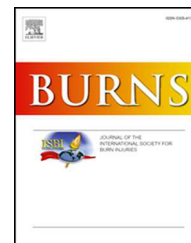


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# The cost of keeping warm: a relationship between a rise in the cost of domestic energy and burn injuries caused by personal heating equipment<sup>☆,☆☆</sup>

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## ABSTRACT

**Introduction:** During 2022–2023, the UK found itself in the midst of a domestic energy crisis, with the average domestic gas and electricity bill rising by 75% between 2019 and 2022. As a result, the use of hot water bottles, radiant heaters, and electric blankets increased. An unintended consequence of this may be an increase in burn injuries caused by misfortune, misuse, or the use of items in a state of disrepair.

**Purpose:** The aim of this study was to explore any increase in referrals to a single burns centre in England for injuries caused by hot water bottles, radiant heaters, or electric blankets.

**Methods:** This was a retrospective study of a prospectively maintained database of referrals. All referrals between January 2022 and January 2023 were selected and compared with the same period from 2020–2021 (before the rise in energy prices). Referrals were screened for the terms “hot water bottle,” “electric heater,” “electric blanket,” and “heater.” Total referrals in each period, demographic data (age, gender), anatomical location and the mechanism of injury were compared between cohorts.

**Results:** We found a statistically significant increase in the number of burns relating to heating implements between 2020/21 and 2022/23, rising from 54 to 81 ( $p = 0.03$ ) – a 50% increase in injuries. Injuries in working age adults increased significantly (52% to 69%,  $p < 0.05$ ). The most frequently injured area was the leg (30%) followed by the hand (18%). The commonest type of injury described was scald (72%). We found a moderately-strong correlation between the number of referrals and the average cost of energy in 2022–23.

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*Conclusion:* The number of injuries sustained by people using personal heating equipment is significantly increasing, which correlated with the rise in domestic energy prices. The most affected demographic appears to be working age adults, with wider implications around lost work-time yet to be explored. Further prospective, population-based work is indicated to assess the strength of the correlation seen in this study.

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## 1. Introduction

From late 2021 onwards, the United Kingdom (UK) saw a surge in the unit cost of gas and electricity (domestic energy) [1]. This, in turn, drove a “cost of living crisis,” with increased costs driving up inflation, causing the public to have less disposable income and decreasing living standards [2]. Those on the lowest incomes notice the price increase the most, as a larger proportion of their monthly income is spent on domestic energy [3]. In some cases, heating and health have been inextricably linked through the prescription of heating by general practitioners [4].

As people were forced to choose between heating their homes and eating [5], more may have chosen to keep warm in other ways. Items such as hot water bottles, small, electric heaters and electric blankets may all be used to keep an individual warm and to some, may be more economical than using central heating in the home.

The risk of using these items to the individual, though small, is undescribed. Improper use, or the use of items in a state of disrepair, may result in house fires, or direct burn injury from the item itself. Burn injuries are a common presentation to the emergency department [6], and we hypothesised that an increase in the use of personal heating equipment may lead to an increase in the number of burn injuries seen in our centre. This mirrors concerns voiced previously via editorial correspondence [7].

The aim of this study, therefore, was to identify any change in the number of referrals to a burn centre in the UK, which may correspond to the increase in cost of domestic energy.

## 2. Methods

### 2.1. Record identification

This was a retrospective study of a prospectively maintained database of referrals through an online referral system (MDSAS). All referrals to a single tertiary burns service in the United Kingdom (burns centre status) between January 16th 2022 and January 16th 2023 were selected and compared with the same period from 2020–2021. The comparison cohort was selected to represent the period before the rise in energy prices.

Referrals were exported to a bespoke Microsoft Excel spreadsheet for screening. Referrals were screened for the terms “hot water bottle,” “electric heater,” “electric blanket,” and “heater.” Referrals were included if they were related to personal heating or heating equipment. No specific exclusion criteria were applied.

Though patient outcomes were not collected specifically, patients were treated either through advice and guidance to the referring centre, or through outpatient or inpatient admission to the regional burns centre.

### 2.2. Energy prices

Average domestic energy price was derived from the Office of Gas and Electricity Markets official data, using data based on a typical domestic dual fuel customer paying by direct debit [1].

### 2.3. Ethical considerations

As this was a review of routinely collected data, with no change to the patient pathway and no use of identifiable information, specific ethical approval was not required. The study was undertaken in line with the Declaration of Helsinki [8].

### 2.4. Statistical analysis

Analysis was performed in SPSS version 28 (IBM Corp. Armonk, NY). Total referrals in each period, demographic data (age, gender), anatomical location and the mechanism of injury were compared between cohorts. Pearson’s Chi Squared test was used to compare groups.

Correlation was measured using Pearson’s correlation coefficient, with a coefficient of 0.00–0.09 being taken to be a negligible correlation, 0.10–0.39 a weak correlation, 0.40–0.69 a moderate correlation, 0.70–0.89 a strong correlation and 0.90–1 a very strong correlation [9].

