PRESS RELEASE

EDITOR'S CHOICE

Preventing bath water scalds: a cost-effectiveness analysis of introducing bath thermostatic mixer valves in social housing

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ABSTRACT

Aims To assess the cost-effectiveness of installing thermostatic mixer valves (TMVs) in reducing risks of bath water scalds and estimate the costs of avoiding bath water scalds.

Methods The evaluation was undertaken from the perspective of the UK public sector, and conducted in conjunction with a randomised control trial of TMVs installed in social housing in Glasgow. Installation costs were borne by the social housing organisation, while support materials were provided by the UK NHS. Effectiveness was represented by the number of families with at-risk bath water temperatures pre- and post-installation, and the number of bath scalds avoided as a result of installation. Differences in the number of families with at-risk temperatures between groups were derived from the RCT. Cost-effectiveness was assessed and a series of one-way sensitivity analyses were conducted.

Results Unit costs associated with installation were calculated to be £13.68, while costs associated with treating bath water scalds ranged from £25 226 to £71 902. The cost of an avoided bath water scald ranged from net savings to public purse of £1887 to £75 520 and at baseline produced a net saving of £3 229 008; that is, £1.41 saved for every £1 spent.

Conclusion It is very likely that installing TMVs as standard in social housing in new buildings and major refurbishments accompanied by educational information represents value for money.

Trial registration number ISRCTN:21179067.

INTRODUCTION

In April 2010 changes to the Building Regulations for England and Wales came into force, requiring that 'the hot water supply to any fixed bath must incorporate measures to ensure that the temperature of the water that can be delivered to the bath does not exceed 48°C' in new build houses and those where there is a change of use of the building.[1] Thermostatic mixer valves (TMVs) are one engineering solution to this problem, but their cost-effectiveness in domestic settings has not been evaluated.

Scald injuries place a considerable burden on health services with the individual lifetime cost for treating a severe scald estimated to be as high as £250 000[2] and total annual health service costs in England and Wales to be over £61 million.[3] Over 2600 bath water scalds occur each year in the UK.[4] Young children are at particular risk; more than 400 children under 5 years of age are admitted to hospital each year, and most hospital[4] and paediatric burns centre admissions[5] for bath water scalds occur in this age group, as do the most severe scalds.[4] Social inequalities also exist, with admission rates for burns and scalds being over three times higher among children from disadvantaged areas compared with those from affluent areas.[6]

Most bath hot water scalds occur from children falling or climbing unsupervised into baths, or turning on hot taps, or parents putting children into water that is too hot.[5 7] In the UK, home water heater thermostats are frequently set at 60°C or above.[8] At this temperature adults can suffer partial or full thickness burns after 3 and 5 seconds, respectively, with burns occurring in even shorter time periods in children.[2 9] For these reasons, a bath hot water temperature no higher than 46°–48°C is recommended.[1 2]

Interventions to reduce scalds, such as tap water temperature testing and/or thermostat reduction do reduce water temperatures, but temperatures often remain above current recommended levels.[10–14] Legislation to reduce thermostat settings has been more successful, with uncontrolled studies finding reductions in hospital admission rates, total body area burnt, the proportion needing skin grafts, and the proportion scarred.[15] In general, it has been advocated that a combination of education and legislation is a more effective approach to prevention.[16]

The economic literature in this area is sparse. Legislation to lower thermostat settings on domestic hot water heaters plus annual delivery of educational information to utility company customers has been estimated to generate cost savings of $C531 per scald averted,[17] but it has not been possible to find any published economic evaluations of TMVs in a domestic setting. This study therefore aims to assess the cost-effectiveness of installing TMVs and providing educational materials to families living in social housing, and to estimate the cost of avoiding a bath water scald as a result of adopting the strategy.

DESIGN AND METHODS

The economic evaluation was undertaken from a UK public sector perspective and conducted alongside a randomised controlled trial (RCT) of TMVs.[18] The trial was conducted in Scotland, where building regulations require TMVs to be installed in new build properties and major

Table 1 Costs associated with the installation of thermostatic mixer valves (TMVs)

