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Using logic models to enhance the methodological quality of primary health-care interventions: guidance from an intervention to promote nutrition care by general practitioners and practice nurses

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The methodological designs underpinning many primary health-care interventions are not rigorous. Logic models can be used to support intervention planning, implementation and evaluation in the primary health-care setting. Logic models provide a systematic and visual way of facilitating shared understanding of the rationale for the intervention, the planned activities, expected outcomes, evaluation strategy and required resources. This article provides guidance for primary health-care practitioners and researchers on the use of logic models for enhancing methodological rigour of interventions. The article outlines the recommended steps in developing a logic model using the 'NutriCare' intervention as an example. The 'NutriCare' intervention is based in the Australian primary health-care setting and promotes nutrition care by general practitioners and practice nurses. The recommended approach involves canvassing the views of all stakeholders who have valuable and informed opinions about the planned project. The following four targeted, iterative steps are recommended: (1) confirm situation, intervention aim and target population; (2) document expected outcomes and outputs of the intervention; (3) identify and describe assumptions, external factors and inputs; and (4) confirm intervention components. Over a period of 2 months, three primary health-care researchers and one health-services consultant led the collaborative development of the 'NutriCare' logic model. Primary health-care practitioners and researchers are encouraged to develop a logic model when planning interventions to maximise the methodological rigour of studies, confirm that data required to answer the question are captured and ensure that the intervention meets the project goals.

What is known about the topic?

• Logic models can be used to support intervention planning, implementation and evaluation in the primary health-care setting.

What does this paper add?

• The article outlines the recommended steps in developing a logic model, using the 'NutriCare' intervention as an example. The 'NutriCare' intervention is based in the Australian primary health-care setting and promotes nutrition care by general practitioners and practice nurses.

PY16038

Logic models for intervention planning

Additional keywords: chronic disease, general practice, intervention studies, logic model, nutritional management, nutrition therapy, primary care, research methods.

Background

Primary health-care interventions require robust methodologies to maximise the confidence of conclusions drawn from studies (Greenhalgh 2007). However, the methodological designs underpinning many primary health-care interventions are not considered rigorous (Beck *et al.* 2002; Jacobson and Gance-Cleveland 2011; Orrow *et al.* 2012; Smith *et al.* 2012). Two common reasons for suboptimal methodologies are the increasing emphasis on capacity-building initiatives to engage primary health-care practitioners with modest research expertise to participate in research (Friesen *et al.* 2014); and increasing use of multi-component, or 'complex' interventions, which requires advanced skills in methodological design and large teams (Craig *et al.* 2008). It is subsequently recognised that primary health-care practitioners and researchers would benefit from greater support to enhance the methodological design underpinning interventions.

Logic models provide a systematic and visual way of determining the planned research activities and expected outcomes of interventions (Arts and Humanities Research Council UK 2015). Logic models were initially used for program planning and evaluation (Wholey 1979), and are now increasingly recommended as a step in developing health-care interventions (Guttmacher *et al.* 2010). Although their format and scope are variable, the following six components are usually included in logic models: the situation, inputs, outputs, outcomes, assumptions and external factors (Taylor-Powell and Henert 2008). Developing a logic model when planning an intervention is useful for clarifying the logic underpinning the intervention, identifying gaps in resources and in facilitating a shared understanding of the purpose of intervention among stakeholders and team members. In addition, logic models create a visual and conceptual link between the intervention and broad program goals. After implementing an intervention, logic models provide a valuable basis for formative and summative evaluations (Arts and Humanities Research Council UK 2015). Despite evidence of logic models being used to support intervention development in public health (Joly *et al.* 2007; Das *et al.*

2014), community (Chen *et al.* 1999; Medeiros *et al.* 2005) and acute-care settings (Subirana *et al.* 2014), their utilisation in the primary health-care setting is less established (Humphreys *et al.* 2009; Hayes *et al.* 2011).

