

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository:<https://orca.cardiff.ac.uk/id/eprint/103899/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Nurmatov, Ulugbek , Mullen, Stephen, Quinn-Scoggins, Harriet , Mann, Mala and Kemp, Alison 2018. The effectiveness and cost-effectiveness of first aid interventions for burns given to caregivers of children: A systematic review. *Burns* 44 (3) , pp. 512-523. 10.1016/j.burns.2017.05.022

Publishers page: <http://dx.doi.org/10.1016/j.burns.2017.05.022>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



The effectiveness and cost-effectiveness of first aid interventions for burns given to caregivers of children: a systematic review

¹Ulugbek B Nurmatov, ^{2,3} Stephen Mullen, ^{1,3}Harriet Quinn-Scoggins, ⁴Mala Mann, ^{1,3}Alison Kemp

¹ Division of Population Medicine, School of Medicine, Cardiff University, CF 14 4YS, Cardiff, Wales, UK

² Paediatric Emergency Department, University Hospitals of Wales, CF 14 4XW, Cardiff, Wales, UK

³ The Scar Free Foundation Centre for Children's Burns Research, CF 14 4YS, Cardiff, Wales, UK

⁴ Specialist Unit for Review Evidence, Cardiff University, CF 14 4YS, Cardiff, Wales, UK

Abbreviations:

Corresponding author at:

Division of Population Medicine, School of Medicine, Cardiff University, CF 14 4YS, Cardiff, Wales, UK
Email: NurmatovU@cardiff.ac.uk; Phone: 02920 687222

E-mail addresses NurmatovU@cardiff.ac.uk (U.B. Nurmatov), MullenSM@cardiff.ac.uk (S.M. Mullen), MannMK@cardiff.ac.uk (M. Mann), Quinn-ScogginsHD@cardiff.ac.uk (H.D. Quinn-Scoggins), Kempam@cardiff.ac.uk (A. Kemp).

Key words: burns, scalds, child health, burns first aid, systematic review

Abstract

Objectives: the effectiveness and cost-effectiveness of burns first-aid educational interventions given to caregivers of children.

Methods

Systematic review of eligible studies from seven databases, international journals, trials repositories and contacted international experts.

Results:

Of 985 potential studies, four met the inclusion criteria. All had high risk of bias and weak global rating.

Two studies identified a statistically significant increase in knowledge after of a media campaign. King et al. (41.7% vs 63.2%, $p < 0.0001$), Skinner et al. (59% vs 40%, $p = 0.004$). Skinner et al. also identified fewer admissions (64.4% vs 35.8%, $p < 0.001$) and surgical procedures (25.6% vs 11.4%, $p < 0.001$).

Kua et al. identified a significant improvement in caregiver's knowledge (22.9% vs 78.3%, 95% CI 49.2, 61.4) after face-to-face education intervention. Ozyazicioglu et al. evaluated the effect of a first-aid training program and showed a reduction in use of harmful traditional methods for burns in children (29% vs 16.1%, $p < 0.001$).

No data on cost-effectiveness was identified.

Conclusion

There is a paucity of high quality research in this field and considerable heterogeneity across the included studies. Delivery and content of interventions varied. However, studies showed a positive effect on knowledge. No study evaluated the direct effect of the intervention on first aid administration. High quality clinical trials are needed.

1. Introduction

Burns are a global public health problem. Children and young people are particularly susceptible to burn injury [1], especially infants and pre-school age children [2, 3, 4]. Infant and childhood physical and cognitive development means that they rely heavily on caregivers to ensure their safety. This reliance is important as actions and behaviours of the caregiver can impact on the prevention of burn injuries, and the appropriate early first aid of those injuries that do occur. Education of the caregiving population is crucial in the fight against and early management of paediatric burns [5].

Immediate management of the burn injury includes administering correct burns first aid. The aim of which is to stop the burning process, cool the burn, provide pain relief, and cover the burn to reduce the risk of infection [6]. Efficient and appropriate first aid administered within three hours of the injurious event can reduce burn severity, improve the clinical outcome, reduce pain, long-term morbidity [7, 8], decrease healthcare costs [9], and provide a strong protective effect for long-term burn-related physical impairments in later life [10]. For these reasons, it is essential that appropriate burns first aid health education is given to the caregiver based on simple, reliable and evidence-based information [11]. In recent years, epidemiological studies have highlighted that awareness, knowledge and practice of burns first aid is low amongst caregivers worldwide [12-15]. As a result, there is often an inadequate mechanism and duration of cooling [16-18], or the application of natural plant therapies, oils, honey, eggs or butter directly to the wound [19]. Many of these traditional and home remedies are self-perpetuating and generational unless interventional education is provided [19].

Confusion over appropriate first aid may be influenced by the varied recommendations and guidelines advocated by different organisations, various media [20, 21] and incorrect advice provided by family and friends. The volume of information available on burns first aid is extensive and easily accessible, however its quality, accuracy and completeness can be questioned [20, 21].

