conceptual synergy between DRR and CCA

Resilience was examined as a potential conceptual synergy between DRRH and CCAH in order to partly answer FQ3: How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links?

It was found that resilience is used in both national and health policies for DRR and CCA. These policies do not explicitly establish resilience as a common goal between DRR and CCA within or outside of health. However, some national and global interviewees suggested resilience as a potential goal for drawing together key stakeholders. This is supported by broader DRR and CCA literature (Sudmeier-Rieux, 2014; UNFCCC, 2017b). However, the dominant message from stakeholders was that resilience lacks clarity and is poorly defined in health. This is supported by resilience literature in health (Hanefeld et al., 2018) and more broadly (Davidson et al., 2016). Furthermore, resilience was found to be defined differently by different groups. This finding is not surprising considering the numerous definitions specific to context and purpose (as established in Section 4.4.1) and the loss of clarity which has occurred since its adoption in social sciences (Davidson et al., 2016).

Resilience lacked a clear definition used consistently across CCA and CCAH policies. This was also reflected by Case Study interviewees. Davidson et al. (2016) examined resilience definitions according to five dominant categories including: ecological; socio-ecological; disaster; community; and urban resilience. National climate change policies in the Philippines used resilience similarly to definitions of ecological and socio-ecological systems resilience. Only one CCAH policy mentioned community resilience. However, subsequent plans lacked clarity in terms of its application and operationalisation. Comparatively, DRRH stakeholders largely focused on community preparedness when defining resilience (Section 8.2.2). Resilience in DRRH referred to a combination of disaster and community resilience, as characterised by Davidson et al. (2016).

As indicated by global informants, and supported by literature, resilience is moving towards a more operationalised definition (Bahadur et al., 2013; Cutter, 2016; Davidson et al., 2016; Djalante et al., 2013). This includes health systems and disaster resilience in health (Blanchet et al., 2017; Castleden et al., 2011; Cuervo, Leopold, & Baron, 2017; Kruk et al., 2017; Kruk et al., 2015; Overseas Development Institute, 2017c; Van de Pas et al., 2017;
Wulff et al., 2015). However, this remains to be seen in the Philippines. Within the literature there remain significant challenges around the operationalisation of the concept (Anderies, Folke, Walker, & Ostrom, 2013; Fekete, Hufschmidt, & Kruse, 2014), and its use as a uniting concept has been questioned (Baggio et al., 2015; Beichler et al., 2014; Van de Pas et al., 2017). Furthermore, some literature suggests that taking a resilience approach promotes a maintenance of the status quo and does not encourage sustainable development, health systems strengthening or universal access to health systems (Abimbola & Topp, 2018; Kelman et al., 2016; Van de Pas et al., 2017). This is supported by research focusing on resilience in the Philippines following Typhoon Yolanda (Walch, 2018). This research identified that resilience approaches in DRR in the Philippines tend to focus on community preparedness as opposed to the reduction of underlying vulnerabilities and inequalities (Walch, 2018). This research supports this as resilience was more commonly defined from a preparedness and response perspective in the Philippines (Section 8.2.2). Thus, great caution should be used when operationalising resilience from the perspective of linking DRRH and CCAH. It would be necessary to ensure multiple facets of resilience are included, such as vulnerability reduction and resilience to slow-onset stressors.

These challenges in using resilience as the conceptual foundation for linking are not unique to the Philippines, as indicated by the global informants. This is also supported by the literature which challenges the utility of resilience as an effective bridge between varying interdisciplinary uses of the concept (Baggio et al., 2015). There is limited research exploring resilience to climate change and disasters in health simultaneously. However, consideration of resilience to both acute shocks (such as those from sudden on-set disasters) and stresses (such as those from long-term climate change) are becoming evident in health literature (Hanefeld et al., 2018; Overseas Development Institute, 2017c; WHO, 2015c). Furthermore, the present research highlighted that resilience in health concerns both the health system and the community. Thus, a multi-scale framework spanning the community and health system would be necessary. However, cross-scale frameworks of resilience are rare (Overseas Development Institute, 2017a).

This research contributes to the current literature by examining the present utility of resilience for building conceptual synergy between DRRH and CCAH. This has not previously been undertaken in the context of linking DRRH and CCAH. The findings of this research suggest that resilience is primarily useful as a high-level goal for linking DRRH and CCAH. However, through examination in a real-world context, this research demonstrates
that resilience presents numerous challenges for use as an operational frame for linking DRRH and CCAH.

9.2.6 Areas of work for linking DRRH and CCAH

Several areas of technical and operational synergies were examined as potential links between DRRH and CCAH in order to partly answer FQ3: *How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links?* Several existing technical and operational links were identified in the Philippines. These links exist to varying degrees, including in: national DRR and CCA policies; research; improving baseline health status; consideration of health impact pathways through the determinants of health; and disaster preparedness and response as no-regrets CCAH. Identified areas of work where technical and operational synergies could be built in the future included: DRR and CCA policies in health; health systems strengthening through the Six Building Blocks of health; integrated risk assessment; integrated EWS and surveillance; resilience of health infrastructure; and capacity building.

These areas for linkage have been categorised into no-regrets and climate-sensitive hazard specific options. The following section discusses these findings in relation to literature and the broader application of these findings.

9.2.6.1 No-regrets options for linking

Disaster preparedness and response, improving baseline health status, and addressing the socio-ecological determinants of health were identified in this research as no-regrets options for linking DRRH and CCAH (discussed in greater detail below). These linked DRRH and CCAH strategies were classified as no-regrets as they were recognised as having a net benefit for health, as well as addressing disaster and climate change risks.

According to the literature, the net benefit of no-regrets CCAH are felt through reduced: ill-health, disaster mortality, poverty and inequity, and pressure on health budgets (Watts et al., 2015). Strengthening health systems has been suggested as a no-regrets strategies for addressing the simultaneous health risks of disasters and climate change (Phalkey & Louis, 2016). Furthermore, although they may not be explicitly labelled as such, no-regrets CCAH options in the literature include those which strengthen health services and public health measures, particularly on a community level, to prevent negative health
outcomes by addressing determinants of health and reducing vulnerability (Ebi & Hess, 2017; IPCC, 2014b; Keim, 2011).

This research draws together no-regrets options suggested by both DRRH and CCAH literature and identified joint no-regrets options within a real-world context. As such this research highlights that these strategies are both no-regrets CCAH options and no-regrets DRRH. Importantly, these strategies are recognised as both DRRH and CCAH among local-level interviewees. Thus, these joint no-regrets options potentially represent an opportunity for actionable no-regrets linkages at the community level. Understanding that CCA outside of health is most often implemented in the context of multiple stimuli, these no-regrets options are important for strengthening CCA (Berrang-Ford, Ford, & Paterson, 2011). Finally, no-regrets CCAH such as strengthening sanitation have been suggested as important starting points in the absence of climate change and health research (Bowen et al., 2013). This is particularly important where CCAH faces significant challenges with implementation and political will. Thus, these no-regrets options for linking DRRH and CCAH may be considered as starting points for joint DRRH and CCAH action. Furthermore, these options represent an opportunity to initiate CCAH, strengthen DRRH, and improve public health.

This research highlighted the importance of no-regrets strategies as a starting point for linked DRRH and CCAH, emphasized particularly through the global informant interviews. They stressed that these strategies need to be iteratively managed to ensure they remain robust in the face of future climate change. This is supported by CCAH literature (Ebi, 2011a, 2011b; Ebi & Hess, 2017; Ebi et al., 2016; Hess et al., 2012; WHO, 2015b, 2015c), including in relation to climate-sensitive hazards which can evolve into disasters such as heatwaves (Hess & Ebi, 2016).

The WHO Operational framework provides some support for how these joint no-regrets options can be robust in the face of future climate change (WHO, 2015c). However, within contexts where there is low political will and few resources available for climate change action, challenges can be expected in ensuring robustness of CCA (IPCC, 2014a; Sellers & Ebi, 2018), such as in the Philippines. There are options for strengthening the robustness of these three no-regrets strategies in the face of climate change, for example, working closely with sectors monitoring food, water, air and waste to ensure proactive health protection strategies can be put in place to minimize population health impacts (Sellers & Ebi, 2018). Furthermore, iterative management of existing CCAH and DRRH initiatives will be vital in
ensuring their continued appropriateness and robustness in the face of future climate change (Hess & Ebi, 2016; Hess et al., 2012; Keim, 2018a). Significant efforts will be required to ensure these strategies are not merely reactive and remain robust in the face of future risks associated with climate change (Sellers & Ebi, 2018).

Disaster preparedness and response in health in the Philippines is an important frontline no-regrets option for reducing health impacts of climate-sensitive hazards which lead to emergencies and disasters. This is supported by literature which recognises disaster preparedness and response in health as adaptation to climate change (Few, 2007; Keim, 2008, 2011; Paterson et al., 2014). Similarly, literature outside of health identifies disaster preparedness and response as an important starting point for CCA (IPCC, 2012). Preparedness and response was strongly recognised as both DRRH and CCAH across all levels of interviewees in the Philippines. However, the importance of not restricting either DRR or CCA to disaster preparedness and response alone was expressed by global informants. Furthermore, reliance on disaster preparedness and response to address all disaster and climate change risks was identified as problematic by local interviewees. This research highlights that community disaster preparedness and response is an important joint no-regrets strategy for addressing common disaster and climate change risks in the Philippines. It also emphasises that preparedness and response is the starting point for addressing common risks, but should not be the end point of both DRRH and CCAH strategies.

Strengthening baseline health status was commonly discussed as a point where DRRH and CCAH link. These were considered upstream linkages for reducing underlying risks and vulnerabilities associated with population health status. Improving health status was commonly recognised as reducing vulnerability to both disasters and climate change among Philippine health professionals at all levels. Poor health has commonly been highlighted as a factor contributing to vulnerability in both DRR and CCA literature (Climate and Development Knowledge Network, 2012; Few, 2007; Keim & Abrahams, 2012; Shoaf & Rottman, 2000a; Songsore, 2017; J. Tucker et al., 2015; United Nations, 2014; Watts et al., 2015; WHO, 2014b). Thus, it is understandable that improving health status was found to reduce vulnerability to both disasters and climate change in the Philippines.

In the context of the Case Study, improving baseline health status by strengthening health services includes both primary health care, and public health protection and prevention
services. Those specifically highlighted by interviewees included strengthening UHC; as well as strengthening nutrition, immunisation, and maternal and child health services. The literature recognises UHC as an important aspect of CCAH which improves baseline health status (Sellers & Ebi, 2018) and reduces vulnerability to disaster and climate change risks (Overseas Development Institute, 2017c). The strength of existing health services has been found to be a protective factor against population health risks of climate change in Hawaii (Canyon, Speare, & Burkle, 2016). However, health impacts of hazards such as drought increase vulnerability through deterioration of health status (Ebi & Bowen, 2016). Finally, health services such as nutrition may become an increasingly important as climate change progresses, particularly in relation to food security and declining essential nutrient and mineral content in specific food crops (Zhu et al., 2018). Therefore, improving and maintaining high baseline health status potentially represents an opportunity to reduce vulnerability to initial and recurrent/ongoing stresses and shocks of both climate change and disasters. This is supported by present findings in the Philippines.

Phalkey and Louis (2016) suggest health systems strengthening as a no-regrets option for simultaneously addressing climate change and disaster risks in health. It is recognised that strengthening baseline health status through service delivery is an aspect of health systems strengthening. Therefore, in this way, this research supports health systems strengthening as a no-regrets option for addressing climate change and disaster risks.

The Six Building Blocks of health is a potential future opportunity for linking DRRH and CCAH through health systems strengthening. This was demonstrated through the application of the Six Building Blocks to DRRH planning in specific LGUs and the draft DRRH strategic plan. During this planning process, community was added as an additional element, making a seventh building block. This suggests the community plays a significant role in health systems strengthening in the Philippines. This is supported by recent health systems resilience literature which asserts that connecting with the local community is vital for health systems resilience (Hanefeld et al., 2018; Kruk et al., 2017; Kruk et al., 2015). This is supported further through the experiences of the 2015 Ebola outbreak in West Africa which demonstrated that community engagement and trust is vital for health systems resilience in response to health emergencies, as noted by other researchers (Elston et al., 2016; Kruk et al., 2017; Kruk et al., 2015; Manguvo & Mafuvadze, 2015).
Health systems strengthening approaches are being used in DRRH in the Philippines. However, planning processes in CCAH in the Philippines are currently not applying health systems strengthening models, such as the Six Building Blocks. The WHO Operational Framework represents an opportunity for growing engagement of CCAH stakeholders with the building blocks. This is demonstrated by the use of the WHO Operational Framework in national CCAH policies and planning in Fiji (Ministry of Health and Medical Services, 2016), discussed in further detail in Section 9.2.6.2. However, the effectiveness of health systems strengthening for linking is currently limited without the use of the Six Building Blocks by both groups and direct engagement of both DRRH and CCAH stakeholders in health system strengthening processes.

Addressing the socio-ecological determinants of health emerged as an important principle for reducing both climate change and disaster risks to health. This was recognised by stakeholders at all levels, particularly the local level. Furthermore, it was recognised that the health system, health-affecting sectors, and the communities they serve, all have important roles in addressing these determinant groups.

Both social and environmental determinants of health have been linked to health impacts of disasters (Chan, 2017; Phibbs et al., 2016) and climate change (Bowen & Friel, 2012; Watts et al., 2015; Watts et al., 2018). For example, drought in Brazil has been linked to both social and environmental determinants, with the community playing a large role in addressing the social determinants (Sena et al., 2014). Addressing determinants of vulnerability, particularly through strengthening community public health has been highlighted as essential for reducing health impacts of climate-related disasters (Keim, 2011). For example, the robustness of sanitation infrastructure has been found to be a protective factor for population health in the face of climate change in Hawaii (Canyon et al., 2016). Within this context there have been calls for research to build a more comprehensive understanding of determinants that drive health outcomes and influence health systems in a changing climate (Ebi & Hess, 2017; Ebi & Villalobos Prats, 2015; UNFCCC, 2017a).

Social determinants of health have been identified as opportunities for simultaneously addressing disaster and climate change risks in health (Aitsi-Selmi et al., 2017; Chan, 2017). Addressing social sources of vulnerability such as economic livelihood have been suggested as strategies for reducing health-related vulnerability to climate-sensitive disasters (Few & Tran, 2010). Furthermore, Few (2007) proposed examining health impact pathways as a
valuable tool for addressing climate change and disaster risks. This research highlights that both social and environmental determinants should be the primary consideration when examining the common health impact pathways. This finding is somewhat unsurprising considering both disasters and climate change impact health through indirect pathways mediated by social and environmental systems, as identified in Section 4.5.3. Social and environmental determinants offer an opportunity to consider how the commonalities in health impact pathways of climate change and disasters can be addressed.

Place-based initiatives, such as the Healthy Cities Initiative has been suggested as a potential for building resilience to climate change and extreme weather events (Ebi, 2011b), and bringing together all stakeholders in DRR and CCA (Aitsi-Selmi et al., 2017). However, the utility of the Healthy Cities Initiative has not been examined through empirical investigation. This Case Study supports the suggests that the Healthy Cities Initiative is a potential framework for bringing together DRRH and CCAH at a city level. It offers a foundation for simultaneously addressing socio-ecological determinants of health as they relate to disaster and climate change risks. Furthermore, it represents an opportunity for prioritising other no-regrets strategies including disaster preparedness and response, and strengthening health baseline status. Finally, it brings together DRRH and CCAH stakeholders, and engages actors in health-affecting sectors. This is particularly important as multisectoral action is necessary to address determinants of health and climate change risk which lie outside of the direct responsibility of the health sector (Bowen & Friel, 2012; Jancloes et al., 2014; McIver, Bowen, Hanna, & Iddings, 2017).

Importantly, this research identified that both social and environmental determinants, or ‘socio-ecological determinants’, were of great concern to interviewees when discussing disaster and climate change risks to health. This was particularly evident at the local level with examples of concrete and implementable community strategies relating to water and sanitation, as well as the Healthy Cities Initiative. Thus, this research provides empirical evidence of local level strategies to address socio-ecological determinants of health as an opportunity for joint no-regrets DRRH and CCAH.

9.2.6.2 Climate-sensitive hazard specific options for technical and operational linkages

The following potential areas for linkage represent links that incorporate various levels of climate change knowledge and experience in addressing climate-related hazards that can
evolve into emergencies or disasters. These areas represent specific activities which would require engagement of both DRRH and CCAH stakeholders. Furthermore, they would require explicit inclusion of climate change risk data and adaptation knowledge, as well as disaster risk data and risk reduction knowledge.

**National policies** in DRR and CCA were found to make strong links to each other and explicitly call for linkage between DRR and CCA in all sectors. This is supported by an evaluation of the climate change legal framework of the Philippines which found the Philippines to be a good example of integration within national policy (Bautista, 2015). Likewise, a policy case study examining the barriers and opportunities for developing linkages between DRR and CCA in the Philippines found that the current national policy instruments in both areas explicitly state the desire for linkage (De Leon & Pittock, 2017). Similarly to the present Case Study, it was found that the practical steps for developing this linkage are not yet clear (De Leon & Pittock, 2017).

Integration and linkage of DRR and CCA in national policies is poorly defined in the literature (Pilli-Sihvola & Vääätäinen-Chimpuku, 2016). In relation to policy integration, some literature suggests that CCA should be incorporated into existing DRR policies as DRR mechanisms are commonly well-established (Pilli-Sihvola & Vääätäinen-Chimpuku, 2016). Within this context integrated DRR and CCA policy: incorporates CCA policy objectives into DRR policies, addresses aggregated disaster and climate change risks, and commits to reducing inconsistencies between the two approaches (Pilli-Sihvola & Vääätäinen-Chimpuku, 2016). National policies in the Philippines do not incorporate CCA policies into DRR policies, nor do they establish shared objectives for DRR and CCA. However, they strongly recognise the interrelation of disaster and climate change risks, and the need to build resilience to these risks. Furthermore, they express strong commitment to joint work for DRR and CCA, and reducing duplication and contradictions.

National policies are important tools in developing links between DRR and CCA (Begum et al., 2014; Rivera & Wamsler, 2014; UNFCCC, 2016, 2017b). For example, significant policy fragmentation between DRR and CCA in the United Kingdom has been identified as a key cause of the short-term approach as opposed to long-term action based on integrated DRR and CCA (Dias, Amaratunga, & Haigh, 2018). However, there is limited evidence highlighting successful integration of climate change concepts into DRR policies and planning processes (Seidler et al., 2018). Strong links between national DRR and CCA
policies in the Pacific were often discussed by global informants. This is supported by examples of successful policy integration in the Solomon Islands and Vanuatu (Nalau et al., 2016), which has since been scaled-up to regional DRR and CCA policy in the Pacific (Pacific Resilience Partnership, 2016). Policies have also been found to be a mechanism to promote linked DRR and CCA at local government levels in Australia (Forino, von Meding, Brewer, & van Niekerk, 2017), and within sectors (Pilli-Sihvola & Väätäinen-Chimpuku, 2016). Global informants supported this finding, highlighting the NAP process as a potential process for strengthening links.

Links between DRRH and CCAH policies in the Philippines were limited. These links included: the acknowledgement of disaster preparedness and response in CCAH policies, and superficial acknowledgment of climate change as a driver of disaster risk in one of the four DRRH policies analysed. These linkages do not discuss the areas of overlaps between the two approaches, or highlight the need for joint action on climate change and disaster risks. Furthermore, these policies lack actionable steps for linking DRRH and CCAH.

Health policies have been identified as an opportunity for strengthening links between DRRH and CCAH (Aitsi-Selmi et al., 2017) particularly on a local level (Keim, 2008, 2011). However, to the best of my knowledge, no research findings have been published that explores links between DRRH and CCAH policies. One article examines climate change-related disaster response in relation to health workforce governance and policies in the Pacific (Rumsey et al., 2014). However, beyond the acknowledgement that some disasters are related to climate change, it is unclear how climate change is incorporated into these health workforce policies (Rumsey et al., 2014). Mahany and Keim (2012) highlight regional policy processes in the Pacific as examples for joint DRR and CCA commitments that contribute to reducing health risks. However, beyond this, there is limited published research examining how DRRH and CCAH policies can be linked.

There are examples of health policies which incorporate both DRRH and CCAH emerging from the Pacific. For example, the Climate Change and Health Strategic Action Plan 2016-2022 of Fiji is based on the WHO Operational Framework (Ministry of Health and Medical Services, 2016). As such, the plan incorporates DRRH through the ‘Emergency preparedness and management’ component of the WHO Operational Framework (Ministry of Health and Medical Services, 2016). Furthermore, the policy recognises the relationship between disaster and climate change risks; expresses direct support and congruence with
corresponding DRRH policies; and suggests potential areas of collaboration on DRRH and CCAH, including infrastructure assessment, recovery, and addressing climate-sensitive health risks in disaster policies (Ministry of Health and Medical Services, 2016).

The links between DRRH and CCAH in the climate change and health policy in Fiji are supported by strong links between broader DRR and CCA in national policies (Overseas Development Institute, 2017b) and regional policies (Pacific Resilience Partnership, 2016). This suggests that links between DRRH and CCAH policies can translate from strong national policy links. However, as demonstrated in the Philippines, links in broad national DRR and CCA policies do not necessarily translate to links within health-specific policies. There is little examination of enabling factors which allow the linkages between DRR and CCA in national policies to be translated into health policies and plans. More broadly, concerted effort and plans are needed to ensure links between DRR and CCA in national policies are carried through to sectoral policies (Pilli-Sihvola & Väätäinen-Chimpuku, 2016). Further research is needed to examine the extent of this ‘vertical’ policy integration (Pilli-Sihvola & Väätäinen-Chimpuku, 2016).

**Including climate change in risk assessments** used in DRRH planning was identified as an important short-term opportunity for linking within the Case Study. It was suggested that climate change can be considered in DRRH plans through the use of probabilistic hazard assessment which includes climate change risks. It is important to note that biological hazards are not currently included in these hazard assessments in the Philippines. Using probabilistic risk assessment, including climate change risks, to identify current and future hazard exposure of health facilities was suggested as an important use for these risk assessments. However, there was limited application of these linked risk assessments in health at the time of data collection.

