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In hot water: The impact of burn injuries from hot water bottles — Experience of a UK burns unit and review of the literature

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ABSTRACT

Introduction: Hot water bottles (HWBs) are a common domestic item in the UK. Their use is associated with burns injuries, either by contact for prolonged periods with the skin, or through the HWB leaking or bursting.

Methods: We used electronic health records to retrospectively review HWB related burns treated by the Burns Service at Chelsea and Westminster Hospital between January 2017–March 2018. We analysed the mechanism of injury, size and depth of burn, method of treatment and costs associated with HWB burns in our centre.

Results: 80 patients sustained HWB burns during this period, with a similar incidence of contact burns (41/80, 51.3%) and scalds (38/80, 47.5%), with one steam burn. The commonest area burnt was the lower limb (40/80, 50%). Most burns had a TBSA of 1% or smaller (50/80, 62.5%). 30 patients had full thickness burns, with 37 in total received operative management. We estimate that the total cost for managing this cohort of patients was over £68,634.

Conclusions: There are a significant proportion of patients presenting with HWB burns that could be prevented, with significant impact on patient morbidity and resource burden on the NHS. Targeted public awareness campaigns are needed to ameliorate these injuries.

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1. Introduction

A burn can have a wide spanning impact on individuals, families and healthcare systems. The National Health Service managed 120,021 burn patients across Accident and Emergencies throughout England between 2015–2017 [1].

A variety of down stream impacts have been illustrated in literature; these include psychological and physical morbidity and mortality. One large-scale study found that 1077/2573 (45%) of adults admitted for acute burn injury from 1996 to 2005 had at least one re-hospitalisation within 2 years post discharge. Of those

re-hospitalised within 30 days, 25% were admitted for wound coverage/burn infection, 14% for rehabilitation, 10% for sepsis, and 9% for psychiatric reasons [2]. Another study brought to surface the physiological and systemic changes that may occur in the circulatory system following a burn. It found that a burns patient could have 1.46 times as many admissions and strikingly almost three times the number of days in hospital with a circulatory system diagnosis compared to the un-injured cohort for circulatory diseases. It also found that the burn cohort had higher admission rates for ischaemic heart disease, heart failure and cerebrovascular disease. Overall, the burn cohort was found to have increased long-term mortality caused by circulatory system diseases [3].

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Consequences on mental health are widely noted [4–6]. This can be through depression, anxiety, post-traumatic stress disorder and other psychological manifestations [4].

At Chelsea and Westminster Burns Unit, a variety of burn injuries are managed, some accidental and some seemingly preventable.

Interestingly, a significant portion of the presenting burn injuries involves hot water bottles; data on this aetiology however is scarce. Hot water bottles are a common household item that many do not associate with being hazardous. There is recent increased media attention on hot water bottles, claiming that sales have increased 80% its highest sales rate since the 1960s due to rising gas bills in Britain [7,8].

Only one previous cohort study in the UK studied hot water bottle burn injuries, identifying 85 patients between January 2004–March 2013 [9]. Internationally, only a few studies have identified the incidence of hot water bottle burns. 23 patients were managed between January 1998–September 2009 at Royal Adelaide hospital [10] and 155 patients between 2005–2013 in Concord Hospital Burns Injury Unit [11], both in Australia. A study in Changhai hospital in China reviewed 294 patients with hot water bottle injuries between January 1991–December 2001 [12] and in Chile a study identified 795 children between 2000–2014 [13]. From this it is clear that hot water bottles are a significant cause of morbidity requiring medical attention and further review.

Only a few case studies looking into the effects of hot water bottles (HWB) have been reflected on, in particular these have looked at HWB burns in patients with neuropathy or altered nociception to areas such as diabetic feet [14,15] and reconstructed breast tissue [16,18] or cases related to HWB use and injuries in perianal fissures or back pain [19,20].

It is unclear how many hot water bottles are sold annually in the UK. Whittam et al. highlights that in Australia over 500,000 bottles are sold annually [10]. Jabir et al. argues that it is reasonable to assume that the numbers of HWBs sold in the UK is likely to be over 1 million given that the UK population is almost three times that of Australia and the UK weather is much colder [9].

The standard and quality of hot water bottles is outlined by the British Standards 1970:2012 guidelines [21]. This is an internationally recognised UK safety standard for rubber and PVC hot water bottles. Rather than legislation, it's used as guidelines for the manufacture and control of safe products. It also advises how hot water bottles should be filled and how they should be looked after [22].

Given the rising number of hot water bottle injuries in our unit, our aims of this study were:

To evaluate the incidence of hot water bottle burns between Jan 2017–Mar 2018 in Chelsea and Westminster hospital Burns Unit.