The culmination of such research suggests a need for educational programs to address these issues. However, a research gap exists in ascertaining the most effective method of intervention delivery. The following systematic review aims to identify published evidence to evaluate the effectiveness and cost-effectiveness of different methods for delivering burns first aid education interventions to caregivers of children across all settings.

2. Methods

We searched seven databases including Cochrane Library, MEDLINE, EMBASE, CINAHL, Web of Science, AMED, and ERIC for studies published in any language from inception to 31 July 2016 using both subject headings and key words. We searched three major clinical trials repositories (Clinicaltrials.gov (NIH web); Current controlled trials (www.controlled-trials.com); Australian and New Zealand Clinical Trials Registry (<http://www.anzctr.org.au>), and key journals including Burns, Journal of Burn Care and Research, Paediatrics, Health Education, and Injury Prevention. In addition, we reviewed the reference lists of relevant studies and contacted international panel of experts in this field of research for additional papers.

2.1. Study design and outcomes

Interventions of interest were any experimental studies that assessed burns first aid training or education interventions delivered to caregivers (i.e. parents, grandparents, relatives, guardians etc.) of children aged up to 18 years old by trained personnel (i.e. health visitor, community nurse, educator, mass media, other health professional etc.) in different settings. Given the likelihood that we would find only a limited number of RCTs, we searched for non-randomized controlled trials, controlled or uncontrolled before and after studies, interrupted time series, historically controlled studies, cohort, case-control, cross-sectional, and case-series.

Primary outcome measures were caregivers' knowledge about burns first aid, children's Accident and Emergency (A&E) or hospital admissions, morbidity and mortality from burns. Secondary outcomes included Quality of Life (QoL) of children and family members and cost-effectiveness measures. We excluded reviews, systematic reviews, discussion papers, non-research letters, and editorials.

2.2 Study selection

Study titles were independently checked by two reviewers (UN, SM) according to the above selection criteria. Any discrepancies were resolved through discussion and, if necessary, a third reviewer (HQS) was consulted. Full text copies of potentially relevant studies were obtained and their eligibility for inclusion independently assessed. Studies that did not fulfil all of the inclusion criteria were excluded.

2.3 Data extraction, analysis and synthesis

Data were independently extracted onto a customized data extraction sheet by two reviewers (UN, SM), and any discrepancies were resolved by discussion or, if agreement was not reached, the third reviewer (HQS) arbitrated.

2.4. Registration and reporting

The systematic review protocol has been registered with the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42016046376): <http://www.crd.york.ac.uk/prospero/>.

2.5. Quality assessment

We assessed the quality of each study following the Effective Public Health Practice Project (EPHPP) [22]. We focused on the following domains to assess the quality of included studies: selection bias; study design; confounders; blinding; data collection method; withdrawals and dropouts; and final global rating. Each component-specific parameter (i.e. suitability of the study design for the research question; risk of selection bias; exposure measurement; outcome assessment; and generalizability of findings) was given a judgement: “strong”; “moderate”; and “weak”. At the end of critical appraisal, we also provided the overall grading for each study.

3. Results

3.1. Study selection

The searches yielded 985 potentially eligible studies, from which three studies met the inclusion criteria (see PRISMA diagram, Figure 1). One further study was found from hand searches of journals [23]. Searching the references cited by the identified studies, three major clinical trials repositories and contacting international experts in this field of research for on-going or un-published work did not reveal any further studies.

3.2. Characteristics of the included studies

Detailed characteristics of the included studies are provided in Table 1. There were two cohort [24, 25], one prospective intervention study [26] and one impact evaluation study [23]. The studies were undertaken in Australia (n=1), Singapore (n=1), Turkey (n=1), and New Zealand (n=1). They were conducted in different settings; in the participant’s home via a telephone interview [23], in a paediatric emergency department [24], in a regional burns centre [26] and in one study the location was not documented [25] (see Table 1).

The following health promotion methods to promote burns first aid knowledge to caregivers of children were employed: multimedia campaign [23, 26], pictorial guide [24], and face-to-face first aid training at local schools [25].

3.3. Quality assessment of studies

Whilst the case retention was strong across studies and the selection bias was moderate, the other quality standards assessed were weak. Overall, therefore the quality of included studies were judged as being low and the global rating of all included studies was weak (see Table 2).

3.4. Description of studies

King et al. 1999 conducted an impact evaluation study based on “First Aid for Scalds” campaign in Sydney, Australia. The intervention was a multi-media campaign, including advertisements on ethnic minority radio and newspapers in Sydney’s Chinese, Vietnamese, and Arabic speaking communities. As well as advice on duration of cooling under running water (30 minutes), the intervention gave instructions on not using some traditional methods. The leaflets were distributed in Chinese, English and Vietnamese, radio advertisements were on Vietnamese, Cantonese and Arabic language channels. The research team chose a random sample of the population from these minority ethnic groups and population-based telephone interviews were carried out in each language before and after the media campaign. Results of the study demonstrated improved knowledge in members of this diverse population. The knowledge improvement was more prominent in the Vietnamese group, compared with Chinese and Arabic groups (Arabic before 20.9%, after 26.0%, $p>0.05$; Chinese before 4.2%, after 29.9%, $p<0.01$; Vietnamese before 4.4%, after 63.0%, $p<0.001$). Overall, there was statistically significant improvement in those who reported correct knowledge of first aid for scalds in pre and post intervention groups (41.7% to 63.2%, $p<0.0001$) (see Table 1). There was an association between the participants’ recall of the media campaign and an increase in correct first aid knowledge. The study concluded that “First Aid for Scalds” campaign for burns in children in linguistically diverse communities was valuable.

