Agents, mechanisms and clinical features of non-scald burns in children: a prospective UK study

(Word count: 3068)

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ABSTRACT
Aims: To inform childhood burn prevention by identifying demographics, clinical features and circumstances of unintentional non-scald burns.

Methods: A prospective cross-sectional study was conducted across Cardiff, Bristol and Manchester, including six emergency departments, three minor injury units and one burns unit between 13/01/2013-01/10/2015. Data collected for children aged <16 years with any burn (scald, contact, flame, radiation, chemical, electrical, friction) included: demographics, circumstances of injury and clinical features. Scalds and burns due to maltreatment were excluded from current analysis.

Results: Of 564 non-scald cases, 60.8% were male, 51.1% were <3 years old, 90.1% (472/524) of burns affected one anatomical site. Contact burns accounted for 86.7% (489/564), 34.8% (137/394) of which were from objects placed at >0.6meters and 76.5% (349/456) affected the hands. Hairstyling devices were the most common agent of contact burns (20.5%, 100/487); 34.1% (30/88) of hairstyling devices were on the floor. Of children aged 10-15 years, 63.7% (65/102), sustained contact burns of which 23.2% (13/56) were preparing food, and when burnt from hairstyling devices, 73.3% (11/15) were using them at the time of injury.

Conclusions: Parents of toddlers must learn safe storage of hazardous items. Older children should be taught skills in safe cooking and hairstyling device use.

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INTRODUCTION

Worldwide, burns account for 5.9% of all unintentional injuries in children aged 15 years or younger.(1) In the United States approximately 55,000 children aged less than 16 were admitted to hospital due to burns in 2006-2015, accounting for 27% of all burns admissions.(2) In the United Kingdom (UK), fewer than 10% of children with burns require hospital admission (3) although it is estimated that 50,000 children attend Emergency Departments (ED) with burns each year.(4)

Most epidemiological studies have focussed on burns admissions, which by their nature capture larger severe burns, predominantly scalds, and often with data from Burn Centres and units. (5-10) This misrepresents the true scale of the challenge in burns prevention. Although 90% of childhood burns are managed in the ED, many of these ED studies have been short, retrospective, single centre studies, which either combine scalds and non-scald burns (11, 12) or observe scalds alone.(13, 14) While prevention messages for childhood scalds are clear, relating to hot drink hazards, the key prevention messages for non-scald burns are less clear. A previous study of ED attendances for childhood burns in the UK and Ireland identified a number of non-scald burn hazards.(15) At that time, 42% of burns were non-scalds, however there is a constant shift in domestic appliances in use, and thus potential changes in burns risk for children of all ages. Some of these individual agents such as domestic irons, hair straighteners and oven doors have been described in case series.(16-18), but current epidemiological studies have not detailed specific agents, and mechanism of injury for individual age groups.

Home safety education can change parental behaviours and reduce hazards, though there is a lack of evidence that such prevention strategies reduce the number of burns in childhood.(19) For prevention to be targeted and effective, we need to have a detailed understanding of the injuries that are being sustained, and how and where these occur. This is particularly relevant in continually changing environments, with the emergence of new burn hazards in the home for children.

This study aims to identify the demographics, clinical features and circumstances of unintentional non-scald burns in children, to inform and underpin prevention efforts.

METHODS

A prospective cross-sectional study from three UK centres (Cardiff, Bristol and North Manchester) was conducted (figure 1). Individual sites included six ED (University Hospital of Wales Paediatric ED, Bristol Royal Hospital for Children ED, Frenchay Hospital Bristol ED, Oldham Hospital ED, North Manchester General ED, Fairfield Hospital ED), three minor injury units (MIU) (Barry MIU, Rochdale Hospital Urgent Care Centre and Southmead Hospital Bristol MIU) and one paediatric burns unit (The South West UK Children's Burn Centre). Data were collected using a proforma, the Burns and Scalds Assessment Template (BASAT, eFigure 1). Clinicians completed the BASAT at presentation for all children, aged 0-15 completed years, attending hospital with a burn during the period January 13th 2013 to October 1st 2015 (figure 1). Data collected included demographics, presence of developmental impairment, burn type, agent (hot item that caused the injury), location of agent,(itemised on BASAT eFigure 1) from which we estimated height (divided into items on the floor, or at a height of ≤ 0.6 m or > 0.6m, which is the average height of a bedside table/bed in the UK), environment, activity of child at time of injury, anatomical site affected, burn depth, total body surface area (TBSA) percentage, and child protection questions (eFigure 1). Children were grouped into age bands of <3 years, 3-9 years and 10-15 years because children <3 years old also had motor development recorded. No identifiable data were collected, each case was given a unique case number and data were entered into a REDCap database.(20) The data were exported into SPSS v18 and Microsoft Excel 2013 for analysis. House fires and fatalities were excluded from the data collection.

