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Implementation outcomes of a digital, trauma-informed care, educational intervention targeting health professionals in a paediatric burns setting: A mixed methods process evaluation

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Abbreviations: BBSIP, Brisbane Burn Scar Impact Profile; CARE, Create a space Ask & Assess Reflect Evaluate; CFIR, Consolidated Framework for Implementation Research; CHU, Child Health Utility Index; CTSQ, Child Traumatic Stress Questionnaire; EQ5DY, Euro-QOL-5DY; PEDS-ES, Pediatric Emotional Distress Scale – Early Screener; PMTS, Pediatric Medical Traumatic Stress; PSS, Perceived Stress Scale; PTE, Potentially Traumatic Event; PTSD, Post-traumatic stress disorder; STaRI, Standards for Reporting Implementation Studies.; TIC, Trauma-informed care

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ABSTRACT

Trauma-informed care practices are associated with a culture of safety following traumatic experiences, including medical trauma. An interactive, web-based training package ('Responsive CARE') was developed for voluntary uptake by paediatric burns health professionals to increase staff knowledge about trauma-informed practice. This paper reports on a mixed methods process evaluation conducted alongside a preliminary effectiveness study of 'Responsive CARE'. The process evaluation was conducted using The Consolidated Framework for Implementation Research (CFIR) and a logic model, to examine feasibility of both the intervention and implementation strategy. Health practitioners (including senior managers) delivering care to children and caregivers attending an outpatient burns service were eligible to enrol in 'Responsive CARE'. Qualitative interview data and quantitative metadata were used to evaluate the implementation outcomes (adoption, acceptability, fidelity, feasibility and preliminary effectiveness). Children and caregivers attending an outpatient service for change of burn wound dressing or burn scar management during the 3-month control or 3-month intervention period were eligible to enrol in the effectiveness study. The impact on child pain and distress, as well as cost, was investigated using a pretest-posttest design. Thirteen (from anticipated 50 enrolled) health professionals (all female) with mean 10 years (SD=11) of experience with paediatric burns hospital-based outpatient care completed an average of 65% (range 36% to 88%) of available content. Twenty-five semi-structured interviews were completed with health practitioners (21 female) and with 14 caregivers (11 female). Four themes were identified as influencing feasibility and acceptability of the intervention: 1) Keeping a trauma-informed lens; 2) Ways of incorporating trauma-informed care; 3) Working within system constraints; and 4) Being trauma-informed. Preliminary effectiveness data included 177 participants (median age 2 years, and median total body surface area burn 1%). Causal assumptions within the logic model were unable to be fully tested, secondary to lower-than-expected adoption and fidelity. We found no significant difference for pain, distress and per-patient hospital care costs between groups (pre- and post-intervention). Future implementation strategies should include organizational support to keep a trauma-informed lens and to incorporate trauma-informed principles within a medical model of care. Despite efforts to co-design a staff education intervention and implementation approach focused on stakeholder engagement, adaptations are indicated to both the intervention and implementation strategies to promote uptake highlighting the complexity of changing clinician behaviours.

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1. Introduction

Given that many young people (and their caregivers) who encounter a health service have experienced adversity or maltreatment, trauma-informed care (TIC) practice has materialized over the last few decades [1,2]. Exposure to traumatic events, especially in children, heightens a lifelong potential for poorer physical health, behavioural, health, and social outcomes [3,4]. Trauma-informed care culture encompasses the "Four R's": *realizing* the pervasive impact of trauma; *recognizing* the signs and symptoms; *responding* by incorporating knowledge of trauma into policies, procedures, and practice; and *aspiring* to minimize further *re-traumatization* [5]. Hospitalization may be experienced as a potentially traumatic life event for up to 25% of children or their families [6].

The subjective experience of any situation as distressing or frightening may result in a potentially traumatic event [7]. Paediatric Medical Traumatic Stress is the child and their families' reaction to a potentially traumatic event in the medical context. This is an overarching term to encompass psychological and physiological reactions (including symptoms of posttraumatic stress disorder) [7,8], with up to 80% of

children and their parents after paediatric injury reported to subjectively experience at least one symptom [9]. As trauma disrupts normal coping mechanisms and functioning, it may overwhelm a person's self- or co-regulation (e.g., with a caregiver) abilities in their response [6,7]. In a paediatric hospital setting, trauma-informed care involves staff incorporating an understanding of neurobiological responses to trauma-related experiences into routine practice, thereby modifying the subjective experience of the child (and caregivers) to mitigate distress and the risk of further trauma from subsequent medical interventions [10]. Trauma-informed practice includes acknowledging that one's life experiences inform care, providing emotional support, promoting positive coping strategies as well as information to families about emotional and functional response to injury [3,4 10]. This practice improves patient engagement, health outcomes and provider wellness [3,11].

While most healthcare staff support the need for trauma-informed practice, few receive training for consistency in its practice and implementation [3]. Given the limited focus on implementation of trauma-informed care to date [12,13], it is unsurprising that a systematic review of trauma-informed staff education interventions demonstrated short-term

changes in staff knowledge, attitudes and self-reported behavior related to trauma-informed practices immediately after training, but a sustained effect was unclear [14]. Implementation-focused approaches recognize that beyond training, the organizational context (e.g., implementation climate, available resources), characteristics of staff (e.g., leadership) and the intervention (e.g. strength and quality of the evidence) are critical to increase the impact and sustainability of trauma-informed care, including in healthcare settings [12,13]. In our setting, healthcare practitioners indicated their preferred method of training was online [15,16], therefore a web-based training package (termed 'Responsive CARE') was developed by authors (amongst others) of the current study [17]. This health professional-facing educational intervention targeted neurobiology of trauma, trauma-informed care principles, discussion of staff experience of vicarious trauma and presentations of what trauma-informed patient interaction can look like. The intervention was co-designed by clinicians and researchers in collaboration with expert reviewers (from Australia and overseas) who were subject matter experts in trauma-informed care and adult education.