To outline the course of management and complications for this cohort of patients

To provide evidence for greater public awareness on the serious nature of hot water bottle burns

2. Methods

The Chelsea and Westminster Hospital Burns Unit is a specialist service, coordinating care in many recent and high profile tragedies such as treating victims from the Grenfell

tower fire, Parsons Green attack and treating those affected in the recent rise of acid attacks. The service works across a paediatric ward and an adult ward. The adult burns unit comprises of 2 ITU beds, 2 HDU beds, 9 ward beds, 1 theatre room based on the ward and a clinic service, which runs concomitantly. The paediatric ward (Mars Ward) has 6 beds and a busy out patient burns clinic, which sees up to 24 children per day.

For this study we focused on the seemingly preventable HWB causes of burns. A retrospective study was performed evaluating patients who were seen at our adult and paediatric burns wards with HWB burns between 1st January 2017–1st March 2018. We used electronic patient records to record and analyse the demographic data, injury sustained, management, complications and cost. All statistical analyses were carried out using SPSS (version 22.0; SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Demographic data

61/80 (76.3%) were female and 19/80 (24.7%) were male. The largest age group was 51–75, with 35/80 belonging to this age category, of which 8/35 (22.8%) were male, (Fig. 1).

Of the total presenting population, 45% had no past medical history and 55% patients had one or more co-morbidity (including mental health illnesses). Of the latter category, the most common co-morbidities were Hypertension (31.8%), Non-diabetic Neuropathy (25%) and Type 2 Diabetes (22.7%). Of the Neuropathy category, 3 patients had previous road traffic accidents, 4 patients had spinal disease and 2 patients had Multiple Sclerosis.

In terms of social history, 49.2% of the adult category reported themselves as independent and working/studying, 16.9% were independent and retired, 12.3% described having carers and/or needing assistance with activities of daily living. 15.4% described themselves as independent and not working for reasons not mentioned.

3.2. Injury sustained: site of injury, Total Burn Surface Area (TBSA), depth and injury mechanism

3.2.1. Site of injury

The site of a burn injury aids our understanding of the mechanism behind the injury, which can help disassemble future hot water bottle injury cycles. The injury site distribution is highlighted in Fig. 2. In our patient cohort the most common site of injury was the lower limb with 40/80 patients (50%) burning this area. This included either an isolated burn on one limb, bilateral lower limbs or as part of a greater surface including other areas to the body (Fig. 2). 24/40 patients had burns to thighs. Of the 24, 10 patients had bilateral burns to their thighs, 12 patients had unilateral thigh burns and 2 patients had unilateral burns to leg and thigh. Of the 40 patients, 16 had unilateral lower leg burns.

Of the 40 patients with burns to their lower limbs, 50% (20 patients) received operative management.

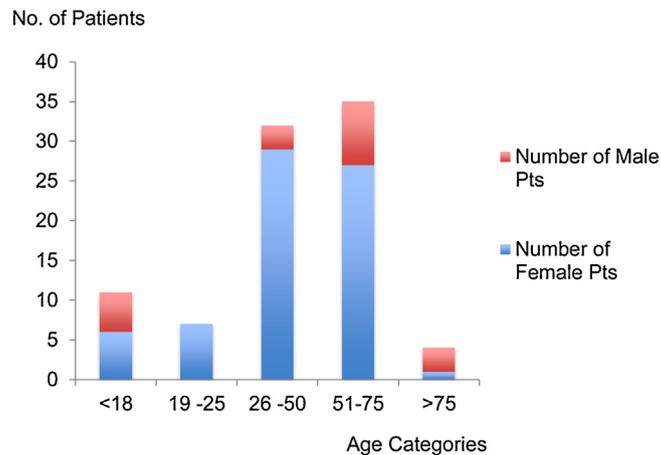


Fig. 1 – Age and sex of patients presenting with HWB Burns, Jan 2017–Mar 2018. This illustrates the demographics of our patient cohort with burns from HWBs.

3.2.2. Total Burn Surface Area (TBSA)

In our patient cohort, 7/80 patients (8.8%) sustained a burn equal to or greater than 5% TBSA. 18/80 patients (22.5%) referred to the Burns Unit were referred with a 1% burn. Similarly 17/80 patients (21.3%) patients were referred with 0.25% burn (Fig. 3).

3.2.3. Burn injury depth

The largest category of burn depths referred was full thickness (FT) burn, with 30/80 (37.5%) patients, followed by 22/80 (27.5%) sustaining superficial partial thickness (SPT) burn injuries (Fig. 4). 21/80 (26.3%) of patients presented with mixed depth burns (i.e. a mix of superficial thickness to deep dermal

thickness). Table 1 summarises the pattern of mixed depth each of the 21 individuals sustained. 5/80 (6.3%) were described as having mid-dermal (MD) burns and 2/80 (2.5%) were described as having deep-dermal (DD) burns.

3.2.4. Injury mechanism

41/80 (51.3%) sustained a scald burn and 38/80 (47.5%) sustained a contact burn. 1 patient sustained a steam burn injury (Fig. 5).

