ABSTRACT
South Africa has a high rate of childhood burns, with as many as 1300 deaths every year, many of which are thought to be preventable. South African investigations have described child burn circumstances of occurrence; perspectives on the aetiology and prevention of childhood burns; and descriptions of a number of prevention interventions. These reports have emphasised the vulnerability of especially infants and toddlers, with the highest incidence among very young black boys. Congested homes, paraffin appliances, family stress and general impoverishment are reported to contribute to childhood burn injuries. This Chapter reviews these contributors and the environmental, legislative and educational preventative strategies and activities reported to have had some success internationally, if not in South Africa, in the prevention of burns. The improvement of home design and layout, installation of electricity, control of hazardous domestic equipment and provision of safe appliances, are all high priority or effective burn prevention strategies. In addition, the formulation of South African legislation to enable these infrastructural improvements, such as policies or standards for both hot water cylinder temperature control and paraffin appliances, is strongly supported. Educational interventions that target children, caregivers and policy makers, potentially consolidate the efficacy of burn prevention. Post-traumatic, psycho-social interventions are important in the South African setting and this Chapter reports on the emerging local and international practices. These include burn camps, support groups, school reintegration, counselling, and expressive arts. However, there remains a scarcity of information on which rehabilitative and preventative interventions work in South Africa, with few scientific evaluations of local interventions.

Keywords: burn injury, epidemiology, prevention, rehabilitation

INTRODUCTION
This Chapter provides an overview of South African burn injury prevention research. It provides a synopsis of the most recent research in the sector, and supplements an earlier review that documented burn injury prevention research and interventions.
burns in South Africa (Van Niekerk, Du Toit, Nowell, Moore & Van As, 2004a). Furthermore, it aims to inform readers about what is currently known about childhood burns and the opportunities for prevention and intervention in South Africa. The Chapter summarises the epidemiology and prevention of childhood burns, highlighting proven and promising interventions, by describing:

a. Epidemiological descriptions of the extent of childhood burn injuries as a priority threat to the health of the South African public.
b. Recent studies that identify significant individual, familial and contextual contributors to burns.
c. The contribution of environmental and technological preventative strategies and interventions.
d. Issues that affect the rehabilitation and support of burn victims and their families.
e. The applicable legislative and policy frameworks that underpin prevention and rehabilitation in South Africa.
f. By highlighting information barriers, prevention priorities, and future research needs for burn prevention and care.

A global and South African social and health threat
The World Health Organization (WHO) estimates that each year about 100 000 children die from flame or fire-related burn injuries, but this excludes deaths as a result of scalds, electricity, chemical burns and other forms of burn injury, about which less is known (Forjuoh & Gielen, 2008; Mock, Peck, Peden & Krug, 2008). In addition, over half a million paediatric hospitalisations are estimated annually (Burd & Yuen, 2005). Thermal injuries may leave disabling scars not only to the skin or the body of the child, but also to her or his psyche. These injuries may impose significant psychological, educational and social impairment to the young child. The consequent adjustments may be exacerbated by a range of factors, including the circumstances, severity and site(s) of the injury, the qualities of the child’s personality, and the access to supportive social relationships (Barss, Smith, Baker & Mohan, 1998; Rode, Millar, Le, Van der Riet & Cywes, 1989; Van Niekerk, Rode & Laflamme, 2004b). In terms of future economic contributions, the younger the child at the point of injury, the greater the potential loss in productive years.

Concepts and definitions
A burn or thermal injury occurs when layers of cells in the skin are destroyed by hot liquid (scalds), a hot solid (contact burns), or a flame (flame burns). Injuries due to electricity, chemicals, ultraviolet radiation and radioactivity, as well as respiratory damage due to smoke inhalation are also defined as burn or thermal injuries (WHO, 2003). In general, these injuries are classified according to two major factors that influence especially management and prognosis, namely the extent of the injury, and the depth of the burn. This categorisation is also of some use for prevention planning. The extent of the injury is expressed as a percentage of the total body surface area (TBSA), which is calculated according to the injured individual’s age (Rode, Millar, Le, Van der Riet & Cywes, 1989). The depth of the burn is expressed either as a partial-thickness or full-thickness injury. Partial-thickness burns involve the epidermis and may extend into the dermis.

For the purpose of referral in South Africa, burns are classified as minor, or moderate to severe. Minor burns are partial-thickness injuries of less than 10% of the TBSA, in a child older than a year. Moderate-severe burns are partial-thickness burns of greater than 10% of the TBSA, full-thickness burns of greater than 3% of the TBSA, all burns involving the hands, feet, face, eyes, ears, and perineum, all inhalation injuries, circumferential injuries, electrical injuries, neonatal burns, or those affecting children with serious pre-existing illness (Rode et al., 1989). Special attention is provided for burns occurring on the face, hands and perineum. Burns in these areas are often referred to as special burns, since the management of these takes priority over other burns. Mismanagement of these burns can interfere greatly with the physical and psychological functioning of the injured child (Rode et al., 1989).
These burns are disproportionately concentrated in low- and middle-income contexts (LMICs), most markedly in South-East Asia and Africa (WHO, 2002), where the consequences of burns are aggravated by the lack or unavailability of specialised intervention policies, staff and technologies (Barss et al., 1998; WHO, 2003). South Africa has reported a high rate of burns (Matzopoulos, 2005), but is one of a number of LMICs for which there is an emerging platform for burn prevention. South African research has recently described child burn morbidity patterns and circumstances of occurrence (Van Niekerk, 2006; Van Niekerk et al., 2004b); and perspectives on the aetiology and prevention of childhood burns (Van Niekerk, Seedat, Menckel & Laflamme, 2007). These investigations have contributed towards indications of the extent of burn mortality and morbidity, and generated increasingly more synthesised descriptions of the demographics and circumstances of child burn morbidity in resource-poor settings (Chopra, Kettle, Wilkinson & Stirling, 1997; Hudson & Duminy, 1995; Kibel, Bass & Cywes, 1990; Peden, 1997; Van Niekerk et al., 2004b, 2004a; Zwi, Zwi, Smettanikov, Soderlund & Logan, 1995).

