

Limited choices: An exploratory study on paraffin use in KwaZulu-Natal

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## **Executive Summary**

Almost all households require energy for cooking, heating and lighting to satisfy basic human needs. Poverty condemns half of the world's population to dependence on unsafe, inefficient and inconvenient energy practices. Globally, more than 3 billion people still depend on solid fuels such as wood, coal and animal dung for cooking, boiling water and heating. Paraffin, also known as kerosene, is widely used by poor households in developing countries. These types of fuels are closely associated with ill health because they are highly polluting.

A programme of accelerated electrification in South Africa since the early 1990s has resulted in an increase in the use of electricity for some domestic purposes. Yet a combination of other sources of fuel such as coal, wood and paraffin are still being used by a significant proportion of low income households. Paraffin is widely used for cooking (21.4%), heating (14.6%) and to a lesser extent for lighting (6.8%). These choices are not only motivated by the affordability and accessibility of paraffin, but also by the low cost of paraffin appliances.

Poverty is pervasive in South Africa and there are also indications that the depth and severity of poverty has increased for the poorest sectors of the population. Given the inability of a significant proportion of the population to meet basic needs, the use of low cost fuels such as paraffin is likely to persist for many years to come. While government's policy has focused primarily on increasing access to electricity for low income households, not enough focus has been given to other forms of energy that continue to be used for cooking and other thermal requirements.

The use of paraffin can impact on poor households in several ways including poisoning, respiratory illnesses as a result indoor air pollution, burns and fires. Paraffin-related incidences, in particular child paraffin poisoning, have been linked to the unregulated supply chain and the failure to prepackage paraffin. The poor design and quality of paraffin stoves have been closely associated with burn injuries and the multiple outbreaks of fire in poor households. The combustion of paraffin has also been closely associated with the health effects of indoor air pollution. Paraffin-related incidents exact an

inordinate toll on families and the state through, among others, health, social, economic and psychological consequences.

Given the inherent toxicity of paraffin, the unregulated nature of the supply chain, the inefficient design and quality of paraffin appliances and, the poor and often stressed living environments in which they are used, a host of vulnerabilities are created. The externality costs of paraffin use are high. The use of approximately 700 million litres of paraffin each year results in a loss of R104 564 million through death, burns and ingestions, a burden 50 times higher that the annual R2.1 million turnover in paraffin sales.

While interventions are underway to regulate paraffin use at the point of manufacture and to regulate safer packaging and the manufacturing standards of appliances, these strategies need to be supported by educational interventions directed at the community and at the individual levels. The Paraffin Safety Association of Southern Africa commissioned the Human Sciences Research Council to explore knowledge levels and strategies to promote the safe use of paraffin in KwaZulu-Natal, with the overall goal of developing a comprehensive community education programme.

Nine focus group discussions were conducted with clinic attendees from sections H, U and V in Umlazi. A semi-structured focus group discussion guide was developed based on a literature review and input from the Paraffin Safety Association of Southern Africa. Themes explored included, types of fuel used, purposes of paraffin use, access to paraffin, paraffin appliances used, adverse consequences experienced, sources of safety education and safety practices adopted, and factors motivating transition to alternate fuels.

The most poignant finding of the study is that of 'limited choices'. Participants are aware of the dangers of paraffin use and its consequences yet they see themselves as having little choice because of prevailing conditions of poverty. Paraffin is the least-liked but most widespread fuel used by low income households. Instituting steps to break the cycle of poverty amongst its users is as critical an intervention as steps to improve the safety profile of paraffin.

Even when most homes are electrified, participants indicated that they continue using multiple sources of fuel because of the opportunity costs associated with electricity use. Paraffin use does not decline when electricity becomes available. Rather, the availability of electricity shifts the end use of paraffin from lighting to thermal applications such as cooking and heating water. Electricity is not only too expensive to fulfill the range of daily chores for which energy is required, but the minimum threshold for electricity sales coupled with the price of related appliances is beyond the reach of many homes that operate on low and unpredictable income levels. The indirect costs associated with accessing electricity also make it a less viable option. Electricity cards are generally sold at urban centres requiring users to pay additional transport costs to purchase them. Paraffin, on the other hand, can be bought at 'spaza shops' within the neighbourhood. The perception of paraffin's affordability is further enhanced by the relatively low price of paraffin appliances, albeit of an inferior quality. Participants also referred to the cost of connection fees that served as a deterrent to electricity use. So poverty alleviation is not only about gaining physical access to basic services but also about continuing to access the resources necessary to pay for services.

The hierarchy of multiple fuel use reported is indicative of the varying levels of poverty experienced in homes with very poor households still relying on biomass fuels (wood and coal) for most household chores supplemented with liquid fuel (paraffin) for lighting. At the next level, most households in our study use liquid fuel for domestic chores and electricity for lighting. At the tail end of the poverty spectrum, a few participants reported using electricity as a primary source of fuel. While this hierarchy of fuel use is in part reflective of the energy ladder, the climb up the ladder is gradual and not always linear, probably because of reliance on fluctuating and unpredictable income levels.

Paraffin is used for a wide variety of purposes and has become entrenched in domestic life well beyond a source of energy. Over and above a range of cultural uses, paraffin is used to make floor polish, clean floors and windows, remove stains and, as an insect repellant. In fact participants have become reliant on paraffin to the extent that the discussion on alternate fuels elicited a strong response against its discontinuation because of its versatility. Such extensive use of paraffin in the home poses a number of threats. Not only does it exacerbate health risks and general flammability of the home, it also poses psychological threats to users. Paradoxically, the very product that offers dignity to their homes strips away their personal dignity through social stigma. The distinctive smell of paraffin becomes a marker of poverty and hence a source of stigma.

The second major finding of the study is that despite the near non-existent level of public education on paraffin safety, save for a few anecdotal cases, participants reported a sufficiently wide knowledge base on the dangers of paraffin use and associated safety practices that could provide the basis for behaviour change. Yet the innumerable paraffin-related incidents reported and the daily risks taken indicate that behaviour change is not taking place. Four to five decades of research, has demonstrated that knowledge is essential for but not sufficient to produce behaviour change and, that given the complex interplay of factors that influence paraffin use, a wide array of strategies are required. Interventions at the individual, family, school, community, organisational and legislative levels are required.

Many of the dangers associated with paraffin use emanate from the inadequacy of the storage containers used and the poor quality of paraffin appliances. More than a decade has passed since public health specialist began advocating for the prepackaging of paraffin in child resistant containers with adequate labeling. Participants in our study reported multiple incidents of paraffin poisoning and strongly supported the need for prepackaging of paraffin. SABS safety standards do exist for the packing of paraffin in dedicated containers with child resistant safety caps and appropriate labeling of hazardous material. However, these standards have not been legislated and hence are not enforceable by law. As an urgent public health policy intervention, perhaps one of the most cost effective strategies, extensive advocacy and lobbying is required to promulgate legislation that mandates the prepackaging of paraffin in child resistant containers.

Participants in the study were well informed of the inefficiencies of and dangers associated with paraffin stoves. Participants related innumerable incidents of burns and runaway fires as a result of exploding stoves, often resulting in injuries and loss of property. They were critically aware of the inefficiency and poor quality of wick stoves but had little choice in using them because of affordability reasons. Tests conducted on the most popular paraffin stoves showed that they do not meet South African Bureau of Standards (SABS) safety recommendations. The SABS standards to regulate the safety of stoves became compulsory on the 01 January 2007. Continued advocacy and lobbying is required to ensure that resources are made available to create awareness of the law and monitor its implementation. Advocacy and lobbying is also required to enact safety standards for pressure stoves.

Interventions to regulate the supply chain, need to be supported by a comprehensive education campaign undertaken in partnership with consumers, retailers, health workers, schools and other key stakeholders. In spite of the failure of institutions and systems to educate the public on paraffin safety, participants have over the year's accumulated substantial knowledge on the dangers of paraffin use as well as safety practices. Many participants recommended community education and community mobilization, supported by traditional forms of awareness raising, as the most appropriate strategy to encourage intrapersonal and interpersonal learning and for the community to take ownership of the challenges associated with paraffin use.

Despite awareness of the risk of ingestions, most participants in our study indicated that they store paraffin on ground level and leave stoves unattended. Low income households are often overcrowded, have limited infrastructure, and may face practical constraints in translating their concern into action. Mothers living in these circumstances are also under significant pressure to meet multiple priorities. Health education may be more effective when accompanied by home visits to reinforce implementation and to devise creative but safe alternatives to overcome infrastructural and other barriers.