We excluded from analysis all scalds, and cases where burn type, age or gender were missing, or those with suspected maltreatment or unknown Child Protection (CP) referral status. Ethical approval was granted, with waived consent; MREC-13/WA/0003, R&D 12/RPM/5587, CAG-1-06 (PR7)/2013. Cardiff University sponsorship number: 1177-12.

Statistical analysis

The ascertainment rates were calculated as a proportion of total hospital attendances for burns and scalds in children aged 0-15 completed years over the study period. If more than one box was ticked for depth of injury the most severe depth was used for analysis. Agents, locations of agents, motor development and anatomical areas were categorised, as shown in eTable 1 and figure 2. A Kruskal-Wallis test was performed to test for differences in age between sites for each centre (eTable 2 and 3) and between those with and without developmental impairment (eTable 4). Chi-square tests were performed to test for difference in age between the three centres and to test for differences in gender between centres. Fisher exact tests were used to test for differences in gender between sites for each centre, (eTable 2 and 3) and those with and without developmental impairment (eTable 4). 95% Confidence Intervals (CI) were calculated to compare the proportion of non-scald burns in this study as previously used (15). All tests were set with 0.05 as the level of significance. Denominators varied due to missing data for some variables.

RESULTS

Demographics

Ascertainment across all sites was initially 80-85% varying across centres, but reached 90-100% as the BASAT became more established in clinical practice. The demographics of the data did not differ significantly between the three centres regarding gender (p=0.594) or age (p=0.132), thus the cases were treated as a single dataset (eTable 2 and 3).

Overall there were 1468 burns, of which 50.5% (741/1468) were non-scald burns. After suspected child protection cases (or where CP status was unknown), and those with missing data in gender, age or burn type were removed, there were 564 non-scald burns cases in total; 60.8% (343) were male, the median age was two years (inter-quartile range [IQR] 6) and the most common type of non-scald burn was contact burn (86.7%, 489/ 564). Male predominance was evident for contact, radiation (sunburn), friction and aerosol burns, whilst flame, chemical and electric burns were recorded more frequently in females (table 1). Children aged <3 years predominantly sustained contact burns (94.8%, 273/288) whilst the older age groups (3-9 years and 10-15 years) were affected by a wider number of causes. All radiation burns were sunburn and so will be referred to as such hereafter (table 1).

Where data were provided, the majority of burns of all types, with the exception of flame and sunburn, affected ≤1% total body surface area (TBSA, 92.6%, 399/431). Across all burn types, the majority were partial thickness apart from electrical and chemical, which were generally less severe (table 1). While this holds true for burns caused by hairstyling devices (77.9%, 74/95 were partial thickness), 9.5%, (9/95) were full thickness burns. Almost all burns from hairstyling devices had a TBSA of ≤1% (97.2%, 70/72) and the remainder were 2-9% (2.8%, 2/72).

Most non-scald burns affected only one anatomical site (90.1%, 472/524) with the exception of sunburn whereby only 26.6% (6/21) affected one anatomical site. The most common anatomical site involved was the hand, accounting for 76.5% (349/456) of contact burns (figure 2). However the most common site for sunburn were the shoulders and upper arm (71%, 15/21) and for chemical burns the face, head and neck (43.8%, 7/16).