**EXTENT, SCOPE AND OCCURRENCE IN SOUTH AFRICA**

In South Africa, burn injury has been reported as a persisting threat affecting children from low-income settings, in particular. About 1300 children die every year as a result of burn injuries (Bradshaw, Bourne & Nannan, 2003), but many lives can be saved, because burn injuries are preventable. The highest childhood burn mortality rates are reported in the first three years, with rates thereafter decreasing until adolescence when burn mortality rates start to increase (Van Niekerk, Laubscher & Laflamme, 2009). This concentration of burn mortality and injury amongst infants and toddlers occurs across South Africa’s population groups, with the highest rates amongst very young black children. Both male childhood mortality, as well as injury rates are higher than those for the corresponding female rates (Van Niekerk et al., 2004b, 2009).

Childhood burn injuries occur according to four typical classes. These classes are differentiated according to the age of the victim, type of burn injury sustained, environmental conditions, season, and body region injured (Van Niekerk et al., 2004b) (see Table 1). The first class describes infant scalds that largely occur to male victims with the upper body part region affected. The second category, toddler scalds, typically involves the lower body region with a concentration of injuries amongst female victims and during evenings. The third class describes pre-school and school-aged children vulnerability with burns mostly caused by flames with injuries occurring at night and during the early-morning hours, and being sustained during winter and to the lower body parts. A fourth injury pattern points to a blend of aetologies and age groups. A large proportion of these occurs outside the home, with injures to the head and neck. Male children are over-represented and, to some extent, school-age children and older toddlers (Van Niekerk et al., 2004b).

**INDIVIDUAL, FAMILIAL AND CONTEXTUAL CONTRIBUTORS**

**Early vulnerability: Temperament and socialisation**

Age and gender have provided consistent indications of children’s vulnerability to burn injuries (Van Niekerk, 2006). In South Africa, there is a concentration of burn injuries in the first three years of life, followed by a progressive decline in incidence. Male children were associated with an overall excess risk to burn injuries compared with girls, as they have in other studies (see for example: Daisy et al., 2001; Lari, Panjeshahin, Talei, Rossignol & Alaghehbandan, 2002), although these gender differences tended to decrease after toddlerhood, but re-emerged with the
older, school-going children. Elsewhere, particularly in India and parts of South-East Asia, females are at higher risk, reportedly due to their involvement in domestic activities near open flames and because of clothing styles (Davies, 1990; Forjuoh, Guyer & Smith, 1995).

The early vulnerability of boys may be considered a reflection of temperament and higher activity levels, with indications that temperament (Schwebel & Plumert, 1999), and to an extent, activity levels (Forjuoh, 2006), are related to injury history. Boys are reported to behave more impulsively and over-estimate their physical abilities (Schwebel & Plumert, 1999). The early effect of differential socialisation is a further consideration, for example parents are less likely to restrain the exploratory behaviour of boys even if the child’s behaviour is perceived to pose an injury risk (Morrongiello & Rennie, 1998). In general, toddlers are characterised by a curiosity of their environment and an increased, but still evolving and unstable physical ability to explore it (Duncan, Van Niekerk & Mufamadi, 2003). Toddlers are faced with the challenge of learning to walk, while still very unsteady on their feet and prone to grabbing objects to steady themselves, but thereby coming into greater contact with heat sources, such as cooking pots, kettles or heating equipment (Barss et al., 1998; McLoughlin & McGuire, 1990).

### Table 1. Child burn occurrence and prevention opportunities

<table>
<thead>
<tr>
<th>Injury group</th>
<th>Who is affected</th>
<th>Injury agent(s)</th>
<th>High risk activities, products and behaviours</th>
<th>What can be done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant scalding</td>
<td>Infants; boys</td>
<td>Hot liquids and foods</td>
<td>Bathing and cooking; hot water geysers without temperature control; not keeping children away from hot liquids.</td>
<td>Mandatory specifications for hot water geysers; parent support and training; home visitation; economic and home care support for female-headed households.</td>
</tr>
<tr>
<td>Toddler scalding</td>
<td>Toddlers; girls</td>
<td>Hot liquids and foods</td>
<td>Bathing, cooking or cleaning; portable stoves and paraffin stoves.</td>
<td>Mandatory specifications for hot water geysers; enforcement of specifications for portable and paraffin stoves; stove guards; access to affordable electrification.</td>
</tr>
<tr>
<td>Older children with flame burns</td>
<td>Preschool and school-aged children; girls</td>
<td>Flames</td>
<td>Cooking, and the lighting of fires; portable and paraffin stoves.</td>
<td>Stove guards; access to affordable electrification; enforcement of specifications for portable and paraffin stoves; home visitation; burn prevention school curricula.</td>
</tr>
<tr>
<td>Older children with mixed aetiologies</td>
<td>Toddlers and school-going children; boys</td>
<td>Hot objects, electrification, and to a lesser extent flames</td>
<td>Outdoor play and experimentation; portable and paraffin stoves.</td>
<td>Burn prevention school curricula; barriers for electrical sub-stations; enforcement of specifications for portable and paraffin stoves; controlled dissemination and disposal of flame accelerants.</td>
</tr>
</tbody>
</table>
Older children are exposed to a greater range of high-risk activities such as cooking, a reflection of greater physical mobility and social independence. In South Africa, children are involved in the gathering of firewood and the lighting of fires for morning and evening meals, activities common for children in low-income settings (Van Niekerk et al., 2004b). Older children spend an increasing amount of time with other children, older siblings and other adults, increasingly outside the home (Duncan et al., 2003). This widening social network may expose them to the risks posed by the open fires (and related hot objects) initiated for heating, cooking or other purposes, with older children involved because of their greater capacity for starting fires, and managing heating appliances and heated appliances or utensils.