To date, no known mixed-methods process evaluations of trauma-informed educational interventions in burns have been conducted. A process evaluation can assist in understanding how outcomes can be explained and improved (i.e., implementation), how the intervention works (i.e., mechanisms of action), and who the intervention works for (i.e., contextual factors) and the relationships between these aspects [18]. The Medical Research Council (London) advocates the use of process evaluations when examining both feasibility and effectiveness of complex interventions in everyday health care practice, to enable insights that optimise their design and evaluation [18]. This method of evaluation can inform the interpretation of intervention outcomes by highlighting implementation problems (or failures) [18]. Logic models that describe the complex intervention and depict anticipated causal relationships and intended delivery of intervention components are pivotal elements of process evaluations [19]. A logic model (available in a protocol paper [20]) was developed early in the current study to propose the intended impact and outcomes of the 'Responsive CARE' intervention. In summary, this model proposed that increased knowledge and self-efficacy for trauma-informed care by staff working in a tertiary burns outpatient setting would increase the use of trauma-informed practice, leading to improved health service and client outcomes [21]. As the Consolidated Framework for Implementation Research (CFIR) [22] has been successfully used to examine the role of staff and system-level contextual factors on the implementation of trauma-informed practices [12] the process evaluation in the current study was informed by this framework.

2. Material and methods

2.1. Study aims and hypotheses

The aim of the current study was to explore the feasibility of the 'Responsive CARE' intervention to support meaningful and sustainable change to patient outcomes in the outpatient

paediatric burns setting. Specific objectives for both implementation and patient-centred outcomes are detailed in a protocol paper [20], hence are summarised in Table 1. It was hypothesised that child participants would experience less acute pain, itch and distress, and caregivers would have higher satisfaction with treatment in the posttest compared to pretest period following staff completion of the intervention [20]. The Standards for Reporting Implementation Research (StaRI) checklist [23] has been used to report the intervention and implementation strategy.

2.2. Recruitment and ethics

This study has obtained ethics and governance approval from Children's Health Queensland Hospital and Health Service (HREC/QRCH/43839), Children's Health Queensland (SSA/18/QCHQ/43839), University of Queensland (2018002021/HREC/QRCH/43839), and Queensland University of Technology (1900000773). Written consent was obtained for all participants in the study. Practitioners enrolled in the web-based 'Responsive CARE' were also asked to respond yes/no to a question seeking consent to use data generated digitally by their use of the intervention.

Recruitment occurred between March and October 2019, with follow up completed by April 2020.

2.3. Study design

This paper reports on a mixed methods process evaluation of a pretest-posttest observational study that aimed to examine preliminary effectiveness of a trauma-informed care educational intervention for health practitioners ('Responsive CARE'). Training meta-data (including number of times visited, length of visit) collected June 2019 to April 2020 provided quantitative data for understanding the implementation and mechanisms of action of the 'Responsive Care' intervention and implementation strategies. Qualitative data collection involved interviews with healthcare providers, child and parent participants. Quantitative data (for preliminary effectiveness) was collected over a 3-month baseline period (pretest, March-May 2019) prior to the implementation of the 'Responsive CARE' intervention (June 2019), with a further 3 months of intervention period data then collected (posttest, July-September 2019). Children (and caregivers) included in the pre-test or post-test groups had baseline, 3-month and 6-month data collected. Baseline data was collected at the second dressing change.

2.4. Study Setting

The study was conducted in the outpatient burns clinic of a tertiary, publicly funded teaching hospital in South-East Queensland, Australia. This clinic for specialist care of children and young people (0 to 18 years) with burns (typically small to medium) from Queensland and northern New South Wales, with approximately 1200 new referrals per year [24]. The burns clinic team is multidisciplinary and core membership is comprised of administration officers, allied health (occupational therapists, physiotherapists, social worker), burns consultants (with a team of 10 registrars and

Table 1 – Specific objectives of study, as reported in study protocol [20].**Objectives of Aim 1 (implementation)**

To determine:

- The acceptability of the Responsive CARE intervention to health professionals
- The demand for trauma-informed care training and use (or intended use) of the Responsive CARE intervention by health professionals in a tertiary, outpatient burn clinical setting
- To what extent the Responsive CARE intervention training can be delivered using existing resources and infrastructure within the tertiary, clinical setting
- Barriers and enablers in the implementation environment and feasibility of the recruitment pathway to inform the amount and type of resources at different organizational levels (e.g. clinician, supervisor, manager) to implement the intervention successfully

Objectives of Aim 2 (preliminary effectiveness)

