Title The Influence of Agents and Mechanisms of Injury on Anatomical Burn Locations in Children <5 Years Old with a Scald

Authors

Assim Ali Javaid (Corresponding Author)

Cardiff University - Division of Population Medicine

3rd Floor

Neuadd Meirionnydd

Heath Park

Cardiff

UK

CF14 4YS

Email: assimjavaid@doctors.org.uk

Phone: 07872619820

Emma Johnson

New Cross Hospital

Wolverhampton Road

Heath Town

Wolverhampton

WV10 0QP

Linda Hollén

Centre for Academic Child Health

Bristol Medical School

University of Bristol

1-5 Whiteladies Road

Clifton

Bristol BS8 1NU

Alison Kemp

Cardiff University - Division of Population Medicine

3rd Floor

Neuadd Meirionnydd

Heath Park

Cardiff

UK

CF14 4YS

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Abstract

Objective: To demonstrate how the mechanism and agent of injury can influence the anatomical location of a scald.

Design: Prospective multicentre cross-sectional study.

Setting: 20 hospital sites across England and Wales including emergency departments, minor injury units and regional burns units.

Patients: Children aged 5 years and younger who attended hospital with a scald.

Main outcome measures: Primary outcome: A descriptive analysis of the mechanism, agent, and anatomical location of accidental scalds. Secondary outcome: a comparison of these factors between children with and without child protection (CP) referral.

Results: Of 1041 cases of accidental scalds, the most common narrative leading to this injury was a cup or mug of hot beverage being pulled down and scalding the head or trunk (132/1041; 32.9% of cases). Accidental scalds in baths/showers were rare (1.4% of cases). Accidental immersion injuries were mainly distributed on hands and feet (76.7%).

There were differences in the presentation between children with accidental scalds and the 103 who were referred for CP assessment; children with scalds caused by hot water in baths/showers were more likely to get referred for CP assessment ($p<0.0001$), as were those with symmetrically distributed ($p<0.0001$) and unwitnessed ($p=0.007$) scalds.

Conclusions: An understanding of the distributions of scalds and its relationship to different mechanisms of injury and causative agents will help clinicians assess scalds in young children, particularly those new to the emergency department who may be unfamiliar with expected scald patterns or with the importance of using appropriate terminology when describing scalds.

Introduction

Scalds caused by hot liquids or steam[1] account for half of all childhood burns[2-6]. In a recent study, we showed a strong relationship between mechanisms of injury and causative agents on the anatomical location of contact burns in children aged less than 5 years-old[7]. We now aim to replicate this study with a focus on scalds.

It is worth noting that most scalds are accidental [6], and studies have identified demographic factors that increase the risk of childhood scalds that include male gender, being between 1-2 years-of-age, being part of a large sibling group, having a young mother, being a member of a single adult household, living in an area of increased material deprivation, being an immigrant from a less developed country, having less developed fine motor skills and hyperactive behaviour in the child[8-10].

The primary aim of this study was to describe how the mechanism of injury and the causative agent influences the anatomical location of a scald and thereby increase the evidence base for objective assessment of a child presenting with a scald and to better inform injury prevention strategies in future health promotion campaigns.

As a secondary outcome, a comparison was also made between accidental scalds and those referred on to children's social services with child protection (CP) concerns. This comparison may bring to light factors that clinicians associate more strongly with concerns of abuse or neglect.

Method

A prospective multi-centre study from 20 hospital sites was conducted from August 2015 to September 2018 (See Appendix 1).

Data Collection

A proforma, the Burns and Scalds Assessment Template (BaSAT) version 7 (See Appendix 2), was used to collect data on children aged less than 16 years presenting with a burn or scald. The BaSAT recorded data on patient demographics, the history and presentation of the burn and the final management plan in terms of treatment and follow up from a safeguarding perspective. Records were anonymised, cases were given unique identifiers and all data were uploaded to a REDCap database[11] without any patient identifiable information.