Item	Unit cost (£)	Source of information	Notes
Installation; costs incurred by Housing Association			
Cost of valve: £45	£5.41	Housing Association documents	Annualised capital charges calculated using 3.5% annual discount rate (assuming TMVs need replacing every 10 years)
Cost of installation: simple fit requiring removal of bath panel, based on 2 h of plumber's time, as at 2008 prices	£103.02	City buildings (Glasgow) Limited Liability Partnership	Bath panel only removed to fit TMV
Cost of installation: complex fit requiring removal of bath, based on 4 h of plumber's time, as at 2008 prices	£260.28	City buildings (Glasgow) Limited Liability Partnership	Bath needed to be disconnected to fit TMV
Cost of repair	£6.96	City buildings (Glasgow) Limited Liability Partnership	Assuming 11% require repair (findings from RCT)
Educational materials; cost incurred by NHS			
Cost of hanger	£1.21	Personal communication	
Cost of leaflet	£0.10	Personal communication	

refurbishments. Participants comprised families with children under 5 years of age living in accommodation provided by the Glasgow Housing Association, the largest social housing provider in Europe. The costs of purchasing, fitting, replacing, and repairing TMVs were borne by the Housing Association, while educational materials were provided by the NHS. Data relating to the cost of TMVs, their installation and repair were obtained from the Glasgow Housing Association and from the City Building (Glasgow) Limited Liability Partnership, who installed the TMVs. Data relating to the educational materials were obtained from NHS staff responsible for study implementation. Estimated costs of treatment and care following a bath scald were obtained from an impact assessment for amending Part G of the Buildings Regulations 2000.[3] A sensitivity analysis was carried out using cost estimates based on the findings of the Hot Water Burns Like Fire (HWBLF) campaign response to the Part G Building Regulations consultation headed by Labour MP Mary Creagh.[19]

Participants were randomised to a treatment arm; those in the intervention arm were offered:

- An educational leaflet mailed prior to TMV fitting.
- A TMV set at a maximum temperature of 45°C fitted by a qualified plumber from City Building (Glasgow) Limited Liability Partnership.
- A waterproof educational guide on how to use the TMV attached to the tap by the plumber at installation.

Control arm families were offered the intervention *after* collection of follow-up data. The effectiveness indicators for use in the cost-effectiveness analysis were the number of families with at-risk bath water temperatures (defined as >46°C) before installation and at follow-up, and the number of bath scalds avoided as a result of installation of the TMVs. The difference in the number of families with at-risk bath water temperature in the installation group relative to the control group was obtained from the results of the trial, while the number of bath scalds likely to be avoided following installation of TMVs was estimated from the baseline risk of a severe bath scald, adjusted for the difference in risk reduction between intervention and control arms in the RCT.

Based on estimated numbers of UK emergency department (ED) attendances from the Royal Society for the Prevention of Accidents (RoSPA) (2002 HASS/LASS figures and personal communication with RoSPA),[20] and the number of hospital admissions reported by the Department of Trade and Industry (DTI) in 1999,[4] it has been assumed that approximately 1107 children aged 0–4 years attend an ED each year with bath water scald injuries.[20] Of these, 249 require specialist treatment or hospitalisation of at least 5 days, and 188 are inpatients for less than 5 days[4]; therefore 670 attend EDs but are not admitted to hospital (classed here as minor injuries). Additionally, DTI data[4] report that an estimated 2.3 children aged 0–4 years die each year from bath scalds. However, fatalities are not included in the analysis or costing detailed in this paper.

There are an estimated 3 496 200 children aged 0–4 years in the UK.[21] The target group for this analysis is children in this age group living in social housing. However, there are no published figures for the number of 0–4-year-olds in social housing in the UK. Therefore, we have used the percentage of children living in low income households (30%),[22] which equates to 1 048 860 children, and divided this by the average number of dependent children per family in UK households (1.8)[23] to derive the number of 'at-risk' households of 582 700.

Further, given that not every child who attends the ED with a bath scald lives in social housing, the level of risk was based on published rates for hospital admissions for thermal injuries in children in England, by quintiles of the Townsend deprivation score.

Table 2 Estimated NHS costs by severity and calculation of unit cost of NHS treatment

Severity of injury from impact assessment (2005–10 unit costs)[3]	Equivalent from DTI report[4]	Cost per person	No. of 0–4-year-olds affected per year	Total cost by age/severity
Very serious with intensive care	Severe injuries (≥5 days as inpatients and/or transfer to specialist burns unit)	£80 516	147	£11 835 852
Serious	Severe injuries (<5 days as inpatients)	£41 134	111	£4 565 874
Minor injuries	Attend emergency department, but discharged and do not require admission	£180	395	£71 100
			Average NHS treatment cost	£25 226