As shown in Fig. 6, the background activity at the time of the injury was recorded. Of those recorded, burn injuries most often took place when the patient was asleep. Along side this background activity, 28 patients described their hot water

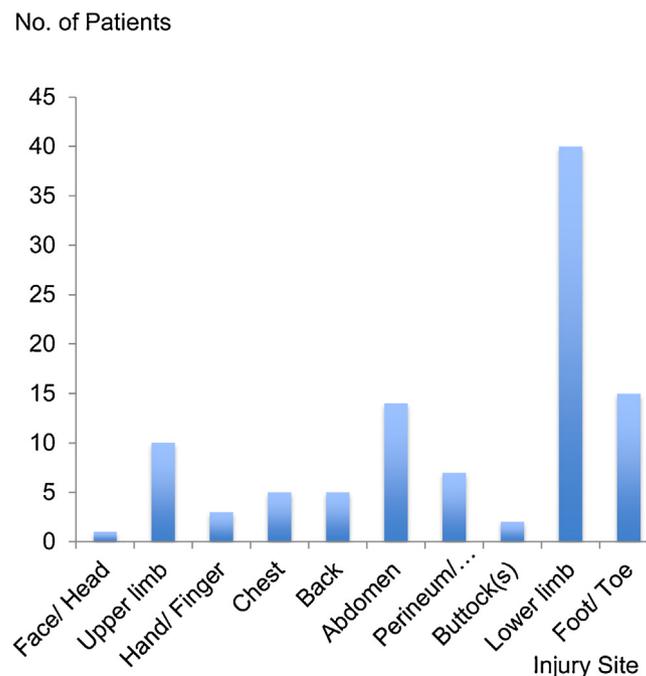


Fig. 2 – Distribution of burn injury sites. This graph depicts the variety of body sites involved in HWB injuries, with the lower limb affected most.

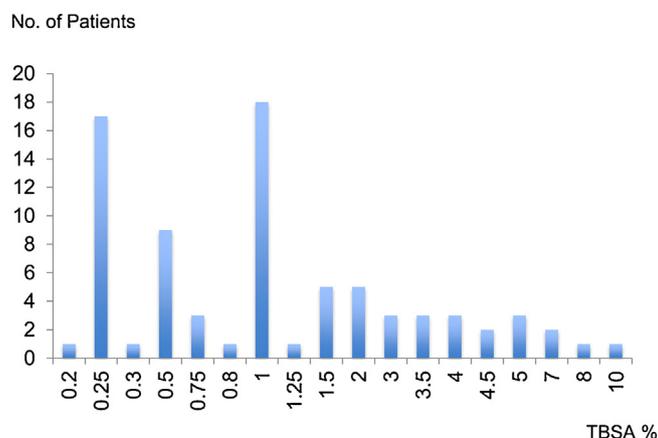


Fig. 3 – Spread of Total Burn Surface Area (TBSA %) caused by HWBs.

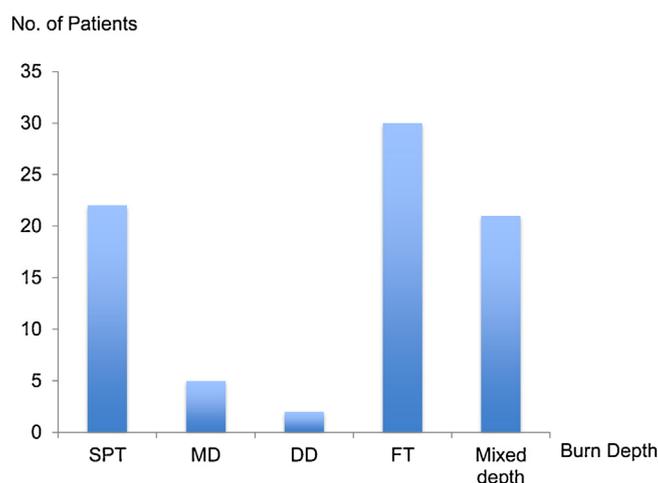


Fig. 4 – Depth of HWB Burns. This graph demonstrates the variety of burn depths caused by HWBs. Abbreviations: Superficial thickness (SPT), Mid Dermal (MD), Deep Dermal (DD), Full Thickness (FT).

bottle ‘bursting’, 15 patients described ‘spilling’ the hot water. 5 patients used a hot water bottle without a cover.

3.3. Management: Burns Dressing Clinic (BDC), surgery, time taken to heal and complications

21/80 (26.3%) patients were admitted (>24h stay for monitoring, IV antibiotics or surgery). 59/80 (73.7%) patients either had day case surgery (<24h stay) or were managed as outpatients in BDC. 37/80 (46.3%) of patients had operative management, of which over half: 21/37 (56.8%) were day cases and 16/37 (43.2%) stayed overnight at the Burns Unit.