The children who were less than 5-years-old and coded as having suffered a scald were included in this study. Data for these cases were exported into SPSS version 25 and Microsoft Excel for analysis. Cases were excluded from analysis if details were either absent or ambiguous (e.g. contradictory information was entered in different parts of the proforma) for one or more of the following categories; the mechanism of injury, the causative agent, the anatomical location of the burn and whether a CP referral had been made (Figure 1). The remaining cases were categorised as those for which a CP referral was made by clinicians and those that were presumed accidental injuries (those that did not have a CP referral).

The BaSAT proforma was completed depending upon the workload faced by individual centres, with no predetermined sampling process in place. The case ascertainment rate for completed BaSATs as a proportion of total cases of childhood burns seen at each of the recruitment centres in the study time period was 70-80% with 35% completed by ED nursing staff and the remainder by medical staff.

Analysis

The scald incidents were categorised according to the agent involved, the mechanism of injury and the anatomical location of the scald (Table 1) as recorded on the BaSAT. The distribution of the scald was recorded on a body map included on the BaSAT and then recorded on the database according to a list of 57 different anatomical locations. These 57 locations were consolidated into 6 larger areas (Table 1), for the purpose of the analysis. Given the nature of liquids to flow down the body with the

effect of gravity, and the most superior part of the scald often being the worst affected as the liquid cools while flowing down the body, the most superior location of the scald on the body was taken as the primary burn location. For example, a scald affecting the head, trunk and right arm was categorised as being a primary burn to the head.

Table 1 – Definitions of variables derived from the BaSAT that informed the study analysis.

Variable	Sub-category	Description
Agent	Hot Beverages in Cups/Mugs	All scalds from a hot beverage (e.g. tea or coffee)
	Hot Water in Kitchen Utensils	All scalds from hot water found in kitchen utensils (e.g. pans, kettles, bowls)
	Hot Water in Baths/Showers	All scalds that occurred in a bath or shower
	Hot Food	All scalds from hot food in liquid or semi-liquid form (e.g. soup, porridge, pasta sauce)
	Miscellaneous	All other causes of scalds. Includes uncommon containers of hot water (e.g. hot water bottles, buckets), unknown containers of hot water and non-water liquids (e.g. oil, wax)
Mechanism	Pull Down	Any injury where a liquid containing object is pulled down from a height
	Spill	Any injury where the child knocked over a liquid containing object
	Immersion	Injuries involving all or part of the body being immersed submerged in liquid
	Independent of the Child	All scalds following events independent of the child's actions (e.g. caused by a third party)
	Unwitnessed	Any scald which was not witnessed by a third party
Location	Head	Any scald where the highest point scalded was on the head or neck
	Trunk	Any scald where the highest point scalded was on the shoulders, chest, abdomen, genitalia, buttocks or back
	Arms	Any scald where the highest point scalded was on the arms
	Hands	Any scald where the highest point scalded was on the hands
	Legs	Any scald where the highest point scalded was on the legs
	Feet	Any scald where the highest point scalded was on the feet

Demographic variables recorded on the BaSAT and used for analysis include gender, age, ethnicity and quintiles of Index of Multiple Deprivation (IMD) (Table 2). IMD is an official measure of relative deprivation for small areas in England[12] and Wales[13], considering factors such as income, education and crime[14]. IMD quintile 1 is the most deprived group and quintile 5 the least deprived. It is worth noting, IMD groupings are constructed differently in England and Wales, so this value is only reflective of a patient's deprivation relative to their country of residence.

A descriptive analysis is provided according to the anatomical location of the scald and the specified agent and mechanism involved (Table 3). Analysis of the child's activity prior to the scald and the resulting anatomical location of the scald and the mechanism of injury has also been made (Table 4). A secondary analysis to determine differences between cases that were accidental and those referred for CP assessment is provided for mechanism, agent, location and other factors previously found to be associated with intentional scalds [15-16]; symmetrical scalds and scalds involving the buttocks or groin. Chi-squared tests or Fisher's exact tests were used, and statistical significance was set at $p<0.05$. For the factors found to be statistically significantly associated with CP assessment, odds ratios (OR) for the effect size have been calculated with 95% confidence intervals (CI).