The recommended approach to developing a logic model involves seeking input and examining the views of all stakeholders who have informed opinions about the planned project (Taylor-Powell and Henert 2008). In the case of primary health-care interventions, this could involve primary health-care practitioners, researchers, patients and carers, funders, commissioning services, and industry or pharmaceutical representatives. The present article aims to provide guidance to primary health-care practitioners and researchers on the use of logic models for enhancing the methodological quality of interventions within the primary-care setting. The article outlines the steps involved in developing a logic model for the primary health-care setting by using an example of a complex intervention, the 'NutriCare' intervention. The NutriCare intervention aims to support general practitioners (GPs) and practice nurses (PNs) to provide nutrition care to patients in consultations.

Methods

Overview

A team of three primary health-care researchers and one health-services consultant led the collaborative development of the NutriCare logic model over a period of 2 months. The team had diverse research experience and utilised learning resources from the University of Wisconsin Logic Model training module (Taylor-Powell and Henert 2008), the W. K. Kellogg Foundation (W. K. Kellogg Foundation 2006) and Center for Disease Control and Prevention to guide the development process (Centers for Disease Control and Prevention 2015). The team developed the logic model in an iterative, consultative manner after a review of original research, behaviour change theories used in the field of knowledge translation, informal and formal meetings to canvass feedback from funders and commissioning groups (such as Primary Health Networks), peer researchers in dietetics, nursing and medicine, as well as focus groups with patients, GPs and PNs. Focus groups were organised through the local Primary Health Network, where 20 patient representatives and 18 health professionals provided ongoing feedback to the research team regarding the logic model.

Four targeted, iterative steps were drafted and confirmed by the team, on the basis of the premise of 'working backwards to implement forwards' (Taylor-Powell and Henert 2008), and included the following: (1) confirm situation, intervention aim and target population; (2) document expected outcomes and outputs of the intervention; (3) identify and describe assumptions, external factors and inputs; and (4) confirm intervention components.

Step 1: confirm situation, intervention aim and target population

'Situation' refers to the overall context in which a study will be implemented, as well as the key problems or issues that the study will attempt to address. The situation statement is usually placed on the left, or on the top, of the logic model to clarify the broad setting for the intervention. The aim of the intervention will determine the level of complexity required in the model, and should be aligned with the situation or context in which the intervention will occur. The aim is often placed at the top of the logic model. In many situations, more than one intervention is worthy of being conducted, and the logic model should include only the intervention aim that has been prioritised. The target population refers to the group, or type of people, that the intervention is seeking to influence. In primary health-care research, this is usually a patient population (for example, males aged over 50 years with history of hypertension), or a health professional population (for example, GPs who work in rural locations). The target population should be specified within the intervention aim.

Step 2: document expected outcomes and outputs of the intervention

Outcomes refer to the ultimate improvements that are intended to occur as a result of an intervention, and are usually placed on the right-hand side of a logic model. The term 'outcome' is often used interchangeably with 'impact'. Ideally, short-term changes in outcomes (such as increased knowledge), and medium-term (such as change in behaviour or practice) and long-term (such as change in health status) outcomes are identified (Taylor-Powell and Henert 2008). The periods of time considered to be short-, medium- and long-term will vary for different interventions, and should, therefore, be specified and appropriate for the proposed intervention. Outputs are listed in the centre of the logic model, and refer to the activities required or tasks to be undertaken to implement an intervention, as well as specifying the stakeholders that are needed to conduct and/or engage in the activities. These activities can include meetings, training, screening, recruitment, intervention delivery, data collection, analysis, interpretation and dissemination. The participants include the potential participant pool for the intervention, as well as stakeholders who facilitate implementation of the study, such as researchers and assistants, health-care practitioners, practice support staff, primary-health networks, patients and carers.