14/80 (17.5%) patients received IV antibiotics at some point, 13/80 (16.3%) only oral antibiotics. 53/80 (66.3%) did not need antibiotics from the Burns Unit, although many patients were given antibiotics from their initial healthcare practitioner before referral to the burns unit. For all 27 patients antibiotics were started due to evidence of cellulitis of the burn. The decision to start antibiotics would be made by the BDC nurses,

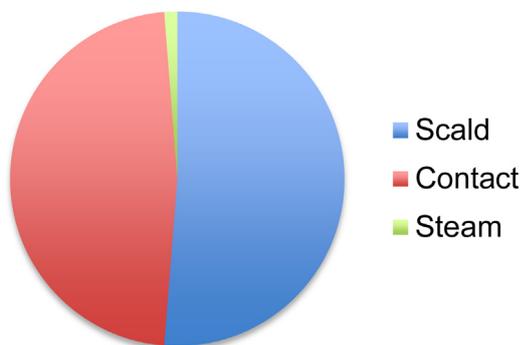
junior doctors and consultants. Factors involved in this decision include whether the patient had any symptoms, local wound features such as erythema and wound swab culture results (if previously indicated and done at an earlier clinic appointment). Often patients are initially seen by their local hospital or GP for burn management and a decision is made on the appropriate burn dressing and whether antibiotics are indicated. Typically referrals from these sites are made when a wound is slow to show signs of healing (lack of epithelial buds and epithelialization), deranged healing (such as the development of an eschar obstructing wound healing) or signs of infection.

3.3.1. Burns Dressing Clinic (BDC)

The BDC reviews patients on an outpatient basis and follows up post-operative patients. Those who were not admitted to the ward >24h for surgery (59/80) and have since been discharged attended a total of 296 clinics (54/59 patients, 5 patients have ongoing clinic reviews). This gives non-operative patients an average of 5 clinic attendances before

Table 1 – Sub-classified ‘mixed depth’ burns in 21 individuals. SPT: Superficial partial thickness, MD: Mid-dermal, DD: Deep-dermal, FT: Full thickness. 6/21 patients required operative management (Y: Yes, N: No).

	Mixed depth sub-classification	Operative management
1	TBSA 4% — abdomen: SPT, left inner thigh: MD, dorsum of foot and left leg: MD	N
2	2% — dorsum of left foot: SPT–MD	N
3	0.5% — lower abdomen with eschar: SPT–MD	Y
4	1% — sole of right foot: SPT with FT patch	N
5	3% — sacrum: MD–DD	Y
6	5% — both medial areas of thighs: SPT–MD–DD	Y
7	<1% — burn to the left breast: MD–DD	Y
8	0.25% — lateral aspect of left heel: MD–DD	N
9	1% — medial aspect of the right upper arm and axilla: SPT–MD	Y
10	1.5% — medial left thigh: SPT–MD	Y
11	<1% — dorsum of left foot: MD–DD	N
12	TBSA 4.5% — left thigh: SPT, left lower arm: SPT with DD patches, left breast: SPT, left abdomen: SPT	N
13	<0.5% — dorsum of right hand: SPT with DD/FT patches	N
14	4% — right thigh anterolateral area: MD/DD	N
15	2% — right upper arm: SPT–MD	N
16	3% — posterior aspect of right thigh: SPT–MD	N
17	6–7% — right lateral thigh and buttocks: MD–DD	N
18	TBSA 3.5% — left anterior thigh: SPT, posterior aspect of left forearm: SPT–MD	N
19	0.75% — dorsum of left foot: DD–FT	N
20	0.5% — left inner thigh: DD–FT	N
21	4% — both dorsum of feet and both buttocks: SPT–MD	N

**Fig. 5 – Burn Injury types caused by HWBs. In our cohort of patients, HWBs caused both scald and contact type burns almost at equal frequency, with 1 patient suffering a steam burn.**

being discharged (not including those who have been discharged to community follow up).

3.3.2. Surgery

During the period of Jan 2017–Mar 2018, a total of 45 procedures were performed over 37 patients (where 8 were repeat procedures). Debridement and Grafting (D & G) was the most common surgical procedure, which was carried out 19 times during our study period (Fig. 7). As some of the patients had to have repeat surgeries (4 patients) we have recorded the number of procedures that have taken place as opposed to number of patients who have undergone a particular type of surgery. The second most common procedure was Excision and Direct Closures (E & DC), which was performed 17 times. Suprathel was applied on two instances on paediatric hot

water bottle burns. Of the 11 children, 6 underwent surgery. 2 had E & DC, 2 had Debridement and SSG and 2 had Debridement and Suprathel applied.

26/45 (57.8%) of the total procedures were using local anesthetic, 13/45 (28.8%) were using general anesthetic and 6/45 (13.3%) were using a mixture of local anesthetic and general anesthetic.

