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Burns treatment for children and adults: a study of initial burns first aid and hospital care

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Abstract

Aim To assess the adequacy of initial burns first aid treatment in the community and its subsequent impact on treatment outcome.

Methods Four-month prospective study of consecutive burn patients presenting to Middlemore Hospital. Patients were interviewed to determine initial burns first aid treatment (BFAT) and assessed as "adequate" or "inadequate", then compared with subsequent treatment. Inpatient care was wound debridement with/without dressings (DO/DB) or split skin grafting (SSG).

Results 40.5% of total 121 patients received adequate BFAT, 59.5% did not, p = <0.001. 50% Caucasians received adequate BFAT, compared with 25% Maori and 33% Pacific Island people, p = 0.084. 15.7% of adequate BFAT patients received DO/DB and 6.6% had SSG, compared with 23.4% and 19.3% respectively for inadequate BFAT, p = 0.03. Scald burns occurred most frequently, 4% adequate BFAT scald patients required SSG compared with 20% of inadequate BFAT scald patients, p = 0.003. Maori and Pacific Island people were over-represented as inpatients (collectively 34.8%) when compared to Caucasian (24.8%) or other ethnic groups, p = 0.25. 38% of all patients were children under 10 with inadequate BFAT tendency compared with adults, p = 0.067. Hospital stay decreased among adequate BFAT paediatric patients, p = 0.016.

Conclusions A public education strategy is required to improve BFAT, targeting at-risk communities. Following this, the study should be repeated to determine the effectiveness of the campaign and any resultant change in community behaviour.

The widespread recommendation for immediate cooling of the burn as a first aid measure suggests that this is a significant determinant of burn outcome, decreasing morbidity and also healthcare costs.[1] Cooling of the burned tissue is an important process in limiting the degree of tissue damage.[2,3] The burn traumatised area consists of three concentric zones of tissue destruction: a central Zone of Coagulative Necrosis (irreversible damage), an intermediate Zone of Stasis, and an outer Zone of Hyperaemia (fully reversible injury within 5–10 days). The Zone of Stasis is most influenced by adequate burns first aid treatment (BFAT) and is an area of sluggish blood flow that may eventually undergo progressive necrosis. Damage in this zone may be reversed by rapidly reducing the tissue temperature.[2] Adequate BFAT may reduce the severity of any burn type (other than full thickness) and improve prognosis for optimum cosmetic healing.[2,3]

What constitutes adequate BFAT? Considerable divergence of opinion exists regarding immersion duration and water temperature; for example, studies involving experimental burn work with animals have resulted in recommendations of 0–3°C for

5–30 minutes,[4,5] 8°C for 5–30 minutes,[6,7] 22–30°C for 30–45 minutes.[8,9] The general advice seems to be the use of water temperatures between 10–15°C or cold tap water for 10–30 minutes.[10–14]

Anecdotal clinical observations at Middlemore Hospital (MMH) suggest that some patients, in particular children, are not receiving adequate BFAT at the time of the burn injury. The aims of this study were to assess the adequacy of BFAT among patients presenting to MMH and its subsequent impact on treatment outcome.

Methods

This was a four-month (10 November 1997 to 9 March 1998) prospective study involving consecutive patients presenting to MMH with burn injuries.

Patients 165 patients presented to MMH with acute burn injuries during this period. 83 were treated as outpatients and 82 were admitted, with 121 being enrolled in the study (43 outpatients and 78 inpatients). Thus patients are divided into two groups: 'outpatients' treated and discharged by the Emergency Department (ED), and 'inpatients' admitted to Plastic Surgery wards for treatment consisting of dressings with or without wound debridement (DO/DB) or for more intensive treatment involving operative procedures such as split skin grafting (SSG). A distinction needs to be made between the groups in that while outpatient numbers represent only the South Auckland population, ie those within the MMH zone for trauma, inpatient figures represent the Greater Auckland area as a whole since MMH is the only tertiary care facility in Auckland that admits burns patients for specialist care. The ethnic demography of the Auckland region comprises 12% Moari and 13% Pacific Island peoples of the total population.[15]

Inclusion criteria consisted of presentation to MMH or the Plastic Surgery Clinic with an acute burn injury during the study period or prior inpatient admission at the commencement of the study. Exclusion criteria included inability to be interviewed, death, or remaining as an inpatient in the Intensive Care Unit (ICU) at the completion of the study period. Patients not enrolled (44 outpatients) were all unable to be contacted following treatment and discharge from the ED. Follow-up duration for this study was six months post injury.