To determine

- Preliminary evidence of perceived effectiveness of the intervention on a health professional's knowledge, attitude, and behaviors. This will provide preliminary indication of the extent to which skills and knowledge following the completion of the intervention have been applied and an evaluation of factors that drive clinician behavior change.
- Preliminary evidence of effectiveness of the intervention on *symptomatology* (child's acute pain, itch, distress), caregiver's treatment satisfaction and health-related quality of life. This will provide an indication of whether the intervention can show change within this group. It is hypothesized that child participants will experience less acute pain, itch and distress in the post-test compared to the pre-test period, and caregiver participants will experience enhanced treatment satisfaction in the post-test compared to the pre-test, following staff completion of the 'Responsive CARE' intervention.
- Estimate healthcare resource use and costs of delivering the intervention to inform cost-related modelling for use in future economic evaluations of web-based education platforms.

residents), burns specialist nurses (including nurse practitioner and clinical nurse consultant), allied health assistants and typically 3 to 4 research higher degree students. As a major teaching hospital, up to 12 undergraduate students may attend the study setting over any one-month period and both medical and allied health have a rotational component to their staffing every 6 to 12 months. Both pharmaceutical and non-pharmaceutical (for example, developmentally appropriate procedural education) pain management protocols are considered standard care at the study setting [25]. Burn specific experience ranged from less than 1 month to over 30 years for core members of the multidisciplinary team at the time of the study (based on self-report to MS).

2.5. Inclusion and exclusion criteria

Healthcare practitioners (including senior managers) involved in the management of children with burns during the study period were included. Student trainees (any discipline) in the study site for < 2 weeks were excluded. All children and caregivers attending the outpatient clinic for a change of burn wound dressing or burn scar management during the control or intervention period were eligible to participate.

2.6. The intervention – 'Responsive CARE'

'Responsive CARE' is an interactive, web-based training package that aims to help health professionals be more aware of and initiate trauma-informed practices in a paediatric healthcare setting [17]. The training package consists of four modules that were developed to be worked through sequentially: 1. Understanding paediatric medical traumatic stress; 2. Introducing the CARE framework; 3. General skills for applying CARE; 4. Taking CARE of yourself (see Table 2). Participants were advised that the training package may take up to one hour to complete. Details of the intervention content are provided in the text and additional files of a protocol paper [20].

iLearn (an online learning environment powered by D2L Brightspace (D2L Corporation)) was utilized to deliver the training, as the web-based platform in the study setting for staff to access educational materials. Technical assistance was available via web-based or hotline numbers provided on the iLearn site. The 'Responsive CARE' intervention was freely available using testor accounts (available from research team members) to all staff in burns outpatients from June 2019 (commencement of training period) to completion of the 6-month post-test follow-up period (April 2020). Staff and students new to burns outpatients during this time ($n = 10$) were informed of the availability of the intervention and offered educational material about how to access the site by the principal investigator (MS) or research assistant as close as possible to their commencement (following informed consent). No changes were made to the content of the intervention during the study period and no automated prompting of users was conducted after they enrolled.

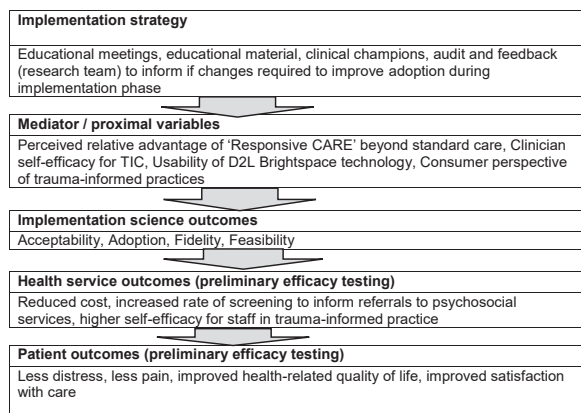
2.7. Implementation plan

Four implementation strategies for the 'Responsive CARE' intervention were identified by consensus from core members of the research team [26]. *Audit and feedback* using training meta-data was completed monthly by members of the research team, following implementation of the 'Responsive CARE' intervention to assess uptake. The number of course enrolments and completion rate were considered a proxy for adoption by health practitioners for the intervention. Three *educational meetings* (to provide an overview of intervention content and presentation of short vignettes of staff telling stories about trauma-informed care) were planned for June 2019 (implementation month), with written *educational material* about how to access the web-based intervention provided at this time. The clinical *champions* for the intervention had a physical (RK) and a bio-psycho-social (MS) approach to care. Both champions worked in the

Table 2 – Topic and Learning Objectives of the ‘Responsive CARE’ modules.

Topic	Learning objectives	Examples of topics
Understanding paediatric medical traumatic stress	This module aims to provide an understanding of Paediatric Medical Traumatic Stress, including the causes, symptoms, and consequences for children of different ages, their families and staff involved in the healthcare system.	What is traumatic about medical experiences and what influences an individual’s response to the same experience. Describes typical responses to PMTS and patterns of recovery, including when specialist help is indicated.
Introducing the CARE Framework	This module aims to provide an understanding of how to provide, and the benefits of responsive trauma-informed healthcare in an acute paediatric hospital setting.	How HCP can identify, prevent, or minimise the impact of PMTS on ill or injured children. How to integrate responsive TIC into standard care using the evidence-informed CARE framework.
General skills for applying CARE	This module aims to reinforce the general application of CARE within paediatric healthcare, as well as how to provide responsive trauma-informed healthcare to vulnerable populations within the hospital setting.	How HCP can provide responsive TIC using flexible delivery methods, so no additional work or responsibility added to the HP’s routine. Areas of discussion include managing disclosure and cultural considerations.
Taking CARE of yourself	This module aims to provide an understanding of how working with children and families in paediatric medical trauma settings can have potential negative effects on health professionals’ well-being and their interactions with the children and their families. The key signs of stress in this setting are described and recommendations provided on how to implement regular self-care to maintain your own well-being.	Exploration of challenges for HCP working with children and families who experience PMTS. Includes checklists to increase self-awareness of signs of stress in this setting, as well as evidence-based strategies to manage their own wellbeing.