A recently conducted cohort study from Singapore was based on a pilot survey of caregivers at the children’s emergency department of Kangang Kerbau (KK) Women’s and Children’s Hospital. The aim was to assess knowledge of burns first aid among caregivers of children and the effectiveness of short educational intervention for paediatric burns. The educational intervention in the form of a simple pictorial guide (an educational poster) was based on the European First Aid Guidelines. It consisted of the four main messages of burns first aid treatment (remove clothing, run water for 20 minutes, call for help, dress with clean cloth) and three steps of what not to do (do not use butter, toothpaste etc., do not apply ice, do not burst blister). The pre-intervention questionnaire included 20 items with six scenarios. The first three scenarios regarded the immediate management of a scald, contact and flame burn, with the remainder discussing duration of application of cold water, management of a blistered burn and the time period in which first aid is effective. The post-

intervention evaluation included immediate assessment of post education materials with four new scenarios.

There was a high response rate (99%). Caregivers' correct responses were associated with a previous healthcare training or experience in forms of a training first aid course. The authors reported statistically significant increase in knowledge amongst caregivers immediately after the educational intervention (22.9% vs 78.3%, 95% CI, $p < 0.0001$) (see Table 2).

Ozyazicioglu et al. conducted a cohort study based on a one-group before and after study and investigated the effect of classroom training programs on mothers' knowledge in certain emergencies, including burns in children. Traditional first aid approaches used by mothers for their children included the application of tomato paste, toothpaste, garlic, oil, yogurt, milk, raw eggs, honey, different herbs, salt, cream, washing with soap etc.

The research team delivered an educational intervention lasting 60-minutes covering treatment of burns, lacerations, fractures and poisoning. The focus was on dispelling old remedies as well as promoting current best practice. The intervention was predominantly lecture based and delivered to small groups numbering between 25-30. A total of 2060 mothers in central Kars participated in the intervention with 1754 (85%) undertaking the six month post-intervention survey. The results revealed a reduction in self-reported use of various harmful traditional first-aid approaches in emergencies (29% vs 16.1%, $p < 0.001$).

Skinner et al. conducted a prospective intervention study that evaluated the effectiveness of a multi-media public health campaign on adequacy of first aid treatment for children with burns. The educational intervention, submersion in water or running cool water for 10 minutes, consisted of an extensive multi-media campaign, which included advertisements on television and radio, billboards, articles in local newspapers and magazines on primary prevention and first aid treatment for burns in children. They were also translated into Maori and some Pacific Island language.

Post intervention interviews with caregivers of children demonstrated an improved knowledge of first aid treatment for burn injuries (59% vs 40%, $p = 0.004$). In addition, there were fewer inpatient admissions (64.4% vs 35.8%, $p < 0.001$) and surgical procedures (25.6% vs 11.4%), $p < 0.001$) with greatest reduction observed for children aged up to 10 years old. The research team concluded that, multimedia public awareness campaign reduced hospitalisations of burns patients including children (see Table 2).

3.5. Health economic analysis

None of the studies reported data on cost-effectiveness.

3.6. Quality of Life Measures

None of the studies reported data on Quality of life of sufferers and their family members

Discussion

We identified only four studies in this field of research. Overall, the body of evidence from these studies was considered weak, but did show significant short-term improvements in first aid knowledge post educational interventions. Included studies applied different techniques for delivering the intervention, taught different first aid methods and evaluated different outcomes. Study populations were generally small and represented high-risk groups in the community or clinical setting. The weak evidence demonstrates some value of first aid education campaigns for caregivers of children in diverse communities.

Current first aid standards as recommended by the British Burns Association [11] are to cool the burn under cold running water for 20 minutes, remove clothing and jewellery, call emergency services or doctor for advice and cover the burn with cling film or a sterile, non-fluffy dressing or cloth and ensure the patient is kept warm [11]. These studies proffered different methods with different cooling time scales [23, 24, 26]. Two studies included advice to discourage the use of inappropriate potentially harmful remedies [24, 25]. Several studies have reviewed the first aid advice given and shown that it varies considerably across agencies [20, 21], yet there is an evidence base as to the optimal temperature and time required to cool a burn [27-30]. There is a need to establish and promote standardised evidence based first aid techniques.