Despite awareness of the correct course of action when children ingest paraffin, mothers continue to feed children milk because of the logistic difficulties of getting to a hospital or clinic immediately. Given these circumstances and the immediate need of parents to relieve distress amongst their children, healthcare workers must offer parents practical first aid strategies that can be implemented in the home without exacerbating paraffin-related injuries.

Pockets of misinformation still exist regarding the course of action when incidents occur. Yet it is also clear that increasing interaction with health personnel is impacting positively on help-seeking behaviour. As part of treatment, care and support, a more rigorous and sustained programme of action is required to dispel myths of the benefits of home remedies to treat paraffin-related injuries and reinforce the need for help seeking.

Children are particularly at risk for paraffin-related injuries and despite parents' best attempts to protect them from paraffin use; they inevitably become users when they take on care giving roles in the home. Hence participants advocated that health education on paraffin use should begin in school. Discussions on paraffin use in school also present a viable opportunity to begin to destigmatize its use and its relation to poverty. As a primary prevention strategy, health education on the safe use of paraffin should be integrated into the Life Orientation learning area especially for learners from low socioeconomic areas.

Participants in our study believe that retailers bear a responsibility towards consumers to ensure the safe use of paraffin. Yet retailers are regarded as callous and disinterested in the safety of consumers – trading a known hazardous product as routinely as any other regular consumable. Education of retailers on the importance of safety caps, labeling of containers and correct storage of paraffin in the home, together with the distribution of safety material at the point of sale, can serve as an important interim measure before legislation for the prepackaging of paraffin is promulgated.

A medium to long-term strategy to alleviate the externality costs associated with paraffin use is to transition users to safer, cleaner and more efficient fuels. Given the dangers associated with paraffin use, participants indicated that the transition to alternate fuels would be heavily influenced by the products safety profile. In addition, accessibility and affordability were also considered as important deciding factors.

### Introduction

#### The global imperative for efficient energy resources

The Millennium Development Goals (MDGs) commits the world to combating poverty, hunger, disease, illiteracy, environmental degradation and discrimination against women by 2015 (United Nations, 2006b). While the thrust of the MDGs is the eradication of extreme poverty and hunger (United Nations, 2006b), energy poverty is not explicitly mentioned in this goal. Yet lack of access to safe and efficient energy sources is one of the ways in which poverty manifests itself in rural and urban households and can hinder many aspects of human development. Almost all households require energy for cooking, heating and lighting to satisfy basic human needs. Improving access to energy is also necessary to achieve the remaining targets of the MDGs among others – to reduce child mortality rates, improve maternal health, reduce the time and transport burden on women and young girls (to fetch wood) and reduce the pressure on already overburdened ecosystems (World Health Organization, 2006). The 2006 report on progress made towards achieving the MDGs shows that while energy use has become more efficient in most regions of the world, CO<sub>2</sub> emissions continue to rise globally due to population and economic growth, particularly in developing countries (United Nations, 2006a). The report recommends that more intensive efforts are required to 'develop and transfer cleaner energy technologies and fuels to developing countries' that are increasingly engaging in energy intensive activities (United Nations, 2006a).

In an average household, women cook at least once a day for their families. Depending on the socio-economic circumstances of the household, they may choose different fuels for specific domestic purposes. Globally, more than 3 billion people still depend on solid fuels such as wood, coal and animal dung for cooking, boiling water and heating (World Health Organization, 2006). Paraffin, also known as kerosene, is widely used by poor households in developing countries. Yet these types of fuels are closely associated with ill health because they are highly polluting. Poverty condemns half of the world's population to dependence on unsafe, inefficient and inconvenient energy practices (World Health Organization, 2006).

#### **Energy use in South Africa**

In South Africa, a programme of accelerated electrification since the early 1990s has resulted in an increase in the use of electricity for some domestic purposes. According to Census 2001 (Statistics South Africa, 2001), most households use electricity for cooking (51.4%), heating (49.0%) and lighting (69.7%). In fact the number of households using electricity for lighting increased from 76.1 percent in 2002 to 80.2 percent in 2005 (Statistics South Africa, 2006). Yet a combination of other sources of fuel such as coal, wood and paraffin are still being used by a significant proportion of households, albeit at a declining level, mainly because of socio-economic reasons. Paraffin is still widely used for cooking (21.4%), heating (14.6%) and to a lesser extent for lighting (6.8%) (Statistics South Africa, 2001). While more and more homes opt for electricity for lighting – probably aided by the 50kWH of free basic energy rolled out to low income households -33.5 percent of households still remain reliant on paraffin or wood for cooking (Statistics South Africa, 2006). The increasing use of main electricity supply between 2002 (76.1%) and 2005 (80.1%) has seen a concomitant decline in the use of paraffin or wood for cooking over the same time period (37.9% vs. 33.5%). But the national average masks significant provincial variations with poorer provinces (Limpopo and Eastern Cape) still heavily reliant on paraffin and wood for cooking. Table 1 reflects provincial variation in the connection to MAINS electricity and reliance on paraffin and wood for cooking.

Province	Connected to MAINS electricity supply	Paraffin or wood for cooking	
Eastern Cape	66.7	58.4	
Free State	88.7	24.9	
Gauteng	82.7	16.4	
KwaZulu-Natal	72.3	34.3	
Limpopo	82.4	63.7	
Mpumalanga	82.1	34.3	
Northern Cape	88.3	23.0	
North West	84.6	38.6	
Western Cape	92.2	9.60	
National	80.1	33.6	

 Table 1: Percentage of households connected to the MAINS electricity supply and using paraffin or wood for cooking

Source: General Household Survey 2005

Low income households rely on multiple sources of fuel for different and sometimes the same purpose either simultaneously or intermittently (Bailie et al., 1999; White, Bank, Jones, & Mehlwana, 1997; Annecke, 1993). These choices are not only motivated by the affordability and accessibility of the fuel but also by the cost of related appliances. So even when poor households have access to electricity, they avoid using it for high energy demand tasks and for which specialized appliances are required (Mehlwana & Qase, 1996; White et al., 1997). Wick paraffin stoves, on the other hand, can be purchased for as little as R30. A study in rural South African villages showed that after 3.6 years of electrification, only 17 percent of homes used an electric stove immediately for cooking and in 44 percent of household's electrical stoves had never been used (White et al., 1997). The majority of electrified households continued to use paraffin or a mix of electricity, paraffin and various solid fuels for cooking (White et al., 1997). White and colleagues (1997) also showed that after 10 years of electrification participants in Soweto continued to use coal stoves to cook and heat because of the cost of electricity for the same purposes. For many developing countries, including South Africa, paraffin remains a fuel of choice for those households where electricity is unaffordable. While government's policy has focused primarily on increasing access to electricity for low income households, not enough focus has been given to other forms of energy that continue to be used for cooking and other thermal requirements (Paraffin Safety Association Southern Africa, 2005).

#### Poverty – driver of the continued use of low cost fuels

The levels of poverty in South Africa remain high and there are also indications that the depth and severity of poverty has increased for the poorest sectors of the population (Hoogeveen & Ozler, 2004). There is increasing recognition that poverty is multidimensional in nature and as such is not only characterized by a lack of income but also by the lack of opportunities and choices to advance human development and to meet the basic standards of living (Noble et al., 2006). In this regard the 2004 AfroBarometer survey (AfroBarometer, 2005) reported that 43 percent of participants went without food at least once in the past year, 36 percent reported that they went without clean water, 40 percent experienced at least periodic shortages of fuel for cooking and space heating, 43 percent experienced periodic shortages of medicine or medical treatment, 45 percent experienced at least periodic shortage of electricity and 60 percent experienced at least periodic shortages of income. Despite a decline in lived poverty from 2000 to 2002, the 2004 survey reports that experienced shortages have regressed to the same level as the 2000 figures (AfroBarometer, 2005). Given the inability of a significant proportion of the population to meet basic needs, despite over a decade of investment in infrastructure development, the use of low cost fuels such as paraffin is likely to persist for many years to come.