Within the literature, risk assessments including climate change have been noted as an opportunity and starting point for linked action on DRR and CCA (Aitsi-Selmi, Murray, et al., 2016; IPCC, 2012; Phalkey & Louis, 2016). Applying climate projections to estimations of risks of extreme events has been previously used in public health planning in the United States (Hoppe, Raab, Blumenfeld, & Lundy, 2018). Furthermore, climate change has previously been incorporated in probabilistic risk assessment of various hazards, including flood (Ward et al., 2014). However, the level of integration of climate and climate change scenarios in risk assessment will vary depending on the context, and technical and
operational capacities (IPCC, 2012). For example, climate change projections have been used to assess health risks associated with flood among populations using private wells in Minnesota and aid public health planning to reduce these risks (Hoppe et al., 2018).

Risk assessment which considers both climate change and disaster risks in health would need to consider climate change across all hazards (Ebi, 2011b) and multiple health risks. It would also need to incorporate population and system vulnerabilities and capacities (UNISDR, 2017b). However, there are significant challenges relating to the application of joint risk assessments in health (Phalkey & Louis, 2016). First, it is becoming increasingly possible to consider the potential increases in frequency and intensity of selected hazards due to climate change (Eckstein et al., 2018; Forzieri et al., 2017; IPCC, 2012, 2014a). However, there are considerable difficulties in assessing the relationship between climate change and risks of extreme weather events (Adger, Brown, & Surminski, 2018; Eckstein et al., 2018; IPCC, 2012, 2014a; Stott et al., 2016; Trenberth, Fasullo, & Shepherd, 2015). Furthermore, there is additional difficulty in applying these same methods to more discreet hazards. For example, those that are slow-onset, and are less easily identified and defined, such as droughts or proliferation of climate-sensitive disease vectors. Risk assessments in some settings have begun to consider these discrete hazards and extensive risks, such as national risk assessments in New Zealand (UNISDR, 2017b). Second, assessments of climate change impacts on health are commonly restricted to a singular health impact, and rarely incorporate multiple health impacts from climate change (Phalkey & Louis, 2016; WHO, 2014a). Comparatively, DRR is progressing towards more of an all hazards approach in risk assessment (Shi et al., 2016; UNISDR, 2017b). However, multi-hazard risk assessments including both climate change and disaster risks are rare (Shi et al., 2016; Xu et al., 2016). Third, numerous risk assessments only consider mortality as the indicator for health impacts of disasters (Eckstein et al., 2018; Shi et al., 2016; Xu et al., 2016), as opposed to considering other indicators such as morbidity. Fourth, disaster risk assessments are beginning to not only account for hazards, but also consider current vulnerability and capacity (UNISDR, 2017b). Similarly, vulnerability and adaptive capacity are being considered in climate change risk assessment (Ebi & Villalobos Prats, 2015; IPCC, 2014a; Weis et al., 2016). Within this context, integrated risk and vulnerability assessments are beginning to emerge in climate change and health (Onyango, Sahin, Awiti, Chu, & Mackey, 2016). However, there are significant complexities in modelling current and future fluctuations in vulnerability and capacity (Onyango et al., 2016), and how climate-sensitive hazards themselves can increase
future vulnerability (Ebi & Bowen, 2016). Finally, there are significant challenges in conducting risk assessments incorporating both climate change and disaster risks as often risk assessments for managing different hazards occur in silos (UNISDR, 2017b) and different methodologies are often used, as is evident through disaster risk assessments and vulnerability and adaptation assessments for climate change.

The present research supports Phalkey and Louis (2016) who suggest that joint risk assessments are important for addressing disaster and climate change risks to health. The present study builds on this to suggest that links between DRRH and CCAH risk assessments could occur at varying levels of complexity to suit the capacity of the setting. For example, as a starting point for joint risk assessment in the Philippines, climate change projection data can be included in probabilistic risk assessments and used to assess the vulnerability of health facilities to current and future hazards.

**Health facilities resilience** was identified as an area for potential overlaps if links between DRRH and CCAH are not strengthened in this area. Collaboration and links between DRRH and CCAH actors on building health facilities resilience was unclear in the Case Study. Despite the CCAH policy framework recognising the need to link initiatives in climate-proofing and disaster resilience, these links were not recognised in later DRRH or CCAH policies. It was found that there is considerable collaboration between health facilities and DRRH actors in the DOH on the Hospital Safety Index. However, the involvement of the CCAH actors in this process is unclear.

When considering global literature linking DRRH and CCAH facilities resilience is the most developed compared to other areas for technical and operational linkages suggested in this research. There is significant ongoing effort to link DRRH and CCAH facilities resilience (Balbus et al., 2016; Paterson et al., 2014). These links range from the acknowledgement of growing disaster risks to health facilities as a result of climate change, as in the Safe Hospitals initiative (WHO, 2015a). They also include the consideration of climate change when assessing future risks, such as in the reconstruction of New York City Hospitals (Kinney et al., 2015; New York City, 2013, 2014; Rosenzweig & Solecki, 2014). Building on this, there is concerted effort to also incorporate climate change mitigation through the SMART Hospitals initiative (PAHO & WHO, 2017). Global informants referred to the Virgin Islands as a strong example of the implementation of the SMART hospital initiative. Finally, health facility resilience to extreme events and climate-sensitive hazards is
suggested as an indicator for CCAH progress in Canada (Expert Panel on Climate Change Adaptation and Resilience Results, 2018). This shows that links between DRRH and CCAH in health facilities resilience can occur at numerous levels.

The link between DRRH and CCAH in EWS and disease surveillance was unclear in the Case Study. At the time of the Case Study there was limited work on incorporating climate change into EWS for climate-sensitive diseases. It was demonstrated within the Case Study that collaboration and coordination on EWS and disease surveillance for DRRH and CCAH was important. Within this context global informants warned of the possible development of overlapping but separate EWS and disease surveillance systems if adequate linkages between these areas are not made, as was observed within the Philippine Case Study.

Integrated health EWS and surveillance are important for detecting shocks and stresses that may impact health service demands and capacity to meet those demands (Ebi & Schmier, 2005; Sellers & Ebi, 2018; WHO, 2015c). These integrated systems should include climate change data to ensure robustness of the system (Sellers & Ebi, 2018). Within the literature there are examples of efforts efforts to develop EWS for climate-sensitive diseases such as dengue and malaria (Coughlan de Perez et al., 2015; Degallier et al., 2010; R. Lowe et al., 2013; Thomson et al., 2006), and climate-sensitive hazards such as heatwaves (D. Lowe et al., 2011; WHO & World Meteorological Organisation, 2015). Climate resilience within EWS includes understanding and anticipating climate change risks to health, and using this information to inform preparedness, surveillance and response (WHO, 2015c). However, integrating climate change data may not always be feasible where baseline health data and disease surveillance systems need strengthening, as illustrated through some LGU experiences in the current Case Study.

The need for strengthening joint research was made clear by expert workshop participants and interviewees, particularly in strengthening the understanding of how disasters, climate change and health risks are interconnected. Similarly, a review of the health impact of extreme events and climate change on health in Asia, found that there is significant paucity of research examining these joint risks (Hashim & Hashim, 2016). In countries which experience significant barriers to the implementation of CCAH, such as the Philippines, research that occurs generally represents short-term vulnerabilities with limited funding for CCAH research (Sellers & Ebi, 2018). However, research on extreme events have been
identified as an opportunity for strengthening the understanding of how climate change impacts health (Filho et al., 2018). The NUHRA has included DRRH and CCAH research under the singular goal to improve health resilience (PCHRD-DOST, 2017b). Furthermore, the current national research priorities promote both joint DRR and CCA research on a national scale and in health (Department of Science and Technology, 2017). These two agendas represent an opportunity for increased funding for joint research.

The Case Study highlighted joint capacity building as a potential opportunity for linking DRRH and CCAH. This linkage could be classed as both a technical and operational linkage. Capacity building for health professionals through formal institutional programmes, as well as training provided by the DOH to DRRH and CCAH stakeholders from national, regional and local levels are important. For example, through developing an understanding of: increased health risks associated with climate change and disasters among health professionals; and what needs to be considered in terms of planning health systems, and joint DRRH and CCAH action. Joint capacity building has briefly been suggested in the literature for linking DRRH and CCAH (Aitsi-Selmi et al., 2017).

There are examples of existing joint capacity building initiatives. For example, building capacity for disaster preparedness and response in health is classified as CCA in the Pacific Islands (Rumsey et al., 2014). Similarly, Keim (2011) suggested that capacity building in disaster preparedness and response, sustainable development, and vulnerability reduction are considered to be both DRRH and CCAH. Increasing preparedness and response capacity for climate-related health impacts associated with extreme events and infectious disease has also been identified as important for capacity building in Australia (Blashki et al., 2011; Purcell & McGirr, 2014). Furthermore, developing capacity for managing risks among vulnerable groups is important (Blashki et al., 2011). The education of health service providers on the importance of climate change impacts on health has been found to be vital for influencing health policy (Purcell & McGirr, 2018). Joint capacity building in health can also occur on a community level. For example, community capacity development on the health impacts of climate change also includes education on increasing disaster risks (Purcell & McGirr, 2014, 2018), and vice versa (Ray-Bennett et al., 2016). For example, long-term community-based capacity building programmes to address mental health impacts of drought are likewise suggested to contribute to CCAH (Hart, Berry, & Tonna, 2011). These represent numerous types and levels of joint capacity building. It would thus be necessary to identify overlaps and
complimentary areas in DRRH and CCAH capacity building, and indicate priorities for joint capacity building.

9.3 Recommendations for future research and action

Recommendations for policy, practice and research emerging from this research are given over the short-, medium-, and long-term (Table 12). These recommendations are intended specifically for the Philippines. However, it is recognised that these recommendations may apply to the development of DRRH and CCAH in other settings and even globally.
Table 12. Recommendations from the research

<table>
<thead>
<tr>
<th>Short-term (1 year)</th>
<th>Medium-term (2-3 years)</th>
<th>Long-term (4-10 years)</th>
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<tr>
<td><strong>Policy</strong></td>
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<tr>
<td>• Develop national guidelines for linking DRRH and CCAH, including technical and operational synergies identified through this research.</td>
<td>• Establish a coordination mechanism within the DOH to link DRRH and CCAH through the areas identified in this research. It should be given sufficient authority, technical capacity and leadership support to ensure implementation.</td>
<td>• Develop joint guidelines for linked DRRH and CCAH and sustainable development.</td>
</tr>
<tr>
<td>• Identify key roles and responsibilities in DRRH and CCAH (including: key stakeholders in the DOH, health sector, and health-affecting sectors).</td>
<td>• Develop shared policy goals for DRRH and CCAH underneath the broader umbrella of sustainable development.</td>
<td>• Develop multi-sectoral plans for linked DRRH and CCAH under the umbrella of sustainable development to address cross cutting risks.</td>
</tr>
<tr>
<td><strong>Practice</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Prioritise the implementation of no-regrets linkages at the local-level, including the community as vital in managing risks.</td>
<td>• Strengthen implementation of CCAH, particularly through governance and leadership.</td>
<td>• Sustain implementation of CCAH with appropriate funding, resource, technical and leadership support.</td>
</tr>
<tr>
<td>• Consider no-regrets options for linking DRRH and CCAH as starting points for joint action. Where there is low commitment to CCAH, these</td>
<td>• Initiate the establishment of links between DRRH and CCAH in prioritising those with overlapping interests with health systems development and broader health development goals, such as those identified in the National Objectives for Health.</td>
<td>• Strengthen climate-specific links incorporating DRRH and CCAH knowledge.</td>
</tr>
<tr>
<td></td>
<td>• Sustained advocacy efforts for joint climate-specific CCAH and DRRH, prioritising mainstreaming DRRH and CCAH in</td>
<td>• Ensure the robustness of</td>
</tr>
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</table>
activities can be undertaken through health development initiatives and health system strengthening.
- Practitioners in DRRH and CCAH at all levels should consider how their work links and how they can engage their counterparts.
- Advocate for stronger national policy guidance on linking DRR and CCA.
- Include the use of probabilistic risk assessments in DRRH and health systems planning processes.

| Linked DRRH and CCAH efforts through iterative management and developing a more preventative approach to these risks, acknowledging that not all areas of work are overlapping or should be linked.
| Research initiatives to reduce the implementation burden at the local level.
| If resilience continues to be used within DRRH and CCAH discourse: consider resilience across scales including both the health system and community; and adopt a national system-wide approach with clear and operational sectoral indicators.
| Identify and report on existing health initiatives which contribute to CCAH as a starting point for local action, then gaps for implementing local level CCAH can be identified.
| Strengthen the knowledge and capacity of DRRH and CCAH practitioners, public health practitioners, and health-affecting sectors to address socio-ecological determinants of health.

| Research regional and local health baseline data to be used in developing health and climate change projections.
| Strengthen CCAH research.
| Develop a joint research plan.
| Strengthen publication and documentation of DRRH and CCAH.
| Develop a research network for Research exploring successful CCAH implementation, including efforts to strengthen CCAH governance identifying ways in which barriers to implementation can be overcome.
| Strengthen empirical evidence of technical and operational synergies identified in this research.
| Work closely with practitioners to identify additional links.
| Share good practice examples of linked DRRH and CCAH, with emphasis on the elements facilitating successful links.

| Investigate the utility of settings-based initiatives to facilitate this and address the socio-ecological determinants of health, such as the Healthy Cities Initiative, should also be examined.
| Research should focus on
| CCAH and DRRH to enable knowledge sharing. | • Conduct empirical real-world exploration of methods for overcoming barriers to coordination and collaboration. | factors facilitating linkages and efforts to overcome barriers to linkage. |
| Explore links between DRRH, CCAH and sustainable development. | • Examine the enabling factors and challenges for translating links in national DRR and CCA policies into sectoral policies. |  |
9.4 Significance and contribution of the research

To the best of my knowledge, this research thesis is the first comprehensive empirical investigation of how DRRH and CCAH can be linked in a real-world context. Before this study, literature on links in health was a scattered and largely theoretical discussion. This research lays the groundwork for future research and action building and sustaining links between DRRH and CCAH.

The findings from this study make several contributions to the current literature. First, it synthesises the scattered literature on linking DRRH and CCAH to present a strong and coherent rationale for linking. Second, it identifies areas of work for technical and operational synergies between DRRH and CCAH. Third, it highlights areas for joint no-regrets DRRH and CCAH action as a starting point for building links. Fourth, it identifies key challenges for bridging DRRH and CCAH work. Fifth, it highlights the challenges in using resilience as a conceptual framework for linking DRRH and CCAH. Importantly, the insights gained from this research may guide decision makers and public health practitioners in linking DRRH and CCAH. This is particularly important to address common and growing health risks from climate change and climate-sensitive disasters.

9.5 Conclusion

This Chapter discussed the findings of the present research in the context of current literature. The priorities and key gaps of both DRRH and CCAH in the Philippines were discussed. Three key challenges were discussed for linking DRRH and CCAH, including: (1) differing priorities and level of operation between DRRH and CCAH; (2) difference in implementation status; and (3) coordination and collaboration. Opportunities for linking DRRH and CCAH were identified and classified into two groups. First, joint no-regrets DRRH and CCAH options were discussed. No-regrets links referred to those with net benefits for improving health, and reducing both disaster and climate change risks. These were particularly recognised as linked DRR and CCA by stakeholders at the local level, including: (1) disaster preparedness and response; (2) improving baseline health status; and (3) addressing the socio-ecological determinants of health. Health systems strengthening based on the Six Building Blocks of health was recognised as a potential future strategy for no-regrets linkages. However, its present utility is limited. Second, climate-specific options for linking DRRH and CCAH were discussed. Climate-sensitive links represent specific activities which would require engagement of both DRR and CCA stakeholders; and explicit
inclusion of climate change risk data and CCA expertise, as well as disaster risk data and DRR expertise. Climate-sensitive options for linking identified through this research include: (1) national DRR and CCA policies; (2) DRRH and CCAH policies; (3) application of climate change inclusive risk assessments; (4) health facilities resilience; (5) EWS and disease surveillance; (6) joint research; and (7) joint capacity building. Recommendations based on the present research were provided for the development of linked DRRH and CCAH in the Philippines. Finally, the significance of the research was highlighted. The following Chapter provides a summary of the thesis.
CHAPTER 10: CONCLUSION

10.1 Introduction

This thesis empirically investigated how DRRH and CCAH can be linked through a country-level example. It includes a review of key literature on DRRH, CCAH and the linkage of these fields, this provided the background and rationale for the research, and facilitated the development of the research questions. Data was collected using a qualitative approach grounded in a Case Study of the Philippines. Data sources included: policy analysis of relevant DRR, DRRH, CCA and CCAH policies; key informant interviews at national, regional and local levels; observations; and a national expert workshop. The Case Study data is supplemented by interviews with global informants in DRRH and CCAH.

The overarching RQ aimed to investigate how DRRH and CCAH can be linked. In answer to the RQ, it was found that there are notable differences in the priorities, gaps and implementation of DRRH and CCAH in the Philippines. This presents challenges for developing joint DRRH and CCAH work. Furthermore, coordination and collaboration present challenges for linking these approaches due to limited clarity on roles and responsibilities and the lack of a coordination mechanism. To strengthen the links between DRRH and CCAH, resilience was suggested by stakeholders as a potential unifying goal. However, they expressed the need for greater clarity, a shared definition among stakeholders, and measurable indicators in order for the concept to successfully serve as a basis for linking DRRH and CCAH. Specific areas of technical and operational synergy were identified where links currently exist and potential links can be developed in the future. These were categorised into no-regrets and climate-sensitive options for linking DRRH and CCAH.

The previous Chapter discussed the key findings of the research in the context of global literature in DRRH and CCAH, and presented recommendations for future action and research. This Chapter summarises the research background, methodology, and findings presented in the Chapters of this thesis.

10.2 Summary of thesis

Climate-sensitive disasters and climate change pose significant risks to health and health systems. These risks will continue to grow as climate change progresses. The
management of these health risks are of increasing global importance. Successful management of these risks will require robust, effective and efficient approaches. DRR and CCA are two key strategies which work toward a shared aim of reducing these risks. It is commonly recognized that much is to be gained through strengthening coherence and links between these approaches. Thus, there are growing calls for DRR and CCA to be linked, including in health.

Linking DRRH and CCAH is particularly pertinent due to the common health risks posed by climate change and climate-sensitive disasters. Furthermore, health is an important cross cutting issue in DRR and CCA, and health engagement in these approaches has grown in recent years. Finally, linking DRRH and CCAH has the potential to strengthen the robustness and efficiency of actions addressing health risks from climate change and disasters. However, there is a distinct knowledge gap surrounding how DRRH and CCAH can be linked.

The extensive literature review revealed that published research on linking DRRH and CCAH is largely limited to theoretical discussion. Presently there is limited published research which empirically investigates how DRRH and CCAH can be linked, particularly in resource-constrained countries. Therefore, this research set out to investigate the RQ: How can DRRH and CCAH be linked? It did so through a Case Study of the Philippines supplemented by global informant interviews. The introduction of the study was provided in Chapter 1. It included the background, rationale for, and scope of, the research. It also summed up the methodology and structure of the thesis.

Part I of this thesis presented a literature review of DRRH and CCAH (Chapters 2 and 3), followed by a review of literature discussing links between DRRH and CCAH (Chapter 4). This extensive literature review established the research gap and provided the theoretical foundation for the research.

Chapter 2 reviewed the literature on DRRH to provide background and context to the research. It presented key concepts of, and relationships between, DRM, DRR, and Disaster Management. This included the phases of the DRM cycle: prevention, mitigation, preparedness, response, and recovery. It also provided insight into the evolution of DRR approaches. Following this, the Chapter provided more specific background to the study through a review of DRRH literature. It summarised the direct and indirect health impacts of disasters. It examined the evolution of the approaches that have emerged to address these
impacts. The Chapter highlighted the growing role of health in broader DRR, particularly emphasised by the Sendai Framework. Recognising the need to increase coherence with other global policies of relevance to health, the Chapter underlined the gap: how DRRH links with other global processes, such as CCAH.

Chapter 3 provided a review of CCAH literature. It begins with an introduction of central concepts to CCA, followed by a summary of the evolution of thematic approaches in CCA. Following this, the health impacts of climate change were presented in terms of direct and indirect pathways. Within this context, CCAH was described as the strategies and approaches that build resilience or reduce vulnerability to health risks exacerbated by climate change. Acknowledging that health was initially excluded from initial climate change science and adaptation efforts, the Chapter highlights the growing role of health in CCA evidenced through global policy and literature. Key research gaps in CCAH literature identified included the need for greater understanding around: climate change risks to health; effectiveness of CCAH action; and implementation of CCAH. The interaction of CCAH with other risk reduction strategies, such as DRR, was a particularly important gap surrounding the implementation of CCAH identified within the literature.

Chapter 4 aimed to examine relevant published literature surrounding links between DRRH and CCAH, and what the existing literature says about how DRRH and CCAH can be linked. Following a discussion of links between DRR and CCA in literature outside of health this Chapter argued that linking DRRH and CCAH was important to address commonalities in health impact pathways of climate change and climate-sensitive hazards which can evolve into emergencies or disasters. Furthermore, linking DRRH and CCAH is important because the role of health actors in both DRR and CCA is increasing and public health actors are well positioned to build these links. The Chapter also identified overlapping areas between DRRH and CCAH where these two approaches could possibly be linked. These included areas of conceptual, technical and operational synergy. Conceptual synergies build on concepts prevalent in both DRRH and CCAH as a foundation for joint action to reach shared goals of reducing long-term health risks. It was identified that the concepts of resilience, vulnerability and risk have the potential to link DRRH and CCAH. Technical and operational synergies are the potential opportunities for joint strategies to reduce duplication and build on existing tools, expertise and implementation of DRRH and CCAH. These synergies are important to strengthen the robustness and efficiency of approaches addressing climate change and disaster health risks. Technical and operational synergies for linking DRRH and CCAH
drawn from the literature included: national policies; joint risk assessments; consideration of health impact pathways; health systems strengthening; health infrastructure resilience; EWSs; and disaster preparedness and response.