Results

A total of 1332 children with a scald were identified but, after exclusions, 1144 were included for analysis (Figure 1). Accidental injuries comprised 1041 cases and 103 were referred for child protection assessment.

Table 2 – Demographic data of children who attended hospital with a scald included in this study

Accidental Scalds (*n*=1041)			**Scalds Referred for Child Protection Assessment (*n*=103)**			***p*-value**
Gender			Gender			
	Number	Percentage		Number	Percentage	
Male	580	55.7%	Male	59	57.3%	
Female	454	43.6%	Female	43	41.7%	
Not indicated	7	0.7%	Not indicated	1	1.0%	0.776
Age			Age			
	Number	Percentage		Number	Percentage	
Less than 1	212	20.4%	Less than 1	20	19.4%	
1 to 2 years	517	49.7%	1 to 2 years	46	44.7%	
2 to 3 years	180	17.3%	2 to 3 years	22	21.4%	
3 to 4 years	85	8.2%	3 to 4 years	9	8.7%	
4 to 5 years	47	4.5%	4 to 5 years	6	5.8%	0.734
Ethnicity			Ethnicity			
	Number	Percentage		Number	Percentage	
White - British	529	50.8%	White - British	52	50.5%	
White - Non-British	66	6.3%	White - Non-British	7	6.8%	
Asian	142	13.6%	Asian	11	10.7%	
Afro-Caribbean	46	4.4%	Afro-Caribbean	9	8.7%	
Mixed Race	44	4.2%	Mixed Race	2	1.9%	
Not indicated	214	20.6%	Not indicated	22	21.4%	0.236
Index of Multiple Deprivation Group			Index of Multiple Deprivation Group			
	Number	Percentage		Number	Percentage	
1- Most Deprived	267	25.6%	1- Most Deprived	44	42.7%	
2	139	13.4%	2	9	8.7%	
3	104	10.0%	3	11	10.7%	
4	96	9.2%	4	9	8.7%	
5- Least Deprived	97	9.3%	5- Least Deprived	9	8.7%	
Not indicated	338	32.5%	Not indicated	21	20.4%	0.071

*Differences between the proportions for each variable as determined by Chi-Squared testing or Fischer's exact test. $p<0.05$ is taken as being statistically significant.

Table 3 - Number of cases where scalds to an anatomical location were caused by a specific mechanism of interaction with an agent for all accidental scalds. The most superior anatomical location of the burn has been taken as the primary burn location.

Agent	Mechanism of Injury	Most Superior Location of Body Scalded (Number of cases, percentage of all scalds to that location)						
		Head	Trunk	Arms	Hands	Legs	Feet	TOTAL
Hot Beverages in Mugs/Cups	Pull Down	132 (54.8%)	210 (60.5%)	60 (36.8%)	9 (10.3%)	31 (22.8%)	10 (14.9%)	452
	Spill	19 (7.9%)	30 (8.6%)	20 (12.3%)	11 (12.6%)	28 (20.6%)	19 (28.4%)	127
	Independent of the Child	11 (4.6%)	11 (3.2%)	8 (4.9%)	3 (3.4%)	9 (6.6%)	5 (7.5%)	47
	Immersion			4 (2.5%)	10 (11.5%)		3 (4.5%)	17
	Unwitnessed	5 (2.1%)	13 (3.7%)	2 (1.2%)		1 (0.7%)		21
Hot Water in Kitchen Utensils	Pull Down	28 (11.6%)	28 (8.1%)	21 (12.9%)	3 (3.4%)	19 (14.0%)	4 (6.0%)	103
	Spill	7 (2.9%)	11 (3.2%)	12 (7.4%)	6 (7.0%)	15 (11.0%)	5 (7.5%)	56
	Independent of the Child	6 (2.5%)	8 (2.3%)	4 (2.5%)	2 (2.3%)	7 (5.1%)	4 (6.0%)	31
	Immersion			5 (3.1%)	6 (7.0%)		3 (4.5%)	14
	Unwitnessed	1 (0.4%)	3 (0.9%)		2 (2.3%)	1 (0.7%)		7
Hot Water in Baths/Showers	Pull Down		1 (0.3%)					1
	Spill							
	Independent of the Child	2 (0.8%)	3 (0.9%)					5
	Immersion		1 (0.3%)	1 (0.6%)	1 (1.1%)			3
	Unwitnessed	1 (0.4%)	3 (0.9%)	1 (0.6%)			1 (1.5%)	6
Hot Food	Pull Down	12 (5.0%)	8 (2.3%)	11 (6.7%)	4 (4.6%)	5 (3.7%)	3 (4.5%)	43
	Spill	2 (0.8%)	3 (0.9%)	1 (0.6%)	3 (3.4%)	4 (2.9%)	2 (3.0%)	15
	Independent of the Child	1 (0.4%)	1 (0.3%)			4 (2.9%)		6
	Immersion	2 (0.8%)		1 (0.6%)	15 (17.2%)		2 (3.0%)	20
	Unwitnessed	1 (0.4%)		1 (0.6%)		1 (0.7%)		3
Miscellaneous	Pull Down	5 (2.1%)	6 (1.7%)	4 (2.5%)		2 (1.5%)	4 (6.0%)	21
	Spill	2 (0.8%)	3 (0.9%)	6 (3.7%)		5 (3.7%)	2 (3.0%)	18
	Independent of the Child	4 (1.7%)	3 (0.9%)		2 (2.3%)	2 (1.5%)		11
	Immersion				10 (11.5%)			10
	Unwitnessed		1 (0.3%)	1 (0.6%)		2 (1.5%)		4
	TOTAL	241 (100%)	347 (100%)	163 (100%)	87 (100%)	136 (100%)	67 (100%)	1041