#### The link between poverty and paraffin use

South Africa uses about 700 million litres of illiminating paraffin each year, over 70 percent of which is consumed by households (National Treasury Report, 2003). Smaller amounts are consumed by the industrial, mining, agricultural and other such commercial sectors (National Treasury Report, 2003). Illuminating paraffin, also known as kerosene, is a hydrocarbon that is highly toxic and has a flash point (lowest temperature at which it can form an ignitable mixture in air) of 43 degree Celsius. Although it is relatively stable, when used in combination with other substances such as methylated spirits (often used to ignite pressure stoves), and contaminated with petrol (due to multiple points of decanting along the supply chain), its flashpoint is lowered, increasing the potential for fire. Similar to water, it is a clear, colourless liquid with a low viscosity that enables easy flow. Paraffin is produced by six oil refineries in South Africa and supplied through a complicated and unregulated supply chain involving a number of intermediaries. Consumers purchase paraffin in small quantities in containers supplied by themselvesoften in cool drink bottles - from 'spaza shops', general dealers, and garages. Paraffin is generally used in low cost and poor quality appliances (lamps, heaters and paraffin stoves), who's manufacture remains unregulated. As a result paraffin appliances are of substandard quality, they continue to be used even when the safety of the appliance is seriously compromised and, they emit health-compromising levels of carbon monoxide and other particulate matter.

Paraffin users tend to live in low cost and in many cases informal housing. Rapid urbanization has led to an explosion of informal settlements adjacent to hubs of economic activity. These informal dwelling are often built with combustible and toxic material such as cardboard, treated or painted wood, and plastic (Truran, 2004). Houses are generally clustered closely together and lack access to the most basic infrastructure and services. Such living environments create the conditions for a number of health hazards and the rapid spread of fire because of the close proximity of homes without firebreaks.

Given the context outlined above: (1) the toxicity inherent in paraffin itself, (2) the unregulated nature of the supply chain, (3) the inefficient design and quality of paraffin appliances and (4) the poor and often stressed living environments in which they are used, a host of vulnerabilities are created. The externality costs (costs arising due to the negative consequences associated with paraffin use) of paraffin use are high. The Treasury Report (National Treasury Report, 2003) on energy use in SA estimates that the use of approximately 700 million litres of paraffin each year results in a loss of R104 564 million through death, burns and ingestions, a burden 50 times higher that the annual R2.1 million turnover in paraffin sales.

#### **Consequences of paraffin use**

Domestic chores such as cooking, feeding and cleaning are mainly the responsibility of women in the home. As such, they tend to be the primary users of paraffin and together with children, bear most of the negative effects of paraffin use (Paraffin Safety Association Southern Africa, 2005). Infants are particularly at risk as they spend most of the time in the kitchen in the care of their mothers. The use of paraffin can impact on poor households in several ways including poisoning, respiratory illnesses as a result indoor air pollution, burns and fires. Paraffin-related incidences, in particular child paraffin poisoning, have been linked to the unregulated supply chain and the failure to prepackage paraffin. The poor design and quality of paraffin stoves have been closely associated with burn injuries and the multiple outbreaks of fire in poor households. The combustion of paraffin has also been closely associated with the health effects of indoor air pollution. Paraffin-related incidents exact an inordinate toll on families and the state through, among others, health, social, economic and psychological consequences.

#### Paraffin poisoning

Paraffin ingestion is the commonest cause of accidental childhood poisoning in South Africa (de Wet, 1994). It is also a major contributor to unintentional injury death among children aged 1-14 years after road traffic accidents, fires and drowning (Bradshaw, Bourne, & Nannan, 2003a). Between 1996 and 2001, it was estimated that approximately 90 000 children ingested paraffin on an annual basis with 40 000 of them developing chemical pneumonia (Paraffin Safety Association Southern Africa, 2005). Although paraffin ingestion rarely results in death, only a small amount (1ml) is required to produce complications through chemical pneumonitis (Govender, 2006), pneumonia and other respiratory complications. These complications often result when paraffin is aspirated into the lungs, sometimes through induced vomiting.

Several hospital-based studies in the late 80s and early 90s reported on the extent to which paraffin is responsible for poisoning amongst children and advocated for the prepackaging of paraffin in child resistant containers. In 1987, 30 percent of cases treated at Red Cross War Memorial Children's Hospital were for paraffin poisoning (Roberts J.C., Leary, Mann, & Glasstone, 1990). Of the 88 children under five admitted for poisoning at Letaba Hospital, Gazankulu in 1986, 72 were for ingesting paraffin (Crisp, 1986) A study at Natalspruit Hospital reported that from January to November 1990, 181 cases were treated in hospital due to complications from paraffin ingestion (Violari & Levenstein, 1991). During 1992, paraffin ingestion was responsible for 78 percent of acute accidental poisoning in children under five at Ga-Rankuwa hospital (Krug, 1994). These figures were likely to be underestimates as they did not take into account children treated as outpatients. A more recent surveillance system established at Prince Mishiyeni Hospital in Umlazi also reported continued incidents of paraffin ingestion between May and August 2006 (see figure 1) (Paraffin Safety Association of Southern Africa, 2006a).





Source: Paraffin Safety Association of Southern Africa, 2006

Most paraffin ingestions are accidental and are in all likelihood as a result of the containers that they are stored in and the accessibility in the home (Krug, 1994; Truran, 2004; Paraffin Safety Association Southern Africa, 2005). Young children are highly likely to mistake paraffin for water or cool drink as it is a colourless liquid often stored at ground level in cool drink bottles. Toddlers below the age of five are most at risk (Krug, 1994; Malangu, Duploon, & Ogunbanjo, 2005) and most ingestions take place during the summer months when they are thirsty. Studies have shown that storing paraffin in child resistant containers can reduce the incidence of paraffin poisoning by half (Krug, 1994) and that allocating a storage space in the household above ground level can reduce the incidence of domestic accidents among children under five (Matanhire, 1994). Lack of parental supervision is also a risk factor for paraffin ingestion. A study by Krug (1994) showed that only 12-25 percent of children who ingested paraffin were under adult supervision. Children left under the care of other siblings – a common practice in low

income households - is also a risk factor for ingestions as up to a third of cases occur under these circumstances (Krug, 1994; Reed & Conradie, 1997).

#### Indoor air pollution

Indoor air pollution from burning solid fuel, mostly for cooking, has been recognized as one of the top ten global health risks and is responsible for 1.6 million deaths and 2.7 percent of the global burden of disease (World Health Organization, 2002). Half of the world's population is reliant on biomass fuels as a source of energy because of poverty. The burning of these fuels is particularly hazardous to the health of women and children who spend most of their time in the kitchen. The Burden of Disease study in SA has reported that lower respiratory infections is the fourth leading cause of death among children under five (preceded only by HIV/AIDS, low birth weight, and diarrhoeal diseases) and recommended environmental and development initiatives, including reduction in exposure to indoor smoke, to improve socio-economic conditions of infants and toddlers (Bradshaw et al., 2003a). The incomplete combustion of fuels on open fires or traditional stoves releases hundreds of pollutants mainly carbon monoxide and small particles, nitrogen oxides, benzene, butadiene, formaldehyde, polyaromatic hydrocarbons and many other health damaging chemicals (World Health Organization, 2006).

Even though paraffin is regarded as a cleaner fuel, studies have shown that it produces sufficiently high levels of pollutants such as carbon monoxide for users to experience negative health effects (Bailie et al., 1999; Muller, Diab, Binedell, & Housome, 2007). Tests on the most popular paraffin stoves showed that they release substantial levels of carbon monoxide to put the lives of users and their families in danger (Paraffin Safety Association, 2006). This is exacerbated through the continued use of appliances that have deteriorated in quality and efficiency over time, resulting in incomplete combustion and the production of copious amounts of carbon monoxide and other particulate matter. Exposure to carbon monoxide can result in no health effects at all at very low levels through to respiratory problems, headaches, irritability, unconsciousness and death with high levels of exposure. Moreover, chronic low levels of exposure to indoor carbon monoxide may worsen ischemic heart symptoms in patients with cardiovascular disease (Bailie et al., 1999). Other demonstrated health effects of inhaling indoor smoke include

pneumonia, acute infections of the lower respiratory tract, chronic obstructive pulmonary disease, asthma, cataracts, tuberculosis, adverse pregnancy outcomes such as low birth weight, interstitial lung disease and nasopharyngeal and laryngeal cancers (World Health Organization, 2006).