Chapter 5 explained the methodological approach of the research. This research aimed to employ empirical methods to investigate how DRRH and CCAH can be linked. In doing so it adopted a qualitative approach grounded in a Case Study of the Philippines and supplemented by global informant interviews. This Chapter provided the rationale for focusing on the Philippines as the Case Study, as one of the most climate-sensitive disaster-prone countries in the world with existing national structures and policies for addressing these risks, and expressed policy aims for linking DRR and CCA. Key background to the Case Study was also given including the parallel structures and mandates to address DRR and CCA nationally and in health. This study employed two phases of data collection. Phase I included the Case Study data collection including: policy analysis of 17 national and health policies on DRR and CCA; key informant interviews of 33 national, 13 regional and 10 local stakeholders in DRR, DDRH, CCA, CCAH and sustainable development; observation; and a national expert workshop with 20 previous national interviewees. A preliminary analysis of findings was conducted to inform the expert workshop. The expert workshop was intended as a form of validation and feedback on the preliminary Case Study findings. Phase II involved interviews with seven global informant in DRRH and CCAH to provide broader context to the Philippine Case Study. These were conducted during a six-month internship with the Climate Change and Health Unit of the WHO. Following this the final analysis was conducted using a thematic analysis approach.

Chapter 6 explored the findings in relation to FQ1: What are the key priorities and gaps for DRRH in the Philippines? The chief priority identified for DRRH was strengthen community-level implementation. Three subthemes were identified: (i) strengthening community-level capacity building efforts for DRRH; (ii) the need to strengthen local governance and leadership support for DRRH; and (iii) human resources for DRRH. Two key gaps were identified in DRRH, including: (1) the role of the health sector in disaster prevention; and (2) inter- and intra-sectoral collaboration. The subthemes relating to the role of the health sector in disaster prevention included: (i) respected role in disaster preparedness and response; (ii) growing role of health in disaster prevention; and (iii) the need to strengthen mainstreaming of disaster prevention within the health sector. The subthemes identified related to inter- and intra-sectoral collaboration included: (i) openness to inter- and
intra-sectoral collaboration for DRRH; and (ii) the need to strengthen DRRH collaboration with inter- and intra-sectoral stakeholders.

The findings provided in Chapter 7 corresponded to FQ2: *What are the key priorities and gaps for CCAH in the Philippines?* The key priority for CCAH identified within the Case Study was to strengthen the national governance and organisational structure for implementation. Subthemes emerging under this priority were: (i) the need to strengthen CCAH implementation across all levels; (ii) the opportunity for strengthening CCAH structures due to existing policy mandate, however it is not being implemented; and (iii) the need to establish and sustain an appropriate governance mechanism. Research and evidence for climate change and health was one of two key gaps were identified in CCAH. It was found that there: (i) is limited research and evidence relating to climate change and health; and (ii) are three specific research needs to drive CCAH action – strengthen baseline health data for linking climate change impacts with health, evidence of health risks associated with climate change; and research on adaptation actions. Within the second key gap, national leadership for CCAH, two subthemes emerged: (i) difficulty sustaining leadership and political commitment for CCAH, and (ii) champions for driving CCAH.

The final results Chapter, Chapter 8, presents results relating to FQ3: *How are DRRH and CCAH linked in the Philippines, and what are the challenges for strengthening these links?* Resilience was examined as a potential conceptual synergy between DRRH and CCAH in the Philippines. The concept was suggested as a possible goal for drawing together key stakeholders by some national and global informants. However, limited clarity and differing definitions among stakeholders restricts the current utility of resilience as the conceptual foundation for a framework linking DRRH and CCAH. Existing technical and operational synergies in the Philippines were found in: national DRR and CCA policies; consideration of the health impact pathways, specifically through examination of the socio-ecological determinants of health; disaster preparedness and response; research for DRRH and CCAH; and improving health services to strengthen baseline health status. Areas of work for developing future links included: DRRH and CCAH policies; health systems strengthening through the building blocks of health; integrated EWS and disease surveillance; resilience of health infrastructure; and joint capacity building. Furthermore, collaboration and coordination were identified as key challenges for strengthening these links.
Chapter 9 provided a discussion of the main findings of the research in relation to relevant published research findings. Key findings summarised and discussed in this Chapter included: (1) priorities of DRRH and CCAH in the Philippines; (2) challenges for linking DRRH and CCAH; (3) limited utility of the concept of resilience for building practical links; (4) no-regrets and climate-specific options identified for linking DRRH and CCAH. No-regrets links referred to those with net benefits for improving health, and reducing both disaster and climate change risks. These were particularly recognised as linked DRRH and CCAH by stakeholders at the local level. Climate-sensitive links represent specific activities which would require direct engagement of both DRRH and CCAH stakeholders; and explicit inclusion of climate change risk data and CCAH expertise, as well as disaster risk data and DRRH expertise. Key recommendations emerging from the research include: (1) consideration of no-regrets options as a starting point for linking DRRH and CCAH; (2) develop guidelines and a formal mechanism for linking; (3) prioritise local-level linkages through joint no-regrets options; and (4) strengthen the empirical evidence base of how DRRH and CCAH can be linked.

Finally, the significance of the research as an important foundation to guide future action and research on establishing and strengthening links between DRRH and CCAH was highlighted, examining the contribution this makes to furthering DRRH and CCAH in the Philippines. To the best of my knowledge, this research is the first to empirically examine links between DRRH and CCAH and challenges for strengthening these links alongside country-level examples. As such it is highly valuable for guiding future research and policy on linking DRRH and CCAH at the national level. The following sections conclude the research by discussing the strengths and limitations, and providing concluding remarks.

10.3 Strengths and limitations of the research

A key strength of this research is the empirical investigation of how DRRH and CCAH can be linked through a country-level example. The extensive literature review demonstrated that previously published literature on this topic was largely restricted to theoretical discussion. This research is the first to identify practical areas for implementing linkages and key challenges in building these links in a real-world setting which faces significant vulnerabilities and exposure to climate-sensitive hazards.

By building on existing literature, this research identifies no-regrets options for strengthening links between DRRH and CCAH, and thus reducing common health risks.
These options represent opportunities for linking DRRH and CCAH regardless of common challenges for CCAH, such as: limited technical expertise, resources, uncertainty of climate change data, and limited baseline health surveillance data. As such, these options represent an opportunity to reduce disaster and climate change risks within settings with limited CCAH implementation. Furthermore, these no-regrets options present an opportunity for improving population health.

To strengthen the in-depth examination of the research problem, prolonged data collection was undertaken through organisations in both DRRH and CCAH. Commonly data collection associated with doctoral research is restricted to three to six months. Undertaking data collection over 12 months assisted a more thorough understanding of the two approaches and how they can and do work together. Spending time with organisations working in both approaches enabled more balanced and valuable insights into both fields, albeit at different levels. Furthermore, this allowed the research to be guided by national and global practitioners and experts.

The generalisability of the results of this research are restricted by the qualitative nature of enquiry and singular case study design. As such, the researcher recognizes that the findings presented here are bound to time and place, thus tightly interwoven with the political, social, cultural contexts of inquiry, including that of the researcher, the Case Study setting, and the participants within the Case Study. However, the global informant interviews served to provide some broader context and applicability to the results. Furthermore, this research is aimed to serve as a foundation for further research in this area. Thus, the primary goal is to offer a conceptual foundation for future work, as opposed to generating a ‘one-size-fits-all’ framework for linking DRRH and CCAH.

The delineation of scope of the thesis presents some limits to the findings, and potential future direction for further research. First, this study did not examine linkages with sustainable development, rather placed DRRH and CCAH activities under the broader umbrella of sustainable development. It is important to acknowledge that not all DRRH and CCAH actions are considered to be sustainable development. However, the recommendation of prioritising no-regrets options in implementing links is believed to provide a solid foundation for joint research examining links with sustainable development. Second, only resilience was investigated for potential conceptual linkages between DRRH and CCAH. The literature review also highlighted risk and vulnerability as potential concepts for promoting
synergy. The utility of these concepts in promoting actionable links is a valuable area of inquiry which should be considered in future research. Third, the thesis did not explicitly examine additional action required to address unique risks faced by vulnerable populations. Due to social and health inequities and inequalities, concerted effort is required to protect the health of groups facing unique risks such as remote populations, indigenous populations, women and children, and those living in areas of conflict. Thus, this is an important area for future research specifically examining how best to address the unique vulnerabilities and risks faced by these groups.

Finally, it is acknowledged that the Case Study presents potential limitations. First, the Case Study occurred at a time of significant political change in the Philippines with the establishment of the Duterte Administration. As a result, participants often expressed their uncertainty with the change of administration and political priorities, particularly in relation to climate change. Within this context, a further challenge encountered during fieldwork related to the availability of interviewees and willingness to schedule interviews, particularly those working in climate change within and outside health. Finally, the data collection was primarily facilitated by the DOH. Thus, the researcher is aware of the potential bias this could introduce to the research in the selection of interviewees and selection of the sub-cases. To reduce bias in selecting interviewees, the researcher also used their personal networks and a snowball approach to sample interviewees to ensure the Case Study included the views outside of those recommended by the DOH.

10.4 Conclusion

This Case Study confirmed that linking DRRH and CCAH is important to effectively and efficiently address common health risks of climate change and climate-sensitive disasters. This research was the first to explore how DRRH and CCAH can be linked through empirical research. It did so by examining potential DRRH and CCAH links and challenges through a Case Study of the Philippines. The Philippines was an important Case Study due to the nation’s experience in addressing significant and concurrent disaster and climate change risks. This study has shown that, in the context of the Philippines, resilience currently has limited utility as a concept for strengthening links between DRRH and CCAH. However, it potentially provides a common goal for stakeholders pending a clearer shared definition with measurable indicators. This study has identified several key technical and operational synergies categorised as no-regrets and climate-sensitive options. No-regrets links referred to
those with net benefits for improving health, and reducing both disaster and climate change risks. These were particularly recognised as linked DRRH and CCAH by stakeholders at the local level. Climate-sensitive links represent specific activities requiring direct engagement of both DRRH and CCAH stakeholders; and explicit inclusion of climate change risk data and CCAH expertise, as well as disaster risk data and DRRH expertise. The research identifies no-regrets options for linkages as the first step for linking DRRH and CCAH including: (1) strengthening baseline health status; (2) addressing socio-ecological determinants of health; and (3) strengthening disaster preparedness and response. This research provides an important foundation for informing necessary policy and action to link DRRH and CCAH to better address the global challenge of growing health risks from climate change and climate-sensitive disasters.
Appendix 1: Publication 1


**Abstract:** Climate change and climate-sensitive disasters significantly impact health. Linking Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) is essential for addressing these ever-present, complex and increasing risks. Recent calls have been made to build these links in health. However, there is a need to clearly articulate why linking DRR and CCA is important in health. Furthermore, little is known about how DRR and CCA should be linked in health. By extensively examining relevant literature, this review presents the current state of knowledge of linking DRR and CCA in health. This includes the potential for maximising conceptual synergies such as building resilience, and reducing vulnerability and risk. Additionally, technical and operational synergies are identified to link DRR and CCA in health, including: policy, Early Warning Systems, vulnerability and risk assessment, health systems strengthening, infrastructure resilience, disaster preparedness and response, and health impact pathways. Public health actors have a central role in building these links due to their expertise, work functions, and experience in addressing complex health risks. The review concludes with recommendations for future research, including how to better link DRR and CCA in health; and the opportunities, challenges and enablers to build and sustain these links.

**Keywords:** disaster; health; climate change; disaster risk reduction; climate change adaptation; integration; synergy; linking

1. Introduction

Climate change and climate-sensitive disasters, such as those resulting from hydrological, meteorological, biological and climatological hazards have significant and increasing impacts on human health [1–3]. Climate change and climate-sensitive disasters impact health through common direct and indirect pathways potentially resulting in increased risk of death, disease and injury, as discussed in Banwell et al. [4] in this special issue. An increase in well-planned, effective and appropriate adaptation and risk reduction is necessary over the short-, medium- and long-terms to address climate change and climate-sensitive disaster risks [1,5–7]. Increasing health action in two broad management paradigms, Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA), under the umbrella of sustainable development, has a significant role to play in this process. This is reflected in key international DRR and CCA policies, and comes as a result of the ever-growing role of health in these contexts [8–11]. This comes partly as a result of the knowledge that health co-benefits of mitigation and adaptation provide a 'health lens' and create a relatable and meaningful frame of
reference for engagement on climate change issues [8,9,12]. Additionally, the growing understanding that appropriate action can greatly reduce the health burden resulting from climate change and disasters [13–16] has seen the recognition of the role of health in DRR and CCA increase. Here, health is used to broadly refer to the government and non-government actors on international, national, sub-national and local levels with a role in public and primary health care, as has been used in previous literature (e.g., [13,14,17–19]).

A large body of research has suggested that building links between DRR and CCA in the context of sustainable development is essential and important to ensure a robust approach to dealing with climate-sensitive disasters and their associated risks [2,8,20–23]. Linking DRR and CCA strategies makes operational sense as it will enable countries to enhance coherency and synergies between DRR and CCA approaches, as well as maximize efficiency in terms of the human, technical and financial resources used to reach common goals, thus reducing the use of resources in duplicated institutional structures and implementation [2,8,21,23–27]. Additionally, linking these two approaches makes technical sense, enabling the sharing of expertise, knowledge, lessons and tools between the two fields, thus increasing the efficiency and effectiveness of risk reduction and adaptation particularly through the consideration of long-term risk and adoption of long-term adaptation options [2,8,21,23–26].

For example, linking DRR with CCA and climate change science has been recognized as necessary for improving DRR strategies, understanding risk, dealing with uncertainties, addressing increasing vulnerability as a result of climate change, and reducing the potential for maladaptation [2,25,26,28–37].

An opportunity for improving the links between DRR and CCA in the context of sustainable development was identified with the overhaul of several key international policies in 2015 [24,38,39]. The Sendai Framework, Paris Agreement, 2030 Agenda for Sustainable Development and Sustainable Development Goals, and the New Urban Agenda were created in a time of increasing coherence between international policies [10,16,24,40,41]. They emphasize the need to work towards linking DRR and CCA in practice [10,16,24,40,41]. Since this time, there have been efforts through international platforms such as the Global Platform for Disaster Risk Reduction [42] and the United Nations Framework Convention on Climate Change (UNFCCC) technical expert meetings on adaptation [26], both in May 2017, to build an understanding about building these links in national policies and various sectors. However, health was not discussed, illustrating that there is limited recognition of the importance of building links in health.

Health is an important end point for both climate change and disasters, and the recognition of the role of health is growing in both DRR and CCA internationally [10,13,14,16,40,41,43,44]. Health has been highlighted as a cross-cutting issue in DRR, CCA and sustainable development [17]. There have been some appeals for greater links between DRR and CCA strategies in health, particularly since 2015 [17,18,40,45,46]. To support these requests there is a need to clearly articulate why linking DRR and CCA is important in health. Furthermore, there are significant knowledge gaps around how to develop these links. There is a need to draw this literature together and summarise what is currently known to strengthen the advocacy for building links in health and identify areas for future work. Therefore, this article reviews relevant literature to provide a synopsis of what is currently known about linking DRR and CCA in health. It aims to provide a strong and coherent rationale for building links in health, discuss what the current literature conveys about how these links can occur, as well as highlight current knowledge gaps. In doing so it intends to serve as the foundation for driving future work on how these links can be formed and advanced.

Here the term ‘linking’ is used to describe the bridges and connections between DRR and CCA in policy and implementation that have been commonly referred to with terms such as ‘coherence’ [14,26], ‘synergy’ [26,36], ‘integration’ [2,26,31], ‘collaboration’ [32,47], and ‘coordination’ [47]. The term linking is used in order to:

- Avoid challenges and contentions in the differing opinions on how these links take shape, such as those surrounding the suggested absorption of one strategy by the other through integration [20,22,33,36,38,48–50];
• Recognize that the links between DRR and CCA may occur differently between and within specific contexts such as partial integration on an international level [26], or mainstreaming on a national level [51];
• Acknowledge that not all areas of work in DRR and CCA overlap, or should be linked;
• Provide an opportunity to explore more than the integration of policy or institutions, such as the exploration of technical, operational and conceptual links in implementation.

To provide a background to why linking is important, and the state of the knowledge in this area, we first discuss how these two fields have evolved to address climate change and climate-sensitive disaster risks in health. Next, the state of the art of current literature in linking DRR and CCA in health is presented under the four themes that have emerged from the review. Finally, the article discusses gaps in the literature and considerations for future research.

2. Disaster Risk Reduction and Health

Within the context of this review, Disaster Risk Reduction (DRR) is defined as policies and actions developed and implemented with the aim of reducing and preventing disaster risk [52]. Health practitioners have played a pivotal role in responding to health needs in emergencies and disasters, such as disease outbreaks and epidemics including smallpox or HIV/AIDs, natural disasters and human conflict, long before the establishment of health preparedness, response, risk reduction or risk management approaches [53]. Originating from disaster epidemiology, disaster medicine, and emergency preparedness and response in health [54], DRR in health has undergone considerable transformation in the last two decades. This has been spurred on by several events of global concern that have posed significant threats to health, including the September 11 terrorist attacks, and the Ebola outbreak of 2015 [55–59]. One key development of this field in the last two decades is the ongoing shift from a response and preparedness focus, such as through Public Health Emergency Preparedness and Response approaches, to an upstream approach of prevention and recovery [14,15,60–63]. A second key development is the increasing recognition of the role and importance of health in international DRR policy in the last decade [13,18].

The first international policy framework in DRR, the Hyogo Framework for Action 2005–2015 (HFA), made little reference to health [16,19,40]. However, the Sendai Framework for Disaster Risk Reduction 2015–2030, which superseded the HFA, recognised health as a key contributor to, and beneficiary of, DRR [13,18]. It did so through numerous direct references to health, the expansion of the definition of disasters to include those caused by health-specific hazards (e.g., biological hazards and epidemics), direct reference to the International Health Regulations, and the recognition of health as a cross-cutting issue captured within five of the seven global DRR targets [13,14,16,18,27,40,64,65].

Amidst the increased role and recognition of health in DRR there is a growing body of literature calling for DRR in health to work more closely with actors across other public health and global health initiatives [64,66–68]. For example, decreasing the visible separation of actors advocating for the International Health Regulations and Sustainable Development Goals, and the separation of DRR and DRM in health actors from the broader humanitarian system [64]. Public health professionals have a stake in addressing both the health outcomes of a disaster and broader health determinants that may also impact health (e.g., loss of livelihood, environmental damage, and disruption to socio economic services) [16]. Thus, they have a role in broader sustainable development processes. Increasing coherence between these processes is essential to enhance the role of health and collaboration across global health initiatives to address health risks in an all-hazards context, including climate-sensitive disasters and climate change.

3. Climate Change Adaptation and Health

Climate Change Adaptation (CCA) refers to “the process of adjustment to actual or expected climate and its effects” and includes moderating or avoiding harm, as well as making the best use
of beneficial opportunities [3] (p. 5). Health and other important health-affecting sectors were not featured in the objectives of the Intergovernmental Panel on Climate Change (IPCC) and United Nations Framework Convention on Climate Change (UNFCCC) when they were first established [69]. However, CCA and health has gained momentum since the mid-2000s [1,69,70]. The growth of research and action in climate change and health has been illustrated and spurred on by the IPCC Assessment Reports, which have featured a chapter on health since the Second Assessment Report in 1995 [69]. International policy processes have also been crucial in promoting the importance of both health and adaptation in climate change action, such as National Adaptation Plans (NAPs) and the Lancet Countdown on Climate Change and Health [1,71,72].

The health chapters of the IPCC Assessment Reports Two through Five have shown an increase in understanding in the direct and indirect impacts of climate change on human health [69]. This is particularly illustrated in the case of climate-sensitive diseases and climate-sensitive hazards and extremes. It is noted that there have been challenges with confidently projecting the health impacts of climate-sensitive hazards and extreme events due to the complexity of the pathways leading to health impacts [69]. However, the IPCC 5th Assessment Report, as well as the Special Report Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) have illustrated that climate-sensitive hazards are likely to increase with the potential for greater health impacts [2,3]. The IPCC SREX was a key publication building clear relationship between disasters and climate change, and calling for linkages between DRR and CCA.

Implementation of CCA in health has largely been driven by the development of NAPs in developing countries. NAPs assist countries to build a greater understanding of climate change risks, vulnerability and adaptation options [71,72]. They also help countries to prioritise and implement adaptation strategies [71,72]. The health component of the NAP (H-NAP) aims to address determinants of health and upstream risk drivers through a health system strengthening approach [71,72]. The H-NAP includes an adaptation plan for health based on a vulnerability and adaptation assessment and outlines specific adaptation goals and mechanisms to achieve these [73]. The NAP process has been, and will continue to be, critical in the effort to increase concrete implementation of CCA in health [73,74]. The development of adaptation plans for health (including H-NAPs), and the integration of these plans into the broader NAP processes is an important indicator used by the Lancet Countdown for Climate Change and Health to track the progress of adapting to indirect impacts of climate change [1].

Tracking the progress made towards CCA for health began with clear and public advocacy by the Lancet Commission on Climate Change and Health in 2015 on the need for health to play a bigger role in climate action [9]. The Commission recognized climate change as an opportunity for furthering health action [9]. However, more engagement from the health sector is needed [9]. To support the increasing role of health, the Commission committed to establishing the Lancet Countdown on Climate Change and Health, an annual report tracking implementation of the health aspects of the Paris Agreement [9]. The first report proposes indicators for monitoring adaptation progress in health [1]. Among these are health impacts and exposure to climate-sensitive hazards including heatwaves, floods and droughts [1]. Recently there has been significant progress towards health action for climate change and in the development of understanding and evidence of climate change impacts on health [1]. However, there is significantly less climate change literature relating to health compared to other sectors such as agriculture or tourism [70,75].

Research in CCA in health is still dominated largely by the quantification of risks, identifying vulnerabilities within populations, and projecting changes to health risks. However, there remains a need for this data and information to be accessible, understood and used by policy and decision-makers [74]. There is little research measuring the effectiveness, appropriateness, and comprehensiveness of adaptation action for health [69,76,77], particularly with regards to implementation and capacity development [69,75,77]. Furthermore, there is a need for research on the interaction between CCA in health and other global processes, such as DRR [69]. The following
sections discuss why linking DRR and CCA is particularly important in health, and how these links can be made.