Outcome measures were largely short term and relied predominantly on improved knowledge [23, 24, 26] or self-reported burns first aid practice [25, 26]. Studies identified a disparity in effect according to educational background [24] and ethnicity [23, 26]. Kua et al. identified that pre intervention scores were better in those with previous healthcare training i.e. first aid. While this is to be expected, the researchers were able to offer an insight into knowledge retention post healthcare training, identifying those who had received training in the last five years scored better than those who had received any training longer than five years ago. The study also identified that those with previous burns exposure or experience fared worse than their counterparts, postulating that they may have been involved in using inappropriate treatments and were sceptical about the information presented to them. This is despite the education poster having 'Do's and Don'ts of Burns'. For a more effective intervention in this group, a knowledge of current traditional local practice may have allowed the team to tailor their intervention better.

Skinner et al. was the only study that demonstrated an improvement in burns first aid practice and not just knowledge. The study recorded reduced inpatient admissions and surgical intervention in a population derived from a regional burns unit. Whilst the latter may be related to improved burns first aid, there are many other variables that would influence these outcome measures. However, there is some promising data from adult research. Wood et al. noted a significant reduction in length of stay (18%, $p=0.001$), decrease in intensive care unit (ICU) admission (48%, $p<0.001$) and a decrease in grafting (13%, $p=0.014$) associated with the use of burns first aid in an adult population [31].

The lack of studies that recorded actual first aid measures used or long term outcomes give little information as to whether improvement in first aid knowledge actually changes practice or whether knowledge is sustained.

Two studies [23, 26] utilised a multi-media campaign. The participants were primarily from minority backgrounds with various first languages spoken. Both studies confirmed a greater beneficial effect in the minority populations. King et al. demonstrated the greatest benefit in the Vietnamese group and smallest benefit in the Arabic group, which the authors believe is attributed to integration of the Arabic group into Sydney's society. The Arabic speaking group parents were likely to have been more exposed to the English language and less likely to follow the Arabic language campaign. In turn, it resulted in smallest improvement in campaign recall and knowledge, as found in the English speaking population. Skinner et al. stated that radio and television has the greatest impact, although did not present any evidence to substantiate this conclusion. They further commented on the need for cycling or repeating this campaign with an awareness of the potential for tolerance.

We believe that this systematic review is the first and most robust evidence based investigation undertaken to date to support the use of first aid interventions for burns given to caregivers of children.

The included studies have a non-randomised study design with poor methodological quality, making it difficult to offer any definitive recommendations on the effectiveness and cost-effectiveness of first aid interventions for burns given to caregivers of children. With the exception of Ozyazicioglu et al. the three other non-randomised studies conducted to date have a relatively smaller sample size (between 165 and 272 surveys). All included studies omitted power calculations. This poor methodological quality makes it difficult to exclude possible confounders and effect modifiers.

The findings of these studies suggested that the interventions employed could result in some improvement of knowledge of caregivers of children with burns, and some reduction in hospital

admissions and surgical procedures. However, it was not possible to estimate the quality or strength of evidence from these educational interventions. It raises important questions about the effectiveness and cost-effectiveness of first aid interventions for burns to caregivers of children and generalisability of findings of this systematic review.

In the absence of RCTs there is no information as to whether these changes would have happened irrespective of the interventions. Although blinded randomised trials are considered the 'gold standard' for interventional studies, they are difficult to design in the face of mass media campaigns to large populations, nevertheless the benefits associated with a well-designed real life study should not be dismissed. The findings of this review would recommend a prospective cluster RCT over a large, heterogeneous population of carers of young children. This would enhance the external validity of the findings, and allow assessment of the extent to which the intervention would do what it is intended to do in routine circumstances [32]. The study should be powered to ensure a statistically significant effect. First aid interventions should be evidence-based [11] and educational means of delivery carefully designed. Outcome measure should include a measure of first aid practice and studies include a health economic evaluation component.

3.7. Strengths and limitations of the study

The strengths of this systematic review are: it was conducted by an independent research team that employed rigorous methods. Comprehensive searches make it likely that all relevant studies were retrieved and included according to our inclusion criteria. The limitations of this review included small numbers of included non-randomised studies of poor quality, small study sample sizes, heterogeneity of study design, interventions, educational delivery methods, inconsistent and differing outcome measures and an inability to conduct meta-analysis due to the heterogeneity of the included studies.

4. Conclusion

Although there is a paucity of evidence in this area, the findings support a positive role of educational intervention for burns first aid. However, there is insufficient data to judge the quality or strength of evidence to support the effectiveness of interventions in practice. Burns first aid interventions were vaguely specified and described, included studies were small and of poor methodological quality making it difficult to offer any definitive recommendations.

Future research should focus on robustly testing the long-term effectiveness of any parent targeted first aid education interventions via randomised controlled trial, alongside a health economic assessment. Intervention content should be based on current national guidelines, and aim to dispel

myths as well as giving clear instructions for correct first aid. Delivery could be face-to-face education, a multi-media campaign or both, although trial design should consider control group contamination if public media campaigns are employed. The primary outcome measure would be an increase in correctly administered first aid by parents, with intermediate outcomes of increased knowledge and confidence in conducting correct first aid. Secondary outcomes would include the severity of burn injuries (i.e. depth, size), need for referral to specialised burns services, admission data including length of stay, number of operations and long-term morbidity. These measures would allow clinical assessment of the impact of the intervention.