Contact burns

Contact burns were the most common type of non-scald burn (86.7%, 489/564, table 1). Where documented, 91.3% (442/484) occurred in the home, 3.3% (16/484) outside, 2.5% (12/484) at school/nursery, 1.4% (7/484) at a public place and 1.4% (7/484) were at miscellaneous locations. The precise location of the agent, and the activity of the child prior to the incident, was recorded for 394 (81.4%) and 434 (89.7%) children respectively. Contact burns occurred predominately when children touched a hot object (80.1%, 392/484), the exception to this being domestic irons, where by unlike other agents of contact burns, only 52.7% (29/55) were caused by touch (table 2). Many contact burns were sustained at estimated heights >0.6 metres (34.8%, 137/394) (table 3).

Hairstyling devices were the most common agents of contact burns, accounting for 20.5% (100/487, table 2) where 99 were hair tongs/straighteners and one was a hair dryer. The floor was the most common location of hairstyling devices (34.1%, 30/88), affecting 34.5% (19/55) of children aged <3 years and 44.4% (8/18) children aged 3-9 years (eTable 5). However, among those aged 10-15, 73.3% (11/15) were using the device at the time of injury. Following hairstyling devices, *oven hobs and cooking items* were the next most common agent of contact burns. Cooking items included hot pans, pots and trays, kettles and several others (eTable 1). Among children aged 10-15, 25.0% (16/64) sustained burns from cooking items, 9.3% (6/64) from oven hobs (table 2) and preparing food/drink was the activity at the time of injury for 23.2% (13/56, table 3) of children in this age group.

Anatomical site involved in contact burns

The anatomical site involved was documented in 93.3% (456/489) of contact burn cases. Contact burns most commonly affected the hands (76.5%, 349/456), followed by the forearm (11.4%, 52/456, figure 2). Only 11.4% (52/456) had multiple contact burns, either on multiple anatomical sites (42.3%, 22/52), multiple burns in a single anatomical site (50.0%, 26/52), or both (7.7%, 4/52); 22/52 affected both hands, four were to both feet, and 19 were in two adjoining body parts e.g. hand and forearm, the remaining seven were to non-adjoining body part areas e.g. leg and forearm having been sustained by pulling an object onto themselves, falling onto the hot object, or exploding objects from bonfires etc.

Sunburn

Sunburn affected 4.1% (23/564), with 16/21 documented cases occurring in the UK, the remainder abroad. Five of the 23 children (21.7%) were <3 years, of whom two were pre-mobile, two early mobile, and one not detailed.

Flame burns

Half of the flame burns (8/16) were sustained when playing with friends outside, using petrol or aerosols. Of the five flame burns amongst children aged 0-9 years, three were candle burns to <3 year olds.

Chemical burns

Chemical burns fell into two distinct groups, 6/16 (37.5%) were sustained in school chemistry lessons from chemicals such as hydrochloric acid. The remaining ten (62.5%) involved household products, five were to children aged <3 years touching cleaning products. These household products were in a variety of locations, ranging from a windowsill, a kitchen cupboard, a low table, the floor, the end of a vacuum cleaner nozzle, and unspecified in four cases.

Electrical burns

All nine were sustained at home and involved a range of different agents including plug sockets, lamps and frayed electrical wire. The location of the electrical agent ranged from the floor, washing machine, in child's hand, wall socket and was unspecified in four cases.

Friction burns

There were only six friction burns, four of which involved a treadmill (aged <3, 3-9 and two children aged 10-15). The remaining two children sustained their burns from a rope and a plastic slide respectively. None of the children sustaining friction burns had associated degloving injuries.

Cold aerosol burns

All five cold aerosol burns occurred in children aged 10-15 years old. These were either self-inflicted or administered by a peer, three of which occurred in school.

Developmental impairment (DI)

Overall DI was recorded in 15 children (2.7%, 15/564), 12 boys, six of whom had learning impairment. The type of burn seen was comparable to children without DI, with contact burns accounting for 93.3% (14/15), and one case of sunburn. There was no significant difference in gender between those with or without DI (p=0.18), although DI children with burns were older (p=0.025, eTable4).