The effects of indoor air pollution can be mitigated by ensuring adequate ventilation in the home. An intervention study to reduce indoor air pollution exposure to young children in two rural villages in South Africa, showed that improving ventilation and the location of the child relative to the source of pollution were the two most viable options to reduce expose to indoor air pollution (Barnes et al., 2004). Natural ventilation refers to the air that is supplied in the home through windows, doors, ventilators and other openings that can be controlled (United States Environmental Protection Agency, 1991). Ventilation is easier to control in formally built structures. However, this is not always possible in informal dwellings where biomass fuels and liquid fuels are most likely to be used. Limited space, impediments to air flow and location of the source of carbon monoxide have been found to contribute to indoor air pollution. The living conditions of informal dwellings is such that space is at a premium with homes often being overcrowded, rooms are small, paraffin stoves are used in the same room where people sleep and airflow impediments are substantial as houses are clustered closely together. In addition, during the winter months, the stove is also used as a heater and ventilation is minimized to retain warmth in the home. In the current South African context, fear of crime also prevents most residents from leaving doors and windows open. Together, these factors exacerbate exposure to indoor air pollution (United States Environmental Protection Agency, 1991).

#### Fire and burns

Fire is a lived fear and reality of residents in informal settlements with low cost fuel use often implicated in the spread of uncontrolled fires. A Markinor survey (Biggs & Greyling, 2001) reported that there are about 46 000 paraffin-related fires in low income households on an annual basis. In Duncan Village alone in the Eastern Cape, Bank and Mlomo (1996) reported over 400 residential fires over a 10 year period, collectively destroying over 4 500 homes. Surveillance data for 2006 from Buffalo City showed that

while fires occur throughout the year in informal settlements, they generally peaked during the winter months (see figure 2) (Paraffin Safety Association of Southern Africa, 2006b)



Figure 2: Number of fires in informal settlements in Buffalo City, 2006

Source: Paraffin Safety Association of Southern Africa, 2006

Fires in informal settlements are often caused by exploding paraffin stoves or when paraffin lamps or candles are knocked over (Godwin, Hudson, & Bloch, 1997). In addition, the flammability of the material with which 'shacks' are constructed together with high residential density due to rapid urbanization, exacerbates the rapid spread of fire, often destroying entire settlements (Godwin et al., 1997). Data from Buffalo city also shows that while most causes of fires are unknown, many can be attributed to energy sources and related appliances including paraffin (see figure 3) (Paraffin Safety Association of Southern Africa, 2006b) and that they had consequences for many more homes than where the fire began (see figure 4) (Paraffin Safety Association of Southern Africa, 2006b).



Figure 3: Causes of fires in informal settlements in Buffalo City, 2006

Source: Paraffin Safety Association of Southern Africa, 2006



Figure 4: Number of structures affected by fires in informal settlements in Buffalo City, 2006

Source: Paraffin Safety Association of Southern Africa, 2006

Barillo and Goode (1996) argue that human behavior must be accounted for as a facilitating factor in paraffin-related fires as human reactions such as stoves left unattended are necessary in the fuel use processes. They go on to recommend that prevention of fire injuries can be achieved by eliminating or reducing the risk of explosions but also by modifying human behavior.

The consequences of fire are multiple often exacting their toll 'on the poorest of the urban poor' (Bank & Mlomo, 1996). For low income households without security of tenure or insurance, the effects of fire are devastating (Truran, 2004). Amongst others, they are faced with the injury and sometimes death of family members as well as severe economic hardship through loss of their home and material possessions, and often interruptions in their economic activities. Residents also live with the fear of victimization of causing the fire and sometimes find themselves victims of 'mob justice', being accused of witchcraft designed to destroy the entire community (Bank et al., 1996).

But fires also carry with them a number of health and psychological consequences. Twelve percent of deaths in South Africa are attributable to injuries (Bradshaw et al., 2003b) of which burns account for approximately 11 percent of injury deaths (Medical Research Council, 2005). The National Injury Mortality Surveillance System of 2004 (Medical Research Council & University of South Africa, 2005) reported that burns were the leading cause of non-transport related unintentional injury deaths among those 15 years and older. Approximately 50 000 households experience paraffin-related burns each year caused primarily by exploding paraffin stoves (63%) and paraffin fires (22%) (Biggs et al., 2001).

In fact, a number of hospital-based studies both locally (Hudson, Rode, & Bloch, 1994; Godwin et al., 1997) and internationally (Mabrouk, A., Badawy, A.E., & Sherif, 2000; Marsh et al., 1996) have identified shack fires and particularly exploding paraffin stoves as the cause of severe burns. A study at Woodstock Hospital in Cape Town reported that, between 1990 and 1992, 11.9 percent of admissions to the burns unit were due to primus stove (pressurized paraffin stove) burns (Hudson et al., 1994). Similarly, a study at New Somerset Hospital reported that between March 1993 and May 1995 99 of the 377 admissions to the burns unit were due to shack fires, underpinned to a large extent by bursting primus stoves (Godwin et al., 1997). Most burns occur in the home when stoves are placed on the ground for cooking and warming water (Mabrouk et al., 2000; Marsh et al., 1996). A surveillance system at Prince Mshiyeni Memorial Hospital in Umlazi between May and August 2006 showed that most incidents occur in the home and that liquid burns were the most common type of burns resulting from paraffin and electricity use (see figure 5) (Paraffin Safety Association of Southern Africa, 2006c).

## Figure 5: Number of energy-related incidents by type of energy source seen at Prince Mishiyeni Memorial Hospital: May-August 2006



Source: Paraffin Safety Association of Southern Africa, 2006

Both the physical and psychological impact of severe burns is significant due to deformity and disfigurement from scars and contractures. Victims not only become socially isolated but also economically constrained as their chances of returning to work and of finding future employment are jeopardized (Godwin et al., 1997).

### Interventions

The rich store of data in South Africa on paraffin use argues for a number of initiatives to enhance its' safety profile. While in the long-term macro level interventions are required to alter the socio-economic trajectory of low income households, in the short- to mediumterm a number of focused interventions are needed. The Paraffin Safety Association of Southern Africa, funded by the six oil refineries in South Africa, has been mandated to spearhead such initiatives. In this regard, the organization has adopted a comprehensive approach to promote the safe use of paraffin. While interventions are underway to regulate paraffin use at the point of manufacture and to regulate safer packaging and the manufacturing standards of appliances, these medium- to long-term contextual strategies need to be supported by educational interventions directed at the community and at the individual levels. In fact the expert forum convened by the Paraffin Safety Association to validate its strategic direction, highlighted the absence of education throughout the paraffin distribution chain (Paraffin Safety Association, 2004).

In this regard, the Association developed preventative messages that focus on harmful paraffin-related incidents in the 11 official languages of South Africa. Given the limited capacity of the Association itself, they have adopted a train-the-trainer communication strategy, relying on the help of government and other public health organizations to achieve widespread diffusion of the message of paraffin safety.

In recognizing itself as the custodian of safety education, the expert report also recommended that education and training must be informed by 'current levels of understanding' of the issue (Paraffin Safety Association, 2004). Two studies conducted in the early 1990s reported on the failure of health education campaigns to bring about changes in paraffin safety practices (Krug, 1994; Donald, Bezuidenhout, & Cameron, 1991). While the wealth of research points towards the need for comprehensive approaches to bring about behaviour change, beyond awareness raising and knowledge transfer, to include skill building and community and policy level interventions, data is not available on the extent to which end-users were consulted to inform the design of health education programmes.

## **Terms of Reference**

## Aim

With the overall goal of developing a comprehensive community education programme, the Paraffin Safety Association of Southern Africa commissioned the Human Sciences Research Council to conduct an exploratory study on knowledge levels and strategies to promote the safe use of paraffin in KwaZulu-Natal.

## Objectives

The study objectives were to explore:

- energy use patterns and the factors motivating their choice
- the purposes for which paraffin is used
- stigma associated with paraffin use
- access to paraffin and storage in the home
- types of paraffin appliances used and response to potential safety devices
- adverse events experienced
- risk perceptions of paraffin use
- knowledge on safety practices
- factors motivating the transition to alternative fuels

## Methodology

#### Study design

In accordance with the exploratory nature of the study, qualitative methods using focus group discussions were identified as the most appropriate study design.