**Supervision**
The concentration of burn injuries amongst infants and toddlers account for up to half of all childhood burns (see e.g., Rossi, Braga, Baruffini & Carvalho, 1998; Vilasco & Bondurand, 1995). This has been attributed to the child's limited physical and cognitive vulnerabilities, its dependence on its caretakers, and the role of the environment, or various interactions between these (Forjuoh, 2006; Van Niekerk et al., 2007). Caregiver testimonies highlight the contribution of necessary social tasks, including chores, child care, unexpected events and crises, and work in undermining the caregiver’s ability to supervise and protect the child in hazardous home environments. Despite recognising their adverse circumstances, caregivers nonetheless experience child supervision and protection as their primary responsibility (Morrongiello, 2005; Saluja et al., 2004).

**Household spatial arrangements**
The harmful impact of impoverished settings on children is asserted to be the result of an accumulation of physical and psycho-social conditions, many of which typically co-vary (Evans, 2004). In particular, restricted home spaces augments the child’s proximity and exposure to domestic appliances and heat sources, with exposure often exacerbated by sudden and unexpected changes to household or child-care routines. The impact of the internal spatial arrangements of low-income homes is a neglected research area in the public health arena, but one recently identified as an area of acute concern in impoverished South African settlements (Seedat, Baadjies, Van Niekerk & Mdaka, 2006). The physical spaces where burn injuries occur are usually small homes, comprising one or two rooms with further temporary internal divisions made of curtains or tall boards. These rooms are utilised for various functions, depending on the times of day and the family’s particular requirements for sleeping, washing, cooking activities, meal-times (Seedat et al., 2006) and in this and other contexts, as a working space (Kellet & Tipple, 2000). In such living spaces the child has nearly permanent access to thermal equipment (Godwin, Hudson & Bloch, 1996; Zwi et al., 1995). Some of this equipment has a documented impact on childhood burn injury, such as kerosene stoves (Kalayi & Muhammad, 1994) and hot water cylinders with excessive water temperatures (Katcher, 1987), but others include informal outdoor heating appliances, and stoves and ovens that are unsteady or inappropriately secured. Despite the prioritisation of electrification in South Africa, it is anticipated that low-income families will continue to rely on kerosene, coal or wood-fired stoves for cooking and heating tasks, and low-quality, hot water cylinders, because of the cost of both electricity and safe essential electrical appliances (Sustainable Energy Africa, 2003).

**Racialised poverty**
There are significantly higher rates of burn injury amongst black, compared with white or coloured children, a likely reflection of greater exposure levels. This is consistent with this group’s historical
marginalisation from social resources such as education, health and others. Despite the country’s social transformation, its current stability and its relative wealth, Africans as a group, continue to report lower income levels, literacy rates and overall health status, and higher levels of household crowding, with widening intra-group economic differences (Day & Gray, 2003). These social variables have been associated with greater childhood burns, specifically low socio-economic status of the family (Delgado et al., 2002; Petridou et al., 1998), low educational levels of the mother (Daisy et al., 2001; Petridou et al., 1998; Werneck & Reichenheim, 1997), and psycho-social stress in the family (Werneck & Reichenheim, 1997). In addition, neighbourhoods have poor living conditions (informal dwellings, kerosene usage, and restricted access to running water and flushing toilets), high child dependency (high child to-adult ratios) and socio-economic barriers (unemployment and high economic and household demands on female household-heads). A number of specific elements related to poor housing conditions and high socio-economic barriers include aspects of the informal dwelling structure (Delgado et al., 2002), such as the lack of demarcations of cooking and washing areas (Delgado et al., 2002; Petridou et al., 1998), the storage and use of paraffin or kerosene (Forjuoh et al., 1995; Kalayi & Muhammad, 1994), household crowding (not necessarily child crowding) (Daisy et al., 2001; Petridou et al., 1998), and female-headed households (Pomerantz, Dowd & Buncher, 2001), all of which have indicated varying degrees of impact on childhood burns or other injury outcomes. It has been argued that globalisation has exacerbated many of the adverse social conditions faced by under-resourced countries and settings (Hurst, 2007), with greater unemployment, especially amongst lower-skilled workers and resultant increases in poverty and social inequality (Milanovich, 2008).

FROM REHABILITATION TO ENVIRONMENTAL AND TECHNOLOGICAL PREVENTION INTERVENTIONS

Rehabilitation and socio/psychological support
The psycho-social care of burn survivors is an essential component of the rehabilitation process, particularly given the increased likelihood of survival from burns (Blakeney, Partridge & Rumsey, 2007). South Africa, however, presents with challenges characteristic of LMICs, namely the shortage of specialised burn care units (Albertyn, Bickler & Rode, 2005) and the critical shortage of trained rehabilitation professionals (Albertyn, Van As & Rode, 2008). Where available, the physical survival and recovery aspects are emphasised to the detriment of emotional recovery and community reintegration (Albertyn et al., 2008). Interventions at a social and psychological level have only begun to emerge with several local agencies attempting to address these gaps in South Africa (see Table 2). However, for the most part, no specific research exists that documents the success of such interventions in the local setting. Consequently, the review that follows explores psycho-social interventions for paediatric and adolescent burn survivors in the international literature, though most of this emerges from the United States.