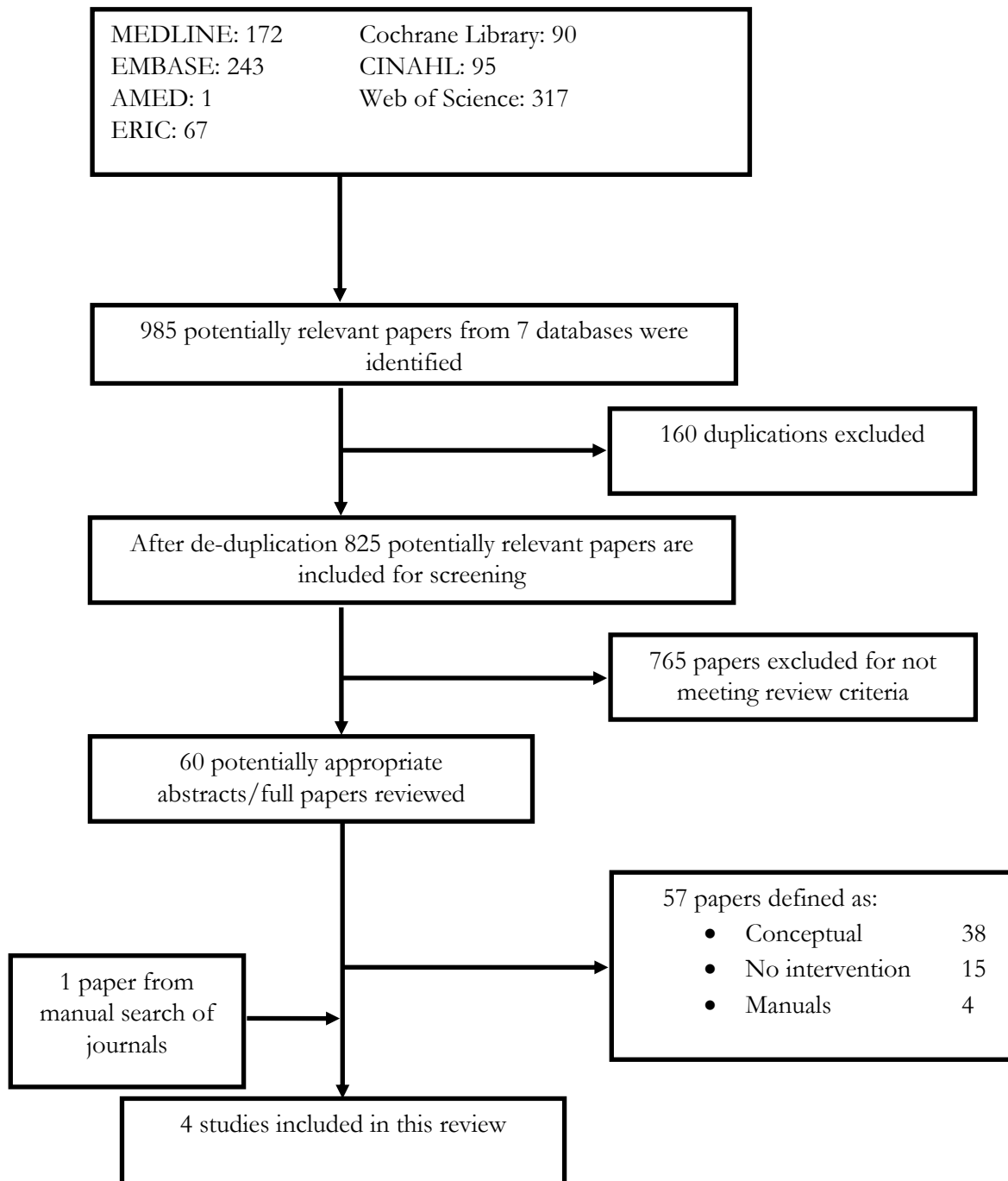
Acknowledgements: We wish to thank all international experts in this field of research that we contacted and the National Centre for Population Health and Wellbeing Research for funding the lead authors post and the Scar Free Foundation for funding SM and HQS as researchers within the Children's Burns Research Network.

Competing interests: The authors have no conflicts of interest.

Contributorship: Ulugbek Nurmatov (UN) and Alison Kemp (AK) conceived the idea for this review and together with Stephen Mullen (SM), Harriet Quinn-Scoggins (HQS), and Mala Mann (MM) formulated the review protocol. UN and MM conducted searches, UN and SM screened, extracted, tabulated and appraised data, UN, SM, and HQS drafted this manuscript, with all co-authors commented on the drafts of the manuscript.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Figure 1: PRISMA flow diagram