3.3.3. Time taken to heal

61 patients (managed surgically and conservatively) from our cohort between Jan 2017–Mar 2018 have been discharged from Burns Dressing clinic after showing evidence of a healed burn. The average number of days to heal was 32.8 days (range 7–115, SD=25.8, 95% CI 26.2–39.4). 7 patients from the cohort group still have ongoing follow up and 3 patients are being followed up in the community, the remaining 9 did not return to BDC for unknown reasons.

Of the total hot water bottle burns, the mean average time to heal from a scald type burn was 23.5 days (range=7–106, SD=21.8, 95% CI 16.5–30.6). The average time to heal from a contact type burn was 47.7 days (range=13–115, SD=25.4, 95% CI 37.3–58.1). It may be of note that of the 19 patients, who do not have a complete heal date, 15 were contact burns and 4 are scald burns, which may affect the overall mean average.

3.3.4. Length of stay

21 patients were admitted to the Burns Unit ward (>24h). A total of 26 admissions were made, as 5 were repeat admissions. This is outlined in Table 2. The range of the total number of days stayed was 2–18 days and the mean average was 6 days.

3.3.5. Complications

Of the total cohort of patients who experienced a hot water bottle burn, 11.3% of patients (9/80) experienced some form of complication to their burn site. 7 of these patients had surgical management and 2 of these patients had conservative

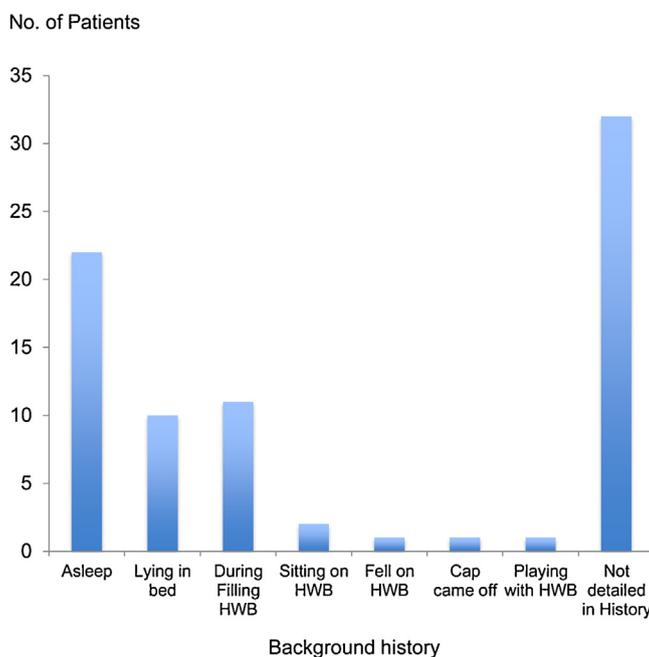


Fig. 6 – History during Burn Injury. This graph aims to highlight human and non- human factors in the history of HWB injuries that may correlate with burns.

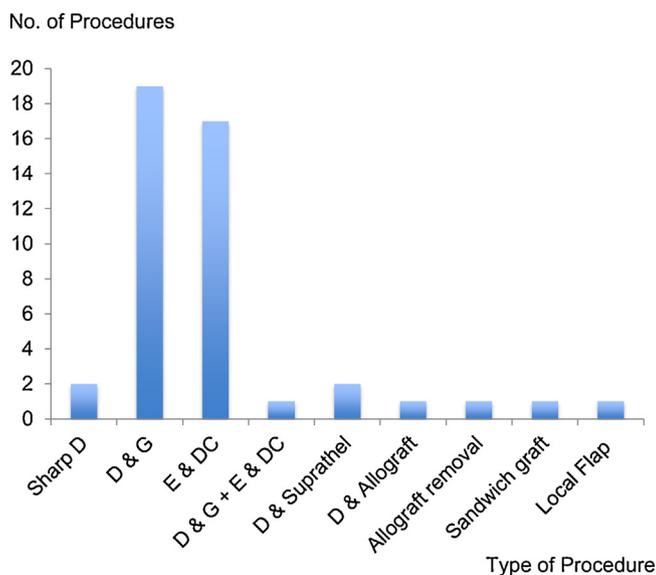


Fig. 7 – Number of Surgical Procedures performed on HWB burns divided by Type. This graph demonstrates the variety of surgical procedures used to treat HWB burns. Abbreviations: Sharp Debridement (Sharp D), Debridement and Grafting (D & G), Excision and Direct Closures (E & DC), Debridement and Suprathel (D and Suprathel), Debridement and Allograft (D and Allograft).

management. Table 3 outlines the variety of complications experienced within our cohort.

3.3.6. Wound cultures

76.3% (61/80) of patients had wound swabs taken (Fig. 8). Of which 17.9% (12/61) had no growth and 14.8% (9/61) cultured non-virulent skin flora. The most common microbial organism cultured was *Staphylococcal aureus* (41%, 25/61) and second most

common was *Pseudomonas aeruginosa* (9.8%, 6/61) followed by *Acinetobacter lwoffii* (4.9%), *Methicillin-resistant Staphylococcus aureus* (4.9%), *Escherichia coli* (3.3%) and *Klebsiella pneumoniae* (3.3%) (with some patients having mixed microbial growth).