Abbreviations: CARE: Create a Space, Ask & Assess, Reflect, Evaluate; HCP: Healthcare Provider; PMTS: Paediatric Medical Traumatic Stress

**Fig. 1 – Relationship between the ‘Responsive Care’ implementation strategy and study outcomes.**

recruitment setting as clinicians and researchers. The relationship between the implementation strategies and study outcomes is depicted in Fig. 1.

2.8. Data collection

2.8.1. Interviews

Interview participants included both healthcare providers and caregivers of children attending the study setting for burns care. Semi-structured interviews and a focus group (see Appendix 1 for interview guides) were completed using purposive sampling of health professionals. The interviews and focus group were audio-taped and transcribed verbatim. All health practitioners who attended the weekly burns clinical meeting (and their senior manager) were invited to participate in an interview, with interviews completed with

all those who agreed. A focus group was completed with available medical staff (residents and registrars) upon request to minimise impact on time. Caregivers were purposively recruited until saturation (operationalized as no new themes arising from two consecutive interviews after thematic saturation). Demographic data was collected from caregivers and via chart audit to provide contextual information about their child’s burns experience/s (such as depth of burn, time to heal, surgical interventions).

2.9. Technical assistance log

All key implementation events and/ or external events that may have impacted the study were recorded in the log, as well as formal and informal feedback received from stakeholders and modifications to the implementation plan. This log was recorded by the principal investigator (MS) during the study period. The descriptive data was reviewed at the completion of the study alongside the quantitative and qualitative data to provide a narrative description of the implementation process and key activities that may have impacted implementation. This data was compared with training meta-data from implementation (June 2019) until end of the study period, to inform consideration of the implementation outcomes.

2.9.1. Training meta-data

Data generated by the iLearn platform was collected throughout the implementation and post-implementation period (June 2019 to April 2020). Characteristics of participants enrolled were collected to describe the reach of the ‘Responsive CARE’ intervention. Dose was operationalized as the duration of time the intervention was viewed and the number of visits by each participant. Fidelity of the intervention was operationalized as > 80% of each of the four

Table 3 – Definition of outcomes and how measured.

Outcome	Definition [29,30]	How outcomes were measured
Acceptability of 'Responsive CARE' intervention	Level of satisfaction, intention to continue use and perceived appropriateness of the intervention.	Semi-structured interviews with health professionals, children with burns and their caregivers in the control and intervention periods. Technical assistance log entries.
Adoption of 'Responsive CARE' intervention	The use of the intervention by health professionals working in the study setting.	Digital metrics generated by health professionals accessing the intervention to evaluate number of enrolments (including demographic data), with N = 50 enrolments anticipated.
Fidelity of 'Responsive CARE' intervention	The actual vs planned implementation of the intervention.	> 80% of intervention content viewed per participant for implementation to be considered successful. Semi-structured interviews with health professionals, children with burns and their caregivers in control and intervention period to identify adaptations to the intervention in the study setting and broader organization and changes to planned implementation strategies.
Feasibility	Perceived sustainability within existing infrastructure and resources, such as time, commitments (or some combination thereof) for health professionals.	Digital metrics generated by health professionals accessing 'Responsive CARE' to evaluate the time burden for participants. Technical assistance log entries. Semi-structured interviews with health professionals in control and intervention period.
Preliminary efficacy testing	Health service outcomes (effectiveness)	Change in knowledge scores* (between pre- and post-course quiz in Responsive CARE intervention). Questions reported in [20]: Additional File 1. Change in self-efficacy* assessed from questions designed for the study as part of the survey completed after the post-course quiz (questions reported in [20]: Additional File 2).
	Patient outcomes (satisfaction, symptoms)	Referrals to psychosocial services in the control and intervention group (over 6-month follow up period). Changes in scores for FLACC (pain*) in control and intervention group (three consecutive dressing changes) Changes in scores for PEDS-ES or CTSQ (child distress*), HRQOL (BBSIP) and PSS in control and intervention group (at 6 months) Satisfaction (parent and child) in control and intervention group (at 6 months)
	Hospitalization-related resource use and costs (per-patient total, direct and indirect costs were estimated. Both direct and indirect costs included broad cost categories such as pharmacy, pathology, imaging, allied health services, operating theatre, hotel goods and services, cost of labour, all goods and services and depreciation costs). Implementation costs (educational meetings, preparation of educational materials, clinical champions)	Collected retrospectively from hospital administration records and implementation personnel. Changes in scores for CHU in control and intervention group (at 6 months)

Abbreviations: TIC: Trauma-informed care; HRQOL: Health-related quality of life; FLACC: Faces, Legs, Arms, Cry, Consolability [31]; PEDS-ES: Paediatric Emotional Distress Scale – Early Screener [32]; CTSQ: Child Traumatic Stress Questionnaire [33]; BBSIP: Brisbane Burns Scar Impact Profile [34,35]; CHU: Child Health Utility [36,37]; PSS: Perceived Stress Scale [38]; *primary outcome measures

online module's content viewed by individual participants. Changes to pre-test and post-test knowledge scores and ratings in self-efficacy were collected as quantitative measures of mechanisms of change.