Interview process Patients (parent/caregivers of patients aged <15 years) were interviewed either at admission to ED, during admission, or on discharge, using a standardised questionnaire designed to provide data on patient demographics, burn type, anatomical location and percentage of body surface area burned, cause of burn injury, physical location of burn injury, clothing worn at the time, initial BFAT (including whether or not clothing was removed), use of cold water therapy (CWT) including temperature and duration, alternative medical practices, understanding of BFAT, and source of knowledge. In addition, MMH specialist management/operative procedures, follow-up clinic attendance, assessment of healing and overall treatment costs (scald burns only) were recorded for the duration of follow up.

Definition of adequate BFAT BFAT received by each patient was assigned a classification of 'adequate' or 'inadequate' or 'none' based upon the interview. Assessment was made by one interviewer who interviewed all patients and hence interrelator reliability was not measured.

BFAT was classified using the most recent Accident Rehabilitation and Compensation Insurance Corporation (ACC) education campaign (1994). In this, 'adequate' BFAT is defined as CWT involving immersion of the burn in either running or stationary water for ≥10 minutes, and 'inadequate' as CWT involving immersion of the burn in either running or stationary water for <10 minutes. Both 'none' and 'inadequate' BFAT will be considered as inadequate in this report. It should be noted that emergency management of severe burns (EMSB) training conducted by the Australia and New Zealand Burn Association Education Committee states that adequate BFAT is CWT for ≥20 minutes.[1]

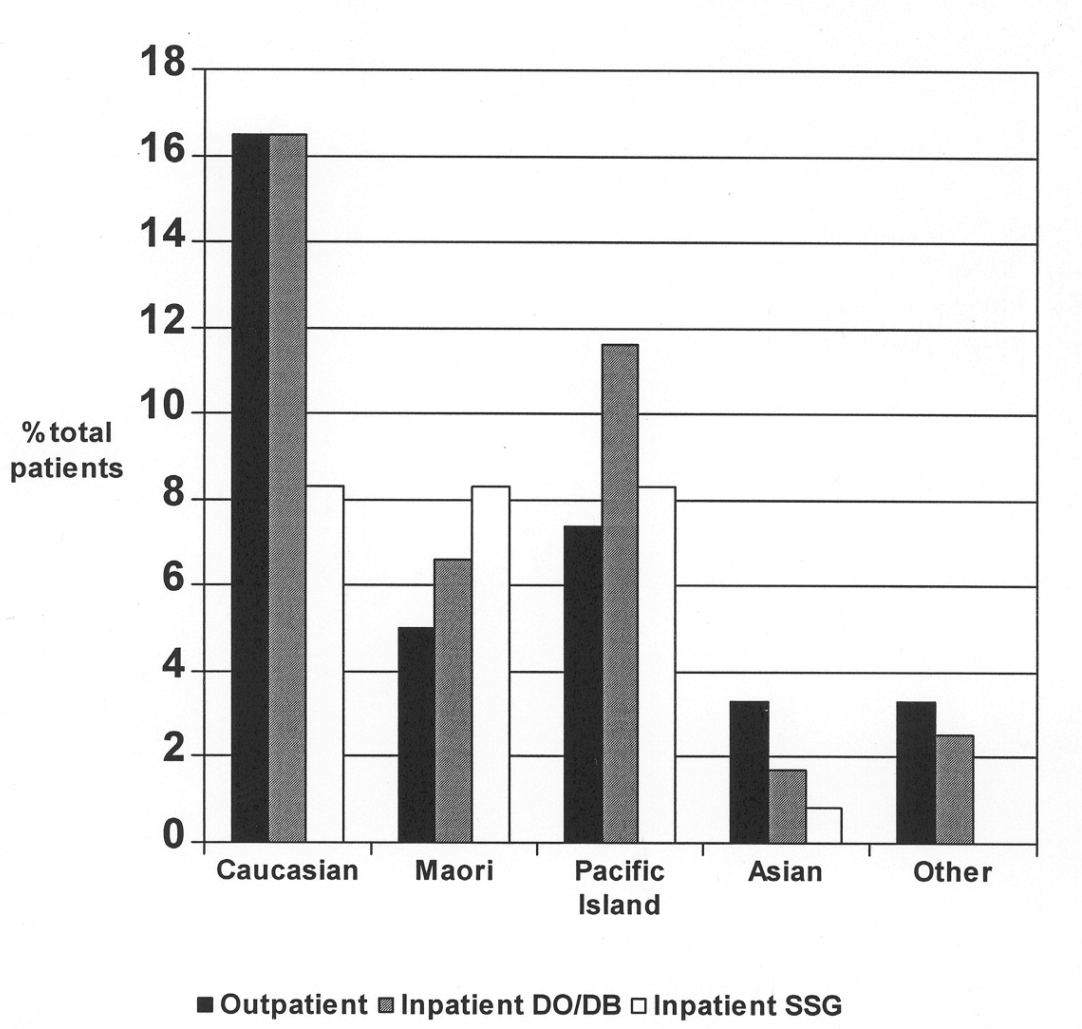
Statistics T-tests were used for differences between proportions, or single proportions as appropriate, to produce the p values and significance statements (with $p = 0.05$ as the critical value). For ethnicity comparison a chi-square test of homogeneity was used.