Social support interventions
Burn camps
The concept of the burn camp in South Africa may prove to be an important intervention to meet the growing psycho-social needs of burn-injured children and adolescents in rural communities, particularly where psycho-social support is lacking (Doctor, 1992). Although burn camps have been identified as serving either a therapeutic/rehabilitative function (i.e., to nurture confidence and self-esteem) or
Table 2. Existing psycho-social interventions in South Africa

<table>
<thead>
<tr>
<th>Agency/Organisation</th>
<th>Psycho-social interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children of Fire</td>
<td>• Hiking retreats and recreational activities;</td>
</tr>
<tr>
<td></td>
<td>• Hospital ward visits.</td>
</tr>
<tr>
<td></td>
<td>Phoenix Foundation</td>
</tr>
<tr>
<td></td>
<td>• Psycho-educational materials (nature of injury, principles of treatment, psychological and</td>
</tr>
<tr>
<td></td>
<td>rehabilitation concerns);</td>
</tr>
<tr>
<td></td>
<td>• School reintegration support;</td>
</tr>
<tr>
<td></td>
<td>• Sports camps and peer-to-peer interactions (<a href="http://www.pbp.org.za/projects.htm">http://www.pbp.org.za/projects.htm</a>);</td>
</tr>
<tr>
<td></td>
<td>• Support groups (Frenkel, 2008).</td>
</tr>
<tr>
<td>Red Cross Children’s</td>
<td>• Children’s yoga creative play and expression, music therapy;</td>
</tr>
<tr>
<td>Hospital</td>
<td>• Community and school integration through public information programmes, training of teachers</td>
</tr>
<tr>
<td></td>
<td>in burns prevention and reintegration of children burn survivors into school setting (Peden</td>
</tr>
<tr>
<td></td>
<td>et al., 2008).</td>
</tr>
<tr>
<td></td>
<td>Thandi Foundation</td>
</tr>
<tr>
<td></td>
<td>• Expressive arts and recreation as a tool for emotional rehabilitation and increase in self-</td>
</tr>
<tr>
<td></td>
<td>esteem;</td>
</tr>
<tr>
<td></td>
<td>• Self-help groups (<a href="http://www.thandifoundation.org.za">www.thandifoundation.org.za</a>).</td>
</tr>
<tr>
<td>World Burns Foundation</td>
<td>• Burn camp jamboree;</td>
</tr>
<tr>
<td>(Southern Africa)</td>
<td>• Burn prevention curriculum (<a href="http://www.burnfoundation.com/e/news_01.htm">http://www.burnfoundation.com/e/news_01.htm</a>).</td>
</tr>
</tbody>
</table>

Nevertheless, burn camps appear to have a favourable influence on issues of body image, self-esteem and social relationships, making this a suitable intervention, particularly with older children and adolescents (see Table 3). A minimum two-year adjustment period following a burn injury appears to be the standard time for recruitment of children for camps (Blakeney et al., 2005).

**Burn survivor and family support groups**

Social support groups are shown to minimise feelings of isolation and powerlessness, facilitate psychological adjustment (Preston-Shoot, cited in Thornton & Battistel, 2001), provide mutual emotional support (Collings, 2004), and enhance social skills and coping ability (Chedekel & Tolias, 2001) among burn survivors. The involvement of skilled professionals as facilitators, however, is necessary to manage group anxieties and circumvent difficult dynamics associated with psychological transference (see Cooper & Burnside, 1996; Partridge & Robinson, 1995; Wiens & Kellogg, 2000).

As a modality which requires cognitive capacity to understand and share experiences, it may be more suitable for older children and adolescents (see Table 4). Beyond survivor circles, support groups for families have shown to facilitate family adjustment necessary for patient recovery (e.g., receiving treatment and financial-related information, gaining emotional support from other families and having the opportunity to resolve feelings of resentment (Bauman & James, 1990). Like burn camps, support groups offer a viable alternative to psycho-social intervention in South Africa, particularly for low-income families who typically would not have access to psychotherapy (see Frenkel, 2008).

**Psychological education: School or community re-entry programmes**

Public education plays a crucial role in sensitising the public around burn survivors, for instance,
through media coverage, talk shows and national campaigns (Doctor, 1992). For school-going children, psychological education is an important on-site intervention (e.g., pre-entry needs assessment and school re-entry programmes) (Quinn, 2007). Cognitive (i.e., changing attitudes) and affective education alleviates anxieties amongst the child, his/her peers and school staff, as well as fosters empowerment and autonomy among burn survivors and their families (Blakeney, 1995). Classroom interventions have shown to lead to improved self-esteem amongst disfigured pupils (e.g., Lovegrove, cited in Rumsey & Harcourt, 2003), and positive adjustment related to social interaction, school enjoyment and peer/staff support (Rosenberg et al., 2006) (see Table 3). Psychological education may accommodate different recovery phases (e.g., pamphlets to individuals and families about emotional and physiological trauma responses), and may be adapted for very young burn children (e.g., through story books and videos) (Nelson et al., 2006) (see Table 5).