2.9.2. Chart audit

Psychosocial or mental health referrals were recorded retrospectively from medical records.

2.10. Data analysis

Outcomes were examined using a convergent approach to qualitative and quantitative data analysis [27] (see Table 3). The process evaluation was conducted alongside analysis of the pre-test post-test preliminary efficacy testing (see Appendix 2 for further description of analysis and results of preliminary effectiveness data). Using the Framework Method [28], themes were generated inductively using the qualitative

dataset and deductively using all the CFIR domains [22]. Transcripts were independently inductively coded by two coders (MS and research assistant), with a third coder (ZT) consulted to discuss the codes (except for two interviews with pre-graduate students that were completed, transcribed and coded inductively by an alternative pair [ZT and research assistant] at the request of these participants). The analytical framework was developed by an experienced qualitative researcher (MS), using a matrix developed in Microsoft Excel (Version 16.57, Microsoft Corporation). The quantitative and qualitative data was analyzed separately, with the findings compared to interpret to what extent they converged, diverged, or were complementary of each other, in line with triangulation [27]. Data interpretation was informed by the aims of the study and the inductively generated themes arising from discussion within the research team.

3. Results

Regarding the implementation outcomes of adoption and fidelity, the 'Responsive CARE' intervention was accessed by thirteen health practitioners (all female) (see Table 4), with the majority (9/13) having < 10 h of prior training in trauma-informed care. Participants completed an average of 65% (range 36% to 88%) of available content, with no participant completing all modules. In regard to feasibility, participants

visited the intervention up to three times, with a mean (SD) visiting time of 61 mins (42 mins), range 11 mins to 2 h, 21 mins. Given the lower-than-expected adoption and fidelity of the intervention (N = 13 vs N = 50 enrolled and 65% of content completed vs 80%), causal assumptions within the logic model were unable to be fully tested. Therefore, preliminary effectiveness results are provided in Appendix 2 to 6 and should be interpreted with caution.

This adoption rate occurred despite changes to the planned implementation strategies in efforts to improve uptake by health professionals throughout the implementation period. Three education meetings were delivered over three months (May, June and August 2019), not one month (June 2019) as planned due to prioritisation of clinical case presentations and discussion within the scheduled clinical meeting time. The clinical champions (MS, RK) spoke to the team at the first education meeting, where RK encouraged mandatory enrolment in the intervention by staff and research personnel, which received a mixed reception. Additional strategies added during the implementation period were *identifying early adopters* and *use of an implementation advisor* (GH) [26]. Allied health staff (n=2) who worked in the clinical setting and had enrolled in the intervention were recruited as early adopters, who shared the impact of the intervention's content on their clinical practice at two clinical meetings in June 2019. Core members of the research team (MS, ZT) engaged with an implementation consultant (GH) about implementation strategies on two occasions (June 2019 and April 2020). Most health professionals (n=7, 54%) enrolled in 'Responsive Care' in the focussed implementation period (June 2019), with a further five participants (38%) enrolled between September-November 2019, and the final participant (8%) enrolled in May 2020. Leadership engagement with the education intervention remained low and therefore was unlikely to have contributed to implementation efforts. We found a 64% increase in referrals to social work and psychology in the post-test period (however this was likely secondary to a clinical trial occurring simultaneously in the study setting [39]). A change in knowledge scores (from a baseline mean [SD] of 71.78 [20.63]) was unable to be calculated, as only 2 out of 13 participants completed the post-course quiz. The survey questions designed to measure change in self-efficacy were not completed by any participant.

Twelve health professionals (84% female) representing medical, nursing and allied health (occupational therapy, physiotherapy, social work) agreed to participate in interviews. Within this group, three of the participants were senior managers and two were under-graduate students. Of the twelve interviewed, four (33%) had enrolled in the 'Responsive CARE' intervention. The in-person focus group (n=9 participants) completed with junior and senior medical staff (excluding burns consultants) was facilitated by the first author (MS). No focus group participant had enrolled in the 'Responsive CARE' intervention. The length of interviews ranged from 17 min to 1 h, 35 min. Mostly female (n = 11, 79%) caregivers of children aged a median (IQR) of 18 months (14, 28; range 11mth-7 yr, 11mth) agreed to participate in an interview (N = 13 interviews, with 14 participants). The length of interview ranged from 10 to 41 min, with the majority (n = 12, 92%) conducted whilst they were attending burns outpatients for an appointment. Of these caregivers, four of their children underwent skin grafting (31%), with one child undergoing two grafting procedures. The majority of

Table 4 – Demographics of health professionals that completed the 'Responsive CARE' intervention.