4. Key Themes from the Literature on Linking DRR and CCA in Health

This review takes a narrative approach in the presentation of the findings. Literature was primarily sourced from Scopus, Web of Science, PubMed, and Google Scholar using ‘disaster risk reduction’, ‘climate change adaptation’ and ‘health’ as search terms. Literature considered relevant to this review needed to explicitly refer to building integration, links, synergies or coherence between DRR, CCA and health in the body of the text (Table 1). The review also draws on integration literature not specific to health where relevant.

Table 1. Key messages of articles on linking DRR and CCA in health.

<table>
<thead>
<tr>
<th>Article</th>
<th>Type</th>
<th>Aim</th>
<th>Key Messages on Linking DRR and CCA in Health</th>
</tr>
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<tbody>
<tr>
<td>Aiti-Selmi et al. (2016) [15]</td>
<td>Review</td>
<td>Review (not health focused) of science and technology in DRR in relation to the Sendai Framework.</td>
<td>Increasing linkage in policy relating to DRR, development, health and climate change occurred through the 2011 and 2013 Global Platforms for DRR. Recognises an opportunity for collaboration on science and technology in risk assessment and early warning which will influence DRR, climate change, agriculture, healthcare, etc.</td>
</tr>
<tr>
<td>Aiti-Selmi, Murray and Wannous (2017) [17]</td>
<td>Book chapter</td>
<td>Review of health impacts; and synergy of both health and climate change, and health and disasters.</td>
<td>Post-2015 policies are an opportunity for building policy coherence. Health is a point of convergence for DRR, CCA and sustainable development. Social determinants of health important in acting on synergies (e.g., strengthening nutrition services; addressing obesity through women’s education; and place-based initiatives such as Healthy Cities).</td>
</tr>
<tr>
<td>Bowen and Friel (2012) [19]</td>
<td>Review</td>
<td>Overview of adaptation and how it relates to improving health and reducing health inequities.</td>
<td>Discusses the need for synergy between CCA and sustainable development in addressing social determinants of health and then goes on to mention disaster management as an important partner. CCA is an opportunity to improve synergies across disciplines that contribute to health. Strategies that address the social determinants of health contribute to sustainable development.</td>
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Table 1. Cont.

<table>
<thead>
<tr>
<th>Article</th>
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<th>Key Messages on Linking DRR and CCA in Health</th>
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<tbody>
<tr>
<td>Filho et al. (2018) [61]</td>
<td>Review</td>
<td>Provides examples from eight countries to examine the health impacts of climate risks and extreme events.</td>
<td>Climate policies that adequately address extremes. Suggests joint resource mobilisation for addressing climate risks and extreme events.</td>
</tr>
<tr>
<td>Keim (2009) [63]</td>
<td>Discussion</td>
<td>Theoretical discussion of the role of preparedness and response in reducing vulnerability to climate change.</td>
<td>Suggests public health preparedness and response as an adaptation to climate change. Vulnerability reduction reduces susceptibility and increases resilience to disasters and climate change.</td>
</tr>
<tr>
<td>Keim (2011) [15]</td>
<td>Discussion</td>
<td>Theoretical discussion of DRR in health as sustainable CCA.</td>
<td>Proposes a comprehensive approach to reducing vulnerability to disasters as adaptation to climate change. Calls for the mainstreaming of CCA, DRR and public health in activities of health affecting sectors and sustainable development.</td>
</tr>
<tr>
<td>Phalkey and Louis (2016) [63]</td>
<td>Review</td>
<td>Reviews disaster and climate change impacts on health and calls for simultaneous action.</td>
<td>Calls for systematic preparedness and adaptation strategies that address both disaster and climate change risks simultaneously. Health systems strengthening as a ‘no-regrets’ strategy.</td>
</tr>
<tr>
<td>Sauerborn and Ebi (2012) [82]</td>
<td>Review</td>
<td>Reviews findings of the SREX in an attempt to attribute disaster-related health impacts to climate change.</td>
<td>Links climate change and disaster-related health impacts. Calls for greater collaboration between climate scientists, health researchers, policy makers and disaster community, particularly on post-disaster surveillance and data collection for attributing disaster-related health impacts to climate change. Provides a conceptual framework on the link between climate and health-related disasters based on an expanded version of the SREX.</td>
</tr>
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DRR: policies and actions developed and implemented with the aim of reducing and preventing disaster risk [52]; CCA: “the process of adjustment to actual or expected climate and its effects” [13] (p. 5); SREX: Special Report Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation [1].

The knowledge around why and how to build links between DRR and CCA is growing conceptually, and at international and national policy levels. However, the development of links between DRR and CCA is still in its infancy [26]. Further exploration into how these links are developed in different contexts at various scales is needed, particularly in health. While there has been some discussion on theoretical ways in which DRR and CCA can be linked in health, this knowledge base is scattered and thin. To build a coherent foundation for driving links in health this review summarises the current state of knowledge.

Of the identified literature, five articles refer directly to how DRR and CCA could possibly link in health [15,45,61,80,82]. Three of four articles present possible ideas for building linkages, including: public health preparedness and response as adaptation to climate change; examination of health impact pathways; the concept of vulnerability reduction; and strengthening health systems as no-regrets adaptation [15,61,80]. The other advocates for greater collaboration around data collection to attribute climate change to disaster-related health impacts [82]. None of these draw on primary empirical data to examine these suggestions in practice. Nor is there any subsequent work building on these suggestions, thus the ideas presented in these articles remain theoretical.

Since 2015, there have been an increase in explicit calls for building the coherence between DRR and CCA in the context of health [17,18,45,46]. However, the majority of articles are discussion pieces. Only two articles and the book chapter draw on case studies from secondary literature as examples to illustrate points for linkage [17,45,81]. This review revealed no articles which draw on
 empirical methods to explore why linkage is important in health, or how the links could occur. The key messages drawn from the articles above are discussed in the following sections.

4.1. Need for Linking DRR and CCA in Health Will Continue to Grow

The push for greater health involvement in DRR and CCA is highlighted in both areas of global policy and research literature [10,14,16,40,41,44]. The need for linking DRR and CCA in health will increase as the role of health in DRR and CCA continues to grow. As the Sendai Framework has broadened the definition of hazards to include epidemics and pandemics as part of an all-hazard approach to DRR [5,13,14,16,40,44], climate-sensitive diseases emerge as a potential area for overlap between DRR and CCA in health. Furthermore, some categories of climate change impacts, such as heatwaves, are not often classified as hazards associated with disasters within climate change discourse [83–87]. As DRR has expanded the definition of disasters to now incorporate slow-onset stressors such as drought there will be increasing overlap in the implementation of DRR and CCA [88]. These potential areas for additional overlap between DRR and CCA in health have not previously been considered in the literature [88]. These overlaps have the potential to increase as DRR continues to move toward an approach which aims to address underlying risks, just as CCA seeks to address underlying vulnerabilities.

4.2. Maximising Conceptual Synergies

Broader DRR and CCA literature indicates that there are overlaps in DRR and CCA strategies [26,29,32,24,47,89,90]. Overlaps also exist in DRR and CCA approaches in health, particularly due to the similar health impact pathways of climate change and climate-sensitive disasters [4]. Anchoring DRR and CCA on conceptual synergies will be important in reaching shared goals of reducing long-term risks [24,26]. Furthermore, maximising conceptual synergies will significantly reduce duplication, and improve the effectiveness and efficiency of implemented strategies [2,8,21,23–26]. Conceptual synergies are the concepts prevalent in both DRR and CCA in health which can provide conceptual foundations for joint action. Potential conceptual synergies in health include resilience, vulnerability and risk [2,15,17,26,61,80].

Resilience inevitably forms part of DRR and CCA discourse in the context of development and humanitarian aid [37,91,92]. Both approaches work towards resilience as a common aim, therefore meaningful and systematic engagement with resilience is necessary [21,24–26,29,35,37,93]. This has also been recognized in the literature on linking DRR and CCA in health [61]. However, resilience is known to have many definitions [94–98] and the utility of resilience as a bridging concept has been contested [99].

Similarly, meaningful engagement with the concepts of risk and vulnerability occur in both DRR and CCA, and these conceptual overlaps offer more motivation to bridge DRR and CCA to address these common aims [38,47,100,101]. Reducing vulnerability is important in addressing the health impacts of both disasters and climate change [15]. Risk and vulnerability reduction are cross-cutting issues in both DRR and CCA in health [15,17,61,80]. The concepts of vulnerability and risk link DRR, CCA and public health practice in multiple ways. First, health emergency preparedness and response has been discussed as reducing climate change vulnerability and disaster risk [15,61,80]. Second, health status has been highlighted as a contributor to disaster and climate change vulnerability and risk [5,9,100,102]. Finally, the determinants of vulnerability to disasters and climate change are similar to the determinants of the health approach commonly used in public health [103]. Incorporation of the social determinants of health has been suggested as a potential opportunity to strengthen both DRR [103] and CCA, particularly if used in conjunction with an iterative approach to decision-making [104,105]. Therefore, conceptual synergies in addressing underlying risks and vulnerabilities are motivators for linkage. Further to this, anchoring DRR and CCA in health on the social determinants of ill-health and vulnerability has been suggested as a potential strategy for building synergy in addressing climate change risk over the long-term [5–7]. This is
particularly important for addressing indirect health impacts, such as those resulting from food and water insecurity [106,107].

As DRR and CCA continue to become more concerned with building resilience, and reducing underlying risks and vulnerabilities, DRR and CCA will have greater conceptual overlaps [2,35,88]. Resilience, risk and vulnerability concepts present potential opportunities for building conceptual synergies between DRR and CCA in health. However, the utility of these concepts to link DRR and CCA in health is still unknown. Further exploration is needed to understand how these concepts serve as potential joint pathways for linking DRR and CCA and thus reducing health impacts.

4.3. Maximizing Technical and Operational Synergies

Linking DRR and CCA is important to build on existing methods and resources in DRR and CCA in order to maximize technical and operational synergies. Technical and operational synergies are those areas of work which offer potential for joint strategies to reduce duplication and strengthen tools, expertise and implementation of DRR and CCA. This shared learning will strengthen the rigor, robustness, effectiveness and efficiency in addressing climate change and disaster risks long-term [16,60,63,80,108,109]. For example, informing disaster risk with the latest climate knowledge and adaptation expertise has been suggested in broader DRR and CCA strategies and is also applicable in health [5,86,110,111]. This is particularly pertinent as DRR needs to shift to a long-term risk prevention approach to address the short- and long-term risks associated with climate change [5,6,16,60,63,80,108]. Similarly, linking DRR and CCA within the health sector can maximize operational synergies by reducing the burden of implementing DRR and CCA separately, including duplicated human and financial resources, particularly in resource constrained contexts [9,14,25,26,36,40,82,110]. Technical and operational synergies are presented together here as often the implementation of DRR and CCA (the operational aspect) cannot be separated from the tools and expertise behind DRR and CCA action (the technical aspect). Some opportunities identified in the literature for technical and operational synergies include: synergies in policy; joint risk and vulnerability assessments; health system strengthening and resilience of health systems; Early Warning Systems (EWS) and risk communication; as well as disaster preparedness and response.

Coherence between national policies are essential for working towards shared goals limiting conflicting or maladaptive strategies. National policy processes, such as the Joint NAPs of several countries in the Pacific, are important for identifying disaster and climate change vulnerabilities, and DRR and CCA options and priorities [26,90]. Numerous examples for successful integration have been identified, including in the South-West Pacific, particularly the Solomon Islands and Vanuatu [51]. These links between DRR and CCA have since been reflected at the regional level through the replacement of the Pacific DRR and Disaster Management Framework for Action 2005–2015 and Pacific Islands Framework for Action on Climate Change 2006–2015 [51] with the Framework for Resilient Development in the Pacific An Integrated Approach to Address Climate Change and Disaster Risk Management 2017–2030, and the development of the Pacific Platform for Disaster Risk Management and Climate Change [112]. These policies themselves represent technical synergies. They also have the potential to facilitate further technical and operational synergies in the implementation of DRR and CCA. National DRR and CCA in health policies are an important foundation for building technical and operational links. The H-NAP process or similar disaster policy and planning processes in health may also offer opportunities for building technical and operational synergies. It is important for climate policies in health to pay adequate attention to the health risks of extreme weather [81]. However, there is no research on links between DRR and CCA through similar policy processes in health. An important step in the H-NAP process is the Vulnerability and Adaptation Assessment.

Risk and vulnerability assessments are important in assessing disaster and climate change risks to the health system and health of populations [16,45,86]. Failing to consider increasing intensity and frequency of disasters as a result of climate change has the potential to lead to maladaptation [36,113–115]. The consideration of long-term climate change risk and vulnerability
is essential in understanding long-term risks to health. However, joint risk assessments are noted as being rare [45]. Uncertainty and a lack of comprehensive climate change data, as well as little research of climate change on health systems, present significant challenges to joint assessments [45]. As such, a greater understanding is needed on how to conduct joint risk assessments in the context of uncertainty of climate change data, and health and health system impacts. The consideration of health impact pathways is a potential starting point for building technical and operational synergy to address commonalities in health risks of climate change and climate-sensitive disasters [80].

The consideration of health impact pathways has been highlighted as an important and useful way to examine underlying vulnerabilities to climate-sensitive disasters and climate change [90]. Focusing on the pathway between a climate-related event or hazard, and the health outcome, and performing integrated risk assessments, enables health professionals to identify key causes of climate change and disaster risks in health simultaneously and identify opportunities for intervention, including necessary broader approaches at systems level [45]. This presents a potential method for identifying common disaster and climate change vulnerabilities related to health, as well as technical and operation synergies in risk reduction and adaptation strategies. Few [80] states that interventions to reduce health risks of climatic hazards occur at multiple points along the health impact pathway, with the understanding that a holistic and long-term approach is needed in reducing risks. For example, Few [80] suggests that climate change mitigation action even be incorporated in the reconstruction of health facilities post-disaster, as well as the consideration in long-term changes in hazard characteristics resulting from climate change. Therefore, when considering an impacts pathways approach, there is an opportunity for health professionals to consider the full spectrum of upstream to downstream risk reduction and adaptation actions. Thus, this potentially creates greater opportunities for identifying strategies for long-term proactive risk reduction and adaptation [29,37,95,116,117] and maximizing the technical and operational synergies between them. However, this sort of process remains theoretical and its utility has not yet been examined through primary research.

Health systems strengthening has been suggested as an important no-regrets strategy for linking DRR and CCA in health [45]. Health systems strengthening has become an important approach in DRR, particularly since the Ebola outbreak, which forced health practitioners and researchers to examine how resilient health systems are in the face of growing global challenges [64,111,118–121]. Similarly, the health systems approach has been picked up in CCA and health literature and technical guidance, such as the aforementioned H-NAPs [71], as well as the World Health Organization’s Operational framework for building climate resilient health systems [6]. If health systems strengthening is going to be developed as a sustainable long-term solution to disaster and climate change risks in health, joint action will be needed in identifying risks and priorities for the health system. This may include the use of key climate change and health data in health planning to prevent slow-onset health disasters from emerging due to changing pressures on health systems. For example, having an understanding of climate change-related migration can improve the ability of health facilities to accommodate population surges in areas as a result of climate related-disasters and thus improve the resilience of the health system [110]. However, there is little health systems strengthening research that maximizes technical and operational synergies by drawing on both DRR and CCA literature and approaches outside of strengthening health infrastructure.

Building the resilience of health infrastructure to disasters is relatively well established within DRR. There is technical guidance on the prevention and preparedness of health facilities dating back to the 2000s [122–124], and a baseline of technical knowledge and experience has been developed through an iterative process to increase the comprehensiveness of strategies [125–127]. Some approaches to building resilience of health facilities also incorporate CCA and mitigation [128]. For example, the consideration of current and future risks exacerbated by climate change in the reconstruction of New York city hospitals and health care system following hurricane Sandy [129–132]. However, the extent of use of these approaches is currently unknown. Commonly the climate change literature refers to ‘climate-proofing’ health infrastructure [69,74] with little mention of how this fits in with existing DRR
efforts. However, there are examples of where this is becoming less prevalent, such as the SMART hospital initiative which offers guidance on how to combine infrastructure resilience with reducing carbon emissions in hospitals [128]. Recent technical guidance for DRR in Hospital facilities, known as the Safe Hospitals Initiative, also includes resilience to future risks and specifically names climate change as key for consideration [125]. It is important to build on the technical expertise developed in both of these approaches to maximize synergies in implementation. However, the application of this in middle and low-income countries is underexplored.

EWS are an important aspect of the resilience of health systems and populations. Both DRR and CCA in health promote EWS as essential tools for preparing for disasters and preventing poor health outcomes from hazards and climate-sensitive diseases [3,23,133]. DRR systems in and outside health have been developing these systems for four decades [23,133]. These efforts have been strengthened by the objectives of the HFA [134], and the Sendai Framework [10]. Recently, a UNFCCC report on adaptation in health highlighted the need to increase risk communication to the public, and early response for climate change, particularly the “need for more guidance to be provided to the public on how to act in the event of climate change impacts such as heatwaves and storms” [74] (p. 18). EWS, public communication strategies, and preparedness for heatwaves are areas that DRR actors in health have existing experience, tools and technical knowledge [85,57]. It is important to draw together DRR and CCA approaches in these areas to ensure they are informed by the most recent climate change science, and early warning and risk communication expertise. Doing so will also be essential to avoid creating unnecessary technical and operational duplication. However, there is no literature relating to how the seemingly separate initiatives do, or will, link together to draw on potential synergies.

Disaster preparedness and response activities in health, including Health Emergency Management, Public Health Emergency Preparedness, among others, have been recognized as adaptation action for climate change [15,61]. By preparing for, and responding to, extreme events and climate-sensitive hazards, countries and populations reduce the potential immediate health risks posed by these events. However, the utility and use of climate change data in preparedness and response is under explored.

The operational synergies of the above suggested synergies exist in the commitment and maintenance of human and financial resources dedicated to the implementation of joint DRR and CCA action in health. There has been wide recognition of the operational needs to link DRR and CCA in the context of the health sector [9,26,40,82,110]. Increased synergies across DRR and CCA in health are suggested to improve funding opportunities [40], as well as the potential for joint policy and capacity development with cross-sectoral engagement [13]. The seven areas of potential technical synergies discussed above—joint policy processes; health systems strengthening; consideration of health impact pathways for identifying opportunities for joint intervention; risk and vulnerability assessment; resilience of health infrastructure; EWS and risk communication; and disaster preparedness and response—are also opportunities for potential operational synergies.

It is essential to build on existing knowledge and expertise in each field in order to strengthen the approaches in both fields. However, as outlined here, there are several areas where the synergies in complementary knowledge, expertise and tools are not being maximized. Currently there is a paucity of research surrounding technical and operational synergies that are or could be made between DRR and CCA in health. Moreover, a significant knowledge gap exists on the nature of these technical synergies and how to build them.

4.4. Public Health Actors: Critical in Bridging DRR and CCA

Practitioners and administrators play an important role in bridging DRR and CCA [33]. Practitioners and administrators working towards improving and securing population health will be vital contributors to effective implementation of DRR and CCA strategies [61]. These public health professionals are experienced in dealing with risk. It has been suggested that public health professionals could thus be readily familiar with concepts and approaches that are commonly used in DRR and CCA [61,67,103,135,136]. Additionally, the public health sector is experienced in addressing
complex problems through multi-sectoral action [137]. As a result, public health professionals are in a strong position to establish and sustain links between and bridging DRR and CCA in health.

4.4.1. Understanding of Central Concepts and Approaches

Public health professionals are experienced in dealing with risk, as well as vulnerability (created by the social determinants of health) in their day to day work functions. Thus, there is the potential for public health professionals to have a strong understanding of resilience, vulnerability and risk [67,103,135,136]. Resilience has been identified as a useful and relevant conceptual framework in DRR approaches in health to align day to day public health activities with DRR and DRM activities in health, allowing public health professionals to begin to see themselves as both public health and DRR practitioners [67]. As such, the familiarity with the concept of resilience may also aid public health professionals with identifying tangible links between DRR and CCA strategies in health.

Commonalities have also been drawn between the concept of vulnerability and the determinants of health in disaster and climate change literature [67,103,135,136]. Public health professionals are inherently familiar with, and have an understanding of, the various causes of underlying risks, including vulnerabilities and complex interactions of determinants of health, including in the context of climate change and disasters [17,67,74,103,104]. This familiarity and experience are useful for interpreting and addressing the direct and indirect health impact pathways, and simultaneous underlying disaster [67] and climate change risks [104]. Furthermore, public health professionals are accustomed to addressing similar types of risk through preventative strategies [63]. Population/public and primary health services work across scales, with a significant focus on communities and vulnerable groups [103]. As such, public health professionals are accustomed to varying risk profiles within populations, as well as addressing health vulnerabilities and needs in complex socio-ecological systems [15]. The unique positioning of the health sector within the community has the potential to improve implementation of CCA and DRR strategies in health as local-level action is important within complex multi-level adaptation and risk reduction [15,61]. Public health professionals are also experienced in engaging and empowering communities to appropriately address their needs [138]. Thus, public health professionals are well-positioned to understand and address the simultaneous climate change and disaster health risks that communities and vulnerable populations face.

4.4.2. Experience in Addressing Complex Problems through Multi-Sectoral Action

Climate change and disasters present significant health risks which occur through complex social and environmental pathways, affecting multiple systems simultaneously [1,2,45]. Addressing these risks will require public health professionals and administrators to draw on previous experience addressing complex public health challenges. Public health challenges often stretch across multiple sectors outside of the health sector alone, and require systemic, long-term solutions, such as when addressing obesity or tobacco control [139,140]. Therefore, public health professionals are experienced in dealing with long-term risks [71] fraught with uncertainty such as those that exist in models of climate change impacts on health [71,104,105], as well as health issues which require multi-sectoral action [103,137,140]. Public health has strengths in adopting socioecological system-wide perspectives, understanding complex interactions in health impact pathways, and developing multi-dimensional strategies for intervention that incorporate the needs and views of key stakeholders including communities and policy makers [103,140]. The strength of health in multi-sectoral action is essential for developing solutions to the complex problems presented by the health risks of disasters and climate change [40,141]. Within this context, public health professionals and administrators working in DRR and CCA should be well equipped to strengthen coordination and develop cross-cutting solutions to address these complex challenges [64,141].
4.4.3. Strengthening Collaboration

While recognizing the strengths of health professionals to potentially build these links, it is also important to acknowledge the silos that exist between groups working on DRR and CCA in health [49,57,67,142]. Therefore, greater collaboration and coordination will be necessary between pertinent groups working on DRR and CCA in health [26,40]. This has been called for in surveillance of post-disaster health impacts and evaluation of the effect of climate change on disaster-related health impacts [82]. However, collaboration needs to extend beyond attributing the climate change component of disaster-related health impacts to enable DRR and CCA to be linked. Collaboration on DRR and CCA to address social determinants through inter-sectoral coordination with health-affecting sectors has been suggested as important [14,17,78,80].

