

An epidemiological study of paediatric burns first aid management by caregivers in Singapore

Regine Lim Li Ying, Cassandra Mah Zi Yuan and Tan Wei Ern Jonathan
Hwa Chong Institution
Singapore

Abstract—To analyse misconceptions in burns first aid management in the local caregiver population so as to formulate better burn prevention programmes, an epidemiological study was carried out on 248 random caregivers at the Accident and Emergency Department and Cleft and Craniofacial Centre of KK Women's and Children's Hospital between October and November 2015. Caregiver demographics (in particular education level), knowledge of cooling methods, cooling duration, use of topical agents, wound treatment and burns first aid procedures were tested. Caregivers showed confidence in handling blisters (74.6% correct), but were unsure of cooling duration (80.2%), wound dressing (67.7% incorrect), avoiding topical agents (59.3% incorrect). A poster-based educational intervention was also successful in improving scores by an average of 3.57 of a possible 8 ($p=1.2689E-95$); the educational level of caregivers was found to have negligible impact on their reception to the intervention ($p=0.689$). Future education programmes can be formulated based on these misconceptions, specifically in the area of appropriate cooling durations, to improve current levels of knowledge.

Keywords-component; Epidemiology, Public Health, Paediatric Burns First Aid, Pre-Hospital Care, Questionnaire-Based Survey, Educational Intervention

I. INTRODUCTION

Locally, childhood injuries is the main cause of death for children age 5 to 14 years old [1], in which the third most common injury among children is burns. Majority of burn patients belong to the younger age distribution and primary cause of paediatric burns is scalding [2]. Paediatric burns accidents tend to occur at homes than in public areas¹⁵ which shows the need for caregivers to be equipped with appropriate burns first aid knowledge.

Paediatric burns have high mortality rates and may result in physical and psychological consequences such as physical disabilities, long term rehabilitation, scarring [3], and depression [4] due to the traumatic experience which a child may find it emotionally difficult to bear [3]. Furthermore, it is estimated that in developed countries such as UK, financial burden of minor scalds ranges at about 4000 pounds per case which accumulates to a huge economic burden on societies [31]. Properly administered burns first aid plays a role in

improving the patient's condition [6]. For instance, rinsing the burn under cool running for 20 minutes helps to reduce burn depth which minimises scarring and speed up recovery in terms of re-epithelisation of cells [9, 10]. Hence, this eases psychological, physical and financial burden on the child and family.

However, caregivers do not possess adequate burns first aid knowledge. A study conducted in South Yorkshire, UK on 188 patients [11] have shown the need for awareness on removal of hot clothes as part of the burns first aid steps. Other studies have also shown that caregivers are ignorant towards the use of cold water therapy [12] or the optimum length of time of treatment [11] and instead, may resort to using ice [2] or cooling for excessively long period of time which may increase risk of hypothermia among children [9]. Caregivers also tend to favour the use of inappropriate topical agents and dressings such as toothpaste, cream and lotion [2, 11, 12]. Such topical applications should be avoided as they do not help with the healing process and may hinder subsequent treatments. Instead, the authors have stated that burns should be dressed with protective coverings such as clean, dry cloth [2].

Locally, caregivers have inadequate knowledge of burns first aid too. According to a 2005 nationwide study on primary caregivers' awareness in Singapore [5], mind sets and practices toward childhood injuries, only 23.8% of surveyed caregivers knew about the appropriate burns first aid procedures to take [5] which shows a serious lack of burns first aid knowledge among Singapore caregivers. For most burns, severity of burns could have been reduced if caregivers have administered adequate first aid to the victims [2, 8]. This can be done through implementation of public awareness and education programmes focusing on potential target groups [2, 13] which will raise awareness of suitable alternatives over traditional methods [14].