Appendix 1

Table 1. Detailed characteristics of included studies

Study	Design	Setting	Population	Aims	Intervention	First aid standard	Results	Lessons learned
King, Australia, 1999	Impact evaluation study	Media campaign in capital city	Campaign aimed towards Chinese, Vietnamese and Arabic speaking communities leaving in Sydney. Population selected randomly based on surname from phone book. Used surname as a means to identify ethnicity. Participant had to care for a child under 5 at least one day a month. Surveyed by independent personnel	Assess impact of a media campaign in knowledge of first aid for burns in 3 minority groups. Pre-intervention occurred 2 weeks prior to campaign. Phone interview. Positive if 2 out of 4 questions answered correctly	4 week media campaign in multiple languages. Radio (up to 5 broadcasts per week for 4 weeks) and newspaper (twice a week for 5 weeks). Post intervention phone interview 2-3 weeks after campaign	Run burn under cool running water for 30 minutes	80.8% of calls answered. 77% not target audience. Pre-intervention 256. Post intervention 301. No statistical difference between pre and post participants. Statistically significant improvement in those who reported correct knowledge of first aid in pre and post intervention groups (41.7% to 63.2%, $p < 0.0001$)	"First Aid for Scalds" campaign for linguistically diverse communities is valuable in burns prevention initiatives in children
Kua, Singapore, 2016	Cohort	Paediatric Emergency Department – tertiary trauma centre	Convenience sample of caregivers. Purposeful selection to recruit over weekdays, weekends including morning, evening and night. Those in need of urgent medical	1. Assess knowledge of paediatric burns first aid among caregivers 2. Determine effect of a short educational intervention on knowledge Trained moderators –	Pre- intervention questionnaire : 20 items. 6 scenarios. 3 regarded the management of a scald, contact and flame burn. The remainder discussed duration of cold water, management of a blistered burn and the time period in	Based on European First Aid guideline – Resuscitation 2007	274 enrolled. 272 completed. Pre-intervention assessment. Correct responses associated with a previous healthcare training such as a first aid course ($p < 0.001$). Statistically significant	A short educational intervention is able to improve knowledge on paediatric burns first aid

			assessment not included. Sample size calculated at 250	students or medical staff	which first aid is effective. Intervention: Simple pictorial guide. 4 main messages, 3 key steps based on European First Aid Guidelines. Post-intervention: immediate assessment post education. 4 new scenarios		increase in knowledge immediately post intervention (pre 22.9%, post 78.3%, 95% CI 49.2-61.4, p<0.0001) Post intervention score related to educational level and pre-score. Sources of information – school and internet	
Ozyazicioglu, Turkey 2011	Cohort	Program offered in neighbourhood schools	All mothers of infants living in central area (Kars) invited to participate (2 786) 6-month period	1. Define first aid practice in Kars 2. Determine effect of a first aid training program for mothers The programme covered multiple aspects of first aid –burns, lacerations, fractures and poisoning Promoted use of appropriate first aid and deterred potentially harmful traditional methods	Pre-intervention survey: researchers designed and piloted; consent gained. Intervention: 60-minute training programme conducted by investigators. Program between 25-30 mothers in each group. Lectures, presentation and QA activities. Post-intervention survey conducted 6 months post training	Questionnaire based on relevant literature. No further information given as to what the standard was	2 060 enrolled (although 2 600 involved in training). Post-test -1 754 (85%) participants. Results demonstrated a reduction in use of traditional methods following the education program (29% pre vs 16.1% post p<0.001)	Education program able to reduce use of traditional methods for first aid in burns

<p>Skinner, New Zealand, 2004</p>	<p>Prospective intervention study</p>	<p>Regional burns unit</p>	<p>All patients with an acute burn injury treated at a regional burns centre over two 4-month intervals. Excluded those who were unable to be interviewed (death or ventilation)</p>	<p>To assess the effect of a multi-media public education campaign. To assess the beneficial effect of adequate burns first aid treatment</p>	<p>Pre-intervention: patients or carers interviewed in ED or as in-patient. Intervention: extensive multi-media campaign (TV, radio, papers, billboards, popular magazines). Translated into Maori and other Pacific Island languages. Included primary prevention and first aid treatment. Post intervention: interview. Followed up for 6 months</p>	<p>Running or submersing in water for 10 minutes. (New Zealand standard at time)</p>	<p>Pre-intervention - 121 participants (out of 165). Post intervention 123 (of a total of 153). No significant difference between groups. Post campaign 76% of participants were aware of intervention. Post campaign improved first aid knowledge (59% vs 40%, $p < 0.001$), fewer inpatient admissions (64.4% vs 35.8%, $p < 0.001$) and fewer surgical procedures (25.6% vs 11.4%, $p < 0.001$). Demographics of participants –only statistical difference noted in Moari and Pacific Island backgrounds</p>	<p>Multi-media campaign for burns first aid improves knowledge. This was sustained over a 4-year period. The campaign also may have impacts on treatment required, although this may be multi-factorial. Greatest benefit was witnessed in minority group and financially disadvantaged</p>
-----------------------------------	---------------------------------------	----------------------------	--	---	--	--	---	---

Table 2. Critical appraisal of included observational studies assessed by the Effective Public Health Practice Project (EPHPP)