DISCUSSION

Non-scald burns represent an increasing proportion of childhood burns attending hospital, accounting for 50.5% (741/1468, 95% CI 0.48-0.53), in contrast to a previous study of childhood burns in the UK conducted between 2008-2010, where 42.0% (510/1215, 95% CI 0.39-0.45) of burns were non-scalds (15). Children aged <3 years accounted for 51.1% of all non-scald burns in the current study, and contact burns were by far the most common type. The prevailing hazards were hairstyling devices, whereby children aged less than 10 years either touched or stepped on the devices, predominantly left on the floor, or in a range of other locations easily accessible to young children. Oven hobs closely followed hairstyling devices in prevalence, and were also most common in children <3 years old, indicating that this age group can reach higher than parents expect. In the UK, the average standing height of a two year old child is approximately 0.88 metres (21), thus they can easily reach oven hobs and kitchen surfaces (average height 0.9 metres).

The high prevalence of burns in children <3 years, and the predominance of boys is well documented (11, 22-24), although a recently published study of burns suggest that the gender prevalence varied with age; boys <2 years were more likely to sustain burns, and girls had more burns between age 5 and 11 years. This study did not detail the type or cause of burns(25). We found the second most common type of non-scald burn, following contact burns, to be sunburn, in contrast to studies of adults and children where contact burns were second to flame burns. (12, 26) This highlights the need for burn specific, as well age specific, prevention strategies. Sun protection strategies need to be targeted at children as, while the risk of melanoma as a consequence of sun exposure are similar throughout life,(27) early sun protection education instils lifelong behaviours.(28) Although we did not see any degloving injuries as a result of friction burns, it would be prudent to include appropriate information in prevention strategies, including wearing protective clothing when cycling or skateboarding and discouraging children from playing around fast moving rotational parts(29, 30). We have also highlighted a possibly emerging burn type; cold-aerosol burns also known as “frosties” which seem to be growing in prevalence among teenagers.

Furthermore, we categorised hairstyling devices separately from other portable devices in order to gain a full understanding of the circumstances surrounding burns related to these devices. As such, we have reinforced the case series identifying hair straighteners and other styling devices as serious hazards.(31) This growing problem may be due to an increase in the number of consumers owning hair straighteners from 4.6 million in 2007 to 5.3 million in 2010 in the UK according to Mintel, a market intelligence agency.(32) Interestingly, a case series and thermodynamic study of hair straighteners found maximum temperatures of 145^0 C can be reached in less than two minutes, and it takes at least seven minutes for them to cool below a temperature that can no longer burn adult skin. Additionally, literature records 10% of cases were full thickness and required surgery with one requiring secondary surgery for burn contracture.(16) Similarly, our data showed that 9.3% of hair styling burns were full thickness, in contrast to all other agents. Prevention strategies could include discussions with hairstyling device manufactures to include hazard warnings on packaging, development of childproof switches, retractable hot elements, and products that automatically turn off when not in use. Though most hair straighteners on the market today include a heatproof mat or pouch, the uptake of use, or effectiveness in preventing injuries is not documented.

It is clear that older school age children need to be carefully supervised during food preparation, and be taught how to handle hot food items carefully, as this was a common source of burns within this age group. Likewise, increasing independence of this age group as they use hair styling devices themselves leaves them exposed to significant burn hazards, as they frequently burnt themselves during use. It is notable that a significant number of school age children sustained severe enough sunburn to warrant hospital attendance, suggesting that more needs to be done to educate this group about safe sun practices.

The strengths of this study include its large sample size, its prospective and multicentre nature, and the level of detailed analysis regarding how and why non-scald burns occur in children. The study highlights the activities that children are undertaking when they sustained the burn, thus complimenting a recent study which concentrated on the associated developmental and behavioural characteristics (25)

Our findings also provide a description of the characteristics of unintentional non-scalds burns, in particular that the majority of cases were of a single contact burn, usually to the hand. When multiple burns were present, they tended to be in adjoining anatomical areas and followed a specific pattern (figure 2). This information may be of value to those assessing the plausibility of the pattern of burn seen from the mechanism described.