Paediatric burns first aid is a critical issue which needs further study in order to reduce the severity of paediatric burns [15]. Therefore, an epidemiological study was conducted to primarily 1) evaluate whether caregivers in Singapore possess adequate burns first aid knowledge and secondarily, to recognise trends between demographics of caregivers and their level of burns first aid knowledge. In addition, we also conducted a short and simple educational session to 2) assess the effectiveness of such a simple educational intervention in raising knowledge of caregivers regarding paediatric burns first aid.

II. HYPOTHESIS

Firstly, the lack of burns first aid knowledge among caregivers is a prevalent issue in many countries [11]. Therefore, we hypothesised that Singapore caregivers still have inadequate knowledge on how to treat burns properly.

Secondly, we hypothesise that our simple educational poster will be highly effective in educating caregivers on paediatric burns first aid, especially for those who receive a higher level of education.

III. METHODOLOGY

A. Materials

A questionnaire was drafted which comprised of two segments. The first segment required caregivers to fill in their demographics: occupation, age, gender, race, number of children in household, highest level of education, monthly individual income. This information collected cannot be traced back to the individual hence, allowing people to give honest responses under confidentiality, thereby increasing the accuracy of results.

The second segment was split into two sections, pre-education and post-education, in which each section comprised 8 scenario-based questions which aimed to assess caregivers' burns first aid knowledge. In this segment, questions were adapted into various burns contexts to increase the applicability of the questions to caregivers by aiding their visualisation of the scenarios. The scenario-based questions were simply phrased for caregivers from different backgrounds to understand the given scenarios without difficulty. Each question is formulated to test on one specific "Do's and Don'ts" actions covered in the educational poster such as removal of hot clothes, cold water therapy, inappropriate application of topical agents, suitable dressings for burns, blisters treatment, seeking proper medical assistance and the recommended procedures. This enabled us to find out common misconceptions in caregivers. The questions also end

with "what will you do, which allowed caregivers to reflect about what they would actually do in the given situation instead of answering theoretically. Questions in the questionnaire were multiple-choice questions which encouraged caregivers to participate in the survey since they could complete it with ease. Yielded data which could be easily analysed since the caregivers' answers originated from a fixed list of options.

A simple educational poster was created and used during the educational session which advised caregivers on the "Do's and Don'ts" of burns first aid treatment. The poster comprised of pictures for easy understanding and a flow chart which visually guided caregivers through the right steps of burns first aid treatment prior to medical assistance from trained professionals. This format helped caregivers to remember the essential burns first aid information within a short period of time.

The survey was conducted in both English and Mandarin, with English being the medium of communication for 241 caregivers, and 7 in Mandarin. English and Mandarin were chosen due to English being the first language of most of the population, with Mandarin coming in second due to the Chinese majority in the local population. Surveys conducted in Mandarin also had questionnaires and educational poster in Mandarin to ensure that the entire survey process was standardised throughout instead of on-the-spot translation which may have affected proper conveyance of meaning.

B. Procedures

The questionnaire-based survey was conducted between 10 October to 27 November 2015 on both weekdays and weekends throughout the day. The settings of the survey were the Cleft and Craniofacial Centre (CCRC) and Children Emergency (CE) of KK Women's and Children's Hospital where children were attended to, in order to minimise inconvenience and to ensure a comfortable setting for the survey. A total of 263 caregivers were interviewed with 248 complete entries recorded. Caregivers were able to stop the survey at any point of time if it was their turn for consultation or if they needed to leave. They were not pressured to rush through the survey, which approximately took about 10 minutes.

Caregivers first fill in their demographics and basic background questions before proceeding into the pre-education segment. Survey moderators would conduct the education intervention explaining the recommended steps for burns first aid treatment. After which, the caregivers would

immediately complete the questions in the post-education segment. This was done as soon as possible to minimise decay factors in retention of information. Throughout the entire process, caregivers were accompanied by one survey moderator to provide any form of assistance such as the explanation of terms used.