#### Study area

The study was conducted in Umlazi, KwaZulu-Natal based on the recommendation of the Paraffin Safety Association of Southern Africa. As part of the association's most recent strategic plan, Umlazi was identified as a nodal area in which the organization is targeting several of its interventions. Through various interventions over the years, the organization has learnt that 'having a dispersed target audience makes it difficult to conduct nationwide intervention' (Paraffin Safety Association, 2005). As such their focus is shifting to 'concentrated interventions in small areas for an extended period of time before moving to the next area' (Paraffin Safety Association, 2005).

Umlazi is an urban township area situated approximately 18 kilometres south of the Durban central business district. Being in extent of 4500ha, it constitutes one of the largest townships in South Africa (United Nations Habitat Settlement Programme & eThekwini Municipality, 2007). Historically, the township was set up as a dormitory town to provide cheap labour to the city centre. Thus it struggles with the major deficiencies characteristic of most township areas in terms of adequate housing and subsequently several pockets of informal settlements, provision of facilities and services and lack of economic opportunities (United Nations Habitat Settlement Programme et al., 2007). It has a population of approximately 388 687, 50 percent of whom have a matric qualification and an unemployment rate of around 57 percent (United Nations Habitat Settlement Programme et al., 2007). About 42 percent of the population lives on less than R1500 per month and most households, consisting of on average of 4.5 members, rely on old age pensions as the sole source of income (United Nations Habitat Settlement Programme et al., 2007). Of the 90.196 households in Umlazi, 58.6 percent are formal dwellings, 38 percent are informal dwellings and three percent are traditional dwellings

(United Nations Habitat Settlement Programme et al., 2007). Formal dwellings in Umlazi are fully serviced with water, sanitation, electricity and telecommunications. Some physical services in the form of pit latrines and standpipes are available in the informal settlements but these services remain inadequate. Prince Mishiyeni Memorial Hospital is the only hospital available in the area, supported by clinics in sections AA, G, N, D, V, K and U (United Nations Habitat Settlement Programme et al., 2007).

#### **Recruitment sites**

Through the support of the Paraffin Safety Association in Durban, a meeting was set up with the local Department of Health from Umlazi to assist with selecting the most relevant sections for data collection and site(s) from which to recruit participants. Sections H, U and V in Umlazi were identified as representing a combination of low and middle income homes consisting of formal and informal settlements where paraffin was likely to be used solely or in combination with other fuels. Furthermore, anecdotal evidence suggested that the prevalence of paraffin-related incidents was high in these sections. Clinics were identified as the most appropriate formal structure from which to recruit participants.

#### **Participant selection**

Clinic attendees from section H, U and V were informed about the study in the waiting room and approached to participate in the discussions. Recruitment of male and females over the age of 18 years, took place a week before the actual focus group discussions. In order to analyse historical patterns and the changing nature of energy use and to achieve homogeneity in the groups, participants of similar age profile were grouped together for the discussions. However, the majority of the recruits at the clinics were not contactable based on the details provided. An alternative strategy had to be implemented, whereby participants were recruited on the day of the discussion at the clinic. As a result it was not always possible to recruit participants within the same age band for each discussion; hence this level of analysis was not possible. Table 2 outlines the profile of the participants for the nine focus group discussions.

Clinic	No. of	Gender		Age	Recruitment	
	Participants			Range		
		Male	Female		Before	On day
H	8	0	8	20-50	1	7
Н	12	0	12	31-45	1	11
Н	7	0	7	24-74	4	3
U	5	1	4	22-47	3	2
U	6	6	0	24-39	0	6
U	7	2	5	25-62	3	4
V	7	3	4	18-26	0	7
V	6	0	6	30-40	0	6
V	6	0	6	39-47	0	6
Total	64	12	52	-	12	52

Table 2: Profile of focus group discussion participants

#### **Research instrument**

A semi-structured focus group discussion guide was developed based on a literature review and input from the Paraffin Safety Association of Southern Africa. The following themes were explored: types of fuel used, purposes of paraffin use, access to paraffin, paraffin appliances used, adverse consequences experienced, sources of safety education and safety practices adopted, and factors motivating transition to alternate fuels.

The focus group discussion guide was prepared in English and translated from English to Zulu. To ensure the accuracy of the translations, the Zulu version of the focus group discussion guide was back translated to English.

### **Data collection**

Nine focus group discussions were conducted with clinic attendees from sections H, U and V (three discussions in each section) in Umlazi. The focus group discussions, consisting of 6-8 participants, were approximately 90 minutes in duration and conducted in a private room at the clinic. Discussions were moderated by first language Zuluspeaking research assistants and tape-recorded. The first focus group discussion served as a pilot. Subsequently, procedures and the discussion guide were adjusted accordingly.

Several steps were taken to ensure that the integrity of the data was not compromised by researcher bias. Data collection was triangulated using two moderators. An assistant was present at each discussion to record detailed notes on the content of the discussions, non-

verbal cues and the procedure used in the discussions. Debriefing sessions were held after each discussion to reflect on the discussion as well as personal feelings arising as a result of the discussion. Data were collected until a point of redundancy was reached. The consistency of the findings amongst discussions also serves as a validation of the findings.

## **Ethic approval**

Ethical approval for the study was obtained from the Human Sciences Research Council Ethics Committee. Permission was obtained from the local health department to recruit participants from the clinics. Counselors in the respective areas were also informed about the study and their support obtained. Active, written consent was obtained from clinic attendees to participate in and to tape record the discussions. They were informed both verbally and in writing that participation was voluntary and that the confidentiality of their information would be ensured. As individual confidentiality cannot be offered in a focus group discussion, group confidentiality was stressed at the outset and during the closure of each discussion. Each participant was reimbursed to the value of R15 to cover transport costs.

#### Data analysis

The data were transcribed verbatim and translated into English. The data analysis process was managed using QSR NVivo version 2.0. Data were analysed thematically. The focus group discussion guide was used to create a tree of themes and new themes were assigned to data that did not fit the existing codes. The quotations selected from specific focus group discussions, best illustrate the findings being described.

## Results

## Multiple fuel use

Participants discussed the range of fuels that they use in their homes. Despite increasing electrification since the early 1990s, the majority of participants continue to use multiple fuels, primarily because of low and fluctuating income patterns. A combination of the following fuels is used:

- batteries (lighting)
- candles (lighting)
- coal (cooking, space heating)
- electricity (lighting, cooking)
- gas (cooking)
- methylated spirits (igniting wood/coal fire, preventing smoke emission from pressure stoves)
- paraffin (cooking, space heating, lighting, igniting wood/coal fire among other uses discussed below)
- wood (cooking, space heating)

A hierarchy of fuel use, indicative of the varying levels of poverty experienced and the unstable income patterns in the home, was reported in the study. While a few participants still use solid fuels (wood, coal) for household chores and supplement with paraffin for lighting; the majority of participants use electricity for lighting and to power appliances. They, in turn, rely on paraffin for household chores. At the other extreme, a few participants rely solely on electricity as a source of fuel, but reserve paraffin for electricity outages or in the event that they run out of electricity.

"I just use log fire and cook on the ground because most of the time we don't work...Sometimes it happens maybe I get cents, I buy paraffin ...I will use it to reheat." (FGD 1 H Clinic)

"I do have electricity but I use it for lighting, but paraffin is mainly used for hard things, like cooking dumpling, samp and beans. It really helps with saving. Electricity gets finished quickly on hard food." (FGD 2 H Clinic)

Seasonal variation in fuel use was also explored. All participants, with the exception of one, reported the use of a combination of fuels year round. One participant reported that during the winter months her home makes use of a coal stove for cooking and space heating. She indicated that the multiple purposes for which the coal stove can be used prevented them from making 'many fires in the home' (FGD 8 V Clinic), thus limiting the potential fire hazard.