Participant characteristics	No. of participants (% of sample)
Female, number (percent)	13 (100)
Mean age (SD), range in years	32.92 (11.41), 21-61
Missing	1
Role	
Administration	1 (8%)
Medical Practitioner	1 (8%)
Nurse	1 (8%)
Occupational Therapist	6 (46%)
Physiotherapist	1 (8%)
Other (e.g., student)	3 (23%)
Mean years of experience with hospital-based care (SD), range	10.26 (11.32), 0-40
Mean years of experience in current role in burns care (SD), range	6.05 (9.37), 0-30
Prior training in trauma-informed care (or psychosocial care)	
No training	5 (42%)
1 to 10 h	4 (33%)
11 to 20 h	1 (8%)
21 to 40 h	0
More than 40 h	2 (16%)
Missing	1 (8%)
How long since you completed training?	
No specific training	7 (58%)
Within the past year	4 (33%)
1 to 4 years ago	1 (8%)
5 to 10 years ago	0
More than 10 years ago	0
Missing	1 (8%)

the burn injuries were to upper limbs ($n = 10$, 53%), below 10% TBSA (median 1%, IQR=1,2.5; range <1%–10%) from predominantly contact with hot objects, followed by scalding. The median time to heal was 17 days (IQR=15,25.5; range 10–29 days).

Deductive analysis using the CFIR framework suggests a mixed perception of the acceptability (and relative advantage over current practice) of a web-based educational package for trauma-informed care, given the level of experience within the clinical (inner) setting.

(...) don't think we have much role conflict in this environment because we all know that it's a team effort (Nurse 2, line 121–124)

(...) you need (someone) to explain it to you properly. One to one. You know, face to face, give you examples, do a practice (Nurse 1, line 317–320)

However, health professionals that engaged with the intervention reported the content of 'Responsive CARE' was acceptable and (even with partial completion) resulted in a perception of increased feelings of self-efficacy.

It's very relatable on what we do every day, and it's...easy tools that you can apply...to what we do every day. (...) I think I'd be more confident. (...) very easy concepts that we can absolutely apply. (Allied Health Professional [AHP]1, line 80–90)

And whilst the overall response was positive to the use of questionnaires to screen for trauma and coping, not all caregivers agreed.

I think it's probably easier to talk about it, just in my experience. Yeah, it just makes it easier and you can summarise it probably better in your own words when you're talking to someone rather than having to write it down (...) and it flows easier. (Parent 5, line 100–104)

When inductive and deductive thematic analysis were triangulated [27], four main themes that further our understanding of the implementation outcomes (acceptability and feasibility) were identified: 1) Keeping a trauma-informed lens; 2) Ways of incorporating trauma-informed care; 3) Working within system constraints; and 4) Being trauma-informed.

3.1. Keeping a trauma-informed lens

This theme captured the impact of relationships in the environment (between burns outpatients and the broader organizational setting) that support the need for a focus on trauma-informed care to raise the acceptability and feasibility of trauma-informed initiatives. A visual/perceptual awareness as well as a cognitive awareness of the impact of trauma on the clinical presentation is required.

I think what you're doing is for the long-term benefit of certainly patients but you know probably helps the nursing staff and doctors as well understand these there's a huge dynamic with

just you know, it's not just the – it's the as you said it's the emotional care as well as the physical care that we have to look at (Parent 1, line 170–174)

Some participants identified this may include: awareness of neurobiological responses to meet immediate physical and psychological needs; to normalize child, family and staff responses; as well as interpersonal interactions to support meaning making of events (e.g., religious, cultural).

The bit that is missing is how we bring that into a whole of organization coherent view, which allows us as a paediatric centre to lead and provide a clear focus around how do we make sense of this for our whole workforce. What is critical for everybody to know? And then where is and how do we intertwine that with an interprofessional framework? And then how do we build beyond that? I think that's the part...the building beyond that is the component that's missing. (Manager 3, line 115–120)

While we found a mixed response from health practitioners to engaging in training about trauma-informed care, caregivers of children with burns were supportive of a workforce capability for trauma-informed practice.

Probably essentially all the staff [providing trauma-informed care] because you've got a referral capacity and then like you know if they're in contact and identify those things (Parent 4, line 127–129)

That's really good that you guys do that [screening] cause some people don't realize it's affecting them as much as it is, or the child. (Parent 7, line 75–77)

3.2. Ways of incorporating trauma-informed care

This theme focused on feasibility of embedding trauma-informed principles and practices within existing resources. Beyond the inner setting (burns outpatients), managers were cognizant that the embedding of trauma-informed principles (for both patients and staff) were still emerging. Educational initiatives were considered acceptable to support building a culture of trauma-informed practice.

(...) that is my responsibility to THINK about those issues. The problem is that I may not always SEE whose involved and especially I may not see how they are affected. That's where the organization needs to come in and say here's the mechanism that they can have support for that. And even to make improvements in care. And that's...this initiative [Responsive CARE] is one of those things. (Medical Practitioner, line 201–208)

3.3. Working within system constraints

This theme captured responses about the sustainability of the intervention and use of trauma-informed practices (i.e., feasibility), including time, beliefs and existing infrastructure within the inner setting.

My biggest barrier has been time. (...) So fitting that in on top of all my other jobs has been...tricky. (...) That's probably the biggest barrier. (AHP3, line 32–36).

...it took the amount of time to get that dressing off what not um., wasn't working like, it wouldn't work for – for every child. It's just, it would be too costly. Yeah, for the healthcare system there's no way. (Student 2, line 282, 285)

Barriers and enablers within the implementation context, identified from deductive analysis informed by CFIR, are summarized in [Table 5](#).