Table 3 Estimates of number of emergency department (ED) attendances and hospital admissions from 2002 HASS/LASS[20] and DTI (1999)[4]

0–4 years	Estimated number per year	Estimated number of children living in social housing scalded each year	Source of information
Severe injuries (≥5 days as inpatients and/or transfer to specialist burns unit)	249	147	HASS/LASS (2002) and DTI (1999)
Severe injuries (<5 days as inpatients)	188	111	HASS/LASS (2002) and DTI (1999)
Minor injuries (attend ED, but discharged and do not require admission)	670	395	HASS/LASS (2002) and DTI (1999)
Total injuries (ED + inpatient)	1107	653	HASS/LASS (2002)

These showed that admission rates per 10 000 children over the period 1992–97 were zero in the two most affluent quintiles, 4.9 in the middle quintile, and 16.0 and 29.9 in the two most deprived quintiles, respectively.[6] Based on this, we estimated that approximately 59% of children admitted to hospital with thermal injuries would reside in the most disadvantaged areas, and assumed that these children would live in social housing. Therefore the estimated numbers of children aged 0–4 years in this target risk group having a bath water scald and attending an ED would be 653; the number of children aged 0–4 years requiring hospitalisation for ≥5 days or treatment at a specialist burns centre would be 147; the number of children aged 0–4 years requiring shorter period of hospitalisation would be 111; and the number of children aged 0–4 years requiring an ED attendance, but who were not admitted to hospital, would be 395.

A series of one-way sensitivity analyses tested the robustness of the findings to variations in underlying assumptions. Key parameters used in assessing the relative cost-effectiveness—rate of risk reduction, number of children aged 0–4 years suffering bath water scalds, percentage of children with very serious bath water scalds requiring treatment at a specialist burns centre or prolonged hospitalisation—were all adjusted by ±30%.

RESULTS

Determination of the costs of installing TMVs

The costs of purchasing, fitting, replacing, and repairing TMVs are shown in table 1, categorised according to which agency paid for the specific component of the service.

Costs to the NHS were obtained from the Department for Communities and Local Government Impact Assessment of amending Part G of the Building Regulations.[3] These costs were derived from NHS data gathered between 2005 and 2009, categorised by injury severity. The reported unit costs of NHS treatment for children aged 0–14 years are £80 516 for very serious cases (£72 246 if no intensive care unit care provided), £41 134 for serious cases, and £180 for minor injuries.[3] The average treatment cost, as shown in table 2, would therefore amount to £25 226.

Lifetime societal costs (including QALY losses, loss of human output, and further medical treatment) were not included in the impact assessment or in the baseline cost-effectiveness calculation, but were considered within the sensitivity analysis using data from the HWBLF campaign's response to the Part G Building Regulations consultation,[19] which estimated the wider societal treatment costs for a bath scald (using the incidence figures above) of £71 902.

Reduction of risk of bath water scalds

The baseline risk of a bath water scald was based on estimates that approximately 653 children aged 0–4 years attend EDs each year with scald injuries, 147 require specialist treatment or hospitalisation of at least 5 days, 111 are inpatients for less than 5 days, and 395 attend an ED and do not require admission (table 3).

As described above, the estimated number of 'at-risk' social housing households in the UK was 582 700. The risk of a child in this target risk group having a bath water scald was estimated as 1 in 892 (653/582 700); the risk of a child requiring hospitalisation for ≥5 days or treatment at a specialist burns centre was estimated as 1 in 3964 (147/582 700); the risk of a child aged 0–4 years requiring a shorter period of hospitalisation was estimated as 1 in 5250 (111/582 700); and the risk of a child aged 0–4 years requiring an ED attendance was estimated as 1 in 1475 (395/582 700) (table 4).

The percentage of families in the intervention arm pre-TMV installation with bath water temperature considered to be at-risk (ie, >46°C) was 100%; this reduced to 19% at follow-up, a reduction in risk of 0.81. The percentage of families in the control arm with bath water temperature considered to be at-risk (ie, >46°C) was 100% at baseline and 87% at follow-up, a reduction in risk of 0.13.[18] The difference in scald risk reduction between groups was therefore 0.68 (0.81 − 0.13) (table 5).