The most significant limitation to this study is missing data, particularly with respect to motor development, TBSA and depth of injury. Similarly, a significant proportion of cases from one centre (Manchester) were excluded due to Child Protection concerns or uncertain CP status. However, as we were anxious to profile unintentional non-scald burns, we adopted a cautious approach by omitting any cases where clinicians did not explicitly record that CP had been considered and there were no concerns. In common with the majority of literature in this field, this study includes only those with medical attendances, thus we cannot assume that similar patterns are present among more minor burn injuries. We did not have ethical approval to record data on ethnicity and socioeconomic status, which may be of interest. Rawlins et al found that, Asian ethnic minorities were over-represented, with 50% of all types of burns being in Asian children, compared to only 20% of the surrounding population being of Asian ethnicity.(11)

In conclusion, childhood non-scald burns are an increasingly common preventable injury, and our study has highlighted specific circumstances and age groups where prevention efforts should be targeted. Strategies should educate parents of young children, specifically pre-schoolers, regarding safe storage of hot objects, specifically hairstyling devices, awareness of how high toddlers can reach, adequate sun protection, and avoidance of carrying or placing a child near cooking items. Older school aged children should be educated in safe practices in the kitchen, using hairstyling devices and not inflicting aerosol burns on one another. Policymakers should consider placing more onus on manufacturers of hairstyling devices to reduce the hazard they present to children. Continued research is warranted to optimise prevention strategies for contact burns in pre-school children, and assess their effectiveness in an ever changing environment where new risks may develop.

ACKNOWLEDGEMENTS
We are grateful to the Burns Collective and The Scar Free Foundation for their support of this study, to all participating centres: University Hospital of Wales Paediatric ED, Barry MIU, Bristol Children's Hospital ED, Bristol Frenchay ED, Southmead MIU, The South West UK Children's Burn Centre, Oldham Hospital ED, Rochdale Hospital ED, North Manchester General ED and Fairfield Hospital ED; Study data were collected and managed using REDCap (20) tools hosted at the University of Bristol. This research is jointly funded by the National Assembly for Wales and The Children's Burns Research Centre. The Children's Burns Research Centre is part of the Burns Collective, a Scar Free Foundation initiative with additional funding from the Vocational Training Charitable Trust (VTCT) and the Welsh Assembly. The views expressed are those of the authors, and not necessarily those of The Scar Free Foundation or other funding bodies.