3.4. Being trauma-informed

Many health professionals considered the provision of trauma-informed care acceptable in their role:

I feel like it's a very important part of my role (...) to contribute to that picture. (AHP1, line 131–132)

I think it should be mandatory. Like I really do. Like if you're entering into this space where you are working predominantly with trauma, there should be a basic level of expectation around your knowledge of trauma-informed care (AHP3, line 473–479)

However, senior managers and some healthcare providers strongly advocated the need for organizational initiatives to ensure a sustained foundational level of understanding of trauma-informed care practice, despite concerns and awareness of the burdensome nature of mandatory training on staff. This speaks to both the acceptability of trauma-informed care initiatives, and consideration of feasibility in terms of the need to sustain trauma-informed practices.

(...) we do poorly. Assess support systems and emotional needs and implement own self care if affected by situation. That, I've seen time and time again. Where suddenly the wheels fall off in teams when there's just...one situation, one patient, that tips them over into being very, very distressed themselves. And it's just that...you know, trauma by drip feed. That it's not one situation, it's that constant, you know, managing traumatic situations. (Manager 2, line 257–263)

But within our framework, we need to be able to point to...a clear understanding of trauma-informed principles because it's contemporary, because it's relevant to that holistic approach [integrated medical and psychosocial] which is part of what we do, and it provides a basis, including a science basis, that will (...) support a critique and understanding more broadly across our organization. Unless we do that, I think we maintain a stronger biological focus which really doesn't do a whole service or justice to our families (Manager 3, line 90–100).

healthcare practitioners in a busy outpatient setting was less than desirable. Whilst content of 'Responsive CARE' was considered acceptable by health professionals that engaged who reported (via interview) feelings of perceived increased self-efficacy to deliver trauma-informed care practices, in the absence of adaptations to the intervention and implementation strategies, the ongoing use of 'Responsive CARE' appears likely to be intermittent at best based on the number of people that engaged with the intervention, both during and after the implementation period. This was despite the use of implementation strategies that are identified amongst the highest in importance and feasibility by expert consensus [40], such as use of champions, audit and feedback, use of educational materials and educational meetings. Whilst it may be that the starting assumption for this study (i.e., that a voluntary educational intervention for trauma-informed care is feasible to improve trauma-informed care practice) was flawed, the experience of others suggests otherwise [41,42]. The provision of protected time when implementing a voluntary online education package to a paediatric medical resident workforce at the commencement of their child advocacy and protection term rotation resulted in a significant increase in trauma-informed practice (discussion of adverse childhood experiences increased from 28% to 42% ($p < 0.01$) and trauma-informed discussion from 13% to 42% ($p < 0.01$) [43].

The theoretical approach (use of logic design and CFIR implementation framework) used to underpin implementation of the web-based education package to clinical care in this study has provided valuable insights into mechanisms of action impacting the intervention and implementation strategies. Factors that appear to have contributed to low adoption of 'Responsive CARE' include limited engagement by staff as to a need for further training in trauma-informed care, a cognitive dissonance between intervention demands (up to 1-hour to complete) and available resources (clinician time), as well as contextual factors (such as an online platform that was perceived as difficult to navigate). Potentially, in the absence of an agreed approach within the participating organization about trauma-informed care practice and principles, individual beliefs about what constitutes trauma-informed care informed working practices that were considered trauma-informed care at the time of the study (e.g., situational awareness, carer education regarding details of the physical injury to their child), regardless of the evidence-base [44]. As trauma can break down people's consciousness of trauma at multiple levels of the health system i.e., clinical and organizational, processes that support a normalized and regular chance for education and supervision and containment of trauma in trauma-saturated teams seems to be reasonable based on trauma-informed principles [45,46]. The use of more influential champions (such as trauma-informed care subject experts) more visibly during the implementation phase may have improved credibility of the evidence for trauma-informed practice and therefore adoption of the intervention. Health professionals that had not engaged with the intervention preferred the short, interactive videos and discussion at the clinical team meeting or in-person with qualified professional about relevant patients/clients. This may have been identified earlier if pre-implementation interviews had been conducted.

4. Discussion

The process evaluation highlighted the adoption of, and fidelity to the voluntary 'Responsive CARE' intervention for

Table 5 – Barriers and enablers of implementation (i.e., uptake).

CFIR construct	Barrier	Both barrier and enabler	Enabler
Individuals	Time constraints for staff	Expectations of staff to be trauma-informed in their practice	Seen as important part of staff role
	Skill and resource constraints for TIC Support (or lack thereof) with translation from theory to practice of TIP Lack of formal training in trauma-informed care Wanting in-person training/coaching/support for TIC	Screening and parent education and referral pathway (if need)	
Intervention	Complexity (e.g., use of acronyms)	HCPs wanting certainty about evidence for TIC	Age-appropriate strategies
	Organisational platform for delivery of intervention		Relatable content Downloadable checklists Use of case studies Use of videos
Inner setting (burns outpatients)	Being kept informed at all times (carer)	Workflow within the clinic environment	More staff talking about trauma to inform their assessment (and referral capacity)
	Wanting medical personnel to be main communicator with family	Team environment Expectations about trauma-informed practices (e.g., child pain, child distress, use of screening tools)	
Outer setting (broader organizational setting)	Lack of inclusion of TIP in organizational policy (such as wellbeing and cultural practices)	Expectations on leadership to be trauma-informed to guide organizational support systems (e.g., including embedding TIP in policy and risk analysis; staff supervision support)	Broader organizational awareness of evidence for TIC
	Routine assessment of support systems and emotional needs and implementation of self-care for staff	Consistency in training delivery	Paediatric healthcare setting Trauma-informed initiatives successfully implemented in peer settings (nationally and internationally)