Step 3: identify and describe assumptions, external factors and inputs

Assumptions refer to the beliefs about the way the intervention is anticipated to work, and these are usually listed on the left-hand side of the logic model. Ideally, the assumptions should be based on evidence and behaviour-change theory, and can include beliefs about the situation, resources, environment or participants (Taylor-Powell and Henert 2008). The logic model should clearly articulate as many implicit assumptions about the intervention as possible. Development of the logic model provides opportunities for the intervention developers to discuss the assumptions in detail. External factors refer to the environment in which the intervention will be delivered. They are

generally outside of the control of the intervention team, but may influence the intervention outcomes. External factors are also listed on the left-hand side, and can include the political climate, health policy climate, cultural climate, media influence or changing priorities within a setting. Inputs refer to the resources required to adequately implement the intervention. The resources can include personnel, funding, materials, equipment, partnerships and technology. Inputs are regarded as a resource area that is most likely to hinder intervention implementation as anticipated. The intervention team is encouraged to continually revisit the inputs after implementation to identify gaps as they arise (Taylor-Powell and Henert 2008).

Step 4: confirm intervention components

After all sections of the logic model have been drafted, greater inspection of the intervention components is recommended. This is usually identified on the logic map as part of the outputs (W. K. Kellogg Foundation 2006). The components of a complex intervention are integral to ensuring that the outputs produce the desired outcomes of the intervention. This final step should confirm the theoretical basis underpinning the intervention components. For example, the behaviour change-technique matrix (Cane *et al.* 2012) has been successfully used in intervention studies in the Australian primary health-care setting (Mazza and Chapman 2010; McKenzie *et al.* 2010). The purpose of the matrix is to facilitate the development of theory-based interventions that have clear causal pathways between intervention components and barriers and facilitators to health-professional behaviours.

Results

The resulting logic model developed for the 'NutriCare' intervention is shown in Fig. 1 and highlights the four steps used to develop the logic model.

Step 1: confirm situation, intervention aim and target population

Situation

The primary health-care setting was identified as an ideal environment for initiatives that facilitate patients to improve their dietary behaviour (Australian Government 2013). Nearly all adults are at risk of developing a chronic disease as a result of poor dietary behaviour (Imamura *et al.* 2015), making dietary behaviour the most common modifiable risk factor for chronic disease (Lim *et al.* 2012). Practice guidelines recommend that GPs and PNs advocate about the importance of healthy eating and drinking behaviour at every appropriate opportunity when in consultations with adult patients (Royal Australian College of General Practitioners 2015). However, GPs and PNs experience many barriers to the inclusion of nutrition care in consultations, and only discuss nutrition in ~7% of all consultations (Britt *et al.* 2015). As a result, the rate that GPs and PNs discuss nutrition in consultations is considered suboptimal.

Intervention aim

The most important aim in this situation was identified as an intervention that reduces the barriers to GPs and PNs incorporating nutrition care in consultations. Achieving this aim will increase the frequency that GPs and PNs provide nutrition care to patients, which will subsequently support improved dietary behaviours of patients.

Target population

The most appropriate target population was identified as GPs and PNs across Australia. The rationale for the target population included the following: (1) 90% of Australian adults consult a GP or PN at least once per year; (2) over 60% of Australian general-practice clinics hire a PN to support their primary health-care services (Australian Practice Nurses Association, see http://www.apna.asn.au, accessed); and (3) there is recognised potential for nutrition care by GPs and PNs to improve patients' dietary behaviours (Ball *et al.* 2015).

Step 2: document expected outcomes and outputs of the intervention

Outcomes

The desired long-term outcomes were identified as improvements in the dietary behaviour of adult patients as measured by the Australian eating survey, as well as improved biomarkers of lifestyle-related chronic disease 12 months after the intervention is implemented. To facilitate the long-term outcomes, the medium-term outcome was defined as an increased frequency of providing nutrition care within consultations with adult patients 3 months after the intervention is implemented, so that more patients with dietary risk factors for chronic disease receive nutrition care when clinically appropriate. This outcome is a measure of clinical activity and is a process measure. To facilitate the medium-term outcome, short-term outcomes were defined as GPs and PNs (1) experiencing fewer barriers to nutrition care, and (2) feeling more confident and competent at incorporating nutrition care in consultations after the intervention has been implemented.