Results

Patients There were 165 eligible patients and 121 (73%) of these were subsequently enrolled. Among those enrolled, 43 (36%) were treated as outpatients and 78 (64%) as

inpatients. 44 patients were lost to follow up, with 42 being uncontactable post discharge from ED, one death, and one remaining as an inpatient in ICU. Two patients suffered intentional self harm and several paediatric patients were referred for specialist, non-accidental injury consultation. We observed an ethnic correlation within the inpatient population, in which a larger percentage of Maori and Pacific Island peoples are represented (collectively 34.8%) when compared to Caucasian (24.8%) or other ethnic groups, p = 0.25 (Figure 1).

Figure 1. Ethnicity vs patient treatment



Age and sex Age of patients ranged from six months to 73 years. Children less than 10 years of age comprised the largest number of burn patients in this study (38%), (Figure 2).

65.5% of burns in children less than 10 years were scalds. 82 eligible patients were male and 39 were female.

Type and physical location of burn injury In this study, 79% of burns occurred in the home and were most frequently caused by hot liquids (scald burns 43%), fire (flame burns 15%), and flash or thermal radiation (explosion burns 16%), (Figure 3).

Figure 2. Age spread of burn patients

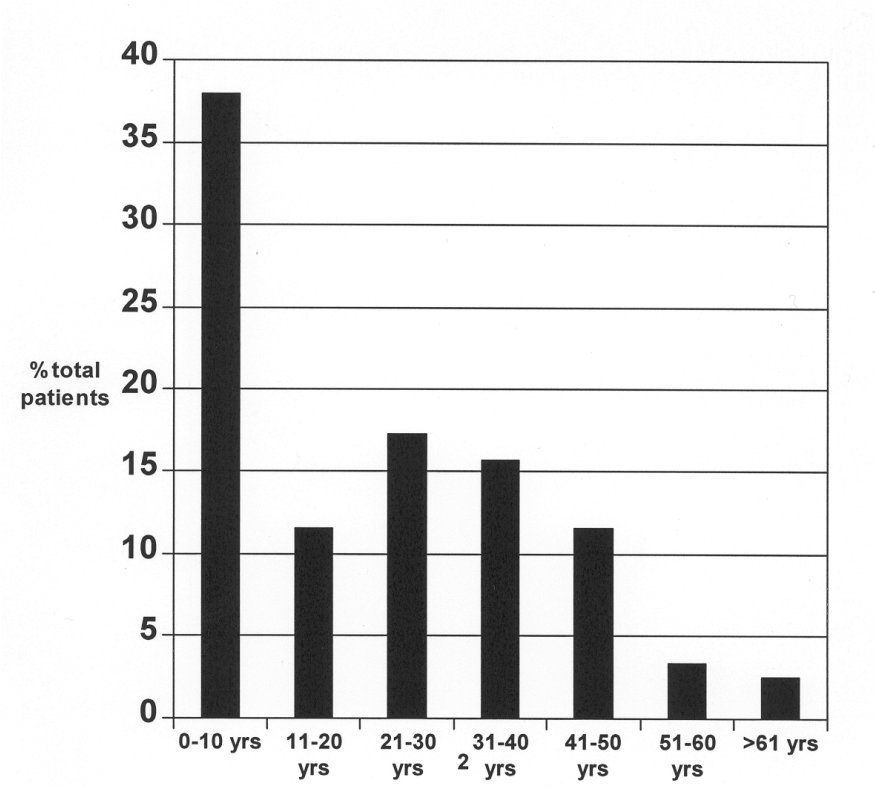
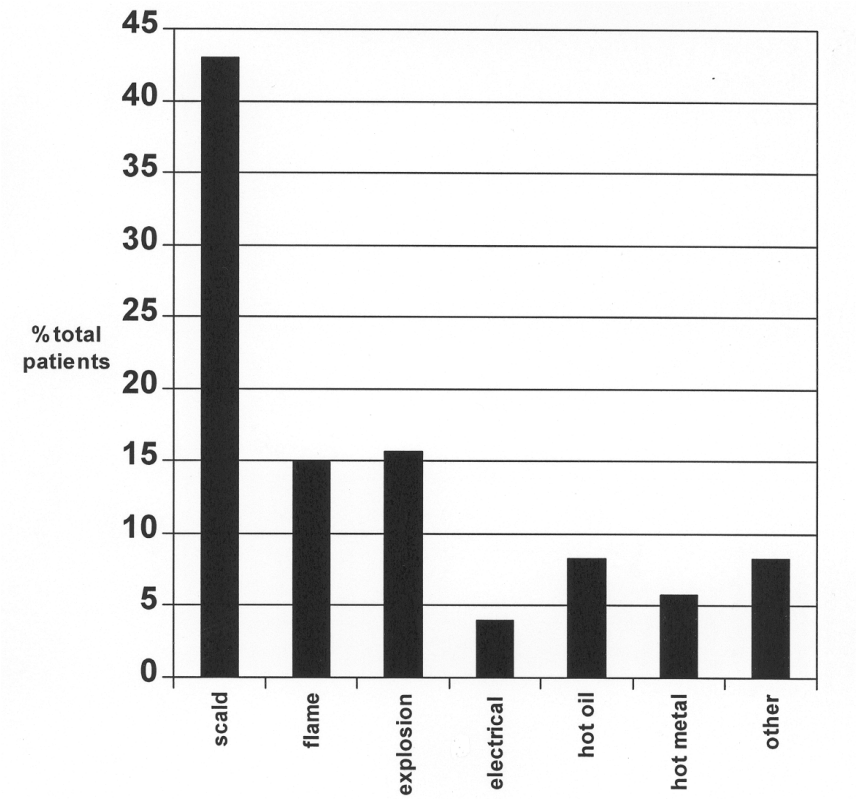