Table 4 Risk of scalds based on 2002 HASS/LASS[20] and DTI (1999)[4]

Severity of injury	Estimated number per year	Estimated number of affected households in social housing in the UK	Risk within population	% Risk within population
Severe injuries (≥5 days as inpatients and/or transfer to specialist burns unit)	147	582 700	1 in 3964	0.025%
Severe injuries (<5 days as inpatients)	111	582 700	1 in 5250	0.019%
Minor injuries (attend emergency department, but discharged and do not require admission)	395	582 700	1 in 1475	0.068%
Total injuries	653	582 700	1 in 892	0.112%

Table 5 Thermostatic mixer valve pre- and post-installation risk

	% Of families with at-risk bath water >46°C (intervention)	% Of families with at-risk bath water >46°C (control)
Baseline	100%	100%
Follow-up	19%	87%
Reduction in risk	81%	13%
% Risk difference between groups	68% reduction (0.81−0.13)	

A 68% reduction in scald risk would reduce the risk of children aged 0–4 years requiring hospitalisation for ≥5 days or treatment at a specialist burns centre following a bath water scald to 1 in 12 398, the risk of a child aged 0–4 years requiring shorter periods of hospitalisation to 1 in 16 186, and the risk of a child aged 0–4 years requiring an ED attendance to 1 in 4625; and would reduce the risk of total ED attendances/admissions to 1 in 2788 (see table 6).

Cost-effectiveness of installing TMVs

In order to assess the relative cost-effectiveness of TMVs, the perspective employed in the baseline analysis was that of the UK public sector and was based on the assumption that the costs of TMV installation are incurred as an integral part of refurbishment or rebuild of the housing stock. The cost of the intervention to the Housing Association consisted of the cost of purchasing and repairing TMVs (based on 11% needing repair) being £12.37, and the cost to the NHS of education materials of £1.31—a total cost of £13.68. Therefore, based on a risk reduction of 68%, estimated ED attendances and hospital admissions described above, and the total cost of installing a TMV (£13.68), the cost per percentage reduction in at-risk families is £0.20 (£13.68/0.68). The cost of averting one bath scald would result in savings to the public purse of £7273 (table 7), based on average NHS treatment costs of a scald of £25 226 (table 2). If the wider societal treatment costs (incorporating lost output, QALY costs, etc) of £71 902 were used from the 2008 HWBLF campaign response to Part G consultation,[19] this would result in a net saving to the public purse for every scald avoided of £53 949 (table 7).

Impact on the public purse

The net cost to the public purse of installing TMVs as part of new builds or major refurbishments where a new bath is installed compared to the total NHS costs of treatment per scald were estimated. First, based on average NHS costs per injured child (£25 226) multiplied by the estimated number of scalds averted each year in the target group (444), the total NHS costs avoided would be £11 200 344 per year. The cost of installing a TMV (£13.68) in the estimated number of households in social housing (582 700) would amount to £7 971 336, producing a net saving of £3 229 008—that is, approximately £1.41 saved for every pound spent.

The net cost to the public purse of installing TMVs as a stand-alone installation in existing bathrooms where a plumber removes the bath panel to fit the TMV is much higher. This includes the cost of a simple fit requiring removal of the bath panel (£103.02), the cost of the TMV (£5.41), the cost of repair (£6.96), the cost of a hanger (£1.21), and the cost of the leaflet (£0.10). Installation costs are thus £116.70, which when multiplied by the estimated number of affected households (582 700), produces a cost of £68 001 090. When the 'lifetime' cost of NHS treatment (£71 902) is used, then the total annual cost of NHS treatment is £31 924 488 and a net positive cost overall of £36 076 602 (table 7).

Sensitivity analysis

The sensitivity analysis took into consideration the following: changes to the base-case minimum cost of installation; the percentage risk reduction from use of TMVs; number of children aged 0–4 years having bath water scalds per annum; percentage of children aged 0–4 years with bath water scald requiring at least 5 days hospitalisation or transfer to a specialist hospital or unit; percentage of children aged 0–4 years with a bath water scald requiring at least 5 days hospitalisation or transfer to a specialist hospital or unit (based on wider societal treatment costs of £71 902); estimated number of affected households in social housing in the UK; maximum cost of purchasing and installation of TMVs and educational materials from a wider societal perspective; changes in the base-case minimum cost of installation and treatment costs with wider societal treatment costs of £71 902; and finally, the estimated number of children admitted to hospital with thermal injuries residing in the most disadvantaged areas (59%). Each of these parameters in the assessment of relative cost-effectiveness was adjusted by ±30% and the results are shown in table 8. The cost of the intervention of £13.68 has been used as the base-case for the purpose of the sensitivity analysis.