5. Conclusions

Linking DRR and CCA in health is critical for effectively addressing the numerous health impacts of disasters and climate change. As the role of health grows in both DRR and CCA, the need for linking these two approaches will increase. Linking DRR and CCA in health is fundamental to maximise conceptual linkages in order to reach common goals including building resilience, and reducing risk and vulnerability. Therefore, there is a need for empirical research to investigate if and how these common concepts can facilitate linkages between DRR and CCA in health. Similarly, linking these two fields can build technical and operational synergies. So doing builds on: existing expertise and resources available in each field, including in policy; health systems strengthening; risk and vulnerability assessment; resilience of health infrastructure; EWS and risk communication; disaster preparedness and response; and the examination of health impact pathways to identify points for joint intervention. Health professionals and administrators play a vital role in building these links due to their experience in dealing with risks and complex health problems, and potential familiarity with concepts and approaches in DRR and CCA. However, there is currently a lack of in-depth knowledge on how these links can be advanced and the forms they take, as well as the opportunities, challenges and enablers for building and sustaining these links. Therefore, empirical examination of the development of links between DRR and CCA in health is necessary in order to understand how best to address the growing health risks from climate change and climate-sensitive disasters.

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References


35. Portfeliu, B. Climate change as a major slow-onset hazard to development: An integrated approach to bridge the policy gap. Environ. Hazards 2015, 14, 187–191. [CrossRef]


38. Kelman, I.; Gaillard, J.C.; Mercer, J. Climate change’s role in disaster risk reduction’s future: Beyond vulnerability and resilience. Int. J. Disaster Risk Sci. 2015, 6, 21–27. [CrossRef]


43. Dietzelt, A. The Paris agreement—Protecting the human right to health? Glob. Policy 2017, 8, 313–321. [CrossRef]


74. UNFCCC. Human Health and Adaptation: Understanding Climate Impacts on Health and Opportunities for Action; Synthesis Paper by the Secretariat; Advice, SBFSAT, Ed.; UNFCCC: Bonn, Germany, 2017; Volume 46, pp. 8–18.

76. Ebi, K. Climate change and health risks: Assessing and responding to them through ‘adaptive management’. *Health Aff.* 2011, 30, 924–930. [CrossRef] [PubMed]


79. Bowen, K.J.; Friel, S. Climate change adaptation: Where does global health fit in the agenda? *Glob. Health* 2012, 8, 10. [CrossRef] [PubMed]


86. Hoy, D.; Roth, A.; Lepers, C.; Durham, J.; Bell, J.; Durand, A.; Lai, P.; Souzares, Y. Adapting to the health impacts of climate change in a sustainable manner. *Glob. Health* 2014, 10, 82. [CrossRef] [PubMed]


89. Lei, Y.; Wang, J.A. A preliminary discussion on the opportunities and challenges of linking climate change adaptation with disaster risk reduction. *Nat. Hazards* 2014, 71, 1587–1597. [CrossRef]

90. UNFCCC. Opportunities and Options for Enhancing Adaptation Actions and Supporting Their Implementation: Reducing Vulnerability and Mainstreaming Adaptation; UNFCCC: Bonn, Germany, 2016.


94. Manyena, S.B. Disaster resilience: A question of ‘multiple faces’ and ‘multiple spaces’? *Int. J. Disaster Risk Reduct.* 2014, 8, 1–9. [CrossRef]


113. Batabyal, A.A. The concept of resilience: Retrospect and prospect. Environ. Dev. Econ. 1998, 3, 221–262. [CrossRef]


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**Abstract:** Disasters and climate change have significant implications for human health worldwide. Both climate change and the climate-sensitive hazards that result in disasters, are discussed in terms of direct and indirect impacts on health. A growing body of literature has argued for the need to link disaster risk reduction and climate change adaptation. However, there is limited articulation of the commonalities between these health impacts. Understanding the shared risk pathways is an important starting point for developing joint strategies for adapting to, and reducing, health risks. Therefore, this article discusses the common aspects of direct and indirect health risks of climate change and climate-sensitive disasters. Based on this discussion a theoretical framework is presented for understanding these commonalities. As such, this article hopes to extend the current health impact framework and provide a platform for further research exploring opportunities for linked adaptation and risk reduction strategies.

**Keywords:** health; public health; disaster; climate change; disaster risk reduction; climate change adaptation; health impacts; risk; emergency

1. Introduction

The health impacts of climate change and climate-sensitive disasters (caused by various climate-sensitive hydrological, climatological, biological and meteorological hazards) are of increasing importance globally [1–7]. The number of people affected by disasters in 2016 was the highest it has been in the last decade, of which hydrological, meteorological and climatological disasters comprised 90.9% [8]. This does not include those biological hazards which are also influenced by climate change. While the 8733 reported disaster deaths in 2016 was lower than in previous years [8], these mortality rates reflect the tip of the iceberg in terms of health impacts of climate change and disasters [9,10]. Disasters increase mortality and morbidity rates, including health impacts such as injury, toxic exposure, disease, and mental health, among others [5,11–13]. These impacts are well documented, as are the potential pathways and endpoints for climate change impacts on health. Climate change may trigger increased morbidity and mortality, as a result of climate-sensitive diseases, extreme weather events, increasing non-communicable diseases, and exacerbating existing health problems [14]. The complex interactions of both climate change and disasters with social, environmental and biological factors on individual and systems levels make their health impacts difficult to measure [9,10,15,16]. The true extent of health impacts of disasters is often underrepresented due to the reliance on
mortality rates as indicators of health impacts, complexity of interactions leading to health impacts, and challenges in collecting data during, and in the aftermath of, disaster events [9,10,17,18]. Similarly, health impacts of climate change are notably difficult to measure due to the time and spatial scales over which health impacts arise, the complex pathways that involve both ecosystems and human systems, numerous stakeholder groups involved in coordinating and collecting data, as well as limited baseline data [15,16,19,20]. Not only are there commonalities in the current and potential impacts on health, there are overlaps in the different pathways through which these impacts occur.

Health impacts of the disasters resulting from hazards (defined in Section 2) have commonly been discussed in terms of two categories, direct and indirect impacts on health and health systems [1,18,21,22]. Similarly, the potential health impacts of climate change have been discussed in terms of direct and indirect pathways since the early nineties [6,16,19,23–27]. Although not all disaster-related health impacts are the result of climate-sensitive hazards or influenced by climate change, and not all climate change impacts are related to disasters, the impacts on human health and health systems have “considerable overlap” [13] (p. 455).

Previous discussions of these health impacts have not identified the commonalities in direct and indirect health impact pathways between climate change and climate-sensitive disasters. Direct health impacts are those unmediated impacts of climate-sensitive hazards on health [5,6,9,11,12,14,18,21,22,28–31], while indirect health impacts are mediated through ecosystems and human systems [5,6,11,14,18,21,28–30]. The involvement of health in disaster risk reduction, climate change adaptation, and sustainable development continues to grow internationally [1–4,32–36]. It is therefore of increasing importance to understand the commonalities in health impact pathways of climate-sensitive disasters and climate change as a starting point for developing joint strategies to adapt to, and reduce, health risks, particularly in resource constrained and highly vulnerable settings.

Therefore, this article discusses commonalities between health impact pathways of climate change and climate-sensitive disasters. It first offers a clarification of key terminology. It then discusses health impacts of disasters and climate change in terms of direct and indirect pathways. Following this, their commonalities in risks to health are presented in a novel framework. The framework was developed by examining similarities in the elements and relationships presented in existing relevant and commonly cited frameworks. Components of these frameworks were adapted to illustrate the common pathways between health risks of climate change and climate-sensitive disasters. Following the framework, recommendations for future research are provided with the view to driving further work.

2. Defining Common Concepts in Disaster and Climate Change Risks to Health

The key concepts related to disaster and climate change risks to health are defined here to provide a conceptual foundation for the discussion of commonalities in health impact pathways. It is important to clearly understand that climate change is a driver for climate-sensitive health hazards. The impact of these hazards with respect to the exposure and vulnerability of a community can result in climate-sensitive disasters. Hazards classified as climate-sensitive within this article include hydrological (e.g., flood and rainfall-triggered landslide), climatological (e.g., drought and wildfire), biological (e.g., relevant climate-sensitive diseases such as dengue, cholera, malaria, etc.) and meteorological hazards (e.g., temperature extremes, severe storms). It is the interaction of hazard, exposure, vulnerability and capacity which result in climate change and disaster risks to health [26,37,38]. These key concepts are defined within the context of disasters and climate change in Table 1.
Table 1. Key terms related to disaster and climate change impacts on health.

<table>
<thead>
<tr>
<th>Term</th>
<th>Disaster</th>
<th>Climate Change</th>
<th>Common Elements</th>
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<tbody>
<tr>
<td></td>
<td>The interaction of a hazard with exposure, vulnerability and capacity resulting in serious disruption, losses and impacts to a community [37].</td>
<td>Changes in climate mean and/or variability that persist over long periods [38].</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Potential interaction of hazard, exposure, vulnerability and capacity that present the possibility for losses or impacts on a population and elements of a society [37].</td>
<td>The result of the interaction of vulnerability (including capacity), exposure and hazard [26,38].</td>
<td>Interaction of vulnerability (including capacity), hazard and exposure.</td>
</tr>
<tr>
<td>Exposure</td>
<td>Elements of communities, infrastructure, organisations or systems that are located within the proximity of a hazard, thus potentially subject to damage and loss [37].</td>
<td>Existence of elements of human and ecosystems in places and settings which could be adversely affected by climate change [26].</td>
<td>Presence of system elements in locations which will be potentially impacted by hazards.</td>
</tr>
<tr>
<td>Hazard</td>
<td>An event (geophysical, hydrological, meteorological, technological or human induced) that has the potential to cause losses to human and ecosystems [37].</td>
<td>Natural or human-induced events that have the potential to occur in the future and impact exposed and vulnerable aspects of a system [26].</td>
<td>Interaction of hazard with exposure and vulnerability.</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>“Susceptibility of an individual, a community, assets or systems to the impacts of hazards” [37] (p. 24), caused by economic, social, physical and environmental factors [37,39–43].</td>
<td>Potential to be adversely affected, including factors such as susceptibility, predisposition and capacity [26,38].</td>
<td>Susceptibility to potential adverse effects.</td>
</tr>
<tr>
<td>Capacity</td>
<td>Ability of individuals, communities, organisations and systems to access and use the skills and resources to reduce or manage disaster risk [37,39].</td>
<td>Individual, community, societal, or organizational strengths, attributes, and resources that enable responses to change [26,38].</td>
<td>Use of resources and skills to address risks.</td>
</tr>
</tbody>
</table>

3. Direct Health Impact Pathways

Direct impacts on health include death, injury, disease, mental health impacts, and other health issues such as toxic exposure that can be directly linked back to a disaster event [5,9,11,12,18,21,28]. Discussions of direct impacts of climate change on health include morbidity and mortality, primarily resulting from changes in climate and weather extremes such as heat, drought, cold weather and rainfall [5,6,14,22,26,27,29–31]. Climate and weather extremes are defined here as “the occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable” [26] (p. 116). For example, the frameworks of direct and indirect impacts of climate change and health of both McMichael [16] and Watts et al. [27] suggest that direct impacts of climate change on health originate from climate-related hazards such as storms, droughts, heatwaves and floods. Within the climate change and health literature, it is common that climate-sensitive disasters are referred to as examples within the direct health impacts pathways. However, morbidity as a result of climate change is not always the result of what can be classified as extreme events. Extra morbidity and mortality can occur as a result of climate-sensitive hazards that are anomalous (not extreme) weather. For example, periods of warm or cold weather that deviate from usual conditions which are not classed as climate extremes may have health implications [44–46]. Some climate change and health literature also acknowledges the indirect pathways for health impacts of climate-sensitive disasters [27].

4. Indirect Health Impact Pathways

Indirect health impacts of disasters can result from unmet primary healthcare needs after a disaster due to the change in healthcare demands, and reduced capacity of the health system to meet these needs and baseline healthcare needs (for example, prenatal care, chronic disease management, etc.) [5,11,18,21,28]. These impacts are also a result of the loss of “normal living conditions” [21]
(such as adequate and appropriate shelter), and degradation of “environmental health safeguards” [47] and health-determining sectors and infrastructure that populations and health systems rely on (such as clean water, sanitation, waste management, electricity, etc.) [18,21,28]. For example, outbreaks of diarrhoeal diseases may occur after a disaster or complex emergency when affected populations are living in overcrowded evacuation centres and the water and sanitation infrastructure and practices are degraded [48]. Conversely, acute respiratory infections may occur in susceptible and malnourished populations living in overcrowded evacuation shelters with poor ventilation [48]. Furthermore, adverse mental health effects may occur as the result of physical and emotional trauma, displacement, life stressors after a disaster, and limited social support [49-51]. Social and economic consequences of disasters also indirectly impact health, well-being and development [5,25]. Examples of indirect health impacts include worsening of chronic health conditions due to the limited access to health care services, otherwise avoidable maternal deaths, and declining nutritional status due to food shortage [9,18,21].

Similarly, indirect health impacts of climate change occur as a result of impacts of climate change on secondary factors, which in turn result in health impacts. These indirect impacts occur through two processes mediated by ecosystems and/or human systems [5,6,14,29,30]. Ecosystems mediate health impacts of climate change through alterations in characteristics of vegetation, soil, baseline air and water quality, as well as ecosystems services [14]. Health impacts mediated by ecosystems primarily include changes in disease vector distribution and life cycle, water and food-borne diseases, and air quality and pollution [5,14,29,30,52]. Climate change can alter transmission seasons and geographical distribution of climate-sensitive diseases [53] and this is a key difference between the indirect pathways of health impacts from climate change as compared to disasters. However, the environmental mediation of climate change impacts can often involve climate extremes and climate-sensitive disasters in the process. For example, extended areas of increased temperatures and drought are potentially at risk of outbreaks of waterborne diseases where warmer temperatures cause higher proliferation of pathogens [52,54], and higher concentration of pathogens, increased turbidity and contamination, and decreased pressure at treatment plants result in decrease water quality and availability [52,55]. Health impacts mediated by human systems are those which result from the impacts climate change has on social processes and systems [14], such as access to and quality of health care, population growth, aging, socioeconomic status, and the economy [52,56]. They can include: occupational heat stress, mental health impacts as a result of conflict or livelihood loss triggered by climate change; food insecurity and undernutrition as a result of reduced agricultural production; and restricted access to adequate and necessary public and primary health care [5,14,27].

Climate-sensitive disasters and climate change also impact public and primary health services by impacting functionality through damages to infrastructure and non-structural factors, including equipment and medical supplies, and factors relating to the functioning of vital aspects of the health system, such as losses of medical records, losses or death of general and specialised health personnel, etc. [18,21,57,58]. Secondary impacts of disasters on health systems include the suspension of public health efforts due to the redirection of personnel and financial resources to emergency or disaster response on an ongoing basis [21,59]. For example, increases in vector borne disease may occur over the long term due to interruption of vector control programmes following a disaster [60,61].

The impacts on health systems and those that support them are not well documented [33]. However, there is potential for climate change to impact health facilities and systems not only through extremes in weather and climate events, but also through sea level rise in the context of exposed coastal facilities, as well as increasing burden on the health system through climate-sensitive diseases, such as dengue, malaria, or non-communicable diseases. As a result, these impacts of climate change and disasters on health systems can cause additional indirect health impacts. While these areas are not as well documented as the population health impacts [13,57,62,63], health systems and the systems that support health is becoming an area of increasing concern. The impacts of climate change and disasters on health systems can be categorised in terms of:
• Changes in volume and patterns of health service demand from increased morbidity and mortality [15,21,58,64,65];

• Reduced capacity to meet the primary and public health needs due to interruption of vital components of the health system (e.g., infrastructure or equipment damage, reduced staff) [13,15,18,21,58,64]; and

• Interruption of health-determining services such as access to clean water, sanitation, food, energy, communication, etc. [58,64,65].

5. Framework for Understanding Commonalities in Health Risks of Climate Change and Climate-Sensitive Disasters

The commonalities between health impact pathways of climate change and climate-sensitive disasters can be understood when climate-sensitive disasters are considered as their risk component parts, i.e., where the health of vulnerable communities is impacted by exposure to hazards. Understanding the relationship between climate change and the hydrological, climatological, biological and meteorological hazards that result in climate-sensitive disasters is fundamental for understanding the similarities in the resulting health impacts and the required actions to address them. Figure 1 provides a novel framework for identifying the commonalities in direct and indirect pathways of climate change and climate-sensitive disaster impacts on health, where previously these impact pathways have been considered separately. The commonalities in impact pathways include the influences of climate change as a risk driver for health impacts caused by increasing the frequency and intensity of climate-sensitive hydrological, climatological, biological and meteorological hazards [35,66].

In understanding these commonalities, the distinction between disaster and emergency is important. The authors recognize that the term emergency is at times seen as synonymous with the term disaster [37], in the context of this commentary, emergencies are defined as events that “do not result in the serious disruption of the functioning of a community or society” [37] (p. 13), the key distinction being the level of disruption encountered and if that disruption exceeds current capacity to respond. Climate-sensitive disasters and emergencies are again distinguished from climate-sensitive health hazards which do not evolve into emergencies or disasters, but still impact health. In this framework, climate change has potential impacts on health both as a driver of climate-sensitive disaster and emergency risk, as well as through climate-sensitive hazards that do not evolve into disasters. This distinction demonstrates the commonalities in health impact pathways of climate-sensitive hazards. It also considers both the variation in severity of the disruption and whether coping capacity is exceeded. In doing so, the framework recognises that not all climate-sensitive hazards result in disasters or even emergencies. The authors note, therefore, that the severity of health impacts may differ and thus so must the scale of the response. The list of health impacts and mediating factors provided in the framework are not exhaustive as they are intended as a thematic scaffold to guide understanding.
In this framework hazards (as defined in Table 1) should not be understood in the conventional sense the concept is used in disaster risk management. This framework characterizes hazards as climate-sensitive events that pose risks to human health. This highlights the commonalities in health hazards of concern to practitioners working with climate change and climate-sensitive disaster impacts on health. A distinction is made between hydrological, climatological, biological and meteorological hazards based on the EM-DAT hazard classification [68]. This is to ensure a holistic approach to understanding climate-sensitive health hazards, similar to the all hazards approach now embraced within disaster risk reduction and management. This enables the inclusion of and hazards that have emerged as potentially climate-sensitive, such as weather and climate extremes, and some biological hazards. For example, this broader frame comprises relevant climate-sensitive infectious diseases as hazards, where traditionally these were not considered hazards within disaster risk reduction and management. Furthermore, distinguishing between the different types of health hazards illustrates the extensive range of commonalities in health impact pathways. For example, this classification of hazards ensures that meteorological hazards such as heatwaves are understood as health hazards from both a climate change and disaster perspective, even if the classification of heatwaves as a disaster or emergency occurs in a small portion of experienced heatwaves [69]. It also includes hydrological hazards such as flood and landslides, as well as climatological hazards such as wildfire and drought. In doing so, this allows the framework to also account for climate change-related morbidity and mortality that results from hazards not classified as extreme events or disasters. For example, heat-related health impacts are expected to increase as a result of anomalous changes in temperature which are not classed as extreme events [44,46], such as diurnal temperature variation [45]. Finally, the types of hazards enable the consideration of both acute hazards, such as outbreaks with potential for rapid proliferation and development into a health emergency or disaster, and slow-onset hazards, such as droughts or increasing dengue prevalence. The incorporation of slow-onset hazards broadens the conventional frame of hazards and enables the consideration of those which have conventionally not been considered as potentially leading to disasters. These slow-onset hazards impact health through similar direct and indirect pathways, however this occurs at a different temporal scale to acute hazards.
Finally, this framework incorporates an innovative interpretation of the potential hazard–disaster–impact relationship to allow for the inclusion of escalating health impacts. The framework incorporates a cyclic aspect where climate-sensitive hazards may have impacts on health but these do not necessarily evolve into disasters until after they are mediated by ecosystems or human systems. For example, the initial outbreak of Ebola in 2014 impacted human health but was not seen as an emergency or disaster until after interacting with complex human systems. For example, the limited cultural and religious acceptability of scientific methods for combating transmission worsened the health risk and impact, and thus evolving into health emergencies [70]. While attributing any singular disease outbreak to climate change is not possible, the Ebola outbreak is given as an example of the complex feedback loop which can result in health impacts from climate-sensitive hazards escalating to emergencies and disasters. Here, Ebola is considered to be a potential climate-sensitive hazard as the proliferation of the virus is potentially influenced by climate-sensitive factors such as climatological and meteorological conditions including periods of unusual drought and rain [71–73]. This draws attention to the consideration of a sub-group of infectious diseases which are potentially climate-sensitive but have not yet been identified as such due to current spatial and temporal limitations in meteorological and baseline health data [72].

In addition to the commonalities identified here between in the indirect and direct health impact pathways, there are of course important differences in these pathways. First, the impacts from climate-sensitive disasters and climate change may occur over different time scales ranging from acute events such as typhoons, to slow onset disasters such as sea level rise and droughts exacerbated by climate change [26]. Second, the spatial scales over which health impacts arise may differ, for example climate change can alter the geographic distribution of climate-sensitive diseases [14], whereas climate-sensitive disasters such as a tropical storm are location specific [13]. Third, not all disasters are climate change related, just as not all climate change impacts on health are the result of disasters. Disasters caused by earthquakes or volcanic eruptions are classified as geophysical hazards and distinguished from those known to be caused by climate-sensitive hazards. However, the authors acknowledge that these hazards also result in direct and indirect health impacts. Likewise, anthropogenic disasters such as terrorist attacks and conflict are distinguished from climate-sensitive hazards. Similarly, not all climate change impacts on health are related to disasters. This includes health impacts from some slow-onset hazards such as health risks from salinization of drinking water resulting from sea level rise not linked to storm surge [74,75]. However, these hazards and their associated direct and indirect health impact pathways are not captured in this framework as this is outside of its intended scope.