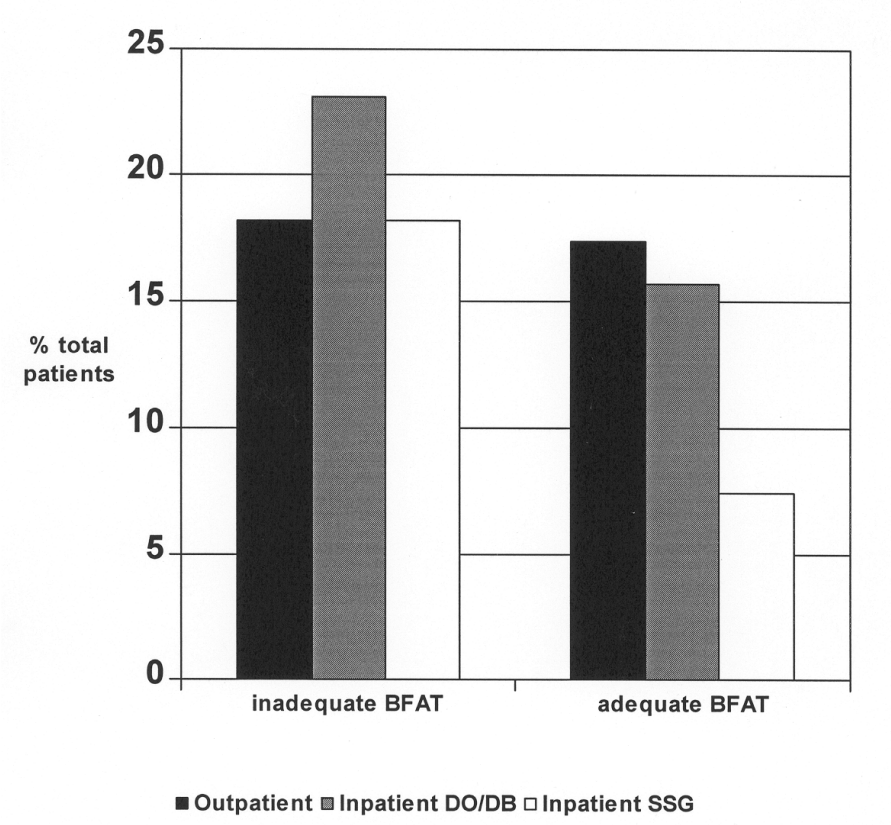
Figure 3. Burn type



Adequacy of BFAT Overall, 59.5% of all patients received inadequate BFAT, while 40.5% received adequate BFAT, p = <0.001. There was some racial difference noted, with 50% of Caucasians receiving adequate BFAT, compared with 25% of Maori patients and 33% of Pacific Island people, p = 0.084. In addition, there was a tendency for inadequate treatment to occur more frequently among children (70%) than adults (53%), p = 0.067, although similar figures for adults and children (41% and 39% respectively) undergoing SSG procedures were found, p = 0.83 (Figure 4).

Adequacy of BFAT versus treatment outcome There was some association between adequate BFAT and the need for fewer DO/DB procedures (15.7% compared with 23.4% for inadequate procedures, p = 0.29). Adequate BFAT was also strongly associated with the need for fewer SSG procedures (6.6% compared with 19.3% for inadequate BFAT, p = 0.03, Figure 4).

Figure 4. Immediate burns first aid treatment (BFT) vs patient treatment



Scald burns in particular showed the most dramatic impact of adequate BFAT. For these patients, the rate of SSG procedures was reduced from 20% to 4% with adequate treatment, p = 0.003. The requirement for inpatient DO/DB among scald burns was reduced from 42% to 36% with adequate treatment. Treatment outcome indicated a racial difference with 8.3% of Caucasian patients requiring inpatient SSG procedures compared with 45.1% of Maori and Pacific Island people collectively (Figure 1).

Hospital stay The mean length of stay was 5.5 days for children and 4.9 days for adults, with maximum stays of 28 and 29 days respectively. Study total inpatient

hospital stay was 556 days, 253 (41%) paediatric and 365 (59%) adult. There was no significant relationship between adequate BFAT and length of hospital stay, however there was a significant yet small decrease in stay among the adequately treated paediatric population, $p = 0.016$.