The most common agent leading to accidental scalds was *Hot Beverages in a Mug/Cup*, which accounted for 63.8% (664/1041) of all scalds. The second most common cause was *Hot Water in Kitchen Utensils*, 20.3% (211/1041). *Hot Water in Baths/Showers* resulted in few scalds (1.4%, 15/1041). Scalds from *Hot Food* accounted for 8.4% (87/1041) of cases. The most common foods involved soup (25/87), noodles (18/87) and porridge (10/87). The remaining 6.1% (64/1045) of scalds were caused by *Miscellaneous* items, of which the most common were cooking oil (13/64), unspecified containers of hot water (12/64) and running water from hot water taps (8/64).

The most common mechanism *Pull Down*, which accounted for 59.6% (620/1041) of all scalds. The second most common mechanism was *Spill*, 20.7% (216/1041). Injuries that were *Independent of the Child* accounted for 9.6% (100/1041) cases; a third party spilled a hot liquid on the child (79/100), the child was immersed in hot water by a third party (8/100) (e.g. an older sibling turning on a hot water tap while in the bath with the child) and an item sprayed a child with hot water (13/100) (e.g. a nearby pressure cooker exploding). *Immersion* injuries from the child's own actions accounted for 6.1% (64/1041) of cases and the remaining 3.9% (41/1041) of cases were *Unwitnessed*.

The primary scald location was most often the trunk (33.3%, 347/1041), followed by the head (23.2%, 241/1041). Of note, scalds to the back were rare, accounting for only 5.3% (55/1041) of all cases. The extremities were rarely the primary scald location; hands in 8.4% (87/1041) of cases and feet in 6.4% (67/1041) of cases.

The relationship between agent and mechanism of injury

Hot Beverages in Mugs/Cups were most strongly associated with *Pull Down* scalds, accounting for 72.9% (452/620) of all scalds from this mechanism. *Beverages in Mugs/Cups* contributed the most to *Spill* scalds (58.8%, 127/216), scalds *Independent of the Child* (47.0%, 47/100) and *Unwitnessed* scalds (51.2%, 21/41). For all four of these mechanisms, the second most common causative agent was *Hot Water in Kitchen Utensils*, followed by *Hot Food*. The exception to this pattern was *Immersion* injuries,

where the most common causative agent was *Hot Food* (31.3%, 20/64) followed by *Hot Beverages in Mugs/Cups* (26.6%, 17/64) then *Hot Water in Kitchen Utensils* (21.9%, 14/64).