<table>
<thead>
<tr>
<th>Context/Sample</th>
<th>Burn Camp evaluation findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>52 adolescents (13-20 yrs) from 3 burn camps [USA]</td>
<td>Focus group themes: camp affords burn-injured adolescents (i) a sense of belonging and acceptance, (ii) shelter from stares and questions, (iii) freedom from having to conceal their bodily scars, and (iv) learning on how to integrate their scars into their overall body image in a positive manner.</td>
<td>Cox et al., 2004.</td>
</tr>
<tr>
<td>43 campers (8-18 yrs) [Connecticut, USA]</td>
<td>Mixed results: increase in self-esteem (37%), no change (30%), and a drop in self-esteem (33%). The hypothesis that the burn camp experience enhances self-esteem was not supported.</td>
<td>Biggs, Heinrich, Jekel &amp; Cuono, 1997.</td>
</tr>
<tr>
<td>Total 77 campers (+ parents) over 4 years (7-16 yrs) [Manchester, UK]</td>
<td>Inconsistent results: little consistent change on self-esteem, social relationships, emotional and behavioural wellbeing over 5 years (quantitative findings); increased confidence and improved coping with burns for 1 year of camp (qualitative findings).</td>
<td>Gaskell, 2007.</td>
</tr>
<tr>
<td>19 children (12-18 yrs), 14 parents &amp; 20 staff members [Brussels, Belgium]</td>
<td>Majority of staff and parents’ evaluations of camps indicated psychological benefits for the attendees (66% and 68% respectively). Only 43% of children reported psychological gains (i.e., self-esteem, adjustment, social skills), 78%, enjoyed camp activities, 10% enjoyed the experience of mutual friendship, and 5% the interactions with the staff.</td>
<td>Maertens &amp; Ponjaert-Kristoffersen, 2008.</td>
</tr>
<tr>
<td>Total 52 children from 3 burn camps (13-20 yrs) [USA]</td>
<td>Focus group themes: camp is a place where burn-injured adolescents (1) feel ‘normal’ and accepted, (2) acquire insight into self and meaning in life, and (3) gain confidence, increase self-esteem and develop empathy.</td>
<td>Williams et al., 2004.</td>
</tr>
</tbody>
</table>
Table 4. Support groups

<table>
<thead>
<tr>
<th>Context/Sample</th>
<th>Support group evaluation findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 adolescents (12 males, 8 females; 11-20 yrs)</td>
<td>Questionnaire results indicated that burn survivor support groups provide a positive therapeutic experience: sharing coping strategies (65%; n=13), meeting others in similar experiences (60%; n=12), and having the opportunity to express their feelings (50%; n=10). Ninety percent indicated willingness to recommend the group to others.</td>
<td>Chedekel &amp; Tolias, 2001.</td>
</tr>
<tr>
<td>Burn survivors and families (173 surveys evaluated)</td>
<td>Post-burn retreat surveys reflected positive outcomes for burn survivors and their families: (i) opportunity to learn about strengths and weaknesses of other group members, (ii) shared knowledge of progressive improvement and provision of hope to those struggling, (iii) reinforcement that recovery is dependent on the individual’s pace and, (iv) assistance with self-esteem, self-image concerns and struggles with negative emotions.</td>
<td>Kereki et al., 2006.</td>
</tr>
<tr>
<td>2 groups: younger (&lt;11 yrs) and older (12-17 yrs)</td>
<td>Recommendations based on a therapy group experience (within a burn camp): (i) social skills training may be beneficial in handling children’s concerns about teasing, (ii) incorporating fun activities through active group exercises may balance out seriousness of group discussion sessions, (iii) camp staff needs to be consulted comprehensively on psycho-social issues.</td>
<td>Wiens &amp; Kellog, 2000.</td>
</tr>
</tbody>
</table>

**Psychological interventions**

**Social skills training.**
Social skills training aims to empower burn survivors in their daily social encounters (Partridge, 1998) by fostering strengths and abilities and encouraging social risk-taking, particularly in children (Steenkamp & Albertyn, 2008). Workshop settings provide a suitable platform (Partridge, 1998) for role-playing, modelling, coaching and positive feedback (Hurren, 1995). Specific cognitive behavioural techniques include diary keeping, relaxation, force field, self-beliefs and body language (see Bradbury, 1996) that targets behavioural modification and the challenge of unconstructive thought patterns to facilitate positive social interactions (Maddern & Owen, 2004; Partridge, 1998; Robinson, Rumsey & Partridge, 1996). Although its effectiveness for burn-injured adolescents has been demonstrated (e.g., Blakeney et al., 2005; Maddern, Cadogan & Emerson, 2006), further studies are needed to demonstrate its efficacy on paediatric populations (Kish & Lansdown, 2000) (see Table 6).
Psychological assessment and psychotherapy
The nature of psychotherapeutic approaches utilised for burn survivors will vary according to the psychological needs during each stage of recovery (Blakeney et al., 2007). Psychological techniques, including hypnosis, relaxation and imagery and cognitive techniques, for instance, have been utilised during the acute phase where medical interventions focus largely on pain relief (Bryant & Touyz, 1996). Although it has been suggested that hypnotherapy, for instance, may be effective for reducing anxiety associated with pain in young children, (Patterson, Questad & Boltwood, 1987), support for this has been flimsy (Foertsch, O’Hara, Stoddard & Kealey, 1998) (see Table 7). Alternatively, a combination of methods has been proposed to deal with pain management and other stages of recovery (Schubart Walker & Healy, 1980) (see Table 3). The use of psychotherapy, however, during the recovery and rehabilitation phases is crucial. As the literature has indicated, post-traumatic stress symptoms are likely to manifest only months after the injury has occurred (Yu & Dimsdale, 1999). Pharmacotherapy and eye-movement desensitisation, psychodynamic psychotherapy and cognitive-behavioural therapy have been suggested as ideal for trauma management (Patterson, 1992). Empirical support for the efficacy of trauma-focused

<p>| Table 5. Psychological education: School or community re-entry programmes |</p>
<table>
<thead>
<tr>
<th>Context/Sample</th>
<th>Psychological education evaluation findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-8 year olds (sample total not specified) [Arizona, USA]</td>
<td>Storybook and animated video intervention as an age-appropriate communication between child, parent and staff. Anecdotal evidence indicated that materials allowed children to feel more comfortable in the burn unit, enabled parents/staff to provide age-appropriate psycho-education to children about their burn injuries, improved overall communication and patient care and diminished the fearful experience associated with the injury.</td>
<td>Nelson et al., 2006.</td>
</tr>
<tr>
<td>134 children (82 males, 52 females) [Texas, USA]</td>
<td>Individualised videotapes and school visits by hospital staff were shown to facilitate burn-injured children’s return to school (with no significant differences between the two different interventions). Follow-up information for 90 children revealed that 90% reported that their child socialised with peers, received support from school staff and children and enjoyed going to school.</td>
<td>Rosenberg et al., 2006.</td>
</tr>
</tbody>
</table>