Source of knowledge of BFAT Patients or parents/caregivers stated that they had gained their understanding/knowledge of BFAT from family (21%) or alternatively from first aid learned from television advertisements, school teaching, formal first aid courses and GP or Plunket nurse visits (45%). In addition, among those using cold water at the time of injury, only 58% stated that it was to cool the burn, while 15% thought that it was to keep the burn wet, 2% thought that it was to clean the burn, and 24% had no knowledge related to their use of this treatment.

Socioeconomic status The addresses of the study burn patients were plotted on a map of the Greater Auckland region showing the education and income decile of each suburb. Overall, burn patients admitted for burn care tended to reside in suburbs of lower socioeconomic status. In addition, it was the outpatient or South Auckland population that had the highest loss to follow up, due most frequently to inability to be contacted at previously given phone numbers because of disconnected telephones and changes of address.

Cost (scalds) Overall direct costs for scald burn care during the study period were $63 440.00 (outpatients $2355.00 at $55.00 per patient, inpatients $57 016.00 at $730.00 per patient, follow-up clinic reviews [inpatient and outpatient] $4069.00 at $79.00 per patient). Costs for inpatient scalds with adequate BFAT were $7806.00 compared with inpatient costs of $49 210.00 for inadequate BFAT. Substantial savings may potentially be possible in scald burn care alone to the order of $75 000–100 000 per annum.

Discussion

Our study concurs with previous findings that adequate BFAT reduces severity of burn injury,[2] with adequate BFAT being associated with a significantly reduced number of SSG procedures and in particular for scald burns.[3] Although we need to examine our findings further, with a larger study population over a longer period and including an initial clinical assessment of burn severity and surface area for comparison, this is concerning in view of 59.5% of patients overall receiving inadequate BFAT.