6. Conclusions

The direct and indirect health impacts of climate change and climate-sensitive disasters are a growing concern for human health [13]. The health impacts pathways of both climate-sensitive disasters and climate change have numerous commonalities [5,6,9,11,12,14,18,21,28–30,47,76] suggesting the potential for synergist and complementary actions. However, the commonalities between these pathways have not previously been discussed. Considering climate-sensitive disasters in terms of their risk components (hazard, vulnerability, exposure and adaptive capacity) enables clear identification of the commonalities in the health impact pathways of disasters and climate change, where climate change is understood as a driver of hazard frequency and intensity. The framework presented here identifies climate change as a risk driver for many hydrological, climatological, biological and meteorological hazards. These climate-sensitive hazards have the potential to directly and indirectly impact health. They also have the potential to develop into disasters through interactions with various degrees of a community’s exposure, vulnerability and adaptive capacity. Subsequently, these disasters also directly and indirectly impact health.

The commonalities in health impact pathways show a clear link between climate-sensitive disaster and climate change risks in health. With this knowledge, it is also reasonable to assume
that the strategies in place, or being developed, to reduce these risks must also have numerous commonalities. This could include actions that address environmental and social determinants of health pertinent to climate-sensitive hazards; increase preparedness and response to both climate change and climate-sensitive disaster risks; develop joint climate information services informing health programmes and services; integrate information services, and risk communication and early warning systems; and strengthen health systems resilience. The intent of this framework is to indicate areas of similarity and overlapping interest for health professionals to facilitate discussions around joint adaptation and risk reduction actions for health. By identifying common health risks, this framework takes the first step in developing a common language for identifying and addressing health risks in both the disaster risk reduction and climate change adaptation spaces. The authors acknowledge that data and analysis techniques are not yet sufficient to directly attribute climate change to all climate-sensitive hazards. However, addressing common health risks of both climate change and climate-sensitive disease facilitates a no-regrets approach to adaptation and risk reduction.

Finally, this article contributes to current literature calling for links between disaster risk reduction and climate change adaptation strategies in health. Since there is a paucity of research examining links between disaster risk reduction and climate change adaptation in health, there is a need to strengthen research to develop a greater understanding of the opportunities and barriers for building these links in not only policy, but also implementation. To this end, by examining commonalities in health risks, this article should be useful in facilitating joint adaptation and risk reduction strategies which safeguard population health.

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Author Contributions: This framework has been developed by Nicola Banwell as part of her research, with substantial feedback and guidance from Shannon Rutherford and Brendan Mackey. Nicola Banwell wrote the original text, with revisions and conceptual guidance provided by Shannon Rutherford, Brendan Mackey, Roger Street and Cordia Chu.

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References
36. Dietzel, A. The Paris Agreement—Protecting the human right to health? Glob. Policy 2017. [CrossRef]
53. UNFCCC. Human Health and Adaptation: Understanding Climate Impacts on Health and Opportunities for Action; Synthesis Paper by the Secretariat; Advice: UNFCCC: Bonn, Germany, 2017; Volume 46, pp. 8–18.

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The following organizational structure represents the DOH structure that was existing at the time of data collection based on what was on the DOH website (http://www.doh.gov.ph/node/2899) on the 16th May 2016 (the start date of Phase I of data collection, relating to the Case Study).
## Appendix 4: Summary of Policies Relevant to DRRH in the Philippines

The following tables present a summary of health within national DRR policy (Table 1) and key points of DRRH policies and plans (Table 2) of the Philippines.

### Table 1. Health in current national DRR policies

<table>
<thead>
<tr>
<th>National DRR Policy</th>
<th>Role of health</th>
</tr>
</thead>
</table>
| DRRM Act (Government of the Philippines, 2010); and Implementing Rules and Regulations of the DRRM Act (National Disaster Coordinating Council, 2010) | • Recognises the need to mainstream DRR and climate change into development processes, including health.  
• Train health professionals to support breastfeeding before, during and after a disaster.  
• Reducing health impacts and lives lost during and after a disaster is a major focus of disaster response.  
• Health losses are listed as potential impacts of hazards and outcomes of disaster risks.  
• Assessing exposure and vulnerability in health is recognised as a part of risk assessment.  
• Secretary of Health and President of the Philippine Health Insurance Corporation are named as a member of the NDRRMC  
• Health of the Local Health Officer is a member of the Local DRRM Council  
• Names DOH as a key agency to assist in the integration of DRRM into school curricula under the Department of Education. |
| NDRRMF (Department of National Defense, 2011)                                       | • DRR and CCA to be mainstreamed and integrated in sectoral policies, plans and budgets (does not explicitly name health).  
• Explicitly names the role of health in disaster response.  
• Health-related disasters (epidemics, pandemics, etc.) are named as a cross-cutting concern to be addressed in all DRRM phases. |
| NDRRMP (Government of the Philippines, 2010)                                        | • Names DOH as a responsible agency in:  
  o Disaster response: provision of basic social services to disaster-affected populations, and meeting psychosocial needs of disaster-affected populations.  
  o Recovery: Psychologically sound, safe and secure citizenry.  
• Recognises the importance of mainstreaming DRR and CCA in development and names health as an important sector. |
| National Disaster Response Plan (NDRRMC, 2014).                                     | • Response clusters include a ‘Health Cluster’ (one of eight clusters).  
• Sub-clusters under the Health Cluster include: Medical and Public Health; Mental Health and Psycho-social Support; and Nutrition and WASH (names specific roles of each sub-cluster along with the DOH bureaus and cluster partners involved in carrying out the functions of the sub-cluster).  
• DOH is the lead of the Health Cluster.  
• Explicitly names HEMB as the coordinating mechanism within the DOH for the Health Cluster.  
• Names functions of the DOH as head of the Health Cluster in the phases immediately before, during and after a disaster.  
• Names roles of support agencies of the Health Cluster immediately before, during and after a disaster. |
For coordination of disaster preparedness, DOH is a partner in Information, Education and Campaign; Capacity Building; DRRM localisation; and Preparedness for Emergency and Disaster Response.

Resilience of health facilities acknowledged under the Sendai Framework.

Importance of mental health services for those affected by disasters.

Specific roles of DOH in preparedness:
- Health Emergency Preparedness trainings at national, regional and local levels.
- Other capacity building, simulations, drills, knowledge management and standards related to Health Emergency Preparedness.
- Institutionalisation of DRRM for health on a local level, including the development of guidelines and protocols, conduct of necessary trainings, etc.
- Integrated risk assessments and plans necessary for the health sector and health risks, including at a local level.
- Prepare business continuity plans for health service providers and hospitals, and the DOH itself.
- Assistance with health aspect of the preparation of the integrated disaster information platform, and dissemination of disaster-related health information.
- Identify minimum standards for quality of relief goods.
- Establish evacuation protocols and plans.
- Issue guidelines for pandemic preparedness and response.
- Development of health-related standards for response preparedness.
- Ensure proposer coordination with other clusters as relevant.

### Table 2. Key points from national DRRH policies

<table>
<thead>
<tr>
<th>DRRH Policy or Plan</th>
<th>Key points</th>
</tr>
</thead>
</table>
- Overarching aim is to reduce mortality and morbidity from disasters, and prevent physical and mental harm to affected populations and responders.  
- Recognises the role of the DOH in:  
  o Leading health sector preparedness and response  
  o Leading response to disease outbreaks and epidemics, and role of health sector in all response efforts.  
  o Providing an efficient system for DRM including coordination and collaboration with partner agencies and stakeholders  
- Outlines 10 strategies: Capacity development and facilities enhancement; service delivery; health information and advocacy; health policy; networking and social mobilization; research and development; resource mobilisation; information management system and surveillance; standards and regulation; and monitoring and evaluation.  
- Provides details on implementation and roles and responsibilities of all agencies for carrying out the ten strategies.  
- Institutionalised DRRM in health in DOH Regional Offices and Hospitals. |
<table>
<thead>
<tr>
<th>Document Title</th>
<th>Information</th>
</tr>
</thead>
</table>
| HEMB DRRM in Health Strategic Plan 2014-2016 (HEMB, 2014)                      | • Strategic goal: to enhance capacity of the health system to ensure continuity of services and improve responsiveness to disasters and emergencies, and thus ensure zero casualties.  
  • Sets out specific activities for implementation according to five objectives related to strengthening the response system, health facility resilience and timely and appropriate health service delivery in emergencies.  
  • Draws on lessons learnt from Typhoon Yolanda.  
  • Recognises the role of disaster preparedness and response, particularly infrastructure resilience, in strengthening Universal Health Coverage. |
| Integrated Policy on DRRM in health (draft) (DOH, 2016c)                       | • Policy mandate aims to strengthen capacity for DRRM in health and increase health system resilience on a local level, including to the impacts of climate change.  
  • Sets out three goals for DRRM in health:  
    o Avoid preventable morbidities and mortalities,  
    o Ensure no secondary outbreaks occur, and  
    o Ensure uninterrupted health service delivery.  
  • Sets out roles of national DOH offices; Regional Offices; hospitals; and LGUs with considerably more detail than previous plans.  
  • Specifies roles of various levels of LGUs (Provinces, Municipalities and Cities, and Barangays) and provides a greater focus on local level than previous plans. |
| HEMB DRRM in Health Strategic Plan 2017-2022 (draft) (HEMB, 2016a)            | • Intended to provide a framework for the institutionalisation and building capacity for DRRM in health at all levels, particularly at the LGU level.  
  • Continues to draw on the lessons learnt from Yolanda.  
  • Actions planned based on five objectives, to strengthen:  
    o HEMB and ensure it is sustained;  
    o Capacity of Regional DOH Offices to support LGUs;  
    o Hospital capacity to manage health risks of disasters;  
    o LGU capacity to institionalise DRRM for health; and  
    o Community and family capacity to deliver health services during disasters  
  • Sets the vision of “Health disaster safety in the hands of the people” translated as “Kaligtasang pangkalusugan ng kalamidad sa kamay ng komunidad” and intends to build the disaster resilience of the community by decreasing lives lost and damage and losses to health infrastructure in the community. |
APPENDIX 5: SUMMARY OF POLICIES RELEVANT TO CCAH IN THE PHILIPPINES

The following tables present a summary of health within national climate change policy (Table 1) and key points of CCAH policies and plans (Table 2) of the Philippines.

Table 1. Health in current national climate change policies

<table>
<thead>
<tr>
<th>National CCA policy</th>
<th>Role of health</th>
</tr>
</thead>
</table>
| Climate Change Act (Government of the Philippines, 2009) | • Secretary of the Department of Health is a member of the Climate Change Commission advisory board.  
• Health listed as a climate-sensitive sector. |
| NFSCC (Climate Change Commission, 2010) | • Names health in the vision of the NFSCC  
• Recognises the impact of climate change on health  
• Climate-responsive health sector is a priority under CCA  
• Specific priorities for managing climate change in health:  
  o Assess vulnerability of the health sector (including infrastructure resilience of health care facilities);  
  o Ensure the health system is responsive and less sensitive;  
  o Identify, monitor and control climate-sensitive diseases; and  
  o Improve surveillance and response to climate-sensitive water- and vector-borne diseases. |
| NCCAP (Climate Change Commission, 2011) | • Health in ‘human security’ priority which aims to “reduce the risks of women and men to climate change and disasters” (p.14).  
• Climate change responsive health and social protection systems is an outcome under the human security priority.  
• Health is recognised as a key issue related food security, water-borne disease, and environmentally sustainable transport  
• The DOH is named as a key stakeholder under: ‘Food security’, ‘water sufficiency’ and ‘human security’ |

Table 2. Summary of CCAH policies and plans of the Philippines

<table>
<thead>
<tr>
<th>CCAH Policy or Plan</th>
<th>Key strategies and points</th>
</tr>
</thead>
</table>
| Philippine Strategy on Climate Change Adaptation: Health Sector (DOH, 2010d) | • Summarised the state of CCAH, identified gaps and reported plans of the time on CCAH and emerging institutional arrangements, thus performed more as a strategic plan document without specific strategies;  
• Highlighted the need for a CCA policy for the health sector, as well as clarification of roles of stakeholders.  
• Outlines objectives for the National Framework of Action:  
  o Identify and assess vulnerabilities in health  
  o Identify existing CCA actions in the health system  
  o Identify possible CCA mechanisms in health, including: policy, governance, interdepartmental institutional arrangements, capability and service delivery, financing and regulation |
| **National Policy on Climate Change Adaptation for the Health Sector** (DOH, 2012b) | • Sets overall strategies for climate change in health, including:
  1. Policy, plans and partnerships.
  2. Service provision, capacity and infrastructure enhancement.
  3. Health promotion, research, surveillance, monitoring.
  4. Strengthening organisational structure for climate change at national, regional and LGU levels.
• Defines key terms related to climate change in health.
• Outlines requirements for enhancing capacity of health systems and engaging key partners in CCA to protect population health.

| **Operational Guidelines of Administrative Order No. 2012-0005, “National Policy on Climate Change Adaptation for the Health Sector” (DOH, 2012a)** | • Outlines the concrete activities for implementing CCAH policy according to the four overall strategies for CCAH outlined in the National Policy on Climate Change Adaptation for the Health Sector
• Four objectives to develop (p.1):
  1. “Procedures on how to implement the strategies”
  2. “Roles of key stakeholders”
  3. “Procedures on the mobilization of funds” and
  4. “Monitoring and evaluation procedures”

| **2014-2016 National Climate Change Adaptation in Health Strategic Plan** (DOH, 2013a) | • Plan for specific activities in the DOH on CCAH
• Three objectives (p.9):
  1. “Improve the adaptive capacity of the health care delivery system”
  2. “Enhance support mechanisms to adaptation and mitigation efforts on climate change in the health sector” and
  3. “Empower communities to manage health impacts of climate change.”
• Seven strategies and 14 corresponding Key Result Areas for Climate Change and health

|  |  | o Align with national and international agreements. |
### APPENDIX 6: ORGANISATIONAL MECHANISMS FOR CCAH IMPLEMENTATION

#### Organisational Structures for CCAH Implementation

**Developed based on:** (DOH, 2010a, 2011a, 2012a, 2012b, 2016b; Government of the Philippines, 1991a).

**National Health Sector**

<table>
<thead>
<tr>
<th>DOH Climate Change Executive Committee</th>
<th>Inter-Agency Committee on Environmental Health</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Membership</strong></td>
<td><strong>Membership</strong></td>
</tr>
<tr>
<td>- Undersecretary of the Office of Technical Services (Chair);</td>
<td>- Secretary of Health (Chair).</td>
</tr>
<tr>
<td>- Director DPCB (Vice-Chair);</td>
<td>- Secretary of Environment and Natural Resources (Vice-Chair).</td>
</tr>
<tr>
<td>- Internal members: Director HEMB; Deputy Director, DPCB;</td>
<td>- Secretaries of: Public Works and Highways; Interior and Local Government; Agriculture, Trade and Industry; Transportation and Communications; Science and Technology; Labor and Employment (Members).</td>
</tr>
<tr>
<td>- Director Health Facilities Development Bureau; Director Bureau of Local Health Systems Development; Director Epidemiology Bureau; Director Health Promotion and Communication Service.</td>
<td>- Director General of: National Economic and Development Authority; Philippine Information Agency (Members).</td>
</tr>
<tr>
<td>- External members: Representative – University of the Philippines College of Public Health; Representative – WHO Country Office.</td>
<td></td>
</tr>
</tbody>
</table>

**Roles**

1. Review and approve policies and guidelines, and identify strategies for mainstreaming CCAH.
2. Establish policies and procedures for coordination on climate change.
3. Approve framework, plan and agenda for CCAH.
4. Assist in implementation of CCAH.
5. Confirm unified protocols and standard adaptation and mitigation actions for regions.
6. Improve training on international standards and best practices relating to climate change.
7. Manage resources for the CCA in health program.
8. Continuously evaluate effectiveness of initiatives, research and training programs, and enforcement of regulations.
9. Approve tools for the implementation of CCA in health.
10. Review implementation progress and make recommendations.

**Regional**

**Climate Change Unit**

Under the Environment and Occupational Health Office of the DPCB.

**Roles**

1. Develop the agenda and provide technical assistance in implementation.
2. Set policies and standards.
3. Develop tools for implementation.
4. Act as technical advisors and resource persons.
5. Secretariat to the IACEH.
7. Develop mechanisms for interagency and private sector partnership.
8. Liaise with other government agencies.
9. Conduct research.

**Local**

**Climate Change focal points in Regional Offices**

**Regional Inter-Agency Committee on Environmental Health**

**Corresponding local structure**

**Technical coordination with climate change focal points in DOH offices**

**Developed based on:** (DOH, 2010a, 2011a, 2012a, 2012b, 2016b; Government of the Philippines, 1991a).
APPENDIX 7: DATA COLLECTION TOOL FOR GUIDING INTERVIEW QUESTIONS

The following questions were used as a guide and to prompt interviewees at the various levels of interview. As the interviews were intended to be semi-structured, not all of the following questions were asked of all participants. Questions were used where appropriate and necessary to prompt conversation, while ensuring the key questions around the research and focus questions of the research were answered.

Interview questions were developed at three levels – global, national, and regional/local. Often local level interviews required the researcher to use more simple language than depicted below. The global informant interview questions were informed by the key findings from the preliminary analysis of the Case Study findings.

Global interviews – guiding questions
What is the state of CCAH implementation in countries? Good practice examples?
Is there a need a more proactive approach to CCAH? Examples of proactive approaches by countries
Is there generally a need for strengthening research capacity for CCAH at the country level?
Do countries often have the climate information in the level of detail necessary to develop health policies and plans for adaptation?
How will countries know if the adaptation options they are implementing are successful or adequate?
How have other countries navigated the sustainability challenges of CCAH programmes and approaches?
Good practice examples of organisational structure for CCAH?

How can DRR strategies and approaches improve CCA in health?
How can CCA approaches improve DRR in health?
What areas can there be more links to improve DRR and CCA in health?

Examples of good practices of linked DRR and CCA
What makes these links work?
Examples of good practices of linked DRR and CCA in health
What factors enable DRR and CCA to work together inside and outside health?
What examples of policy, tools, strategies or approaches (etc) can you give that are a possible opportunities or enablers for linking DRR & CCA?
What are the most pertinent needs which need to be addressed to initiate DRR and CCA linking in the context of health?

Is resilience a potential concept for building links between DRR and CCA in health?
Challenges and benefits of using resilience as a framework for linking DRR and CCA in health?
Are there any specific resilience frameworks that are pre-existing that could be used for this?

**National interviews – guiding questions**
What are the key risks/issues you are facing in the Philippines relating to disasters and health?
What role does the health sector have in DRR in the Philippines? Who are the key stakeholders in DRR in the health sector?
What do you think the health sector SHOULD be doing in DRR? Why?

Is climate change an issue for the Philippines? What do you think it will mean for disaster risks in the Philippines?
What do you think climate change will mean for the work of the DOH in DRRM-H?
Do you think it is progressing well? Why/why not?
What are some of the challenges for progressing this work?

Speaking broadly about all of the health impacts of climate change, what is the role of the health sector in climate change in the Philippines?
Who are the key stakeholders and what are their roles? Is there much collaboration within the health sector on CCA?
What is the DOH's role in this?
And where does HEMB sit in relation to this?
What do you think the health sector SHOULD be doing in CCA? Why?

International policies are calling for work on disasters and climate change to be linked and work closely together. Thinking about CCA and DRR in general here in the Philippines, is there linkage at the moment?

*If yes....*
To what extent are DRR and CCA linked?
Where is this link happening?
Are there any benefits of this linkage -organisational, outcomes, etc? What about the drawbacks?

*If no....*
Do you think this link should be happening?
Where do you think the link should happen?
Can you think of potential benefits of this linkage? What about the drawbacks?

Now thinking more specifically about the DOH, are there linkages between DRR and CCA in the DOH? Could you give me some examples?
Do you think there is adequate linkage between DRR and CCA within the DOH? Why/Why not?
Can you think of any instances where there are overlaps in work on DRR and CCA within the DOH?
If there were to be better links between DRR and CCA in the DOH, what would this look like? What would this involve?
What would be needed to make this happen?

Do you think linking DRR and CCA is important in your work? Why/why not?
Does this link happen in your work? Can you give me examples?
Can you think of any additional places where this link could happen within your work? Why do you think this link hasn't happened? What would you need to make this link happen and make it strong and sustain it?

What does the term resilience mean to you in your work? What is the role of the health sector in building resilience? What are the characteristics of resilience in the health sector? What are the characteristics of resilience in the community? How is the DOH working towards building resilience? Often the term resilience is used in both DRR and CCA as the end goal. Do you think using resilience as a framework could help to create a better link between DRR and CCA? If so, why and how?

**Regional and Local interviews – guiding questions**

What are the key risks/issues you are facing in your area relating to disasters and health? How is your Region/Province addressing these risks? What are the main challenges in the managing these risks? What role do health professionals, hospitals and health clinics have in understanding and responding to these risks? What do you think health professionals, hospitals and health clinics SHOULD be doing to address these risks, relative to what the health sector is doing now?

Do you think climate change is an issue for your region? What do you expect climate change to mean for your region/Province? What does climate change mean for your province in terms of disaster risks?

How is your Region/Province addressing climate change risks? Who is responsible for CCA in health? What roles do they have in CCA and health? What are the main challenges in managing these risks? What more do you think the health sector SHOULD be doing to address climate change, relative to what they are doing now? Why do you think this?

How does your region/province/etc link DRR and CCA? Where are those links happening? Particularly in the DOH and context of health? Examples? What work items, policies, programmes and activities within health are both DRR and CCA? What areas of work are both DRR and CCA but are being implemented separately? What needs do you have in strengthening these linkages and programmes in DRR and CCA into the future?

A lot of policies are now talking about building resilience to disasters and climate change. What does this term mean to you, in the context of your work? Can you provide a recent example of how your region demonstrated resilience to a disaster? What made the communities resilient? What made the health sector resilient?