## 3. Results

In the period covering 2020–2021, 1682 referrals were received, of which 54 (3.2%) were related to personal heating equipment. For the period covering 2022–23, 1746 referrals were received, of which 81 (4.6%) were related to personal heating equipment. We found a statistically significant increase in the number of referrals received relating to personal heating equipment ( $p = 0.03$ ), with a 50% relative increase in referrals.

Table 1 shows the demographic details of patients with heating-related injuries. The majority of those with injuries were female (69%). Injuries in working age adults (18–65 years) increased significantly (52% to 69%,  $p < 0.05$ ), with the relative number of children injured decreasing (22% to 18%,  $p = 0.50$ ), as well as a decrease in injuries in the over 65’s (26% to 14%,  $p = 0.08$ ).

**Table 1 – Demographic characteristics of included referrals.**

Characteristic	2020-21 n (%)	2022-23 n (%)
<i>Gender</i>		
Male	19 (35%)	23 (29%)
Female	35 (65%)	57 (71%)
<i>Age Group</i>		
Child (< 18)	12 (22%)	14 (18%)
Adult (18-65)	28 (52%)	55 (69%)
Older Adult (65 +)	14 (26%)	11 (14%)
<i>Injury Type</i>		
Scald	41 (76%)	56 (70%)
Contact	12 (22%)	20 (25%)
Radiant	1 (2%)	1 (1%)
Flame	0 (0%)	1 (1%)
Electrical	0 (0%)	1 (1%)
Chemical	0 (0%)	1 (1%)
<i>Injury Site</i>		
Abdomen	8 (15%)	6 (8%)
Back/Buttocks	6 (11%)	6 (8%)
Chest	4 (7%)	9 (11%)
Foot	5 (9%)	7 (9%)
Groin/Genitals	2 (4%)	5 (6%)
Hand	10 (19%)	14 (18%)
Head/Neck/Face	1 (2%)	4 (5%)
Lower limb (excluding foot)	13 (24%)	27 (34%)
Upper limb (excluding hands)	1 (2%)	1 (1%)
Not stated	4 (7%)	1 (1%)

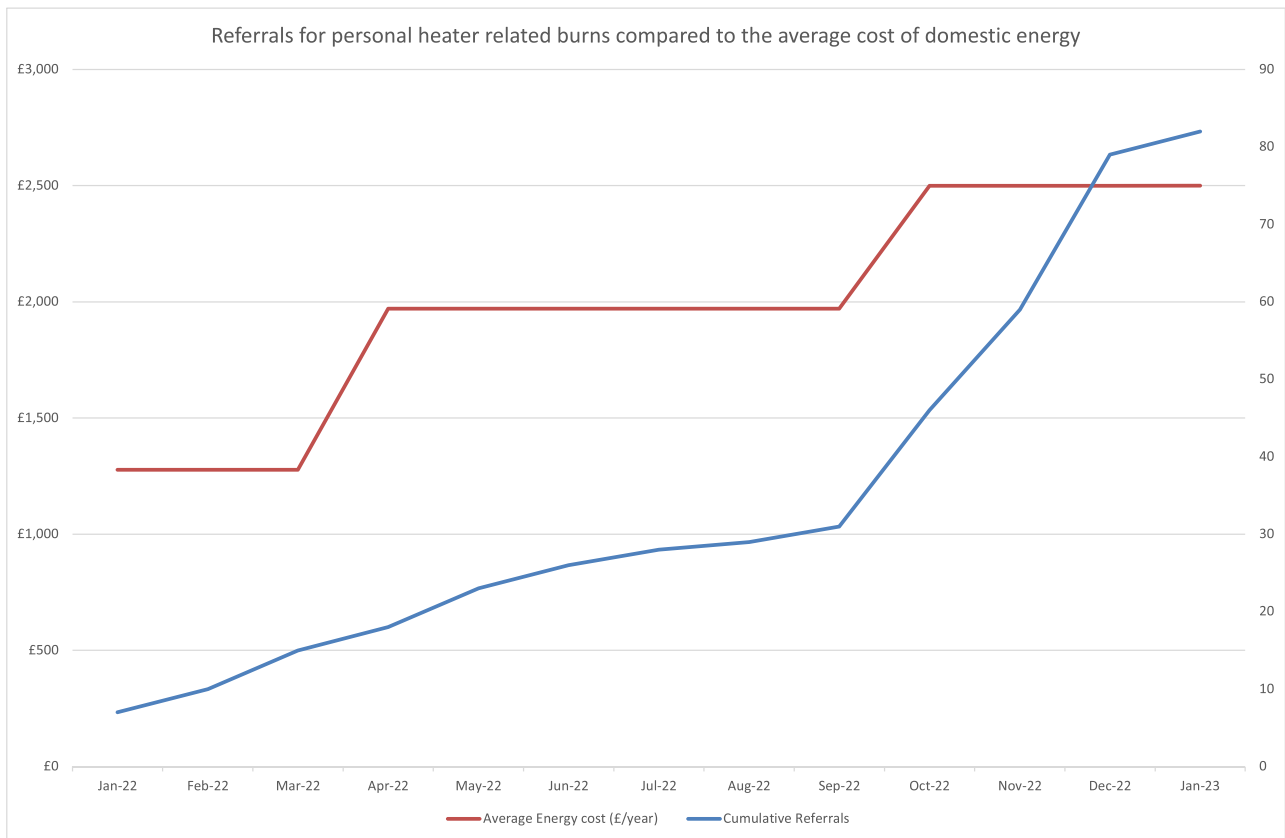
For all heating-related injuries, the most frequently injured area was the leg (30%) followed by the hand (18%). The commonest type of injury described was scald (72%).