Sensitivity analyses indicated that the cost of purchasing and installing the TMV and the cost of treating a scald requiring five or more days hospitalisation or transfer to a specialist burns hospital or unit had the greatest impact on the cost per scald averted.

DISCUSSION

Principal findings

This economic analysis has demonstrated that the installation of TMVs in social housing with children under the age of 5 years, when undertaken as part of new build or major

Table 6 Reduction in child risk post-thermostatic mixer valve (TMV) installation (based on TMVs reducing risk by 68%) (HASS/LASS[20] and DTI (1999)[4])

Severity of injury	Estimated number per year	Estimated number of affected households in social housing in the UK	Risk within population	% Risk within population
Severe injuries (≥5 days as inpatients and/or transfer to specialist burns unit)	47	582 700	1 in12 398	0.008%
Severe injuries (<5 days as inpatients)	36	582 700	1 in16 186	0.006%
Minor injuries (attend emergency department, but discharged and do not require admission)	126	582 700	1 in 4625	0.022%
Total injuries	209	582 700	1 in 2788	0.036%

Table 7 Estimated cost of averting one bath water scald

	NHS perspective	Lifetime perspective
Estimated total number of scalds per year	653	653
Estimated number of affected households in social housing in the UK	582 700	582 700
Protected children (due to 68% reduction in risk)	444	444
Average NHS costs per injured child	£25 226	£71 902
Cost of TMV	£13.68	£13.68
Total cost of TMV installation	£7 971 336	£7 971 336
NHS costs avoided	£11 200 344	£31 924 488
Net savings of programme	£3 229 008	£23 953 152
Net saving per scald avoided	£7273	£53 949
Cost of TMV	£13.68	£116.70
Total cost of TMV installation	£7 971 336	£68 001 090
NHS costs avoided	£11 200 344	£31 924 488
Net savings (costs) of programme	£3 229 008	(£36 076 602)
Net benefit (cost) per £1 spent	£1.41	(£0.47)

TMV, thermostatic mixer valve.

refurbishment with installation of a new bath, is likely to produce cost savings for the public purse. This finding was robust to adjusting all parameters used in the analyses by a factor of ±30%, except when the risk reduction is lowered to 0.48, the estimated number of children scalded reduces to 457, or when TMVs are fitted as a stand-alone installation in existing bathrooms. These parameters then produce positive costs (table 8).

Strengths and limitations of the study

To our knowledge this is the first economic evaluation of TMVs in a domestic setting. Our finding of a 68% reduction in water temperatures to the recommended 'safe' level of 68% is larger than the reduction in admission rates (57%) found in an uncontrolled study evaluating a programme of interventions to reduce scalds in families in high-risk areas, including installing anti-scald devices in showers, sinks, or baths depending on parent preference.[24] Were we to base our analyses on a reduction in scald risk of 57%, the cost of averting one bath scald would result in savings to the public purse of £3798, based on average NHS treatment costs of a scald of £25 226. If the wider societal treatment costs of £71 902 were used, this would result in a net saving to the public purse for every scald avoided of £50 474.

It is generally accepted that interventions resulting in a cost per QALY of less than £20 000–£30 000 represent value for money.[25] A cost-utility analysis of a specialised burn treatment centre in Spain estimated a mean EQ-5D score at follow-up of 0.87.[26] The study did not report a pre-injury EQ-5D score, but assuming a utility decrement of 0.13 (consistent with the findings from a recent study of hospitalised adults with burns[27]) which applies over the remaining lifetime, a bath water scald would result in a loss of 9.1 QALYs (70 additional life years × 0.13 loss of quality of life) on average over a lifetime, and a loss of 3.5 QALYs if discounted at 3.5% per annum. In order for TMVs to be within the cost-effectiveness threshold for value for money, the cost per scald averted would have to be <£105 000 (ie, £30 000 × 3.5 QALYs). If the assumption regarding the utility decrement for childhood bath water scalds is a reasonable one, our findings suggest that fitting TMVs in social housing during new builds or major refurbishments falls within the threshold defined as 'value for money'.

Our findings are likely to be generalisable to families living in social housing in the UK and other countries with similar costs of purchasing and installing TMVs and healthcare costs. They are not generalisable to families who do not live in social housing, whose risk of scalds would be lower. Furthermore, in this situation, families would need to fund the purchase and fitting of TMVs, while the NHS would benefit from savings from averted scalds. This highlights an important issue, relating to who pays for the safety intervention and who receives the benefits. In this study the costs were mainly incurred by the housing association, with the benefits we included in our base-case analysis accruing to the NHS. However, public health interventions such as these are likely to have benefits beyond the health sector and the analysis demonstrated that cost savings were larger when a wider societal perspective was employed.