C. Data Analysis

The collected raw data comprising of the caregivers' demographics data and answers to the various knowledge questions were entered into a collated Microsoft Excel sheet. The general effectiveness of the educational intervention was then analysed by comparing the scores of the pre-intervention scores against the post-intervention scores. Average improvements of scores were compared against educational levels to determine if the effectiveness of the educational intervention were affected by caregivers' levels of education. Comparison of the percentage of incorrect answers for each questions was made to determine the common misconceptions. Comparison of the general race proportion in Singapore with our study population, was used to determine the applicability of our results to the nation.

IV. RESULTS AND DISCUSSIONS

With reference to Fig 1 below, 52.4% of respondents were correct in thinking that clothes/jewellery should be removed. However, 47.6% of parents would omit this step, citing concerns such as the clothes sticking to wounds and that it would be better and safer to let a medical personnel to do it. With regards to cold water treatment, although most parents (62.9%) were right in running the wound under cool water many were unsure of the appropriate duration of this action, where 80.2% of those surveyed got the duration wrong making it the most badly done question. One study¹⁰ found out that burn wounds treated with cold water therapy for 20 minutes result in quicker re-epithelisation and better scar appearance. Consequently, without knowledge on the appropriate duration, it is highly likely that the wound recovery might be hindered. These findings are not only exclusive to this study and are found to be similar in other studies conducted¹¹.

In previous studies conducted [11, 12, 13], it was noted that caregivers of Asian ethnicity tend to apply inappropriate topical agents to the wound such as toothpaste, petroleum jelly. As an Asian society, our study sees correlations with the aforementioned where 59.3% of respondents felt the need to put some form of topical agents (such as butter or toothpaste) to help with healing. Traditional beliefs that putting topical agents aid recovery may have played a role in this misconception. Respondents were uncertain of wound dressing, and more than half 67.7% opted to let the wound recover naturally, neglecting the possibility of increased risk of infection. This highlights a possible area for us to focus on where more than a single misconception clearly exists. Most of the respondents (76.4%) have the knowledge on how to treat blisters, making it the most well answered question. Yet, particularly concerning was that given a scenario where a child suffered severe burns, only 50.4% of parents would seek help from the A&E department in hospitals. The rest either felt no need for medical help or that visiting the family clinic would suffice. When the child received inappropriate or delayed treatment, it hinders recovery process resulting in psychological trauma and greater treatment costs. Overall, 41.5% of respondents got the burns first aid sequence correct, despite being given all the correct steps but placed in random order.

The awareness of burns first aid knowledge among caregivers is inadequate. Majority of those surveyed showed misconceptions in various aspects on their understanding on how to treat burn wounds.

To raise awareness on how to treat burns, an education intervention was shown to caregivers, before they reattempt the scenario based questions. Our study shows that the educational intervention is effective in raising caregivers' burns first aid knowledge. There was an increase in average scores from 3.75 to 7.32 out of 8. Fig 2 shows that the educational intervention had positively benefitted all caregivers surveyed to varying degrees.

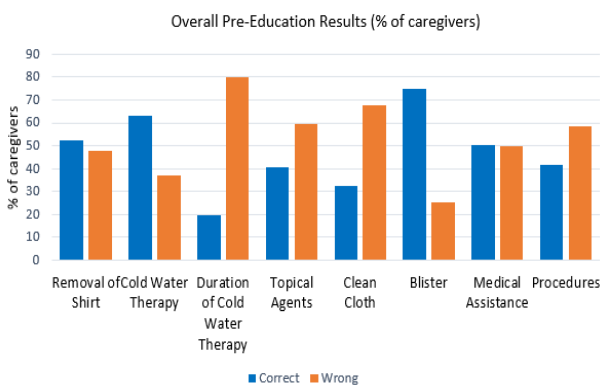


Figure 1. Overall Pre Education Results (% of Caregivers)