<p>| Table 6. Social skills training |</p>
<table>
<thead>
<tr>
<th>Context/ Sample</th>
<th>Social skills training evaluation findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>64 adolescent burn survivors (12-17 yrs) [USA]</td>
<td>Following a group social skills training intervention, the treatment group showed greater improvement in psycho-social adjustment one year later as measured on the Child Behavior Checklist (CBCL) compared to control group (who only received their usual hospital treatments).</td>
<td>Blakeney et al., 2005.</td>
</tr>
<tr>
<td>29 children with disfigurement (4 from burns scarring) (5-16 yrs) [UK]</td>
<td>Intervention was based on 4 sessions of individual cognitive behavioural therapy (including social skills training and problem-solving) was effective in children with disfigurements who were mildly to moderately anxious and withdrawn. Parents’ reports on CBCL indicated positive behavioural changes over course of intervention (particularly in Somatic Complaints and Anxious/Depressed scales).</td>
<td>Maddern et al., 2006.</td>
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cognitive behavioural interventions in children is fairly strong (Stoddard, cited in Cohen, Mannariono, Berliner & Deblinger, 2000).

**Creative interventions/ expressive therapy**
Creative interventions aim to facilitate pathways to emotional healing and grieving over loss (i.e., body image, self-esteem, family) (Levinson & Ousterhout, 1980). For paediatric burn survivors in particular, creative modalities of play, art, music or dance, reflect developmentally-appropriate coping strategies which are action-oriented and external (Malchiodi & Perry, 2008). The use of music therapy and yoga on burn survivors, however, stress the physical benefits (e.g., Neugebauer, 2006; Tenenhaus, 2006). In general, the evidence to suggest the effectiveness of these treatments has been anecdotal (see Table 7). A holistic approach to burn care is an approach adopted by the Burns Unit at the Red Cross Children’s Hospital (see Albertyn et al., 2008), where the use of touch therapies (reflexology and aromatherapy) is used alongside music and art therapy in the early rehabilitation phase, followed by yoga, creative play and music therapy in the second phase.

**Prevention: Environmental and technological interventions**
The improvement of home and neighbourhood environments, for example, via the provision of formal houses, electrification, access to safe cooking and other home appliances are key interventions in South Africa (Butchart, Kruger & Lekoba, 2000; van der Merwe & Steenkamp, 2007). Environmental modification and technological advancement are passive burn prevention approaches designed to make environments and products safer, irrespective of the behaviour of individuals (Atiyeh, Costagliola & Hayek, 2009; Gielen & Sleet, 2003). These measures are further strengthened by legislation that specifies the enforcement of safety standards (Atiyeh et al., 2009; Liao & Rossignol, 2000; Forjuoh & Gielen, 2008).

The physical environment can be created and amended to reduce the likelihood of injury (Hammond, cited in Atiyeh et al., 2009; Torrell & Bremberg, 1995). This includes the introduction of new or stricter building codes as well as the modification or improvement of construction materials (Forjuoh & Gielen, 2008). Housing layout

<table>
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<th>Table 7. Other psychological interventions</th>
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<tr>
<td><strong>Context/Sample</strong></td>
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<tr>
<td><strong>PSYCHOLOGICAL ASSESSMENT AND THERAPY</strong></td>
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<tr>
<td>8 yr old girl with 2nd-3rd degree burns [USA]</td>
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<tr>
<td><strong>CREATIVE INTERVENTIONS/EXPRESSIVE THERAPY</strong></td>
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<tr>
<td>Art and play therapy as a projective technique, diagnostic tool and treatment modality. Anecdotal evidence suggested that children displayed reduced anxiety, mood elevation and cooperation with staff.</td>
</tr>
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improvements could ameliorate the exposure of children to certain parts of the home, such as the kitchen, or reduce the likelihood of electrical fires and electrocution (Van Niekerk, 2007). Hazards in the home can be reduced by a change in the design of home equipment (Forjuoh & Gielen, 2008; McLoughlin, 1995), as in cooking equipment (Forjuoh & Gielen, 2008; Van Niekerk, 2006), the isolation of cooking areas, e.g., by using stove guards (McLoughlin, 1995; Van Niekerk, 2006), and the separation of cooking areas from living areas (Forjuoh & Gielen, 2008).

Despite the increased electrification in South Africa, electricity tariffs have risen substantially, especially for the poor, thus sustaining the use of sources such as coal, wood and paraffin (Taylor, 2007). About 40% of South African households already use paraffin (kerosene) to meet some part of their domestic energy needs, as it is a more affordable option (Intern Africa, 2009; Matzopoulos, Jordaan & Carollisen, 2006). There is, however, a scarcity of safe appliances that use paraffin, with illegally imported stoves dominating in South Africa. A recent survey indicated that out of 141 stores, only 14 were selling the legal, though more expensive appliances (Intern Africa, 2009; Mabandla, 2009). An example of the latter is the Sri Lanka’s Safe Bottle Lamp Programme, which has demonstrated some effectiveness in preventing kerosene spills when stoves tip over (http://www.safebottlelamp.org/). However, a small number of evaluations of these interventions have been published, possibly due to the lack of funding to conduct such studies and partly due to lack of expertise in many of these LMICs (Forjuoh & Gielen, 2008). The liquid petroleum gas (LPG) and ethanol gels are advocated (Matthews, 2009) as safer more efficient alternatives to paraffin, with the latter more environmentally friendly (Byrd & Rode, 2005), although both are more expensive (Matthews, 2009).