What more do you think the hospitals/health clinics and health professionals in your Region/Province could do to help the community be more resilient in the future? Does your region/Province have specific plans to build resilience? What are the challenges you have to building resilience in your region/Province?
APPENDIX 8: LIST OF OBSERVATIONS FROM CASE STUDY DATA COLLECTION

Observations which occurred during the Case Study data collection are listed below.

National observations:

- Public Health Emergency Management in the Asia Pacific training (18th-27th May 2016; Manila Bay View Hotel, Manila)
- Dissemination Forum on the Manual of Operations on Health Emergency and Disaster Response Management (29th July 2016, Richville Hotel, Mandaluyong, Manila)
- Attendance of 10th Philippines National Health Research System Week Celebration (9th-11th August 2016, Puerto Princesa, Palawan)
- DOH Omnibus Policy Focus Group Discussion – policy research observation (6th June 2016; DOH San Lazaro, Manila)
- From the Safe Hospitals Philippines Indicators to a Hospital Safety Index Philippines Tool (August 31st 2016; Hotel Jen, Manila)
- Inception Workshop “Integrating Climate Change and Disaster Risk Management in Investment Programming Processes under the Resilience and Preparedness towards Inclusive Development Project” (NEDA-RAPID; 31st August – 1st September 2016, Marco Polo Mandaluyong)
- Climate Change Commission, Convention on the National Climate Change Framework (22nd November 2016, Pasay, Metro Manila)
- Emergency Medical Team Workshop (23rd and 24th November 2016, Tagaytay)
- 8th National Convension on Health Emergency Management (7th – 97th December 2016, SMX Convention Centre, Pasay)

Regional observations:

- Disaster Risk Reduction and Management in Health Training and Launch of Strategic Direction (19th-23rd July 2016; Tacloban, Alejandro Hotel, Region 8)
- Salcedo Barangay Health Emergency Management System (BHEMS) training (21st July 2016, Salcedo, East Samar, Region 8)
- Provincial DRRM Drill (29th September 2016, Albay Province, Region 5)
Human Research Ethics Approval
“Linking Disaster risk reduction and climate change adaptation in the health sector: A case study of the Philippines Department of Health”
(Ref: 2016/282)

I am pleased to advise that this research has full approval from the Griffith University Human Research Ethics Committee, a committee established and operating in accordance with the standards and principles of the Australian National Statement on Ethical Conduct in Human Research (2007) and Griffith University policy and registered with the Australian National Health and Medical Research Council.

The decision to approve is dated 03 May 2016 and covers the period 03 May 2016 to 31 August 2017.

For any queries regarding this ethical approval please contact the Committee Secretary on 3735 4375 or research.ethics@griffith.edu.au.

Yours sincerely,

Rick Williams
Secretary to the Griffith University
Human Research Ethics Committee and Manager Research Ethics and Integrity
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Griffith University
Nathan QLD 4111 Australia

03 May 2016
CERTIFICATION

This certifies that the University of the Philippines Manila Research Ethics Board (UPMREB) Review Panel 2 is constituted and established, and functions in accordance with the requirements set by the University of the Philippines Manila, the Philippine Health Research Ethics Board (PHREB); and in compliance with the WHO Standards and Operational Guidance for Ethics Review of Health-related Research with Human Participants (2011), the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (1996), and the National Ethical Guidelines for Health Research (2011).

The current members of the UPMREB Review Panel 2 are in the attached document. UPMREB Review Panel 2 actions and recommendations are facilitated through consensus. In reference to protocol of Dr. Cordia Chu, entitled “Linking Disaster Risk Reduction and Climate Change Adaptation in the Health Sector: A Case Study of the Philippines Department of Health” UPMREB 2016-268-01, the decision was APPROVED for the aforementioned study protocol and documents specified in the approval package through expedited review.

Final APPROVAL was processed through EXPEDITED REVIEW and issued on 23 June 2016.

[Signature]
Coordinator, UPMREB
23 June 2016
APPENDIX 11: PUBLICATION 3


**Developing the Philippines as a Global Hub for Disaster Risk Reduction – A Health Research Initiative as Presented at the 10th Philippine National Health Research System Week Celebration**

October 25, 2016 - Discussion

**Citation**


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**Abstract**

The recent Philippine National Health Research System (PNHRS) Week Celebration highlighted the growing commitment to Disaster Risk Reduction (DRR) in the Philippines. The event was lead by the Philippine Council for Health Research and Development of the Department of Science and Technology and the Department of Health, and saw the participation of national and international experts in DRR, and numerous research consortia from all over the Philippines. With a central focus on the Sendai Framework for Disaster Risk Reduction, the DRR related events recognised the significant disaster risks faced in the Philippines. They also illustrated the Philippine strengths and experience in DRR. Key innovations in
Background to the impact of disasters on the Philippines

Widely recognised as one of the most disaster-prone countries in the Asian Region, and the world \(^7\), the Philippines was ranked second on the World Risk Index in 2014 in terms of exposure and risks to natural hazards \(^5\). The Philippines was also the 5th most affected country by natural hazards from 1994 to 2013, and ranked as the most affected country in 2013 according to the 2015 Global Risk Index\(^2\). Between 1993 and 2012, the Philippines experienced 311 extreme weather events, the highest number globally, and falls within the top ten countries in the world most affected by extreme weather\(^7\). Most recently, the Philippines was found to have the highest expected annual mortality, affected population, and loss in GDP globally in relation to climatic hazards \(^10\). This data is to the exclusion of impacts associated with non-climatic, biological or technological hazards.

The country is exposed to a variety of hazards across all categories – natural, biological, technological and social hazards such as mass gatherings\(^11\). Several geographic factors contribute to the high natural hazard exposure of the Philippines, including the country’s location in the ‘Pacific Ring of Fire’ at the junction of two large tectonic plates, the Philippine Sea Plate and the Eurasian Plate, facing the Pacific Ocean\(^12\) and one of the most active typhoon belts in the world \(^13\).

In addition to these exposure factors, significant vulnerability as a result of inequity in access to healthcare and social protection mechanisms, as well as rapid unplanned urbanisation and development in economic hotspots, contribute greatly to the disaster risks faced by the population and economy of the Philippines \(^5,14\).

DRR in the context of climate change has become a national priority with structures established to address these challenges. The national government has enacted the Climate Change Act of 2009 (RA 9729) and established the Climate Change Commission at the national level \(^15\). The National Disaster Risk Reduction and Management Act of 2010 (DRRM Act, RA. 10121) has also been enacted and corresponding structures established \(^15\). These structures are known as the National Disaster Risk Reduction and Management Council (NDRRMC), and are replicated at regional levels, known as Regional Disaster Risk Reduction and Management Councils (RDRRMC). National frameworks and plans in DRR and climate change have been developed and are in various stages of implementation \(^17\) with the sunset review of the DRRM Act currently underway. Within the Department of Health (DOH), health emergency preparedness and response structures are institutionalised at the national level through the Health Emergency Management Bureau\(^18\).

The combination of these three factors, the risk profile, experiences and established structures in DRR, positions the Philippines to potentially become an international leader and global hub for DRR. However, several aspects need strengthening to support the development of the Philippines as an international hub for DRR. The key areas for strengthening identified through analysis of the content presented at the PNHRS Week Celebration include: integrated national hazard assessment, strengthened collaboration, and improved documentation.

Science and technology innovations in the Philippines and areas for further development

In addition to the institutional structures mentioned above, the Philippines has relevant scientific and technical structures to contribute to the understanding of hazards and risks, and development of scientific innovation in DRR. These are coordinated by the Department of Science and Technology (DOST), and include, but are not limited to, the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), to contribute to the understanding of hazards and risks, and development of scientific innovation in DRR.

Local governments are mandated to mainstream DRR and CCA in their local Comprehensive Land Use Plan (CLUP) and Comprehensive Development Plan (CDP). It is intended that these plans use vulnerability analysis and assessment within an integrated DRR and CCA framework \(^19,20,21\). Further to this, Health Emergency Preparedness and Response and Recovery Plans at a regional and local government level contain natural hazard assessments for their corresponding areas \(^21\). These hazard assessments provide potential sources for contributing to a detailed and integrated all-hazard assessment for the nation.

Examples of recent innovations in hazard mapping and assessment showcased during the PNHRS Week Celebration include the Nationwide Operational Assessment of Hazards, known as ‘Project NOAH’ and ‘FaultFinder’. Both of these web-based applications providing information on various hazards in the country, including meteorological and climatologically hazards, as well as major fault systems and earthquake risk mapping. Using a layered approach to mapping hazards, Project NOAH, allows users to select or search for a location and provides weather updates, data on rainfall and river inundation, as well as real-time information on rain, weather and tides. The web-GIS tool provides hazard maps for floods, landslides and storm surge. It provides updates on flood reports, information on jurisdictions and critical infrastructure, as well as an impact assessment in the event of a hazard (available at: http://noah.dost.gov.ph) \(^22\). FaultFinder maps active fault systems, and allows users to search active fault systems of interest using GPS location on their mobile device, by
science and technology showcased at the conference include the web-base hazard mapping applications ‘Project NOAH’ and ‘FaultFinder’. Other notable innovations include ‘Surveillance in Post Extreme Emergencies and Disasters’ (SPEED) which monitors potential outbreaks through a syndromic reporting system. Three areas noted for further development in DRR science and technology included: integrated national hazard assessment, strengthened collaboration, and improved documentation. Finally, the event saw the proposal to develop the Philippines into a global hub for DRR. The combination of the risk profile of the Philippines, established national structures and experience in DRR, as well as scientific and technological innovation in this field are potential factors that could position the Philippines as a future global leader in DRR. The purpose of this article is to formally document the key messages of the DRR-related events of the PNHRS Week Celebration.

Funding Statement

The Australian Department of Education and Training, by virtue of the Endeavour Postgraduate Scholarship, has provided Nicola Banwell, PhD Candidate of the Centre for Environment and Population Health, Griffith University, with financial support to conduct research through the Health Emergency Management Bureau of the Philippine Department of Health as part of her PhD thesis. Nicola is a visiting PhD student at the Philippine Department of Health, one of the core agencies of the Philippine National Health Research System. The Department of Education and Training had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. Authors from the PCHRD involved in organising the 10th annual PNHRS Week event assisted in the editing of this manuscript.

Introduction

The 10th annual Philippine National Health Research System (PNHRS) Week Celebration, from the 8th to 12th August 2016 in Puerto Princesa, Palawan, Philippines, brought together health researchers, policy makers and practitioners from across the Philippines. The conference theme Research and Innovation for Health and the Environment aimed to facilitate smoother exchange of health-related research among key stakeholders via ten pre-conference events, seven parallel sessions, and two plenary sessions. This year’s conference saw an unprecedented focus on Disaster Risk Reduction (DRR). The purpose of this publication is to formally document and communicate the key messages that emerged from the conference.

The 10th PNHRS Week Celebration placed the Sendai Framework for Disaster Risk Reduction (Sendai Framework) at the front and centre of its agenda, highlighting the growing recognition among researchers and policy makers of the need to bolster research in this area within the Philippines. The key DRR-focused events included the Pre-forum workshop on Framework for Disaster Research in Health, the parallel session National Health Research Program on Disaster Risk Reduction and the plenary session on The Philippines as a Research Hub on Global Health Innovations to Deal with Climate Change and Natural Disasters. These events highlighted key strengths and challenges of DRR research in the Philippines within the broader context of positioning the Philippines as a global hub for research and innovation in DRR.

The year 2015 has been noted as a historic year in international policy, with the finalisation of three landmark United Nations agreements. These are:

- The **Sendai Framework** that focuses on reducing disaster risks and losses in terms of lives, livelihoods and health.\(^1\)^\(^,\)^\(^2\)\(^,\) It was adopted in Sendai, Japan in March 2015 by 187 member states and endorsed by the UN General Assembly in June 2015.\(^3\)\(^,\)

- The **Sustainable Development Goals** (SDGs), which followed on from the Millennium Development Goals, and saw the significant positioning of health within a specific health goal with notable links to other goals of the SDGs.\(^4\) The SDGs were agreed in New York, USA by 193 countries.\(^5\)

- The **Paris Agreement on Climate Change** was finalized and agreed upon by 195 countries in December at the Paris Climate Conference (CoP21).\(^6\)

Further to these agreements, the Sendai Framework was followed by the UNISDR Science and Technology Conference on the Implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030 in January 2016 which included in its recommendations the ‘Need for formal “national DRR science-policy councils/platforms” or a form of national focal points for science to support disaster risk reduction and management plans identified’.\(^7\) A second conference on the implementation of the health aspects of the Sendai Framework for Disaster Risk Reduction 2015-2030 in March 2016 lead to the Bangkok Principles which aim to strengthen health implementation of DRR.\(^8\) Additionally, the landmark paper of the 2015 Lancet Commission on Health and Climate Change, called for health to play a larger role in tackling climate change, viewing climate change as an opportunity and necessary area of strengthened action for the health sector in coming decades.\(^9\)
name of location, and by browsing a detailed map view (available at: http://faultfinder.phivolcs.dost.gov.ph) \(^2\). These projects aim to advance scientific research and risk communication.

A health-based technological innovation cited by the Department of Health at the PNHRS Week Celebration was ‘Surveillance in Post Extreme Emergencies and Disasters’ (SPEED). Developed through a collaboration between the Philippines Department of Health and the WHO Philippines, SPEED uses web-based software to assist in gathering data relating to communicable and non-communicable diseases and conditions in extreme emergencies and disasters \(^2\). SPEED gathers syndromic information from health facilities such as Evacuation Centers and Barangay Health Stations or Rural Health Units, and initial diagnoses from hospitals and private clinics \(^2\). Data can be entered via manual encoding, SMS, or online. SPEED enables the monitoring of trends and early detection of disease outbreaks with the aim of providing timely and appropriate health response to minimise morbidity and mortality in an emergency or disaster \(^2\).

Challenges in collaboration on DRR research in health was a key challenge noted by PNHRS conference participants. A key barrier to collaboration, which was noted by participants during the event, was the lack of awareness and documentation of DRR research and activities. Further to this, it was observed that there was limited representation of other government sectors, UN agencies, private sector and NGOs present at the event. Strengthened documentation of DRR activities, as well as involvement of these stakeholders in relevant future events will help to promote the establishment of the Philippines as a hub for DRR and build full cross-sectoral and cross-stakeholder engagement in the initiative.

Barriers to documentation of DRR research, policies and activities highlighted during the PNHRS Week Celebration include: lack of prioritisation of DRR research and documentation, as well as a lack of system and capacity for documentation. Prioritisation of DRR research is particularly absent in the context of health-related research, with the current National Unified Health Research Agenda for 2011 to 2016 making no direct mention of disaster-related research in health \(^2\). While DRR research in health was acknowledged by panelists to be occurring, this research is happening on a limited scale, and is not included in existing national health research databases.

Two national registries for health-related research were promoted at the PNHRS Week Celebration, including the Health Research and Development Information Network (HERDIN) and the Philippine Health Research Registry. A recent search of these databases reveals limited documentation of DRR research in health and for those that were documented there was limited availability of related publications and outcome documents. At this point there exists no central system for documenting disaster-specific research. Key messages from the DRR sessions at the PNHRS Week Celebration included a need to prioritise and document DRR research if the country which could be developed as an output from possible global hub for DRR.

The conference participants considered that it would be beneficial to strengthen the documentation of DRR research and strategies to build the credibility and evidence base for the Philippines as an international exemplar for DRR and disaster risk management (DRM). To address the challenges in documentation, it would be helpful to consider the need for:

- capacity development with wider engagement through research mentoring;
- a system for documentation in each science and technology sector facilitating a centrally held inventory of DRR research across sectors and agencies;
- the improvement of capacity for peer-reviewed publication;
- improved library facilities for accessing peer review and grey literature resources;
- a facilitated rapid ethical clearance processes and the possible establishment of pre-disaster guidelines for research to be undertaken at the time of a disaster and in its aftermath.

**Proposal for the Philippines developing a Global Hub for DRR**

Promotion of the Philippines as a global hub for DRR research and innovation to support the implementation of the Sendai Framework has the potential to strengthen DRR investment in the country. The establishment of relevant laws, structures, and technical capability demonstrates the importance of, and existing commitment to, DRR in the Philippines. These factors lend themselves well to this development of the Philippines as a global hub for DRR and DRM.

Experts and policy makers whom attended the PNHRS event frequently referred to the Philippines as a ‘laboratory’ of disasters in Asia. Panelists at the PNHRS identified the importance of climate change and the role of the health and the wider scientific community in developing the scientific and technological capacity of the Philippines in DRR. Within this context, panelists recognised not only the extensive risk profile of the country, but also the significant knowledge and experience developed in DRR and DRM through its established DRR structures.

The concept of developing a national focus in science and technology in the Philippines started more than two years ago as a key outcome of the partnership between the PCHRD and COHRED (the Council on Health Research for Development,
accessible via this link: http://www.cohred.org/). Through this partnership the first Global Forum for Research and Innovation for Health in Manila in August 2015, “Forum 2015”, was hosted jointly by COHRED, PCHRD, DOH and DOST 26,27. The ‘hub’ concept intends to create a focus for national development, particularly through inter-departmental and inter-sectoral action, as well as international collaboration 29. Developing a ‘hub’ also aims to optimize the socio-economic impact of investments in science and technology.

Initial interest in the Philippines of becoming a leader in shaping the global research agenda in health and science more broadly was stated at Forum 2015. The event focused on how research and innovation can improve food security and nutrition, health in megacities and, most importantly, DRR. The DRR events that took place during Forum 2015, showcased examples in DRR from several nations, including the experience of the Philippines in strengthening and mobilizing local government units and communities for DRR 27. In the period following Forum 2015, COHRED and PCHRD outlined the field of concentration more sharply in a first concept paper prepared for DOST and DOH: the interface between science and innovation and the impact of disasters – or DRR – with health as a key outcome measure 30. This then became the basis for further internal and external consultations and for making this the focus of the 10th PNHRS Anniversary meeting in Palawan.

At the recent 10th Philippine National Health Research System (PNHRS) Week Celebration, the rationale for developing the Philippines as a hub for DRR was presented and well supported by the panelists from the PNHRS, the Department of Science and Technology, Department of Health and key national and international academic and private sector stakeholders present. During the plenary session, key stakeholders in DRR and health and the wider sciences and private sector demonstrated widespread support for the push to develop the Philippines as a global hub for innovations to deal with climate change and natural disasters, using an all hazard approach. Panelists in the plenary placed health as a central contributor to DRR, particularly recognizing that ‘zero casualty is not zero damage to health’ 29, and the need to reduce hazard exposure and vulnerability, as well as increase coping capacity within the context of health innovations for climate change and disasters 29. Panelists made note of the established structures and human resources that are already committed toward DRR in the Philippines, as well as the desire to share the experiences and expertise of the Philippines in addressing disaster risks 30. With the Sendai Framework providing a method to build research activities and outputs in order to enhance DRR capabilities, the Philippines could position itself as a global hub on DRR 31. However, there is a clear deficit in documentation and publication of these experiences and expertise, which needs to be addressed 32. Panelists also showcased the growing engagement of the private sector in strengthening DRR and clear support for developing the Philippines as a hub for DRR 33. Placing the Philippines at the centre of the converging points on health and the wider sciences addressing sustainable development, DRR and Climate Change Adaptation would be beneficial 34.

The positioning of the Philippines as a global hub could require significant financial investment, however, this has the potential to provide return on investment in DRR 35. An important reference was made to the triple dividend of DRR investment 36, where:

- the single dividend represents an approach that saves lives;
- the double dividend represents an approach that builds social and economic protection of livelihoods and assets including infrastructure and essential services; and
- the triple dividend represents economic co-benefits as a spinoff of technological innovation in DRR leading to a source of economic development for the country.

Overwhelming support by key political stakeholders was demonstrated for developing the Philippines into a global hub. This was echoed in the strong rationales presented by panelists in the DRR-related events, as well as by the attendees of the conference. The panelists of the DRR-related sessions clearly presented compelling reasons why the Philippines is well-positioned to become the global hub for DRR. These reasons include the disaster risk profile of the Philippines, experience in DRR and established structures necessary to support the initiative.

**Conclusion**

As a consequence of its disaster incidence, especially with regards to the frequency and intensity of climate-related extreme events, the Philippines is widely recognised as one of the most at-risk countries in the world, with a developed strength and experience in DRR. This conference demonstrated the emergence of commitment towards using these experiences to strengthen DRR at Barangay, local, regional and national levels. The equal commitment demonstrated towards sharing these outputs with other at-risk countries globally is the driving force behind developing a global hub in the Philippines. The event also highlighted health research as a pivotal area for development in strengthening DRR in the Philippines towards the development of a global hub.
The commitment to the hub was announced at the 10th Philippine National Health Research System Week Celebration. Continuing work to determine what this might mean and how this concept might develop, particularly in the context of science and technology for health in DRR, will be undertaken prior to the presentation at the Global Platform for Disaster Risk Reduction to be held in May 2017 in Cancun, Mexico on 22-26 May. The Global Platform is the premiere international forum dedicated to the international DRR agenda and the 2017 Global Platform will be the first opportunity for initial assessments of the progress towards the Sendai Framework (The Global Platform website can be accessed via this link: http://www.unisdr.org/conferences/2017/globalplatform).

**Competing Interests**

The authors would like to make it known that Virginia Murray is an editor on the Review Board for PLOS Currents: Disasters.