The effect of the mechanism and agent on the location of the scald

Both the mechanism of injury and causative agent influenced the location of the primary scald location on the body. *Pull Down* scalds contributed to a higher proportion of burns to the upper body compared to the lower body. For example, 73.4% (177/241) of burns to the head were from *Pull Down* injuries, compared to 31.3% (21/67) of burns to the feet. We see the opposite pattern in *Spill* injuries that were more likely to affect the lower parts of the body. In this case only 12.4% (30/247) of burns to the head were from *Spills*, whereas this mechanism caused 41.8% (28/67) of burns to the feet.

The primary locations of *Immersion* scalds were limited to the hands, arms, or feet, with only 4.7% (3/64) of cases affecting other areas. Regardless of where the primary scald was located, the most common causative agent was *Hot Beverages in Mugs/Cups* followed by *Hot Water in Kitchen Utensils.*

Number of areas scalded

Further analysis of the data found that in 61.9% of cases (644/1041), scalds only affected one location. 34.5% (359/1041) involved adjacent areas. As such, only 3.7% (38/1041) scalds involved multiple locations on non-confluent areas.

Table 4 – Comparison of child activity prior to (where it was recorded n=870) scald to the highest body location and the mechanism of injury.

		Child Activity Prior to Scald						
		Standing	Sitting	Running or walking	Being carried or held	Lying down	Crawling	Climbing
Highest Body Location Scalded	Head	101 (29.4%)	15 (7.5%)	68 (34.7%)	2 (2.5%)	7 (35.0%)	4 (21.1%)	1 (9.1%)
	Trunk	129 (37.5%)	55 (27.5%)	78 (39.8%)	16 (20.0%)	3 (15.0%)	3 (15.8%)	3 (27.3%)
	Arms	63 (18.3%)	33 (16.5%)	27 (13.8%)	11 (13.8%)	3 (15.0%)	5 (26.3%)	0 (0.0%)
	Hands	17 (4.9%)	25 (12.5%)	5 (2.6%)	12 (15.0%)	0 (0.0%)	5 (26.3%)	3 (27.3%)
	Legs	24 (7.0%)	61 (30.5%)	5 (2.6%)	25 (31.3%)	3 (15.0%)	1 (5.3%)	1 (9.1%)
	Feet	10 (2.9%)	11 (5.5%)	13 (6.6%)	14 (17.5%)	4 (20.0%)	1 (5.3%)	3 (27.3%)
	Total	344 (100%)	200 (100%)	196 (100%)	80 (100%)	20 (100%)	19 (100%)	11 (100%)
Mechanism of Scald	Pull Down	253 (75.3%)	93 (46.5%)	123 (62.8%)	25 (31.3%)	6 (30.0%)	9 (47.4%)	7 (63.6%)
	Spill	35 (10.2%)	55 (27.5%)	52 (26.5%)	24 (30.0%)	4 (20.0%)	8 (42.1%)	3 (27.3%)
	Independent	14 (4.1%)	20 (10.0%)	3 (1.5%)	11 (13.8%)	2 (10.0%)	2 (10.5%)	1 (9.1%)
	Immersion	24 (7.0%)	25 (12.5%)	11 (5.6%)	20 (25.0%)	8 (40.0%)	0 (0.0%)	0 (0.0%)
	Unwitnessed	18 (5.2%)	7 (3.5%)	7 (3.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Total	344 (100%)	200 (100%)	196 (100%)	80 (100%)	20 (100%)	19 (100%)	11 (100%)

The relationship between the child's activity with the location of the scald and the mechanism of injury

When a child was upright (*standing*, *running, or walking)* at the time of injury, scalds were more likely to affect the upper body (Table 4) than the lower. For example, scalds to the head or trunk accounted for 66.9% (230/344) *standing* scalds and 74.5% (146/196) of *running or walking* scalds but only 35.0% (70/200) of *sitting* scalds. Pull Down scalds were the most common mechanism of injury for all child activity apart from when the child was *lying down* prior to the scald.