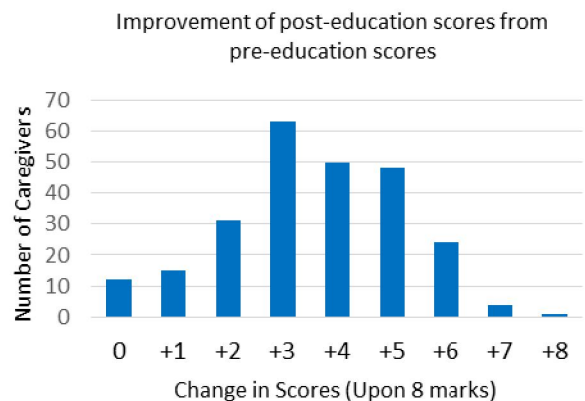


Figure 2. Positive change between pre-education and post-education scores

To further confirm that the improvement in scores was not by chance, a t-test shown in Fig 3 was conducted and as $p < 0.001$, the increase in scores is statistically significant.

t-Test: Paired Two Sample for Means		
	Variable 1	Variable 2
Mean	3.75	7.326612903
Variance	2.277327935	1.046738279
Observations	248	248
Pearson Correlation	0.197323001	
Hypothesized Mean Difference	0	
df	247	
t Stat	-34.18475729	
P(T<=t) one-tail	6.34449E-96	
t Critical one-tail	1.651046077	
P(T<=t) two-tail	1.2689E-95	
t Critical two-tail	1.969614755	

Figure 3. T-Test of average pre-education and post-education scores

Regarding the question on duration of cold water therapy, the number of respondents with incorrect answers dropped from 80.2% to 7.7%. Similarly, the number of participants that will apply topical agents dropped from 59.3% to 3.6%, indicating the correction of a severe misconception in the local population.

From Fig 4, we can see that higher levels of education showed no correlation with average score improvements. Respondents with basic education (Primary and Secondary Education) had an average 95.0% increase in scores (3.4 marks improvement out of a total of 8 marks). Caregivers with GCE A level, Diploma or Degree experienced an average 95.0% improvement in scores (3.63 marks improvement from 3.82 to 7.44 out of a total of 8 marks), while caregivers who are postgraduates experienced an average 97.6% improvement in scores (3.59 marks improvement), out of a maximum 8 marks. This indicates that education level play no significant role in their enhanced understanding of burns first aid management. Furthermore, as $p > 0.05$, our hypothesis that the education intervention will be more effective for caregivers with higher levels of education is disproved.

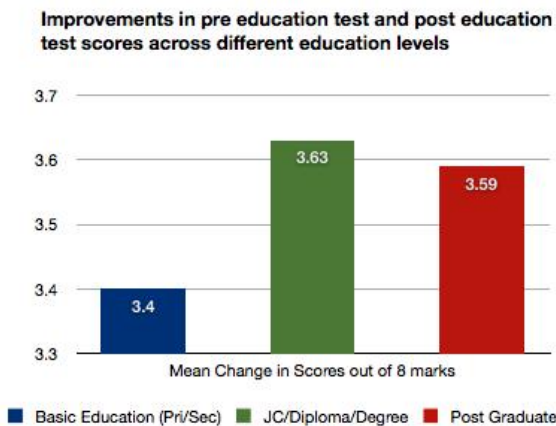
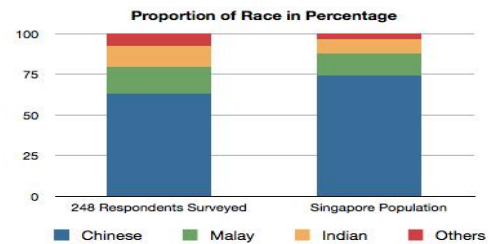


Figure 4. Improvement in scores across the three education categories

With reference to Fig 5, a slight deviation exists between the Singapore population [16] statistics and the demographics of the respondents. Yet, noting that the percentage of respondents correspond in relation to the population makeup (in order of size), the above results are relevant since the demographic (race) of respondents generally represent their respective communities in Singapore.