Results indicating a decrease in adequate BFAT among Maori and Pacific Island people and an increase in this group as inpatients suggests the need to further examine these ethnic differences. This reflects the finding also that inpatients tended to reside in areas associated with a lower socioeconomic status. We acknowledge that any discussion based on ethnic differences is complex. It is a potentially problematic surrogate for an array of variables including cultural practice, socioeconomic status and education.[14]

Findings of burn injuries being more common among children than adults are supported elsewhere.[16] In addition, our need during this study to refer patients for specialist, non-accidental injury consultation supports a previous finding that 20% of all non-accidental injury deaths in infants (<1 year old) and 10% of those in 1–4 year olds result from burns.[17] In the 5–14 year age group 12% of unintentional injury

hospitalisations result from burns.[17] This group of patients is severely disadvantaged and unlikely to receive adequate BFAT.[2,3]

Although we found only a modest significance between length of hospital stay and adequacy of BFAT, these findings may prove more substantial with more extensive investigation; there was a decrease in stay among adequately treated paediatric patients. It has been shown that a reduction in duration of inpatient stay reduces the cost of care and disruption to the lives of patients, but more importantly minimises the psychological complications of inpatient care apparent (especially in children) beyond 14 days.[18] Children with less severe burns are more likely to be admitted for short-term analgesic and dietary care than adults.

In general, inpatient care costs tend to exceed those for outpatients and our data for scald care suggest promising financial savings associated with adequate BFAT at the time of injury. This cost can be examined in terms of the known overall cost to society, including additional costs arising from revisional surgery, lost work time of patient and caregiver, ongoing rehabilitation (not currently funded by ACC), and psychosocial impact of burns scars.[2]

The understanding of cold water therapy (CWT) by the public is deficient. Varied first aid practices exist in the community; for example, the application of butter and toothpaste, both of which have no effect on cooling and may contribute to further tissue destruction. It is difficult to determine reasons for these diverse practices. Many factors such as culture, educational status and health service accessibility may contribute to ignorance of the importance of CWT.[1,2]

Our message regarding CWT is that the best form of BFAT is immersion of the injured body part under running tap water for at least 10 minutes. It is cheap, readily available, usually clean, safe, analgesic, and rapidly reduces the heat of burned tissue, diluting injurious chemical agents. It should not be used on electrical burns if the patient is still attached to the electrical device. Caution should be exercised with immersion of facial burns. Hypothermia may result from prolonged whole-body immersion and application of cold wet bandages, especially in children. Hypothermia should be avoided and **ice should never be used** to cool a burn.[1–3,19] A time delay is incurred when filling a bath sufficiently deep for immersion, and emphasis needs to be placed on the necessity for immediate CWT under running water. Milk or soft drink is effective if cold water is unavailable. Topical lotions should be avoided because they may obscure burn examination or affect subsequent therapy.[2] Minor burns are best dressed with a clean, dry cloth, and severe burns or large surface areas should have protective coverings such as ‘glad wrap’ PVC cling film applied, restricting fluid loss and preventing airborne infection.[18]

A public education strategy should be targeted at the community at large focussed on populations at high risk, such as Maori and Pacific Island people, those living in lower socioeconomic groups, and the caregivers and parents of children under 10 years of age. This is supported by our findings that public awareness campaigns such as television and magazine campaigns, school teaching, formal first aid courses and community health providers tend to act as good sources of knowledge. Following implementation of an education programme, this study should be repeated to assess its effectiveness and any change in public behaviour.

Conclusions

Middlemore Hospital cares for many burns patients who have received inadequate first aid. This tends to increase the likelihood of hospital admission and subsequent need for increased intensity of treatment. Inadequate BFAT tends to occur more frequently among Maori and Pacific Island people than among Caucasians. In addition, preliminary costings suggest a potential for financial savings from improving burns first aid in the community. This may be achieved through better public education of adequate BFAT. The problem of the present situation involving inadequate BFAT within the community needs to be discussed with Government agencies emphasising the social, personal and financial costs of what may be unnecessarily severe burns resulting from lack of public knowledge. A national education strategy is required to increase education among the public, targeting in particular high risk populations such as Maori and Pacific Island communities and caregivers or parents of children less than 10 years of age.[3]

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