Table 8 One-way sensitivity analysis

Parameter	Base-case	Range of values	Cost per scald avoided
Base-case minimum cost of installation incurred by Housing Association and costs of education materials incurred by NHS (£13.68) (£)	£13.68	£9.58–17.78	Cost savings of £12 653; cost savings of £1892
Risk reduction using TMVs	0.68	0.48–0.88	£242; cost savings of £11 363
Number of children aged 0–4 years having bath water scalds per annum	653	457–849	£405; cost savings of £11 411
Percentage of children 0–4 years with bath water scald requiring ≥5 days hospitalisation or transfer to specialist hospital or unit	23%	16–30%	Cost savings of £4680 (based on treatment costs decreasing to £22 633); cost savings of £10 229 (based on treatment costs increasing to £28 182)
Percentage of children 0–4 years with bath water scald requiring ≥5 days hospitalisation or transfer to specialist hospital or unit (based on wider societal treatment costs of £71 902)	23%	16–30%	Cost savings of £53 949 (based on treatment costs remaining at £71 902 as per HWBLF response)
Estimated number of affected households in social housing in the UK	582 700	407 890–757 510	Cost savings of £12 659; cost savings of £1887
Maximum cost of purchasing and installation of TMVs and educational materials	£273.96	£191.77–356.15	£226 451–442 181
Base-case minimum cost of installation incurred by Housing Association and costs of education materials incurred by NHS (£13.68) (£) with treatment costs based on wider societal treatment costs of £71 902	£71 902	£50 331–93 473	Cost savings of £32 378; cost savings of £75 520
Estimate of the proportion of all admissions and attendances that occur to children living in social housing (59%)	3.49	41–77%	£571; cost savings of £11 459
Estimate for admitted patients only	297/437		Cost savings of £1614–45 062

TMV, thermostatic mixer valve.

Comparisons with existing literature

We have not been able to find any published economic evaluations of installing TMVs with which to compare our estimates. The 2004 Cochrane Review by Turner *et al*[28] does highlight studies that report drops in scald incidence, however they draw attention to methodological issues that weaken the results of several of these studies. And most, if not all of the studies tend to be designed around literature dissemination and none of the RCTs actually used a TMV and/or direct action against water temperature. Therefore, we have no comparative proportional reduction estimates to use in this paper. A recent cost-effectiveness analysis of legislation to set thermostats on new domestic water heaters to a maximum 49°C and annual educational information sent to utility company customers found the intervention resulted in a saving of $C531 per scald averted.[17] This intervention was much cheaper than installing TMVs, and as the legislation applied to the entire population, not just those living in social housing, the potential impact may be greater. However, findings from our RCT indicated that most families would not be happy with kitchen hot water at the same temperature as their bath hot water.[18] This suggests that similar legislation to lower new boiler thermostats may not be acceptable to the UK population.

Implications for policy and research

It is very likely that installing TMVs in social housing new builds and major refurbishments with installation of new baths accompanied by educational information represents value for money (as measured by cost/QALY). Current building regulations for England and Wales mandate TMVs in new builds and where there is a change of use of the building, but do not mandate TMVs when bathroom fittings (eg, a bath) are merely replaced. Disadvantaged families who are less likely to live in new build accommodation are therefore likely to benefit less from current regulations than more affluent families, potentially increasing inequalities in scalds. Social housing providers should therefore consider fitting TMVs when baths are replaced, as well as complying with existing building regulations.

Further work is required to estimate the long-term cost of bath water scalds to children, families, and society, and to quantify their impact on quality of life. The impact of amendments to the building regulations for England and Wales requires evaluation, especially in terms of their effect on inequalities in childhood bath water scalds.

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Competing interests None.

Patient consent Obtained.

Ethics approval The trial protocol was reviewed by Nottingham Research Ethics Committee. As the trial did not involve NHS staff or patients and hence did not fall within the remit for NHS ethics committee approval, the committee was able to provide a review, but not approval. The trial received NHS organisational approval from Nottinghamshire County Primary Care Trust (PCT) (formerly Broxtowe and Hucknall PCT) as some research staff working on the trial were employed by the PCT.

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