REFERENCES

1. Peden M. World report on child injury prevention: World Health Organization; 2008.
2. Association AB. National Burn Repository 2016. Available at: http://wwwameriburnorg/2016ABANBR_FINAL_42816pdf. 2006-2015.
3. Wilkinson E. The epidemiology of burns in secondary care, in a population of 2.6 million people. Burns. 1998;24(2):139-43.
4. UK accident statistics, Home and Leisure Accident Surveillance System http://www.hassandlass.org.uk/reports/2002data.pdf 2002 [4th September 2014].
5. Alnababtah KM, Davies P, Jackson CA, Ashford RL, Filby M. Burn injuries among children from a region-wide paediatric burns unit. Br J Nurs. 2011;20(3):156, 8-62.
6. Arslan H, Kul B, Derebasinlioglu H, Cetinkale O. Epidemiology of pediatric burn injuries in Istanbul, Turkey. Ulusal Travma ve Acil Cerrahi Dergisi = Turkish Journal of Trauma & Emergency Surgery: TJTES. 2013;19(2):123-6.
7. Tse T, Poon CHY, Tse K-H, Tsui T-K, Ayyappan T, Burd A. Paediatric burn prevention: an epidemiological approach. Burns. 2006;32(2):229-34.
8. Duke J, Wood F, Semmens J, Edgar DW, Spilsbury K, Hendrie D, et al. A study of burn hospitalizations for children younger than 5 years of age: 1983-2008. Pediatrics. 2011;127(4):e971-7.
9. American Burn Association. National burn repository(R): report of data from 1999–2008; version 5. 0 [Internet]., . American Burn Association. 2009.
10. Saeman MR, Hodgman EI, Burris A, Wolf SE, Arnoldo BD, Kowalske KJ, et al. Epidemiology and outcomes of pediatric burns over 35 years at Parkland Hospital. Burns. 2016;42(1):202-8.
11. Rawlins JM, Khan AA, Shenton AF, Sharpe DT. Epidemiology and outcome analysis of 208 children with burns attending an emergency department. Pediatric Emergency Care. 2007;23(5):289-93.
12. Chipp E, Walton J, Gorman DF, Moiemen NS. A 1 year study of burn injuries in a British Emergency Department. Burns. 2008;34(4):516-20.
13. Yates J, McKay M, Nicholson AJ. Patterns of scald injuries in children--has anything changed? Irish medical journal. 2011;104(9):263-5.
14. Guzel A, Aksu B, Aylanc H, Duran R, Karasalihoglu S. Scalds in pediatric emergency department: a 5-year experience. J Burn Care Res. 2009;30(3):450-6.
15. Kemp AM, Jones S, Lawson Z, Maguire SA. Patterns of burns and scalds in children. Arch Dis Child. 2014;99(4):316-21.
16. Wilson Jones N, Wong P, Potokar T. Electric hair straightener burns an epidemiological and thermodynamic study. Burns. 2008;34(4):521-4.
17. Gaffney P. The domestic iron. A danger to young children. Journal of Accident & Emergency Medicine. 2000;17(3):199-200.
18. Yen KL, Bank DE, O'Neill AM, Yurt RW. Household oven doors: a burn hazard in children. Arch Pediatr Adolesc Med. 2001;155(1):84-6.
19. Kendrick D, Young B, Mason-Jones AJ, Ilyas N, Achana FA, Cooper NJ, et al. Home safety education and provision of safety equipment for injury prevention (Review). Evid Based Child Health. 2013;8(3):761-939.
20. Paul A. Harris RT, Robert Thielke, Jonathon Payne, Nathaniel Gonzalez, Jose G. Conde, . Research electronic data capture (REDCap) - A metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-81.

21. Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud PA, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. Jama. 1999;282(15):1458-65.
22. Carlsson A, Uden G, Hakansson A, Karlsson ED. Burn injuries in small children, a population-based study in Sweden. Journal of Clinical Nursing. 2006;15(2):129-34.
23. Kemp AM, Jones S, Lawson Z, Maguire SA. Patterns of burns and scalds in children. Archives of Disease in Childhood. 2014;99(4):316-21.
24. Teo AIC, Van As AB, Cooper J. A comparison of the epidemiology of paediatric burns in Scotland and South Africa. Burns. 2012;38(6):802-6.
25. Emond A, Sheahan C, Mytton J, Hollén L. Developmental and behavioural associations of burns and scalds in children: a prospective population-based study. Archives of Disease in Childhood. 2016.
26. Stylianou N, Buchan I, Dunn KW. A review of the international Burn Injury Database (iBID) for England and Wales: descriptive analysis of burn injuries 2003-2011. BMJ Open. 2015;5(2):e006184.
27. Dennis LK, Vanbeek MJ, Beane Freeman LE, Smith BJ, Dawson DV, Coughlin JA. Sunburns and risk of cutaneous melanoma: does age matter? A comprehensive meta-analysis. Annals of epidemiology. 2008;18(8):614-27.
28. Ho BK, Reidy K, Huerta I, et al. Effectiveness of a multicomponent sun protection program for young children: A randomized clinical trial. JAMA Pediatrics. 2016;170(4):334-42.
29. Castana O, Dagdelenis J, Rempelos G, Paneris P, Anagiotos G, Diplas D, et al. Traumatic injuries with deep abrasion: "a burn". Ann Burns Fire Disasters. 2009;22(1):44-7.
30. Spitz L, Coran AG. Operative pediatric surgery. Boca Raton: Taylor & Francis; 2013.
31. Sarginson JH, Estela C, Pomeroy S. 155 burns caused by hair straighteners in children: a single centre's experience over 5 years. Burns. 2014;40(4):689-92.
32. Mintel Webpage. Accessed 31/03/2016. Available at: http://www.mintel.com/press-centre/beauty-and-personal-care/hair-straighteners-making-waves-over-a-quarter-of-women-now-cant-live-without-them.