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**References**


29. Egawa, S. (2016). Presentation; Presented Thursday August 11th, Plenary Session 2, 10th PNHRS Week Celebration, Palawan, Philippines
34. Law, R. (2016b). Presentation; Philippines as a hub for DRR and CCA; Presented Thursday August 11th, Plenary Session 2, 10th PNHRS Week Celebration, Palawan, Philippines.
## Appendix 12: Summary of research priorities in CCAH policies and plans in the Philippines identified through the policy analysis

Table 1. Framing of research in CCAH policy in the Philippines based on the policy analysis

<table>
<thead>
<tr>
<th>Policy</th>
<th>How research is framed in the policy</th>
<th>Priority areas and actions in climate change and health research</th>
</tr>
</thead>
</table>
| **Philippine Strategy on Climate Change Adaptation: Health Sector**     |  • Research is considered an important part of policy and health system development and included under one of the four Pillars of the Strategy, Pillar 3 “Service delivery”.  
  • Recognises the importance of evidence-based climate change and health actions.  
  • Notes a gap in climate change and health knowledge and research.       |  • Operational and impact research to be carried out by the DPCB  
  • Recommends the DPCB undertake multi-disciplinary studies to take into account mediating effects across sectors.  
  • Recommends research focuses on: Vulnerability and adaptation capacity of the community, Health Impacts Assessment, geographical research using GIS overlay, operations research, impact studies.  
  • Highlights the NUHRA as a pathway for prioritising climate change and health research. |
| **National Policy on Climate Change Adaptation for the Health Sector**  |  • Includes evidence-based CCA as a guiding principle for the policy and as such identifies research as important for ensuring this.  
  • Includes research under “Health Promotion, Research, Surveillance and Monitoring”, one of the four key strategies of the policy. |  • Prioritises evidence-based decision-making.  
  • Research emphasis on research illustrating climate change and adverse health impacts.  
  • Notes the importance of surveillance and information management systems, as well as monitoring and evaluation. |
<table>
<thead>
<tr>
<th>Operational Guidelines of Administrative Order No. 2012-0005, “National Policy on Climate Change Adaptation for the Health Sector” (DOH, 2012a)</th>
<th>• Provides priority strategies for research in climate change and health.</th>
<th>• Inclusion of climate change in DOH research agenda. Research needed on: vulnerability and capability assessment, baseline surveys, health impact studies, cost-benefit analysis, impact on health infrastructure. Calls for partnership between government and academia on research.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014-2016 National Climate Change Adaptation in Health Strategic Plan (DOH, 2013a)</td>
<td>• Key goals for the strategic plan:</td>
<td>Integration of climate change and health research into DOH research agenda (Timeframe: 2014). Complete three research studies and disseminate results (2015 and 2016)</td>
</tr>
<tr>
<td></td>
<td>• Analyses key strengths and gaps in climate change and health research at that time.</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix 13: Analysis of ‘resilience’ in DRR and CCA policies in the Philippines

Table 1. Uses of resilience in national DRR and CCA policy in the Philippines based on the policy analysis

<table>
<thead>
<tr>
<th>Policy</th>
<th>Key statement from the policy</th>
<th>Use</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>National climate change policy</strong></td>
<td></td>
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<tr>
<td>Climate Change Act (Government of the</td>
<td>“As a party to the Hyogo Framework for Action, the State likewise adopts the strategic goals in order to build national and local resilience to climate change-related disasters.” (Government of the Philippines, 2009, p.2)</td>
<td>No further use of the term.</td>
<td>No definition provided.</td>
</tr>
<tr>
<td>Philippines, 2009)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCCAP (Climate Change Commission, 2011)</td>
<td>Climate change action plan aims to: “enhances adaptive capacity and resilience of communities and natural ecosystems to climate change.” P.5</td>
<td>Used in the ultimate outcomes of the priority relating directly to health. Immediate outcomes of this include:</td>
<td>No definition provided.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Joint implementation of DRR and CCA in all sectors</td>
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<tr>
<td></td>
<td></td>
<td>• Health system responsive to climate change</td>
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<td><strong>National DRR policy</strong></td>
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<td>-------------------------</td>
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<tr>
<td><strong>DRRM Act</strong> (Government of the Philippines, 2010)</td>
<td>Incorporated in the first statement of the act. “Uphold the people’s constitutional rights to life and property by addressing the root causes of vulnerabilities to disasters, strengthening the country’s institutional capacity for disaster risk reduction and management and building the resilience of local communities to disasters including climate change impacts” (Government of the Philippines, 2010, p. 1)</td>
<td>States that the NDRRMP should aim to build the disaster resilience of communities. Acknowledges the importance of institutionalising the budget and structures for DRRM to enhance resilience. Names the responsibility of the NDRRMC in building resilience.</td>
<td>“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.” (Government of the Philippines, 2010, p. 9) (National Disaster Coordinating Council, 2010, p. 7)</td>
</tr>
<tr>
<td><strong>NDRRMF</strong> (Department of National Defense, 2011) Vision: “Safer, adaptive and disaster-resilient Filipino communities toward sustainable development” (Department of National Defense, 2011, p. 17)</td>
<td>Resilience is used in the vision of the framework and when discussing the HFA. Health is recognised as a cross-cutting concern but no specific mention of resilience in health.</td>
<td>‘Disaster-resilient’: “The risk reduction efforts have been successful and made the people stronger…increasing their ability to bounce back after a disaster. We want to instill the culture of safety by increasing people’s capacity to bounce back and decrease disaster losses and impact.” (Department of National Defense, 2011, p. 17)</td>
<td></td>
</tr>
<tr>
<td><strong>NDRRMP</strong> (Government of the Philippines, 2010) Has the same vision as the NDRRMF with resilience as a central concept in the vision, (“disaster-resilient Filipino communities” (Government of the Philippines, 2010, p. 2). Acknowledges how each phase of</td>
<td>Discusses the role of institutionalising DRRM as important for building resilience and as a highlight of the plan. Outlines key action for enhancing resilience of communities (including: enhancing knowledge, skills,</td>
<td>No definition provided.</td>
<td></td>
</tr>
<tr>
<td>National Disaster Response Plan (NDRRMC, 2014)</td>
<td>Acknowledges the role of disaster recovery in enhancing resilience, and the importance of “the ability of our responders and rescuers to effectively engage all affected sectors during disaster operations” to build resilience (NDRRMC, 2014, pp. Chapter 1-6).</td>
<td>Resilience is commonly used in relation to specific functions in disaster response, including resilient communication systems, resilient processes for disaster recovery, and community resilience to psychosocial impacts of disasters.</td>
<td>No definition provided.</td>
</tr>
<tr>
<td>National Disaster Preparedness Plan (NDRRMC, 2015)</td>
<td>Resilience is a key feature DRR and DRM, where “impact and outcomes must demonstrate knowledge, skills, behaviours, and attitude of preparedness that are indicative of resilience before a hazard or threat occurs; when the hazard is emerging; when the impact of hazard is imminent; when disaster occurs; and immediate post-disaster where loss and damage are apparent.” (NDRRMC, 2015, p. 2).</td>
<td>Recognises the need to enhance community-based resilience. Discusses the role of disaster preparedness in building resilience (including: household preparedness, social capital). Calls for resilience of critical infrastructure including health facilities. Resilience is referred to several goals of the NDPP (those related directly to health include: capacity building, and DRRM localisation)</td>
<td>“Ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.” (NDRRMC, 2015, p. iv).</td>
</tr>
</tbody>
</table>
Table 2. Uses of resilience in DRRH and CCAH policy in the Philippines based on the policy analysis

<table>
<thead>
<tr>
<th>Policy</th>
<th>Key statement from the policy</th>
<th>Use</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Climate change and health policy</strong></td>
<td></td>
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</tr>
<tr>
<td>Philippine Strategy on Climate Change Adaptation: Health Sector (DOH, 2010d)</td>
<td>Building community resilience is one of the six activities under the first (of five) pillars for CCA: “The issue of community resilience should also be considered in order that we will be able to reduce vulnerabilities.” (DOH, 2010d, p. 16)</td>
<td>Resilience is not a central feature of the policy, however is used when discussing the resilience of health infrastructure to climate change, and community resilience.</td>
<td>No definition provided.</td>
</tr>
<tr>
<td>Administrative Order No. 2012-0005, National Policy on Climate Change Adaptation for the Health Sector (DOH, 2012b)</td>
<td>Resilience referred to in the definition of CCAH: “Climate Change Adaptation for Health (CCAH) refers to national and local health responses to improve community and health system resilience to adapt to the public health challenges and health risks posed by climate change.” (DOH, 2012b, p. 2).</td>
<td>Acknowledges the need to develop specific strategies for building community resilience (as one of the six activities under the first (of five) pillars for CCA).</td>
<td>No definition provided.</td>
</tr>
<tr>
<td>2014-2016 National Climate Change Adaptation in Health Strategic Plan (DOH, 2013a)</td>
<td>Vision of the strategic plan is “A climate-risk resilient Philippines with healthy, safe and self-reliant communities” (DOH, 2013a, p. 35).</td>
<td>Policy direction of the strategic plan is to pursue CCA. CCAH focuses on the resilience of the health care delivery system, and of the community (DOH, 2013a, p. 33).</td>
<td>No definition provided.</td>
</tr>
<tr>
<td><strong>DRRH policy</strong></td>
<td></td>
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<tr>
<td>ao168s.2004 National Policy on Health</td>
<td>No mention of resilience.</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Source</td>
<td>Description</td>
<td>Other Infrastructure Resilience</td>
<td>Definition</td>
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<td>--------</td>
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<tr>
<td>Emergencies and Disasters (DOH, 2004)</td>
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<tr>
<td>HEMB DRRM in Health Strategic Plan 2014-2016 (HEMB, 2014)</td>
<td>Infrastructure resilience, mainly hospitals: “Hospital resiliency must also be built up to withstand mega disasters (Objective 4). This will first necessitate regular assessment of the structural, non-structural and functional components of hospitals (Key Result Area 4.1) and any weakness / gap discovered strengthened (Key Result Area 4.2).” (HEMB, 2014, p. 37)</td>
<td>Other infrastructure resilience includes: warehouses for prepositioning of medical supplies and communication infrastructure.</td>
<td>No definition provided.</td>
</tr>
<tr>
<td>Integrated Policy on DRRM in health (draft) (DOH, 2016c)</td>
<td>Included in the policy mandate: “Build the health system resilience of local communities to disasters, including climate change impacts” (DOH, 2016c, p. 2)</td>
<td>Outlines three goals to adhere to the mandate that is set forth by the DRRM Act, but gives no more specific mention about resilience.</td>
<td>Uses same definition as the DRRM Act (DOH, 2016c, p. 5)</td>
</tr>
<tr>
<td>HEMB DRRM in Health Strategic Plan 2017-2022 (draft) (HEMB, 2016a)</td>
<td>The strategic plan aims “to build a coherent disaster-resilient health system at all levels of administration” (HEMB, 2016a, p. 1). Resilience is also central to the DOH DRRH mission “to support the community’s disaster resilience building” (HEMB, 2016a, p. 2). Five specific objectives are outlined for how this will be attained.</td>
<td>Community and LGU resilience is a new central focus of the DOH approach to DRRM (under strategic objective 2), in keeping with the NDRRMF and DRRM Act. Community empowerment and resilience is a key principle of the strategic plan.</td>
<td>No definition provided.</td>
</tr>
</tbody>
</table>
### APPENDIX 14: LINKS BETWEEN DRR AND CCA POLICY IN THE PHILIPPINES

Table 1. Summary of links between DRR and CCA in Philippine national CCA policies based on the policy analysis

<table>
<thead>
<tr>
<th>Policy level</th>
<th>Y/N</th>
<th>How is the link stated</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Change Act (Government of</td>
<td>Y</td>
<td>• Recognises the relationship between DRR and CCA</td>
<td>“Climate change and DRR are closely interrelated and effective DRR will enhance CCA capacity, the State shall integrate DRR into climate change programs and initiatives.” (Government of the Philippines, 2009, p. 2)</td>
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<td>the Philippines, 2009)</td>
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<td>• Commits to integrating DRR into climate change action</td>
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<td>• Chair of NDRRMC member of Climate Change Commission Advisory Board</td>
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<td>• Climate Change Commission to ensure synergy with DRR when mainstreaming climate change</td>
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<td>in national, sector and local development plans</td>
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<td></td>
<td></td>
<td>• Calls for a close partnership between the Climate Change Commission and NDRRMC</td>
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<tr>
<td>NFSCC (Climate Change Commission,</td>
<td>Y</td>
<td>• Recognises disasters as a big part of climate change risk</td>
<td>“In the overall effort of combating the effects of climate change, disaster risk reduction (DRR) shall be the first line of defense.” (Climate Change Commission, 2010, p. 32)</td>
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<td>2010)</td>
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<td>• DRR is named as one of the seven Key Result Areas of the NFSCC, which aims to</td>
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<td></td>
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<td>reduce disaster risks from climate change.</td>
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<td>• Climate-Responsive Health Sector 1 of 7 Key Result Areas. Inc.: assessment of</td>
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<td>vulnerability, increased responsiveness of the health sector, and surveillance and</td>
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<td></td>
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<td>response to climate-sensitive disease.</td>
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<td></td>
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<td>• Calls for strengthening of early warning systems (particularly for typhoons, floods,</td>
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<td></td>
<td></td>
<td>and landslides); local level capacity building for planning, preparedness and</td>
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<td></td>
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<td>response; community vulnerability assessment.</td>
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<tr>
<td>NCCAP (Climate Change Commission,</td>
<td>Y</td>
<td>• Names disasters as part of the Human Security priority (one of seven overarching</td>
<td>“The objective of the human security agenda is to reduce the risks of women and men to climate change and disasters.” (Climate Change Commission, 2011, p. 6)</td>
</tr>
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<td>2011)</td>
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<td>priorities of the plan), one of the objectives of which is to implement DRR and</td>
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<td></td>
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<td>CCA in all sectors at all levels.</td>
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<td></td>
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<td>• Recognises climate change influence on disaster risk.</td>
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<td></td>
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<td>• Calls for capacity building in DRR and CCA.</td>
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<td></td>
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<td>• Numerous outcomes of the seven priorities are related to DRR.</td>
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</tbody>
</table>
Table 2. Summary of links between DRR and CCA in Philippine national DRR policies based on the policy analysis

<table>
<thead>
<tr>
<th>Policy level</th>
<th>Y/N</th>
<th>How is the link stated</th>
<th>Example quotes</th>
</tr>
</thead>
</table>
| DRRM Act (Government of the Philippines, 2010) | Y | • Recognises climate change as a contributor to disaster risk  
• Calls for mainstreaming DRR and climate change initiatives in development and key sectors (names health)  
• Names Executive Director of the Climate Change Commission a member of the NDRRMC | “Uphold the people’s constitutional rights to life and property by addressing the root causes of vulnerabilities to disasters, strengthening the country’s institutional capacity for disaster risk reduction and management and building the resilience of local communities to disasters including climate change impacts” (Government of the Philippines, 2010, p. 2) |
| Implementing Rules and Regulations of the DRRM Act (National Disaster Coordinating Council, 2010) | Y | • As above in the DRRM Act  
• Designates the NDRRMC and Climate Change Commission with the responsibility of developing a framework for CCA and DRR  
• Local DRRM Councils are responsible for integration of DRR and CCA into local development plans  
• Local DRRM Officer is responsible for consolidating all local risk information, including climate change risk | “In coordination with the Climate Change Commission, formulate and implement a framework for climate change adaptation and disaster risk reduction and management, from which all policies, programs, and projects shall be based” (National Disaster Coordinating Council, 2010, p. 10) |
| NDRRMF (Department of National Defense, 2011) | Y | • Includes CCA in the Vision, and convergence of DRR and CCA in the definitions related to the vision  
• States that DRRM is linked to CCA  
• Recognises DRR and CCA as cross-cutting themes of development  
• Lists key relevant DRR and CCA targets from the development plan  
• Provides detail of points relevant to DRR from the Climate Vision: “Safer, adaptive, and disaster-resilient Filipino communities towards sustainable development” and “Emphasis are on risk reduction and adaptation to show the convergence of DRR and CCA and
| NDRRMP (Government of the Philippines, 2010) | Y | Three of the six disaster prevention priorities refer to CCA:  
  o mainstream DRRM and CCA in national, sectoral, regional and local development policies, plans and budget  
  o DRRM and CCA-sensitive environmental management  
  o Strengthening community-based DRRM and CCA assessment, mapping, analysis and monitoring  
  One of five disaster preparedness priorities refers to CCA:  
  o Increased DRRM and CCA capacity on a local level  
  One of five disaster recovery priorities refer to climate change:  
  o One of the Climate change-resilient infrastructure one of the rehabilitation and recovery outcomes  
  NDRRMP was aligned with the NCCAP, including timelines  
  Calls for the development of a Joint Work Plan for DRR and CCA  
  Calls for the development of joint advocacy materials  
  Development of tools to analyse hazard and vulnerability are an important part of achieving mainstreaming | Recognises “the importance of mainstreaming DRRM and CCA in the development processes such as policy formulation, socio-economic development planning, budgeting and governance, particularly in the area of environment, agriculture, water, energy, health, education, poverty reduction, land-use and urban planning and public infrastructure and housing, among others.” (Government of the Philippines, 2010, p. 5) |
| National Disaster Response Plan (NDRRMC, 2014). | N | N/A | N/A |
| National Disaster Preparedness Plan (NDRRMC, 2015). | Y | CCA included in one of the overarching objectives  
  Makes reference to the Climate Change Act  
  Calls for the inclusion of climate change scenarios in risk assessment  
  Names joint DRR and CCA responsibilities in preparedness (e.g. standardization of policies, and capacity building). | “Increased Disaster Risk Reduction and Management (DRRM) and Climate Change Adaptation (CCA) capacity of Local DRRM Councils, Offices and Operation Centers at all levels” (NDRRMC, 2015, p. 1) |
<table>
<thead>
<tr>
<th>Policy level</th>
<th>Y/N</th>
<th>How is the link stated</th>
<th>Example quotes</th>
</tr>
</thead>
</table>
| **Philippine Strategy on Climate Change Adaptation: Health Sector (DOH, 2010d)** | Y | ● Recognises disasters as part of climate change risk  
● Names DRR initiatives as part of CCA  
● Calls for specific DRR action as part of CCA: disaster preparedness capacity building at the local level; revision of the hospital safe from disasters programme to include climate change. | “Department of Health is committed to:…Strengthen public health systems and disaster preparedness and response activities, particularly surveillance and monitoring systems” (DOH, 2010d, p. 2) |
| **Administrative Order No. 2012-0005, National Policy on Climate Change Adaptation for the Health Sector (DOH, 2012b)** | Y | ● Makes reference to the DRRM Act  
● Of the four strategic components of the policy, DRRH is mentioned in one of the four strategies relating to Policy, Plans, and Partnerships. | “Ensure effective and efficient climate change intervention – including preparedness, and response to health emergencies” (DOH, 2012b, p. 4) |
| **Operational Guidelines of Administrative Order No. 2012-0005, “National Policy on Climate Change Adaptation for the Health Sector” (DOH, 2012a)** | Y | ● Does not mention health emergency preparedness or DRRM Act as per above in the ao.2012-0005  
● Designates responsibilities to HEMB in roles and responsibilities, including joint advocacy for DRRH and CCAH; enhancing capacity of the health sector to respond to disasters and reduce risks; assist with the promotion of Safe Hospitals campaign in hospitals; implementation of early warning systems during disasters; monitoring hazards; institutionalisation of DRRM at the local level; and coordination and collaboration with partners in DRR and CCA. | No key quotes relating to DRR or linkage. |
| **2014-2016 National Climate Change Adaptation in Health Strategic Plan (DOH, 2013a)** | Y | ● Disasters named as the key climate change challenge faced in the Philippines  
● Makes reference to the DRRM Act  
● DRRH and HEMB named as strengths of the DOH in CCAH under the one strategic component related to DRR outlined in | Under the first objective of the strategic plan to increase health care delivery system adaptive capacity: “Strategy 1 calls for a systematic review of existing |
| Capacity building for CCAH specifically includes DRR training of the health workforce provided by HEMB |
| Highlights the need to address continuity of healthcare in disaster-prone areas |
| Acknowledges existing capacity building efforts in DRR including: Basic Life Support and first aid; response cluster training; SPEED; preparedness and response training; etc. |
| Acknowledges existing efforts on disaster resilience of hospital infrastructure. |
| Under the first objective of the strategic plan to increase health care delivery system adaptive capacity, the first strategy makes direct reference to disasters (see quote in adjacent column). |
| Outlines the roles of HEMB in CCA (exactly the same as those in the operational guidelines above). |
| Uses local level implementation of disaster preparedness and response as an indicator of CCAH. |

program policies and guidelines and identify specific components that need to be modified in order to become climate change-responsive, be it during disasters or emergencies or in anticipation of extreme events that may occur especially in high risk or hazard-prone localities” (DOH, 2013a, p. 36)
Table 4. Summary of links between DRR and CCA in Philippine DRRH policies based on the policy analysis

<table>
<thead>
<tr>
<th>Policy level</th>
<th>Y/N</th>
<th>How is the link stated</th>
<th>Example quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ao168s.2004 National Policy on Health Emergencies and Disasters (DOH, 2004)</td>
<td>N</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>HEMB DRRM in Health Strategic Plan 2014-2016 (HEMB, 2014)</td>
<td>N</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Integrated Policy on DRRM in health (draft) (DOH, 2016c)</td>
<td>Y</td>
<td>● Recognises climate change in the mandate of the DOH on DRR (see quote in adjacent column). ● Designates that all provinces, cities, municipalities and barangays should ensure that their DRRM for Health Plan is integrated into the Local Climate Change Adaptation Plan</td>
<td>“the DOH is hereby mandated to…Build the health system resilience of local communities to disasters, including climate change impacts” (DOH, 2016c, p. 2)</td>
</tr>
<tr>
<td>HEMB DRRM in Health Strategic Plan 2017-2022 (draft) (HEMB, 2016a)</td>
<td>Y</td>
<td>● Recognises that climate change changes the frequency and intensity of disasters</td>
<td>“Recent developments such as climate change, growing social unrest, and rapid urbanization are increasing the exposure of populations to, the frequency and magnitude of disasters” (HEMB, 2016a, p. 17)</td>
</tr>
</tbody>
</table>


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Dwirahmadi, F. (2016). Disaster risk reduction and climate change adaptation partnership through collaborative governance to build urban community resilience to flood risks in Jakarta. (Doctor of Philosophy), Griffith University, Brisbane, Australia. Retrieved from https://research-repository.griffith.edu.au/handle/10072/367157


323


Manga, L., Bagayoko, M., Meredith, T., & Neira, M. (2010). *Overview of health considerations within National Adaptation Programmes of Action for climate change in least developed countries and small island states*. Retrieved from Geneva:


333


Trenberth, K. E., Fasullo, J. T., & Shepherd, T. G. (2015). Attribution of climate extreme events. *Nature Climate Change, 5*(8), 725. doi:10.1038/nclimate2657


UNFCCC. (2015a). *Conference of the Parties, Twenty First Session: Adoption of the Paris Agreement.*