The use of safety equipment, such as smoke detectors (Forjuoh & Gielen, 2008; McLoughlin, 1995; Van Niekerk, 2006) and automatic sprinklers (Forjuoh & Gielen, 2008; WHO, 2006) has been reported to be effective in high income countries (e.g., Forjuoh & Gielen, 2008; McLoughlin, 1995; Rivara, 1998). These measures are expensive to implement and maintain (Forjuoh & Gielen, 2008) and would thus be difficult to implement in LMICs such as South Africa.

Policy and regulatory interventions
The three most prominent and evaluated measures, with support for their effectiveness, involve laws on the temperature of hot-water taps, the banning of fireworks and standards for child-resistant lighters.

Temperature of hot-water taps
Decreased tap water temperatures are reported to significantly reduce child burns and scalds (Feldman, Schaller, Feldman & McMillon, 1998; NSW Health, cited in Public Health Association Australia, 2008). A number of countries have legislated the maximum water temperatures at tap outlets at 49°C to 54°C (Public Health Association Australia, 2008), while others identify 49°C as the optimal temperature of hot water delivery (Huyer & Corkum, 1997; Katcher, Landry & Shapiro, 1989; Waller, Clarke & Langley, 1993). The Washington State, USA, legislation in 1983 introduced the pre-settings of hot water temperatures to 49°C which saw a 50% reduction in tap water scalds hospital incidences (Feldman et al., 1998; Skelton, 2002). Consequently, 84% of homes changed to lower hot-water temperature taps. Countries such as Scandinavia and the Netherlands shared similar successes, having reported a lower incidence of bath scalds due to their water temperature control (Tennant & Davison, 1991). The hot water temperature for toddlers and children is recommended to be even lower, and restricted to a maximum of 38°C (Mather, 2006).
To reduce the temperature of the hot water delivered at the bathroom to 50°C the relevant Australian and New Zealand Standards were amended to enforce temperature control on newly installed hot water systems. Very often the control or regulation of this measure may be accomplished by altering the thermostat settings or by installing thermostatically controlled mixing devices; the installation of new valves and/or the use of end-of-line devices to shut off water flow above the set temperature (Huyer & Corkum, 1997; Waller et al., 1993). A thermostatic control valve is a device that automatically mixes cold water in the hot water supply at the point of use to bring the temperature down to the output temperature that conforms to the country’s national guidelines (Tees, Esk & Wear Valleys NHS Foundation Trust, 2008). Scald prevention campaigns (running across USA, Scandinavia, Netherlands and Australia) highlighted the importance of supplementary educational programmes with scald prevention legislation (MacArthur, 2003). This also resulted in an increased awareness of products that reduced scalds within the home environment. Other educational interventions successful in reducing burns in Norway (Ytterstad, 1995) and New Zealand (Waller et al., 1993) also aimed at reducing the hot-water temperature. At present there is no such legislation in South Africa.

**Child-resistant lighters**

The US Consumer Product Safety Commission (CPSC) authorised that all disposable and novelty cigarette lighters are child-resistant. There has been a 58% decline in child-play lighter fires since this standard has been in effect, and the number of deaths associated with these fires declined by 31%, resulting in annual savings of $125 million (Miller, Romano & Spicer, 2000; Smith, Greene & Singh, 2002). Other countries followed suit, in 2007 the European Union introduced laws requiring manufacturers and importers to comply with the European standard for child-resistant lighters (EUROPA Press Release, 2007). South Africa has as yet not instituted similar legislation.

**Banning of fireworks**

The use of multifaceted community campaigns, led to a successful reduction in firework injuries in Italy and Denmark. Considering the severity of injuries and the cost incurred, many high-income countries have banned firework purchase or ownership by children. These have resulted in a decrease in the number and severity of firework injuries. The Italian legislation for example resulted in a 32% decline in third degree burns related to firework incidences (D’Argenio, Cafaro, Santonastasi, Taggi & Binkin, 1996). The campaigns implemented in Italy and Denmark used legislation that was reinforced by school and community based educational campaigns. South African legislation also specifically controls when and where fireworks may be released (i.e. Guy Fawkes, Divali and New Year’s Eve days are accepted) (Mbanga, 2008; Sargeant, 2007), but there is as yet no published indication of its effectiveness.

**Child garment legislation**

Another major source of child burns and scalds are those obtained from clothing ignition flames (Kalayi & Muhammad, 1994; Oglesbay, 1998). To address this risk, Western nations (such as the US, UK, Canada and New Zealand) began enacting legislative efforts on children's clothing fabric content from the 1960s (Horrocks, Nazaré & Kandola, 2004; Langley & McLoughlin, 1988; Sian Elias, 2008). These efforts proved to significantly reduce thermal injury rates (Langley & McLoughlin, 1988). Legislative efforts on clothing garments are limited in South Africa, where the principal focus is located on safety efforts (i.e. from communities or non-governmental organisations [NGOs]) and the legislation placed on the safety mechanisms of appliances and/or its heating methods (Panday & Mafu, 2007).
Paraffin appliance standards

Educational strategies
Educational strategies when combined with legislation and standards, product modification appear to reduce the incidence of burns (Ballestros, Jackson & Martin, 2005; Forjuoh & Gielen, 2008). This is particularly the cases when there are behavioural prerequisites to the application of certain technological advances (Gielen & Sleet, 2003; McLoughlin, 1995). The individual’s effort is also needed for legislation to be effective (Gielen & Sleet, 2003), for instance, in the selection and purchase of safe stoves. Injury reduction often requires some element of behavioural change that involving the use of safer products and appliances (Gielen & Sleet, 2003), action by policy makers (Cataldo et al., 1986; Gielen & Sleet, 2003), and the establishment and maintenance of appropriate safety behaviour by parents, health educators and others (Cataldo et al., 1986).