Abbreviations: CFIR = Consolidated Framework for Implementation Research; HCP = healthcare provider; TIC = trauma-informed care; TIP = trauma-informed principles

A three-stage model has been proposed, focusing on the *before*, *during* and *after* for long-term adaptations to guide the implementation of a trauma-informed model of care in burns [47]. Using this model, the authors identified training as a core component of the 'before' (for both healthcare practitioners as well as those staff that support healthcare service delivery) to build readiness for change and advocated for organizational-level integration to support implementation. This call to action that supersedes direct service is supported by a systematic review that considered the effects of organizational interventions with a trauma-informed staff education component [14]. Strategies important for clinical change supporting better trauma-informed practice have been identified from a quality improvement evaluation during the coronavirus disease (COVID-19) pandemic [48]. These conditions included supervision and technical assistance (for example, use of webinars, facilitated discussion groups) of clinical teams and containing vicarious trauma

which can work against knowledge acquisition and procedural change in a trauma-saturated setting [47]. Trauma-informed training with the highest impact on patient outcomes have been those in which organizational policy changes simultaneously with staff training [14,45,46]. These findings suggest that successful implementation of a trauma-informed model of care will involve effective leadership, an organizational commitment and trauma awareness that informs funding, service policy, management, and administration.

4.1. Strengths and limitations

Whilst participants from medical, nursing, and allied health enrolled, more than 75% of those eligible chose not to access the intervention. These findings highlight the complexity of the participating service and broader health system, and the challenges of instituting trauma-informed care within that

context. Whilst the front-line healthcare providers were the target group for 'Responsive CARE' in the current study (acute hospital setting), clear alignment of trauma-informed care with the roles and practices of most health professionals meant mixed beliefs regarding the relevance of a trauma-informed care education package which likely contributed to the low adoption rate. The need for an agreed organizational approach to trauma-informed care, better captured within policy and procedures, was identified by line managers as critical to achieve changes in staff knowledge and attitudes to trauma-informed care, with anticipated impact on patient care.

The lower than expected adoption and fidelity of the training particularly by medical and nursing professionals highlights this as a gap in the literature. Fidelity to trauma-informed care education has rarely been examined [49,50] and deserves further attention in that if health professionals do not access the training then potential changes in knowledge, attitudes and practices cannot be attributed to the education. A lack of completion of trauma-informed care education by medical residents has been identified by others potentially due to their busy workloads [51] aligns somewhat with our finding that medical and nursing staff did not engage with the package. Thus, further exploration of the implementation outcomes of fidelity and adoption are indicated in relation to trauma-informed care education.

The use of CFIR informed understanding of the process and contextual factors impacting implementation. With no additional domains identified from analysis, this framework appeared to be a good fit for the study purpose. However, the number of participants in the interviews and focus group was based partly on pragmatic considerations (staff availability). Additional interviews (for example, with more nursing staff and nursing leadership) may have elicited further themes.

In future, it may be worth considering the use of the Normalization Process Theory [52], for a theory-informed approach to address factors needed for successful implementation of trauma informed care practices and principles into routine work. This may lead to a better understanding how different disciplines of healthcare providers integrate trauma-informed care into their everyday practice and interactions with colleagues and patients, Future research may also benefit from the use of systems theory to inform implementation of organization-led initiatives to embed trauma-informed practices into stepped models of care approaches through investigation of healthcare teams as complex adaptive systems [53].

5. Conclusions

The embedding of trauma-informed care policy and practice as part of standard care in clinical settings is a complex process. Clinical leadership (such as professional leads) support of trauma-informed care, in addition to cultural change champions, were examples of the application of trauma-informed principles to progress towards cultural change regarding trauma-informed practice applied in the current study. This process evaluation has highlighted that changes to the educational intervention design/approach

used in the current study are needed prior to further investigation into impact on health service and/or patient outcomes. Also, expecting health professionals to complete online training within existing resources is unlikely to result in long-term adaptations that support transformational change in the delivery of trauma-informed care. Assessing readiness and capacity for change may be central to successful knowledge implementation in trauma-informed care.

CRediT authorship contribution statement

All authors have reviewed the final manuscript. Megan Simons, Zephania Tyack, Alexandra G. De Young, Roy Kimble, Steven M. McPhail contributed to achieving funding for the study, study design and interpretation. Lucinda McMillan contributed to data collection and preparation of this manuscript. Gillian Harvey, Sanjeewa Kularatna, Steven M. McPhail, Elizabeth G. Ryan provided expert consultation that contributed to data analysis and interpretation, and manuscript preparation.

Consent for publication

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Availability of data and materials

The datasets generated and analysed during the current study may be available if appropriate permissions are obtained (by those seeking to access the data) from the data custodians with appropriate ethical and governance approvals from Children's Health Queensland Hospital and Health Service Human Research Ethics Committee who can be contacted at the following email: CHQETHICS@health.qld.gov.au. The author MS can be contacted at Megan.Simons@health.qld.gov.au for further information regarding access to the dataset.

Declaration of Competing Interest

MS, ZT, ADY were members of the project team that designed the web-based education intervention (Responsive CARE) used in this study.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.burns.2024.03.032](https://doi.org/10.1016/j.burns.2024.03.032).

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