#### Purposes of paraffin use

Participants discussed the various purposes for which paraffin is used in the home. Over and above the widespread and well known conventional uses of *cooking, ironing, lighting and space heating*, the range of domestic chores for which paraffin is used is not merely a reflection of its versatility as a product but of the limited choices participants are faced with and their adaptability, creativity and determination to maintain normality (living in a clean environment that offers pride and dignity to their home) under these circumstances. Many participants indicated that they use paraffin as a *cleaning agent* for a variety of purposes. These include:

• making floor polish (mixed with candle wax that is melted on a paraffin stove)

"...I used to take any candle and melt them. ...I then pour paraffin ... into the candle mixture and it becomes soft and manageable, you then apply it on the floor and you won't believe the beauty that is there! It gives the home dignity especially when you don't have the means of buying floor carpet but you want it to be clean..." (FGD 3 H Clinic)

- washing floors and windows (combined with water)
- removing stains (rust, paint, grease, gum)
- as a lubricant to oil padlocks
- burning household rubbish

- as a pest repellant (ants, mosquitoes, insects, frogs, snakes)
- as first aid to stop bleeding (traditional practice that is no longer used)

Paraffin is also used for a range of *cultural or traditional practices*. Most participants were familiar with the use of paraffin as an ingredient in traditional medicines to exorcise evil spirits. A mixture of paraffin, coarse salt, sand, methylated spirits, and camphor is sprinkled in the home or yard to chase away evil spirits. Alternatively, participants 'steam' themselves to remove evil spirits by covering the head with a cloth or blanket that is held over traditional medicine boiling on a paraffin stove.

'Men use the primus stove when they want to steam the body or to cook traditional 'muti' (medicine) for inducing vomiting. For steaming, they put the stove underneath the blanket with muti boiling." (FGD 8 V Clinic)

A number of other traditional uses of paraffin were mentioned anecdotally. These include:

- as a 'love potion' to attract potential partners (paraffin is held in the mouth and released onto a flame in the direction of the loved one)
- as a potion to sway the outcome of soccer matches (a mixture of paraffin, sea sand and other ingredients are sprinkled onto the soccer field with the intention of slowing down or tiring the opponents)
- to make the traditional medicine known as 'fool maker' ('Umathithibala')- that disorientates victims
- to revive a sick baby following prolonged labour

"My older sister who stays at the farm was pregnant. At the farms they take very long to send pregnant women to the hospital. As a result she had labour pains for three full days. By the time the baby was born, the baby was tired. This woman in the village who knew everything, she cut the umbilical cord. Using her mouth, she inflated (released) paraffin into the child's umbilical cord. The child's umbilical cord became inflated and she (baby) cried." (FGD 6 U Clinic)

### **Reasons for paraffin use**

Participants discussed the reasons motivating their use of paraffin over other fuels. They indicated that they engage in a constant trade off between coping daily with the dangers of paraffin use and what is affordable. For some participants there is no choice, they simply cannot afford alternate fuels. For others, the small and variable quantities in which paraffin can be bought fit their pattern of low, irregular and unpredictable income. Whereas electricity cards are sold in fixed denominations, a litre of paraffin, that can be used for a variety of purposes, can be bought for as little as R5-6.

"... I only have R5 what can I buy? Paraffin or 1 litre, I will cook with that litre as well as with the lamp, the following day I might be able to get electricity. You can even iron your clothes." (FGD 5 U Clinic)

"...When you are unemployed you cannot go buy electricity like all other people because you do not work and you are staying at home. Here are the kids wanting food. When you find a temporary job and you get just a little bit of money you need food. You cannot even buy electricity. Life goes on with paraffin because with it you can buy just small amounts, litre by litre." (FGD 9 V Clinic)

Participants also incur indirect costs when purchasing electricity cards as these are only sold at urban centres (such as shopping centres and at the station). Paraffin, on the other hand, is readily accessible in the neighbourhood, often sold at 'spaza' shops or even by neighbours.

"Paraffin is not expensive, and you can buy it nearby. Neighbours can order it and resell it but with the card you have to take transport to go and buy it at the Umlazi station. You come all the way from a far place just to get a card." (FGD 1 H Clinic)

Participants indicated that the direct (connection fee) and indirect costs (paying for transport to municipality) associated with applying for electrification also serves as a deterrent towards its use. Many participants referred to the speed with which meals are prepared when using paraffin. In effect, they felt that paraffin offers a cost saving when
they prepare 'hard foods' (for example samp and beans that form part of their staple diet) that require a longer duration to cook.

# Access to paraffin

# Quantity purchased, cost and duration of use

Participants described the procedure followed when they borrow or purchase paraffin. Paraffin is generally purchased from 'spaza' shops in the neighbourhood or alternatively, garages or supermarkets in town. While a few participants indicated that they buy in bulk (25L for the month), fluctuating income patterns prevent most participants from choosing this option. Hence smaller quantities (1L, 2L, or 5L) are purchased, often at a higher cost. Participants also borrow or lend paraffin in similar measurable quantities of one or two litres.

Depending on the level of supplementation with other fuels, a litre of paraffin can be used for between one to three days. Participants pay between R5-6.50 for a litre of paraffin. Prices tend to be higher at local 'spaza' shops because of the additional mark up. Hence some participants prefer purchasing paraffin from local garages, where prices are strictly regulated.

Participants know paraffin to be a clear, colourless liquid. However, sometimes the paraffin purchased from 'spaza' shops is contaminated, identifiable by floating particles or a murky colour. Participants were also uncertain as to whether a second type of paraffin had been introduced into the market as sometimes the paraffin that they purchase is yellow in colour. They reported that the 'new' type is quicker to burn. Participants felt affronted that manufacturers had not informed them of the difference between the two types of paraffin such that they could make informed choices when purchasing paraffin.

# **Containers**

Women generally purchase paraffin in the home as they bear responsibility for cooking and cleaning. They, in turn, most often dispatch children of around 10 years of age and older to buy paraffin. Due to the unregulated nature of the supply chain, the consumer assumes responsibility for the container in which paraffin is purchased. Participants indicated that they generally use cool drink bottles, milk containers, juice bottles and in some cases alcohol bottles to purchase paraffin. Safety caps are not used to seal containers, neither are bottles appropriately labeled. In cases where the caps are lost, containers are sealed with paper or mielie corn.

#### Safety information at the point of sale

Participants were asked whether safety information is provided at the point of sale. Overwhelmingly, they indicated that no such information - whether about the container, cap or the dangers of paraffin use - is given at the point of sale. Participants equated the purchase of paraffin to any other household commodity – "it is like how you buy bread", "it is just give (money) and take (paraffin) only" (FGD 7 V Clinic). In fact they perceived retailers as callous as their primary concern was making a profit. They indicated that retailers believed that safety was the concern of the consumers.

"They don't have a problem even if there is no cap, they just don't mind."

"Or even if it (container) has jeyes fluid or anything."

"...they don't care they know that you are the one who needs to check how your container is. Whether you send your child or you go for yourself, even it there is oil, he will just pour." (FGD 1 H Clinic)

"Even if he can see that he spilled on the bottle when he was pouring, he doesn't care, you will just take your bottle and go." (FGD 2 H Clinic)

## Storage of paraffin in the home

Despite an overwhelming consensus that paraffin should be stored out of the reach of children – motivated by innumerable incidents of paraffin ingestions – only a few participants indicated that paraffin was stored in a locked cupboard or above ground level. Perhaps acting within the constraints of their physical environment, the majority of participants stored paraffin on the floor, either hidden behind a table cloth, appliance or furniture under the belief that "the child does not usually reach there" (FGD 1 H Clinic). Some participants store paraffin within easy reach of children and merely issue a warning to them "not to touch it" (FGD 2 H Clinic). Those few participants who had changed the storage position did so as a result of personal experiences of children ingesting paraffin.

"...We used to put it just anywhere, until the child ingested it. We have now decided to put it on the highest shelf in a lockable cupboard." (FGD 7 V Clinic)

Interestingly, participants who do not have children in their home did not perceive themselves to be at risk for ingestion. They store paraffin anywhere in the home. Yet a few participants related incidents of adults ingesting paraffin, when they were in a hurry or inebriated.

"I don't really pay close attention. I just leave it in the kitchen with other bottles just like that." (FGD 5 U Clinic)

## Paraffin appliances

## Types of paraffin appliances

A number of paraffin appliances are used in the home. These include pressure (primus stove) and non-pressure or wick stoves (referred to as 'Sikeni' stoves by participants – a brand of wick stoves widely used in the study area), glass lamps, heaters and in some cases paraffin-enabled refrigerators. Paraffin lamps are sometimes made in the home - known as Isiphefu - by weaving a wick or cloth into a tin and decanting paraffin into it. Several participants indicated that home-made lamps are particularly dangerous as they emit copious amounts of smoke (they do not have a glass cover), often leak and explode when tipped over.