3.3.7. Cost

To understand the burden of cost of hot water bottle injuries we analysed the relative costs of burns management (Table 4).

Table 2 – This table outlines the number of patients who have stayed short-, mid- and long-term due to HWB burns.

Number of days	Number of admissions
<5	11
5-10	11
>10	4

One must bear in mind that this is a crude attempt to understand the burden of costs of HWB injuries, as some injuries are more complex than others.

Wound cultures cost £9.68, a total of 61 were performed over this period costing £590.48. The cost of the management of HWB burns over our study period (Jan 2017–Mar 2018) is likely to be greater than our current approximated cost of £68,634 (£68,049.5+£590.48), as this does not include the costs of ward based and operative medication and materials such as specialised dressings. We included service provision such as the BDC appointments and cost of band 6 nursing care, cost of an overnight bed at the burns unit with nursing and HCA care and theatre time. Only procedures requiring general anaesthetic were included (19 procedures). Theatre costs include the cost of the anaesthetists, surgeons, OPDs, HCAs, scrub nurses and recovery room time. As these are calculated as 4-h theatre list slots, each of the 19 operation times were reviewed and costs were approximated relatively (Table 4).

4. Discussion

We have demonstrated a one year experience of HWB injuries at a UK burns unit and from doing so we believe greater

public health awareness is received to reduce the incidence of these injuries, and consequently cost and resource burden to NHS.

Our patient cohort had a male to female ratio of 19:61 (24.7%:76.3%) with the highest prevalence in the age category 51–75 (43.8%). Comparatively a study by Schwarze et al. [17] at St. Andrews Centre for Plastic Surgery, also found a higher HWB burn incidence in females. Although the difference between the sexes was to a lesser degree (male: female ratio of 44.7%:55.3%) [9]. NHS England 2013 identifies young men and children as groups more likely to suffer from burns [22]. The Bradford burn study [23] evaluated burns from all causes attending a single A&E department over a 1-year period, which revealed a higher burn incidence in males with a male to female ratio of 1.4:1.0. This provides evidence that the demographic of patients suffering from hot water bottle burns is unique as a subcategory of burns.

In our study the leading co-morbidity was Hypertension (32%) followed by Non-diabetic Neuropathy (25%) and Type 2 Diabetes (22%). Thombs et al. evaluated the relationship between co-morbidities in 31,338 adults with an acute burn injury and length of stay across 70 burn centers using data from the American Burn Association National Burn Repository [24]. Similarly within this study Hypertension was identified to be the most common co-morbidity (9.6%), in their study this was followed by alcohol abuse (5.8%) and chronic pulmonary disease (5.1%). Their study identified that increased length of hospital stay was significantly predicted by paralysis (90% increase), dementia (60% increase) and peptic ulcer disease (53% increase). In our study, 12/80 had neuropathy (including MS, neuropathy from previous RTA and sciatica) of which 6 were admitted. Length of average stay was 11.2 days per patient with neuropathy (range: 2–18 days). This is markedly

Table 3 – This table demonstrates the variety of complications following a HWB burn divided as individual cases.

	Background	Initial management	Complication	Management following complication
Patient 1	72F 0.75% steam burn to face	Admitted for IV antibiotics	Rash-impetigo	Referred to a dermatology clinic.
Patient 2	83M Contact burn to right shoulder	Managed as outpatient with specialized burns dressings.	Rash-Shingles	Followed up over 22 days in BDC.
Patient 3	35M 3% Mixed depth contact burn to sacrum	D & G	Persistently non-healing wound	One further Surgical procedure (SSG/Allograft Sandwich Grafting).
Patient 4	79M 0.1% FT contact burn to right hallux	D & G	Graft loss: Adverse reaction to Clindamycin	Resuscitation and a HDU bed. Two further procedures (Sharp D and later D & G).
Patient 5	9F 3.5% SPT scald burn to perineum and bilateral thighs	D & G	Hypertrophic scarring	Referred to scar removal clinic.
Patient 6	12M Contact burn to thigh	E & DC	Wound dehiscence	Conservative management in BDC. Delayed wound healing of 77 days.
Patient 7	44F Contact burn to abdomen	E & DC	Wound dehiscence and wound infection	Admitted for IV antibiotics and wound washout.
Patient 8	59F Contact burn to leg	E & DC	Wound infection + bacteraemia	Admitted for IV antibiotics over 3 weeks
Patient 9	73M Contact burn to back of thigh	D and Local flap to the burn site (V-to-Y Flap).	Wound dehiscence and wound infection	IV antibiotics and 3 further surgical procedures (D & SSG & VAC, D of failed SSG and D & Delayed primary closure).