Proportion of race	Survey Respondents %	Singapore population %
Chinese	63.3	74.3
Malay	16.1	13.3
Indian	13.3	9.2
Others	7.3	3.3

Figure 5. Proportion of Race in Singapore obtained from Singstat

There were also limitations in the accuracy of the data collected due to its nature. Surveys took place while patients waited for their turns. The most significant factor would be the time delay between viewing the educational poster and answering post-intervention questions. Efforts were made to standardise the scope of explanations during the intervention phase so as to minimise variations in the time allocated for viewing the poster. However, delays in between were beyond our control and could have negatively impacted scores. This is because impressions of the poster would not be as impactful with a time delay, especially in instances where the delay was more than 20 minutes [17]. In addition, the questionnaires were conducted by survey moderators who did not undergo any formal training and are not medically trained. On occasions when caregivers raised certain burns-related questions, moderators may give inadequate responses thus caregivers' may not be convinced by the explanation given.

V. CONCLUSIONS

The results obtained showed that the educational intervention is effective in educating caregivers on burns first aid knowledge but have no correlation with education levels of caregivers. This project is limited to a relatively small study population, so one could enlarge the scope of the study by extending it to a wider range of caregivers for more reliable results. Moreover, this can be easily done since survey moderators recruited do not require professional training. Another possible future extension to consider is to investigate the long term effects of an educational intervention after

extended time periods [18]. This would allow for a more accurate gauge of memory retention of information conveyed to respondents enabling us to effectively evaluate the success of the educational intervention.

There is a need for caregivers to be able to respond swiftly so as to reduce severity of burns and minimise consequences on children. Thus, our study has identified common burns first aid misconceptions which need to be addressed and along with the use of improved educational intervention, will then help formulate more effective future educational programmes in burns first aid education for caregivers.