Educational burn prevention programmes may involve the distribution of educational brochures and press releases to the public (i.e. universities, health agencies, fire fighters and NGOs), lectures, activity books, posters and demonstrations, among others (Maguina, Palmieri, Curri, Nelson & Greenhalgh, 2004; Mondozzi & Harper, 2001; Tan et al., 2004). It is important that the complexity surrounding the responsibility for burn education is accounted for – educators must play an active role in the education, as well as ensure that the target population can understand the level of such educational initiatives (Tremblay & Peterson, 1999). Similar burn prevention strategies may be used for both adults and children (MBC, 2009), but children are favoured as the logical target of burn prevention campaigns as they comprise the largest at-risk group to burn injuries (Hsiao et al., 2007).

Educational strategies may include, amongst others, first-aid treatment that includes the application of cool water to burns (Jandera, Hudson, De Wet, Innes & Rode, 2000; Mohan & Varghese, 1990), or the use of sand buckets in areas such as the kitchen, should clothes catch fire (Marsh et al., 1996), or Stop, Drop, and Roll programmes (Mondozzi & Harper, 2001). Studies have shown the usefulness of the media, in particular television, to promote accident preventative type of behaviour (Glang, Noell, Ary & Swartz, 2005; Vidanapathirana, Abramson, Forbes & Fairley, 2005; Wong et al., 2007). Educational programmes in schools and communities have also been shown to enhance burn safety knowledge among children and adults (Warda & Ballesteros, 2007). There is, however, little evaluation of the long-term prevention outcomes of educational prevention measures (Warda & Ballesteros, 2007).

PRIORITY RECOMMENDATIONS
Because childhood burns primarily occur in the home, the home is, thus, a key intervention site. Improvements to the home include the utilisation of appropriate construction materials; installation of electricity; the replacement of faulty, substandard paraffin appliances; the management of flammable
substances such as paraffin and gas; the control of ignition sources such as matches; and the development and provision or subsidisation of safe, low-cost stoves. The use of household technology with demonstrated effectiveness in HICs, such as temperature controls to hot water cylinders, smoke alarms and even automatic sprinklers, require consideration, particularly, passive and low cost interventions that are not dependent on extensive individual participation. There has in recent years, been considerable progress in meeting some social reconstruction and development objectives, e.g., housing targets, with over 2 million homes built since 1994. Others objectives, such as social inequality reduction, as may be manifest by declining income differentials and indirectly greater access to safer infrastructure, facilities and appliances, remains high and have even increased (Day & Gray, 2003). Poor families confront ongoing poverty barriers from the level of physical and financial deprivation, to inadequate safety interventions, to persisting social prejudice. There are thus persisting barriers to the implementation of promising safety measures, one of which is cost, and most of which are not easily modifiable. Others include the nature of most low-income homes (small, with constrained spaces), and the multiple and often complex daily demands on such families (Van Niekerk, 2007). South Africa still needs specific home safety policy and standards, whether it is for hot water temperature regulation, safe stove standards, garment specifications, or the control and sale of fireworks to the under-aged. Greater effort is also needed to ensure that the current or future legislation is effective and as far as possible complementary of everyday consumer practice. Burns-safety awareness needs to be promoted at all levels of educational media (i.e. posters, plays and television) to individuals of every age.

Psycho-social interventions for the many South African child-burn survivors have great potential value. Some (including, burn camps, support groups, art) are beginning to gain ground. The role of psychological education in sensitising communities and the general public about the burn-injured individuals remains a necessary part of facilitating social and community reintegration. Other interventions, such as burn camps and support groups, are highly adaptable to semi-rural contexts where counselling and psychotherapy is not readily available. The success of these interventions is, however, still only anecdotally supported (e.g., Frenkel, 2008) instead of being substantiated by empirical research. This speaks to the lacuna in intervention research necessary to strengthen the foundation for tertiary prevention initiatives in our community.

**Key messages**

- South Africa has a high rate of burns, with as many as 1300 children dying every year from these injuries, with many others hospitalised, with significant psychological, educational and social consequences for the child and family.
- Childhood burns are largely environmentally conditioned; successful burn prevention has involved safe home layout and design, electrification and the use of appropriate, low-cost cooking and heating appliances.
- Successful or promising legislative efforts include restrictions to the temperature of hot-water outlets, taps; paraffin cooking and heating appliance standards; and specifications to child garment composition.
- Education around burn prevention programmes offer a range of interactive learning methods to be utilised by both children and caregivers to increase and promote accident preventative-type behavioural responses; one example is the Learn not to Burn Curriculum, currently being piloted in South African pre-schools.
- Post-burn trauma interventions are important; interventions such as burn camps, support groups and social skills training require evaluation. In addition, the training of mental health professionals need to be extended to burn recovery rehabilitation settings which requires specialised methods of intervention for each recovery phase.
local setting. There is also a great need for adequately trained professionals to lead in individual and group-based psychological interventions as necessitated during each phase of physical and emotional rehabilitation.

There remains an overall lack of burn prevention and rehabilitation intervention research in South Africa, as for LMICs more generally. There have been few scientific trials of child safety interventions, although it is possible for existing interventions to be modified, adapted, and tested here (Norton, Hyder, Bishai & Peden, 2006). A South African research agenda has yet to be compiled, but is not by itself sufficient. A critical mass of people to conduct this research, prevention and rehabilitation work is essential. Thus, the inclusion of burn-safety in the curricula for the training of safety research and intervention staff is a high priority. Individuals need to be trained and institutions supported to institute this focus in their curricula and to support the implementation of quality scientific research, safety intervention training and internships, and greater rehabilitation opportunities.

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