Fig. 1 shows the cumulative number of referrals for heater related injuries in the 2022–23 period, alongside the average energy cost for the same time period. The Pearson correlation coefficient between referrals and energy cost was 0.68, indicating a moderate (borderline strong) correlation.

#### 4. Discussion

The impact of the rise in domestic energy prices, and the wider cost of living crisis, has been described in the national media, official government reports [2], and published, peer reviewed literature [10,11]. As the crisis continues, the true scale of the impact may not be known for some time. This study is the first to describe a correlation between the increase in energy prices and burn injuries arising from the use of alternative means of keeping warm. Burn injuries caused by personal heating equipment are not new, and they have been shown to have significant morbidity and impacts upon health services [12], however this study shows a significant increase in injuries of this type.

The findings of this study have been observed previously; energy shortages in the United States were linked to an increase in the number of admissions and the severity of burn injuries in a regional burn unit in 2002, with authors



**Fig. 1 – The number of referrals received alongside the average cost of domestic energy in the UK, for the period 2022–23.**

identifying a correlation between a sharp price rise and the number of admissions [13]. In the current study, the price cap (the maximum cost per unit energy companies are allowed to charge customers [14]) rise in September 2022 was associated with a sharp rise in referrals to the service. Recent studies have explored the impact of increasing costs of living upon wider public health [15], mental health [16] and oral health [17], but no other studies have explored the impact upon highly specialised services such as burn care.

Previous studies have found that burns from hot water bottles most commonly affected children and the elderly [18], which was shown in the 2020–21 cohort in this study. However, the proportion of burns in working age adults significantly increased in 2022–23, which may have a subsequent effect upon lost productivity or work-time. The financial impact caused by time off work and repeated travel to burn centres for dressing changes, may only serve to deepen those already in difficulty. Exploring this impact was outside of the scope of this study, but further studies should aim to quantify the financial burden of these injuries on both patients and healthcare services.

The rise in referrals may be independent of weather and outside temperature. The winter of 2020–21 was colder than normal [19] whereas the autumn of 2022 and winter of 2022–23 were slightly warmer than average [20,21], though did have deep cold spells [22]. The increase in referrals is also despite the end of COVID-19 lockdown restrictions, which saw the end of people being advised to stay at home, and the subsequent increase in domestic energy use [23].

This study has several limitations. Firstly, and most significantly, the observational nature of the study means only correlation, not causation, can be derived from the results. It is possible that an unexplored factor, independent of the factors already discussed, caused the described rise in injuries. The numbers involved were too small to attempt regression analysis to control for confounding factors, and future observational studies should take place on a population basis to mitigate for this. This would control for unexplored factors such as number at risk (i.e. variation in the regional population). Secondly, the observed increase in referrals may represent a shift out of the COVID pandemic, during which patients were advised to stay at home to relieve pressure upon secondary care services. However, as the regional burns service has offered remote, telemedical and outreach services for several years, the impact of the pandemic upon referrals (as opposed to admissions), was minimal. Finally, due to the primary outcome being referrals, further study is needed to identify any difference in patient-level outcomes between cohorts.

## 5. Conclusions

This study describes a relationship between a rise in domestic energy prices and the number of burn injuries from personal heating equipment such as hot water bottles, personal heaters and electric blankets. Whilst strong conclusions are unable to be drawn from this observational study, the scale and consequence of rising costs of living remains unseen. Burn care providers and public health

bodies should be vigilant to the risks posed by personal heating equipment.

## CREDiT authorship contribution statement

Joshua P Totty – Conceptualisation, methodology, Investigation, formal analysis, data curation, writing (original draft). Orla Austin – Conceptualisation, writing (review and editing), supervision. Muhammed Umair Anwar – Conceptualisation, writing (review and editing), supervision. Preetha Muthayya – Conceptualisation, Investigation, writing (review and editing), supervision. Alan R Phipps – Conceptualisation, writing (review and editing), supervision.

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## Declaration of Competing Interest

All authors have no conflicts of interests to declare.

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