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REFERENCES

- [1] Thein MM, Lee BW, Bun PY. Childhood injuries in Singapore: a community nationwide study. *Singapore Med J.* 2005;46(3):116-121.
- [2] 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.
- [3] Gaurav Mukerji, Shobha Chamania, G.P Patiadr, Saurabh Gupta. Epidemiology of paediatric burns in Indore, India. *Burns* 2001; 27:33-38
- [4] Stoddard FJ, Stroud L, Murphy JM. Depression in children after recovering from severe burns. *Journal of Burn Care and Rehabilitation.* 1992;13(3):340-347.
- [5] Thein MM, Lee BW, Bun PY. Knowledge, attitude and practices of childhood injuries and their prevention by primary caregivers in Singapore. *Singapore Med J.* 2005;46(3):122-126.
- [6] S. Rea, J Kuthubutheen, B. Fowler, F. Wood. Burn first aid in Western Australia--do healthcare workers have the knowledge? *Burns* 2005; 31(8): 1029-34.
- [7] Wang Xina, Zhang Yina, Zhang Qina, Liu Jiana, Peter Tanuseputrob, Manuel Gomez et al. Characteristics of 1494 pediatric burn patients in Shanghai. *Burns* 2006; 32: 613-618.
- [8] C G Cason. A study of scalds in Birmingham. *Journal of the Royal Society of Medicine* 1990; 83: 690-692.
- [9] Bartlett N, Yuan J, Holland AJ, Harvey JG, Martin HC, La Hei ER, Arbuckle S, Godfrey C. Optimal duration of cooling for an acute scald contact burn injury in a porcine model. *J Burn Care Res.* 2008;29(5):828-834.
- [10] Cuttle L, Kempf M, Liu PY, Kravchuk O, Kimble RM. The optimal duration and delay of first aid treatment for deep partial thickness burn injuries. *Burns.* 2010;36(5):673-679. DOI:10.1016/j.burns.2009.08.002.
- [11] 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):438-443. DOI:10.1016/j.burns.2011.08.016.
- [12] Rawlins JM, Khan AA, Shenton AF, Sharpe DT. Epidemiology and outcome analysis of 208 children with burns attending an emergency department. *Emerg Med J* 2007; 23(5): 289-93.
- [13] Cronin KJ, Buffer PEM, McHugh M, Edwards G. A 1-year prospective study of burns in an Irish paediatric burns unit. *Burns.* 1996;22(3):221-224.
- [14] 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):81-83.
- [15] Sadanori Akita, Hiroshi Nakagawa, Katsumi Tanaka, Akiyoshi Hirano. Analysis of pediatric burns in Nagasaki University from 1983 to 2002. *Burns* 2005; 31: 1041-1044.
- [16] Department of Statistics, Ministry of Trade and Industry, Republic of Singapore. *Population Trends 2014.* Singapore: Department of Statistics; 2014 p. 5.
- [17] Ebbinghaus H (1964) *Memory: A contribution to experimental psychology.* (H. ARuger & C. EBussenius, Trans.) New York: Dover.
- [18] Wang, B. (2014). Effect of Time Delay on Recognition Memory for Pictures: The Modulatory Role of Emotion. *PLoS ONE*, 9(6), e100238. <http://doi.org/10.1371/journal.pone.0100238>
- [19] UK Office for National Statistics. Summary: Leading cause of death in England and Wales. UK: ONS; 2009. [cited 2015 August 1]. Available from ONS:<http://www.ons.gov.uk/ons/rel/subnational-health/leading-causes-of-death/2009/leading-causes-of-death-in-england-and-wales-2009.html>
- [20] National Burn Care Review Committee. *Standards and Strategy for Burn Care: A Review of Burn Care in the British Isles.* 2001 National Burn Care Review 2001.
- [21] Fact sheet: Facts about injuries: Burns [Internet]. World Health Organisation, International Society for Burn Injuries [updated 2014 April; cited 2015 August 1]. Available from: http://www.who.int/violence_injury_prevention/publications/other_injury/en/burns_factsheet.pdf
- [22] World Health Organisation. *International classification of Impairments, Disabilities, and Handicaps: A Manual of Classification Relating to the Consequences of Disease* [document on the Internet]. Geneva, Switzerland; 1980 [cited 2015 August 1]. Available from IRIS: <http://apps.who.int/iris/handle/10665/41003>.
- [23] Robert L. Spitzer, Kurt Kroenke Md, Janet B. W. Williams. *American Psychiatric Association's Diagnostic and Statistical Manual, Third Edition.* American Psychiatric Association. 1980 [cited 2015 August 1].
- [24] Kelvin Grove. *Emergency management of severe burns manual.* 7th Edition. The Australian and New Zealand Burn Association. 2002 [cited 2015 August 1]
- [25] Sullivan TP, Eaglstein WH, Davis SC, Mertz P. The pig as a model for human wound healing. *Wound Repair Regen* 2001; 9(2): 66-76.
- [26] Meyer W, Schwarz R, Neurand K. The skin of domestic mammals as a model for the human skin, with special reference to the domestic pig. *Curr Probl Dermatol* 1978;39-52.
- [27] Cuttle L, Kempf M, Phillips GE, Mill J, Hayes MT et al. A porcine deep dermal partial thickness burn model with hypertrophic scarring. *Burns* 2006; 32(7): 806-20.
- [28] Kempf M, Cuttle L, Liu PY, Wang XQ, Kimble RM. Important improvements to porcine skin burn models, in search of the perfect burn. *Burns* 2009; 35(3): 454-5.
- [29] Velde SV, Broos P, Bouwelen MV, Win RD, Sermon A, et al. European first aid guidelines. *Resuscitation* (2007) 72, 240-251.
- [30] C. L. Mallows. Some comments on Cp. *Technometrics* 1973; 15(1): 661-675.
- [31] Griffiths HR, Thornton KL, Clements CM, Burge TS, Kay AR, Young AE. The cost of a hot drink. *Burns* 2006;32(3):372-4 <http://www.makingthelink.net/node/181>