Outputs

The desired outputs of the NutriCare intervention were identified as (1) collaborative communication with stakeholders to identify potential participants for the study, (2) delivery of the intervention and (3) collection and review of data. These outputs will require participation from GPs and PNs, researchers, practice managers, support staff and primary-health networks.

Step 3: identify and describe assumptions, external factors and inputs

Assumptions

Three assumptions of the NutriCare intervention were identified and supported by behaviour-change theory and literature. The assumptions were that (1) the intervention will adequately produce the desired outcomes, (2) patients with dietary risk factors for chronic disease will be receptive to

receiving nutrition care from GPs and PNs within consultations (Hegney *et al.* 2013; Ball *et al.* 2014) and (3) the resultant nutrition care provided by GPs and PNs will achieve the overall goal of supporting the adoption of healthy dietary behaviour in adults at risk of chronic disease (Ball *et al.* 2013, 2015).

External factors

Two external factors were deemed as most relevant to the NutriCare intervention, and reflected ongoing changes to the policy and funding structure of the Australian primary health-care setting.

Inputs

The inputs of the NutriCare intervention were identified as appropriately skilled research members, sufficient funding, confirmed methodology and data-collection procedures, as well as fully developed and tested intervention components.

Step 4: confirm intervention components

The four components of the NutriCare intervention were developed using the behaviour change-technique matrix (Cane *et al.* 2012), and are outlined in Table 1. The table explains the causal link between the intervention components and anticipated outcomes. Each intervention component targets one of the following three most commonly reported barriers to GPs and PNs incorporating nutrition care in consultations: (1) low self-efficacy (Levine *et al.* 1993; Kushner 1995; Hiddink *et al.* 1997; Cass *et al.* 2014; Martin *et al.* 2014); (2) lack of nutrition knowledge (Levine *et al.* 1993; Hopper and Barker 1995; Kushner 1995; Ball *et al.* 2010; Cass *et al.* 2014; Martin *et al.* 2014); and (3) limited time in consultations (Kushner 1995; Hiddink *et al.* 1997; Ball *et al.* 2010; Wynn *et al.* 2010). For each targeted barrier, a description of the relevant behaviour domain from the behaviour change-technique matrix is outlined. The table also shows the (1) type, (2) mode and (3) content of the intervention component that will target the barrier and the mechanism of action, justifying how the component will achieve success in reducing the barrier.

Discussion

This article provides guidance on the use of logic models for enhancing the methodological quality of interventions in primary health care. Logic models can be developed for interventions targeting different levels of change (W. K. Kellogg Foundation 2006; Taylor-Powell and Henert 2008; Centers for Disease Control and Prevention 2015). For example, logic models can be developed at a ‘macro’ level to address broad programs of research, at a ‘meso’ level for studies within a broad program of research, or at a ‘micro’ level for targeted, one-off studies (Taylor-Powell and Henert 2008). The NutriCare logic model is an example of a meso-level project, because it is one study within a program of research that supports the optimal provision of nutrition care to patients with dietary risk factors for chronic disease who attend primary-care consultations. Therefore, the NutriCare intervention will

contribute to the recognised need for the primary health-care setting to support patients to have healthy lifestyle behaviours, including healthy dietary behaviours (Australian Government 2013).

The benefits and challenges of using logic models have been previously documented (Kaplan and Garrett 2005). Three benefits are particularly relevant to the primary health-care setting; namely, logic models help (1) build consensus through collaboration with a variety of stakeholders, (2) strengthen the design of interventions by clarifying underlying assumptions and addressing barriers and facilitators for implementation and 3) demonstrate how primary health-care interventions can influence health outcomes at a population level. However, the greatest challenge of developing a logic model is the time required to engage in discussions with stakeholders. This challenge is particularly relevant in primary health care, where a lack of time is inherently experienced as a barrier to intervention planning and overall research capacity (Farmer and Weston 2002). Given that the effectiveness and utility of a logic model is dependent on the engagement and discussion of stakeholders (Kaplan and Garrett 2005; Taylor-Powell and Henert 2008), it is essential that steps are taken to facilitate open communication among stakeholders in this setting.