Study, year	Design	Selection Bias			Study Design			Confounders			Blinding			Data Collection Method			Withdrawals and Dropouts			Global Rating		
		S	M	W	S	M	W	S	M	W	S	M	W	S	M	W	S	M	W	S	M	W
King, 1999	Impact evaluation study		✓				✓			✓			✓			✓	NA					✓
Kua, 2016	Cohort		✓			✓		✓				✓			✓	✓						✓
Oyzazicioglu, 2011	Cohort		✓			✓				✓			✓		✓	✓						✓
Skinner, 2004	Prospective intervention study		✓				✓	✓				✓			✓	✓						✓

Abbreviations:

EPHPP the Effective Public Health Practice Project

S Strong

M Moderate

W Weak

NA

Not applicable

Appendix 2: Search strategy 1 MEDLINE_EMBASE Format

- 1 exp burns/
- 2 (scald* or burn*2 or burning).tw.
- 3 (thermal adj3 injur*).ab,ti.
- 4 ((injury or injuries or accident* or burn* or scald*) adj3 (hot drink* or hot water)).tw.
- 5 (exp Accidents, Home/ or exp "Wounds and Injuries"/ or exp Fires/) and (hair straighten* or fireworks* or caustic or fire setting or firesetting or cooking or sparkler or aerosol* or hairspray* or flame* or fire or fires or bonfire*).ti,ab.
- 6 ((injury or injuries or accident* or burn* or scald*) and (hair straighten* or hair dry* or hairdry* or firework* or caustic or fire setting or firesetting or cooking or baking or cooker* or oven* or chip pan* or hob* or stove* or sparkler or aerosol* or hairspray* or flame* or fire or fires or bonfire*)).ti,ab.
- 7 or/1-6
- 8 exp First Aid/
- 9 exp Emergency Treatment/
- 10 ("first aid" or first response or prehospital care or emergency response or emergency treatment or emergency care).ti,ab.
11. ((teaching or information or internet or web* or online or on-line or electronic or written or video or print*) adj5 material*).tw.
12. ((internet or web* or online or on-line or electronic or audio* or video* or written or print*) adj5 information).tw.
13. ((action or emergency or manag* or treat* or care) adj5 (plan? or guide* or protocol*)).tw.
14. exp teaching materials/ or practice guidelines as topic/
15. (manag* adj5 (program* or material* or procedure* or strategy or strategies)).tw.
16. health knowledge attitudes practice/
17. (educat* or instruct* or teach* or learn* or coach* or train* or counsel* or advis* or advice* or written procedure*).tw.
18. (emergency and inform*).mp.
19. exp health promotion/
20. exp health education/
21. or/8-20
22. ((parent* adj3 program*) or (parent* adj3 train*) or (parent* adj3 educat*) or (parent* adj3 promot*) or (parent* adj3 skill*) or (parent* adj3 intervent*)).mp. (14444)
23. 7 AND 21 AND 22

Search strategy 2: ERIC format

1. "first aid" OR "emergency care" OR "emergency treatment" OR "emergency response" OR "prehospital care" OR "first response"
2. injury or injuries or accident* or burn* or scald* N3 hair straighten* or hair dry* or hairdry* or firework* or caustic or fire setting or firesetting or cooking or baking or cooker* or oven* or chip pan* or hob* or stove* or sparkler or aerosol* or hairspray* or flame* or fire or fires or bonfire*
3. thermal N3 injur*
4. scald* or burn or burns or burning
5. 1 OR 2 OR 3
6. (Child* or infancy or infant or baby or babies or toddler* or pre-school* or preschool* or preschool-age parent* or father* or mother* or paternal* or maternal* or Mum or Dad) AND (program* or educat* or promot* or train* or skill* or intervent*)
7. 1 AND 5 AND 6

Search strategy 3: Free-field format

("first aid" OR "emergency care" OR "emergency treatment" OR "emergency response" OR "prehospital care" OR "first response")

AND

(scald* or burn or burns or burning)

AND

(parent* or father* or mother* or paternal* or maternal* or Mum or Dad)

AND

(program* or educat* or promot* or train* or skill* or intervent*)