Table 5 – Table comparing accidental scalds to scalds referred for child protection assessment for the following factors; causative agent, mechanism of injury, highest body location affected, presence of symmetrical scalds, and burns involving the buttocks or groin.

		Accidental		Referred for Child Protection Assessment		
		Total Number	Percentage	Total Number	Percentage	*p*-Value*
Agent	Water in Mugs/Cups	664	63.8%	58	56.3%	0.134
	Water in Kitchen Utensils	211	20.3%	18	17.5%	0.499
	Water in Baths/Showers	**15**	**1.4%**	**11**	**10.7%**	**0.000**
	Hot Food	87	8.4%	8	7.8%	0.836
	Miscellaneous	64	6.1%	8	7.8%	0.519
	Total	1041	100%	103	100%	
Mechanism	Pull down	620	59.6%	58	56.3%	0.522
	Spill	216	20.7%	17	16.5%	0.308
	Independent of the Child	100	9.6%	11	10.7%	0.726
	Immersion	64	6.1%	7	6.8%	0.795
	Unwitnessed	**41**	**3.9%**	**10**	**9.7%**	**0.007**
	Total	1041	100%	103	100%	
Location	Head	241	23.2%	24	23.3%	0.973
	Trunk	347	33.3%	33	32.0%	0.790
	Arms	163	15.7%	14	13.6%	0.580
	Hands	87	8.4%	9	8.7%	0.894
	Legs	136	13.1%	16	15.5%	0.481
	Feet	67	6.4%	7	6.8%	0.887
	Total	1041	100%	103	100%	
Other Factors	**Symmetrical Scalds**	**40**	**3.8%**	**17**	**16.5%**	**0.000**
	Burns involving the buttocks or groin	29	2.8%	2	1.9%	1.000

*Differences between the proportions for each group as determined by Chi-Squared testing or Fischer's exact test. $p<0.05$ is taken as being statistically significant.

Comparison of accidental scald cases to scalds referred for child protection assessment

In terms of demographics, a larger proportion of cases who were referred for CP assessment came from IMD Group 1, the most deprived group, 42.7% compared to 25.6% of accidental scalds. However, this did not reach statistical significance (p=0.071). Several factors were more likely to result in a CP referral (Table 5). These factors were; scalds associated with *baths/showers* (OR 8.2, CI 3.7-18.3), *Unwitnessed* scalds (OR 3.6, CI 1.3-5.4), and *Symmetrical* scalds (OR 4.9, CI 2.7-9.1) (Table 5). There are no statistically significant associations with the anatomical location of a scald and referral to CP assessment (Table 5).

Discussion

This study has demonstrated that given the agent and mechanism, we can estimate the expected primary location of a scald. For example, if a child aged 5 years or younger pulls down a cup of hot beverage, they are more likely to have a scald that involves their head or trunk than solely their legs or feet. Conversely, given that a spill occurs when objects are knocked over on a surface within the child's reach, they are unlikely to occur above shoulder level. Perhaps unsurprisingly, the position of the child prior to the injuries was found to play a role in the distribution of a burn also.

Scalds from *Hot Water in Mugs/Cups* continue to be the biggest cause of scalds in childhood[17]. Children have skin that is 40-60% thinner than adults[18], and as such are at risk of greater burns from given injuries[19]. Given the risks of long term psychological and physical injury from any scald[20-21] it is considered an important focus for public health interventions. The recent SafeTea campaign[22] was specifically aimed at educating parents on the risks of leaving hot drinks within a child's reach, as well as appropriate first aid measures in cases of scalds. Other useful measures, such as the Cool Runnings app[23], an app-based intervention aimed at increasing the knowledge of childhood burn risk and correct first aid methods, have also been found to be effective interventions in preventing scald injuries. The

results from this study and future epidemiological studies can continue to inform, reinforce, and evaluate prevention strategies focussed on hot beverages and other hot liquids in the kitchen.

Cases referred to children's social services with CP concerns were more likely for unwitnessed scalds, those that happened in the bath or shower and scalds of a symmetrical distribution. These factors have previously been shown to be an indicator of physical abuse[16] and would seem to be influencing clinicians to make a CP referral. It is, however, important to consider that referrals for CP could have occurred in each case for reasons other than those analysed here (e.g., a history of domestic violence in the household or other associated injuries).