The UK Medical Research Council recommends the use of theory in the development of multifaceted interventions (Moore *et al.* 2015). Furthermore, logic models are recommended to be developed during the planning stage of an intervention (Guttmacher *et al.* 2010). Unlike decision-analysis tools, logic models are also useful during the implementation and evaluation stages of research (Arts and Humanities Research Council UK 2015). For example, during the implementation stage of research, logic models can be used as a reminder of the aims, activities and processes of a project, and facilitate continuous improvement. The model can be used as a basis for formative evaluation, and can strengthen communication and commitment between the intervention team and stakeholders. After implementation has been completed, logic models contribute to the evaluation of the effectiveness of the intervention. The logic model can be used as a basis for summative evaluation, where performance indicators are assessed against pre-determined targets. These actions assist in strengthening the link among the intervention, recommendations and policy directives (Arts and Humanities Research Council UK 2015).

It is important to acknowledge that the benefit of using a logic model cannot be rigorously tested through implementation research because of the unique context of workplaces and variable intervention designs. The logic model for the ‘NutriCare’ intervention is one example of a logic model in use at a pre-implementation time point. The ‘NutriCare’ logic model will be amended after a pilot of the intervention occurs and again after implementation. In addition, the logic model will be used as the foundation for conducting the process and impact evaluations. The depiction of the logic model in graphic form can vary depending on the creativity and perspective of the developers (W. K. Kellogg Foundation 2006). Updating the logic model by reflecting on the progress as the intervention becomes established is an example of action learning (Casey 2007). Continually reflecting on the

logic model is important in increasing the likelihood that positive outcomes of the intervention can be sustained through translation to ongoing health-care practices.

In conclusion, logic models help enhance the methodological rigour of interventions through engagement with stakeholders. The development process of the 'NutriCare' logic model can act as a guide when planning interventions. Researchers and primary health-care professionals are encouraged to develop logic models when planning, implementing and evaluating interventions.

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Conflicts of interest

None declared.

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Table 1. Components of the NutriCare intervention

GP, general practitioner; PN, practice nurse

Component	Targeted barrier	TDF domain and description	Component of intervention	Mechanism of action
1	Low self-efficacy of GP/PN	*Beliefs about capabilities*: acceptance of the truth, reality, or validity about an ability talent or facility that a person can put to constructive use	*Type:* modelling *Mode:* desk quotes *Content:* pre-collected excerpts from GPs and PNs who feel confident in briefly providing nutrition care	The quotes will act a passive examples for the types of questions and statements that can be used to incorporate nutrition care into consultations
2	Lack of nutrition knowledge of GP/PN	*Knowledge*: awareness of the existence of something	*Type:* education *Mode:* fact sheet (electronic and paper-based) *Content:* the Australian Dietary Guidelines, including recommended servings of each food group and serving sizes	The fact sheet will increase participants' nutrition knowledge by providing the foundational nutrition information required to provide nutrition care to patients
3	Limited time of GP/PN	*Environmental context*: any circumstance of a person's situation or environment that discourages or encourages behaviour	*Type:* persuasion *Mode:* 10-min discussion with a respected peer GP/PN 'nutrition champion' *Content:* the discussion outlines the potential impact that brief nutrition care can have on patients' dietary behaviours and encourage brief advocacy statements in consultations	The discussion will use communication to induce positive feelings and stimulate action about including brief nutrition care in consultations
4	Low priority of GP/PN	*Intentions*: a conscious decision to perform a behaviour or a resolve to act in a certain way	*Type:* environmental restructuring *Mode:* on-screen prompts on patient management system *Content:* the prompt will encourage GPs/PNs to advocate about the importance of nutrition before concluding the consultation	The prompt will remind the GP/PN about including nutrition care in the consultation

Fig. 1. Logic model of the NutriCare intervention, and steps used to develop the model. GP, general practitioner; m, months; and PN, practice nurse.