References

1. World Health Organisation (WHO). Violence and Injury Prevention: Burns. 2016 http://www.who.int/violence_injury_prevention/other_injury/burns/en/ [accessed 23.01.17].
2. Delgado J, Ramírez-Cardich ME, Gilman RH, Lavarello R, Dahodwala N, Bazán A, et al. Risk factors for burns in children: crowding, poverty, and poor maternal education. *Inj Prev* 2002;8(1):38-41.
3. Kemp AM, Jones S, Lawson Z, Maguire SA. Patterns of burns and scalds in children. *Arch Dis Child* 2014;99(4):316-21.
4. Zhou B, Zhou X, Ouyang L-z, Huang X-y, Zhang P-h, Zhang M-h, et al. An epidemiological analysis of paediatric burns in urban and rural areas in south central China. *Burns* 2014;40(1):150-6.
5. http://apps.who.int/iris/bitstream/10665/69871/1/WHO_NMH_VIP08.01_eng.pdf. Assessed 23.01.2017.
6. Hudspith J, Rayatt, S. First aid treatment of minor burns. *BMJ* 2004;328(7454):1487-9
7. Cuttle L, Kimble RM. First aid treatment of burns injuries. *Wound Pract Res* 2010;18:1.
8. Nguyen NL, Gun RT, Sparnon AL, Ryan P. The importance of immediate cooling – a case series of childhood burns in Vietnam. *Burns* 2002;28(2):173-6.
9. Skinner A, Peat B. Burns treatment for children and adults: a study of initial burns first aid and hospital care. *N Z Med J* 2002;115(1163):U199.
10. Forjuoh SN, Guyer B, Ireys HT. Burn-related physical impairments and disabilities in Ghanaian children: prevalence and risk factors. *Am J Public Health* 1996;86(1):81-3.
11. http://www.britishburnassociation.org/downloads/BBA_First_Aid_Position_Statement_-_8.10.14.pdf
12. Davies M, Maguire S, Okolie C, Watkins W, Kemp AM. How much do parents know about first aid for burns? *Burns* 2013;39(6):1083-90.
13. Graham HE, Bache SE, Muthayya P, Baker J, Ralston DR. Are parents in the UK equipped to provide adequate burns first aid? *Burns* 2012;38(3):438-43.
14. Harvey LA, Barr ML, Poulos RG, Finch CF, Sherker S, Harvey JG. A population-based survey of knowledge of first aid for burns in New South Wales. *Med J Aust* 2011;195(8):465-8.
15. Gamelli L, Mykychack I, Kushnir A, Driscoll DN, Fuzaylov G. Targeting Burn Prevention in Ukraine: Evaluation of Base Knowledge in Burn Prevention and First Aid Treatment. *J Burn Care Res* 2015;36(1):225-31.

16. Matthews RN, Rauf KG, Warren J. The Coventry thermal injury study. *Burns* 1991;17(1):33-6.
17. McCormack RA, La Hei ER, Martin HC. First-aid management of minor burns in children: a prospective study of children presenting to the Children's Hospital at Westmead, Sydney. *Med J Aust* 2003;178(1):31-3.
18. Rawlins JM, Khan AA, Shenton AF, Sharpe DT. Epidemiology and Outcome Analysis of 208 Children With Burns Attending an Emergency Department. *Pediat Emerg Care* 2007;23(5):289-93.
19. Cuttle L, Pearn J, McMillan JR, Kimble RM. A review of first aid treatments for burn injuries. *Burns* 2009;35(6):768-75.
20. Tiller G, Rea S, Silla R, Wood F. Burns first aid information on the Internet. *Burns* 2006;32(7):897-901.
21. Butler DP, Perry F, Shah Z, Leon-Villapalos J. The quality of video information on burn first aid available on YouTube. *Burns* 2013;39(5):856-9.
22. The Effective Public Health Practice Project (EPHPP). Quality assessment tool for quantitative studies. Available from: <http://www.ephpp.ca/tools.html>
23. King L, Thomas M, Gatenby K, Georgiou A, Hua M. "First Aid for Scalds" campaign: reaching Sydney's Chinese, Vietnamese, and Arabic speaking communities. *Inj Prev* 1999;5:104-8.
24. Kua Phek Hui J, Allen JC, James Mok WL. Attitudes on first aid for paediatric burns: Pilot survey of a developed city state. *Burns* 2016;42:926-37.
25. Ozyazicioglu N, Polat S, Bicakci H. The effect of training programs on traditional approaches that mothers use in emergencies. *Inj Prev* 2011;37(1):79-85.
26. Skinner AM, Brown TLH, Peat BG, Muller MJ. Reduced Hospitalisation of burns patients following a multi-media campaign that increased adequacy of first aid treatment. *Burns* 2004;30(1):82-5.
27. Bartlett N, Yuan J, Holland AJ, Harvey JG, Martin HC, La Hei ER. et al. Optimal duration of cooling for an acute scald contact burn injury in a porcine model. *J Burn Care Res* 2008; 29:828-34.
28. Cuttle L, Kempf M, Liu P-Y, Kravchuk O, Kimble RM. The optimal duration and delay of first aid treatments for deep partial thickness burn injuries. *Burns* 2010;36:673-679.
29. Rajan V, Bartlett N, Harvey JG, Martin HC, La Hei ER, Arbuckle S, et al. Delayed cooling of an acute scald contact burn injury in a porcine model: Is it worthwhile? *J Burn Care Res* 2009;30(4):729-34.
30. Allison K, Porter K. Consensus on the prehospital approach to burns patient management. *Emerg Med J* 2004;21:112- 114.

31. Wood FM, Phillips M, Jovic T, Cassidy JT, Cameron P, Edgar DW, et al. (2016) Water First Aid Is Beneficial In Humans Post-Burn: Evidence from a Bi-National Cohort Study. PLoS ONE 11(1):e0147259.
32. Saturni S, Bellini F, Braido F, Paggiaro P, Sanduzzi A, Scichilone N, et al. Randomized controlled trials and real life studies. Approaches and methodologies: a clinical point of view. Pulm Pharmacol Ther 2014;27(2):129-138.