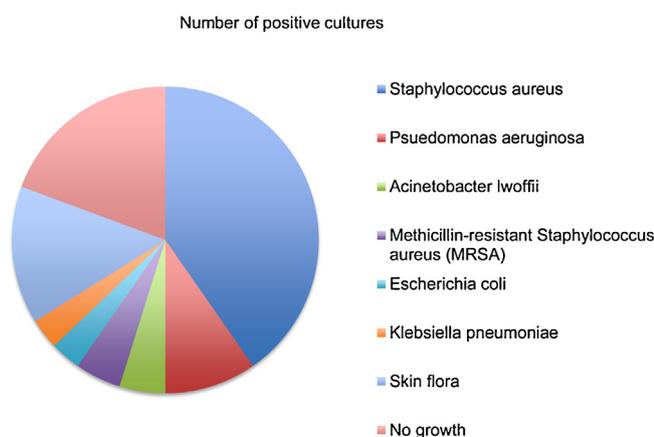


Fig. 8 – Positive cultures from HWB burns. This image depicts the variety of microorganisms cultured from HWB burns.

more than overall mean length of stay for our cohort, which was 6.3 days.

In our study the leading most common site of burn was the lower limb. Although this could be correlated with the body map presented by Jabir et al. [9], we relatively had fewer abdominal and groin burns. It's interesting to contrast this with study by Khan et al., where burns from all causes were evaluated finding that hand and wrist (36%) and upper limb (21%) were the most common sites of burns. As Ben et al. explains, this is likely due to the purposeful placing of heat to the lower extremities due to poorer circulation to these areas [12].

Two of the larger cohort studies evaluated the incidence of HWB burns following public intervention over 10 years. Whittam et al. evaluated the impact of multimedia campaigns (radio, newspaper and television) and legislation of HWB sales (describing the minimum safety requirements in line with BS 1970:2006 standards) to find a reduction of admissions from HWB burns [10]. Since media campaigns and changes in legislation in Australia, the study found that there was a decrease from 10 admissions from HWB burns (between January 2004 to December 2005) to 2 admissions (between January 2008 to September 2009).

In Chile a study completed in 2017 [13] evaluated the changing frequency of scalds from HWB rupture. It analysed 795 patients under the age of 15 between the years 2000–2014. It identified a large increase in incidence of HWB scalds in the years 2000–2004 (+272.7%) and then a sharp decrease from

2005 to 2014 (–81.3%). These findings were correlated with preventive measures and manufacturing standards regulations and quality control. The results from the initial 5 years was used for greater public awareness through alerting authorities, merchants and users about the risks of hot water bottles. This provides positive evidence that hot water bottle burns are injuries that can be prevented with public intervention. In the case of hot water bottles, a short video could be created highlighting correct use of hot water bottle (as guided by BS 1970:2012) [21]. This could be used in GP waiting rooms, because often HWBs are used for chronic diseases such as musculoskeletal back pain and menstrual pain [9].

There are limitations in this study. An inherent limitation is the retrospective evaluation of case notes, which means the quality of the data is dependent on the quality of documentation, which can be variable. It is unclear whether the injuries are associated with user misuse or hot water bottle failure, with lack of detail on whether the patient had filled the bottle three quarters (as recommended in the BS 1970:2012 guidelines [21]) or full to the top, how old the water bottle may be and whether there were signs of wearing and how much pressure or weight was applied to the hot water bottle [12]. Ben et al. attempts to evaluate whether the hazard posed by HWBs are due to user mishandling or manufacturing faults by collecting detailed data on the background of the mechanism of injury (e.g. filling HWB to quickly causing overflow) [12]. These details could prove useful in targeting future prevention programs; we could consider this to be incorporated into clerking proformas/referral forms to ensure adequate documentation for patient care and further research on risky behavioral patterns.

Unlike previous studies on HWBs, cost was analysed to help contextualise the burden of HWB burn injuries and to provide further evidence why this mechanism of burn injury needs to be addressed. The approximate cost of the management of HWB burns over our study period (Jan 2017–Mar 2018) is estimated to be over £68,634. This does not include the costs of ward based and operative medication, specialised dressings and surgical materials. This gives further evidence that not only HWB injuries have significant impact on burden of morbidity on patients but also financial implications on the NHS.

5. Conclusion

The results from this study and previous cohort studies confirm that burns from hot water bottles have a significant impact on burden of morbidity, complications and cost. There

Table 4 – This table approximates the costs of managing HWB burns.

Medical provision	Cost	Number of times service used (Jan 2017–Mar 2018)	Total cost
BDC: Clinic nurse band 6/h	£30	423 total clinic attendances (80/80 patients, initial appointments 30min, follow up appointments typically 20min)	Initial: £1200 F/up: £3430
Burns ward/night (1:4 nursing ratio +1:6 HCA ratio)	£347	157 total nights	£54,479
Burns operating/4h	£1572	19 operating slots (procedures under GA) ^a	£8940.5
Total			£68,049.5

^a We did not include procedures under LA, as most of the operating costs were from management of GA by Anesthetists/Operating department practitioners/requiring the recovery room etc.

is a clear need for increased public intervention and patient education and requires a collaborative effort of healthcare staff, managers, policymakers and the media.