## Cost, duration of use and quality of stoves

Wick stoves (R20-30) are considered of inferior quality and have a life-span of between three to six months while primus stoves (R80-100) are considered sturdy, easier to use and generally have a life span of several years provided that they are serviced regularly. Although wick stoves are widely used, mainly because they are cheaper, participants generally favoured primus stoves. Reasons include:

- Wick stoves are made of poor quality metal.
- They are malleable hence bend under the weight of heavy pots. As a result heat distribution becomes uneven making it difficult to cook and pots and stoves become unbalanced and risk tipping over.

- Stoves rust easily, holes develop and are often the reason for fires.
- Stoves are not subject to quality control before sale. Many leak paraffin.
- Stoves emit paraffin fumes and smoke that leaves a layer of black soot on pots, table tops, walls and other surfaces in the home.
- Stoves often overheat and explode.

Participants were uncertain whether the frequent explosions of paraffin stoves could be attributed to paraffin itself or the poor design of stoves. There was also a widely held perception that the quality of stoves had deteriorated over the past few years. A few participants pointed out that the 'Sikeni' stove was not SABS approved and in fact could not be bought at chain stores. They indicated that such poor quality stoves could only be purchased at local supermarkets in the neighbourhood, often associated with the supply of substandard goods.

"I don't know whether it's their guarantee or paraffin is too strong sometimes because Sikeni stoves often burst even the primus stove as well. The Sikeni stoves are worse. The problem is either paraffin is powerful or Sikeni too weak." (FGD 5 U Clinic)

# Maintenance

Participants generally try to maintain the stoves themselves, and seldom consult the few repair shops in the area. Although not designed to be repaired, wick stoves are regularly cleaned on the inside, rust is scraped off, and wicks are washed and replaced (with strips of old t-shirts or towels). Primus stoves are maintained in similar ways and sometimes require the valve or head to be replaced.

# Usage of stoves

Participants were mindful of the dangers associated with paraffin stoves. Hence they indicated that mothers, who are primarily responsible for cooking, mostly operate paraffin stoves. However, during the course of the discussion, it emerged that children were in fact using paraffin stoves – often out of necessity, when they return home from school and adults are away at work.

## Safety information on stoves

Participants were asked whether stoves were accompanied with an information leaflet. While a few participants indicated that stoves included a pamphlet with drawings that are difficult to follow, the majority indicated that they did not receive directions on how to use or maintain the stove, or warnings on potential dangers. Participants reported that all the safety and maintenance information gathered over the years was through personal experience.

Interviewer: "Okay, so you have never received information."

Participant: "Never, we use our psychology and the technology we invent ourselves." (FGD 4 U Clinic)

## Recommendations to improve the design of stoves

During the course of the discussion, participants offered a number of suggestions to improve the design and overall safety of paraffin stoves. These include:

- Wick stoves should be designed such that the wicks can be replaced (most users replace the wicks anyway to prolong its use) and replaceable wicks should be sold at stores.
- Wick stoves should be made of a better quality metal similar to containers used for gas cylinders that does not corrode as easily.
- Wick stoves must make allowance for a funnel to refill paraffin. Currently the stove does not accommodate space for a funnel resulting in paraffin spillages.
- The holding area for paraffin in the stove should be transparent and appropriately demarcated to prevent overfilling and such that users can gauge when to refill the stove.
- Similar to electric stoves, paraffin stoves should be built such that a naked flame is not visible, rather only the plate/rings should burn.
- Quality control mechanisms should be instituted to ensure that stoves are in good working condition before they are sold.

#### Scenarios – risks associated with paraffin stoves

Three scenarios that outline risks associated with the use of paraffin stoves were discussed. The first concerned moving a stove that was in use, the second, refilling a stove that was in use and the third tested participants' response to a device that would shut the stove off when moved. All three scenarios elicited mixed responses. While some participants were convinced that the stove could not be moved or refilled without switching it off and allowing a period of cooling down before switching it on again, due to the risk of burns, others did not perceive such a need. Their immediate concern was for the meal that would potentially be ruined thus compelling them to move the stove or refill it while it was burning. As this was their regular practice and had not as yet resulted in any harm, they underplayed any potential threat.

"If you move it while it is on, it will explode on your face, boo, explode."

You can't move around with stove while it is still on, because when it releases the steam you may get burnt on your face." (FGD 1 H Clinic)

"...I take a chance. I open it and pour paraffin while it is still on. I do not switch it off. When there is little paraffin the flame is also low, so I pour paraffin." (FGD 9 V Clinic)

Similarly, participants reported that a safety device that shut off the stove when moved would be an inconvenience to the cooking process. Only when a tangible example was given of a child pulling on the tablecloth and the stove tipping over, did participants acknowledge its potential usefulness.

During the course of the discussion, participants also raised two strategies that they used when they run out of paraffin while cooking. With the knowledge that paraffin floats on water, some participants fill the stove with water in the belief that as long as the wick of the stove are in contact with the remaining paraffin in the tank, the cooking process would continue. Others shake the stove vigorously such that the steam generated completes the cooking process. "Sometimes I time how much food I want to cook and then I pour water into the stove and then paraffin over it. The strings will touch paraffin not the water. I will continue cooking until I finish." (FGD 4 U Clinic)

Most participants make use of a funnel (even home made funnels) to decant paraffin into the stove. However, some participants experienced difficulty using a funnel as the angle at which it entered the stove makes it awkward to decant paraffin. They felt more at ease decanting paraffin directly from the bottle into the stove.

# Adverse events related to paraffin use

Participants related some of the negative consequences as a result of paraffin use. These include:

- accidental and intentional ingestions
- acts of violence
- burns
- fire
- indoor air pollution
- skin exposure

With the exception of suicide and violence, participants had intimate knowledge of paraffin-related injuries and sometimes death through innumerable personal experiences. Table 3 describes some of these experiences and the reasons that participants attribute for their occurrence. Despite a critical awareness of the dangers of paraffin use, and clearly their consequences, often the incidents reported emanate from preventable causes - paraffin stoves/appliances left unattended, tablecloths pulled off tables, paraffin stored in cool drink bottles on ground level, drunkenness etc. Taken together with the findings outlined earlier, what is evident is that in the majority of cases – whether for lack of resources or other reasons – safety practices are not being instituted.

Table 3: Adverse events experie	enced as a result o	f paraffin use
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Incident	Reason	Description
<ul> <li>Indoor air pollution</li> <li>respiratory problems</li> <li>pneumonia</li> <li>tuberculosis</li> <li>eye irritation</li> </ul>	Smoke and fumes from paraffin stoves - prolonged exposure - poor ventilation	"I used paraffin last year and I was living in a house that did not have ventilation and windows. We used it a lot and at that time my baby was still very small and today that child has chest problems because of paraffin." (FGD 7 V Clinic) Interviewer: "The other thing is that the smell is suffocating, causing diseases. Is there anyone who is a witness to that? Participant: "I am a witness to that. I suffer from TB because I use a wick stove. When I extinguish it produces smoke. I will cough for the whole day. Sometimes I end up going to the clinic because of continuous coughing. I now extinguish it outside the house because the smell of
		paraffin is not right inside you." (FGD 8 V Clinic)
Ingestion	Children - stored on the floor in cool drink bottle - mistaken for water Adults - mistaken for water when in a hurry or inebriated - suicide	"I once bought paraffin with a coke bottle. The child crawled and reached into it and drank all of it. We did not even see that she drank paraffin. We only realized when we were changing the nappy. Instead of the smell of urine there was a smell of paraffin." (FGD 6 U Clinic) "Some people drink is to that they quickly get rest and lower their stress (suicide)." (FGD 8 V Clinic).
Burns	<ul> <li>stove exploding/bursts</li> <li>toppled pot/stove</li> <li>stove bent/slanted</li> <li>pulled table cloth</li> <li>unstable table/surface</li> <li>unsupervised/asleep</li> <li>inebriated</li> <li>lamp overturns</li> </ul>	<ul> <li>"You see there was this neighbour back home who was lighting her stove, she is an old aunty, it burst and she got burnt and on her entire body she turned white. She didn't survive and she died because of Sikeni." (FGD 1 H Clinic)</li> <li>"my sister's maid was cooking the candle just as it was boiling after putting paraffin, her child was crawling and then tin just fell on the child's headshe just pulled the tablecloth." (FGD 2 H Clinic)</li> </ul>
	- refilling while stove is on	"To put off the flame you had to take sikeni stove outside because of smoke. There is this incident of a guy who left the stove outside and his three year old daughter confused the stove with isigqiki (traditional seat) because it was dark. She sat on it and burnt her bum." (FGD 5 U Clinic)
Skin exposure	- spill from lamp - toppled lamp	"I was a child carrying a lamp and moving from the kitchen and my mother and I were going to sleep and it spilled on me but I did not notice. At midnight I noticed I was itching and my mother put on the lamp and when I looked, I had sores everywhere in this side." (FGD 2 H Clinic).