Strengths and Weaknesses

To our knowledge, this is the first study of its kind to analyse the relationship between the anatomical location of scalds and the influence of causative agents and mechanisms of injury. The study had a large sample size from multiple hospital sites over several years and used a standardised comprehensive assessment proforma for each child. Hepburn et al[24] has previously confirmed that if the BaSAT is well completed by clinicians, when introduced into clinical practice there was significant improvement of clinical documentation particularly in screening for maltreatment.

There were several limitations with this study. Given that scalds are often widely distributed it was a challenge to describe and analyse their location succinctly. The most superior body part affected by the burn was taken as the primary burn location as this allowed for a consistency in making comparisons and is a method that has previously used in scald analysis[25]. However, this assumption is only valid if the child was upright e.g. standing or sitting during the incident. As our data confirms, most children were indeed upright at the time, the mechanisms involved (pull down, spill or immersion) were mostly activated by the children themselves. Furthermore, over 95% of the scalds were limited to one of the six locations or adjoining locations confirming that our approach was a reasonable way to standardise the description of the anatomical location of the scalds.

It is also worth noting that, thresholds and rules for safeguarding assessment tend to vary from place-to-place and clinician-to-clinician, therefore these factors may have also impacted on our results. The study did not confirm final outcomes of safeguarding assessment but reflects the factors that raise concern for the clinical team and instigated a referral to children's social care.

Conclusion

This study found key patterns of scalds related to the mechanism, agent and position of child at the point of injury and highlights the value of comprehensive, standardised history taking and documentation of these three factors together with the location of the scald. This study adds new detail to the body of evidence around accidental scalds. There were key patterns of scalds related to the mechanism, agent and position of child at the point of injury; *Pull down* scalds mostly involved the upper body, S*pills* tend to involve the lower body, *Immersion* scalds were associated with the extremities. Scalds from *Hot Water in mugs/cups* were the most common and scalds from *Hot Water in baths/showers* and *Unwitnessed* scalds were more likely to be associated with child protection referrals. Scalds were also more likely to affect the upper body of children who were upright at the time of injury, than those who were sat down.

Health promotion messages that focus on keeping hot drinks and food out of children's reach could have huge benefits in terms of injury prevention. It is also worth noting that kitchen utensils, such as pots and pans, being filled with hot water led to a fifth of all scalds, highlighting the need of health promotion messages to also focus on the inherent dangers to children in the kitchen.

This study helps strengthen findings from previous studies and highlights predictable patterns of accidental scalds. This will help clinicians assess scalds in young children, particularly those new to the emergency department who may be unfamiliar with expected scald patterns or may be unfamiliar with the importance of using appropriate terminology in documenting histories of scalds (e.g., using the term 'spill' instead of 'pull down' in cases where the latter is more appropriate).

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Ethics Approval

Ethical approval was granted through Cardiff University with waived consent; MREC No. 13/WA/0003, 15/WA/0259 and 15CAG0203.

Figures

Figure 1 Legend – Diagram of exclusion criteria applied to all cases of scalds in children less than five years of age from BaSAT database

Contributorship Statement

Assim Javaid - Lead author - Writing article and data analysis

Emma Johnson - Writing abstract, literature review, article review and reference organisation

Linda Hollén - Data analysis and article review

Alison Kemp - Supervision of article and study design

What is known:

1) Scalds are the most common type of burn injury in children.
2) There have been found to be statistically significant differences in factors involved in accidental contact burns compared to those referred for child protection assessment.
3) Intentional scalds have been found to be associated with several factors, including immersion mechanisms, hot tap water and having with clear upper margins.

What this study adds:

1) A pull-down mechanism is more likely to result in a scald to the upper body whereas scalds from spills are more likely to affect the lower body.
2) Scalds associated with baths/showers, that were unwitnessed, or were distributed symmetrically were more likely to be referred for child protection assessment
3) The findings of this study should allow clinicians to appreciate whether the history and examination of a scald is in keeping with an accidental injury.

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