Conflict of interest statement

The authors have no conflicts of interest to declare and no funding was sought or received for this work.

REFERENCES

- [1] NHS. Hospital Episode Statistics 2017.
- [2] Mandell SP, Pham T, Klein MB. Repeat Hospitalization and mortality in older adult burn patients. *J Burn Care Res* 2013;34 (January-February (1)):36-41.
- [3] Duke JM, Randall SM, Fear MW, Boyd JH, Rea S, Wood FM. Understanding the long-term impacts of burn on the cardiovascular system. *Burns* 2016;42(2):366-74.
- [4] Palmu R, Suominen K, Vuola J, Isometsä E. Mental disorders after burn injury: a prospective study. *Burns* 2011;37(June (4)):601-9.
- [5] Noronha DO, Faust J. Identifying the variables impacting post-burn psychological adjustment: a meta-analysis. *J Pediatr Psychol* 2007;32(April (3)):380-91.
- [6] Chang FC, Herzog B. Burn morbidity: a follow up study of physical and psychological disability. *Ann Surg* 1976;183 (January (1)):34-7.
- [7] Electric blankets, hot water bottles and bed socks will bring down your energy bills, a Conservative peer says. *The Telegraph* 03 Dec 2013.
- [8] Hot water bottle sales soar 80% to highest rate since the 1960 as cash-strapped Britons struggle to keep warm with rising gas bills and prolonged wage squeeze. *Daily Mail* 31 Dec 2017.
- [9] Jabir S, Frew Q, El-Muttardi N, Dziewulski P. Burn injuries resulting from hot water bottle use: a retrospective review of cases presenting to a Regional Burns Unit in the United Kingdom. *Plast Surg Int* 2013.
- [10] Whittam A, Wilson A, Greenwood JE. Burn wounds caused by hot water bottles: audit and loop closure. *Eplasty* 2010;10:88-99.
- [11] Goltsman D, Li Z, Bruce E, Darton A, Thornbury K, Maitz P, et al. Too hot to handle? Hot water bottle injuries in Sydney Australia. *Burns* 2015;41(4):770-7.
- [12] Ben DF, Chen XL, Xia ZF, et al. Hot water bottle burns: a review of 294 cases treated in Changai Hospital Burn Centre in the period 1991-2001. *Ann Burns Fire Disasters* 2004;17(1):5-8.
- [13] Rolando Saavedra O, Fresia Solis F, Carmina Domic C. Children's scalds from tearing of hot water bottle. *Rev Chilena Pediatr* 2017;88(6):730-5.
- [14] Jose RM, Vidyadharan R, Roy DK, Erdmann M. Hot water bottles and diabetic patients: a cautionary tale. *Br J Gen Pract* 2005;55 (512):222-3.
- [15] Rangan S, Baskar V, Spencer E, Singh BM, Walford S. Hot water bottle and the diabetic foot. *Pract Diab* 2003;20(5):164a.
- [16] Gowailly K, Ellabban MG, Iqbal A, Kat CC. Hot water bottle burn to reconstructed breast. *Burns* 2004;30(8):873-4.
- [17] Schwarze H, Küntscher M, Uhlig C, Hierlemann H, Prantl L, Ottomann C, et al. Suprathel, a new skin substitute, in the management of partial-thickness burn wounds. *Ann Plast Surg* 2008;60(2):181-5.
- [18] Faulkner HR, Colwell AS, Liao EC, Winograd JM, Austen WG. Thermal injury to reconstructed breasts from commonly used warming devices: a risk for reconstructive failure. *Plast Reconstr Surg Global Open* 2016;4(10):e1033.
- [19] Lapid O, Walsh S. Perianal and gluteal burns as a complication of hot water bottle treatment for anal fissure. *Burns* 1999;25 (6):559-60.
- [20] Sever C, Kulahci Y, Uygur F, Karagoz H, Bayram Y, Oksuz S, et al. Burn injury due to hot water bottle. *Mod Plast Surg* 2011;1:1-2.
- [21] Hot water bottles safety standard BS 1970:2012. *Sparkle* 2013;660.
- [22] NHS England 2013— Standard Contract for Specialised Burn Care (All Ages) Schedule 2- Service Specifications.
- [23] Khan A, et al. The Bradford Burn Study: the epidemiology of burns presenting to an inner city emergency department. *J Emerg Med* 2007;24(8):564-6.
- [24] Thombs BD, Singh VA, Halomen J, et al. The effects of pre-existing medical comorbidities on mortality and length of stay in acute burn injury. *Ann Surg* 2007;245(4):629-34.