Incident	Reason	Description
Skin exposure continued	<ul> <li>stored on the floor</li> <li>spilled from container, cap not tightly sealed</li> </ul>	"I had an incident where a child rolled from the foam mattress we were sleeping on onto the paraffin lamp. It the morning the child had sores that looked like a severe nappy rash. Apparently the napkin had absorbed all the paraffin." (FGD 3 H Clinic)
		"We sometimes send children to shops to go and by paraffin. Paraffin spills on the child unaware. She will then have burn blisters because paraffin was absorbed by the skin." (FGD 6 U Clinic)
Fire - stove l - stove c - stove l - table c - unstab - topple - user in	<ul> <li>stove left unattended</li> <li>stove explosion/burst</li> <li>stove leaking</li> <li>table cloth pulled</li> </ul>	"I was also using paraffin stove and I placed it without paying attention and I stepped out to go to my neighbours place. As I was coming back I don't know how it caught alight on the cloth." (FDG 1 H Clinic).
	unstable table/surface toppled lamp user inebriated	"A primus stove was left unattended in the kitchen. We were seated in another room. I think the primus stove exploded while no one was there. Near the stove was a cupboard, clothes and cardboard. The room was set alight. By the time we noticed the house was on flames and the roof was falling. It was clear there was nothing we could do. The house was burnt." (FGD 8 V Clinic)
		"I was told that when I was small, while I was trying to retrieve a dummy I mistakenly pulled the lamp and it fell on the blankets and the bedroom got burnt." (FGD 2 H Clinic)
		"And there was this person who was drunk. He fell asleep in a house where the paraffin stove was on. He switched on the wick based stove and it exploded, the curtains caught fire and he also caught fire and got burnt." (FGD 4 U Clinic)
		"My neighbours house at the slum where I stay got burnt. The mother of that house went out for drinking while she was boiling beansThe stove just went that way and the beans that way. The wick stove just exploded. The house got burnt. Even the bed got burnt. It was very cold. That is when I realized how dangerous the wick stove was. You should always be present when it is on or at least in the yard,,," (FGD 9 V Clinic)
Acts of violence	- fight or disagreement	"Yes paraffin is really dangerous because even if you had a fight with someone and since we stay in plank houses here in the shacks, that person can just come back at night and burn your house while you are still sleeping. You see that, many incidents that occur here in the shacks is of people being burnt with paraffin." (FGD 8 V Clinic)

## Stigma

Throughout the discussion participants intimated towards stigma associated with paraffin use – the stigma of poverty. Paradoxically the very product that they use extensively in their homes to uphold their dignity, in spite of limited resources, became the source of stigma. The smell of paraffin is overwhelming and very distinctive; given its extensive use, food cooked on a paraffin stove, their homes and even their person smell of paraffin. The black soot left behind from paraffin use, leaves their homes and themselves feeling dirty and untidy. Hence they feel ashamed to entertain guests in their home or to interact too closely with others – for fear of rejection. In fact, in one of the discussions, mothers reported that children were mocked at school for being paraffin users, identified by the distinctive smell on their clothing.

"When you have visitors maybe at home, people who are not used to paraffin they like complain that the food has a paraffin smell." (FGD 2 H Clinic)

"Everything becomes smoldered even the table and you are now ashamed when people try to visit you; they'll say can this person stay in a place that is like this?" (FGD 7 V Clinic)

"Even when you are all dressed up and ready to go but you still smell of paraffin and you are afraid of leaving because person might try to touch you and they will exclaim about the paraffin smell." (FGD 7 V Clinic)

"At school children who use paraffin can be easily identified and people will know that they are staying in a rented house because their clothes smell of paraffin which means they use paraffin where they stay....They laugh at the fact that they use a paraffin stove." (FGD 9 V Clinic)

## Course of action when incidents occur

Participants devised a number of methods to cope with paraffin-related incidents, some correct and others misinformed. However, what is evident is that through increasing interaction with health care personnel, some of these harmful practices are being discontinued. Nonetheless, many participants remain uninformed of the correct course of

action. What is also encouraging is that despite the initial application of home remedies to paraffin-related injuries, all victims are taken to a health care facility for treatment.

## Indoor air pollution

Participants recognized that indoor air pollution results from the smoke and fumes emitted from paraffin and paraffin appliances. They therefore attempt to improve ventilation by opening windows and doors when cooking, extinguish wick stoves outside the home with a mug or wet cloth to limit the amount of smoke produced, and often step outdoors when the smoke or fumes become overwhelming in the kitchen.

#### Ingestions

When children ingest paraffin, many participants indicated that the child is given milk to induce vomiting. A few participants have altered this practice based on the advice of clinic staff. In these cases, children are not given anything orally and are taken immediately to the clinic for treatment. Others were ambivalent about this advice given the logistic difficulties of reaching a hospital immediately. In the face of limited choices some participants continue with the practice of feeding the child milk until such time that they are able to reach a health care facility.

"The idea of rushing the kid to the clinic is new and it is sometimes a long journey to the clinic. I just give her milk then we go to the clinic because it can take up to two days and you know she will make it." (FGD 5 U Clinic)

#### Burns

Participants use a variety of home remedies to treat burns. These include applying ice, cold water, egg yolk, margarine, condensed milk, bath soap, vaseline, vicks, a mixture of sand and water and 'brasso'. A few participants have been educated that the best course of action is not to apply any home remedies but to immediately take the patient to the clinic.

## Fire

While a few participants were aware that sand was the best option to douse fires, many continue to use water.

"Water makes the flames jump to another place whereas sand just puts pressure on it and extinguishes the fire." (FGD 1 H Clinic)

## Education on the safe use of paraffin

As a consequence of the number of risks associated with paraffin use and paraffin appliances, a discussion on safety education was held. The majority of participants had not received information on paraffin safety. A few participants had some years ago received information via local media (radio and newspaper) on the risk of ingestions. Participants also raised two isolated cases of local shops refusing to sell paraffin in cool drink bottles, due to contamination of bottles that were intended for reuse by the bottling company.

## Safety practices

Despite the paucity of education to the public on the safe use of paraffin, the discussion below outlines the wealth of knowledge that users have accumulated over the years. However, what is striking from the results outlined previously is that widespread knowledge on the dangers of paraffin use only translates into preventative practices for a few participants – some to the extent that their resources allow. Despite awareness of the risks, many feel that economic constraints limit their choices and in fact go on to underplay the risks of paraffin use.

Interviewer: "...do you perceive yourselves to be in danger because of paraffin?"

Participant: "We know, but we are poor and there is nothing we can do."

Participant: "Because of that we are compelled to do something that we know is dangerous. We do not have electricity. It is just these stoves and the coal ones which do not use paraffin. Because we do not afford we are forced to use paraffin knowing that it is dangerous." (FGD 8 V Clinic)

Participants outlined a number of potential safety practices:

- Children below 10-12 years of age should not be allowed to buy paraffin or operate paraffin stoves.
- Paraffin must be stored above ground level out of the reach of children.

- Containers must only be used for storing paraffin.
- Caps on containers must be tightly sealed.
- Containers must be appropriately labeled.
- Doors and windows must be opened to limit smoke and fume inhalation from paraffin stoves.
- Stoves must be operated on table tops to avoid children reaching them.
- Stoves must be placed on an old tray or a surface that can be wiped clean.
- Paper or tablecloths must be fixed to the table to prevent them from blowing into the flame.
- Stoves must be checked for holes before cooking.
- Users must ensure that there is sufficient paraffin before cooking.
- A funnel must be used for decanting paraffin.
- Users should not bend over stoves or get too close to them.
- Stoves should not be left unattended.
- Wick stoves must be switched off outside the home to limit smoke in the home.
- An enamel cup or wet rag must be used to switch off stoves blowing out the flame or using water will result in burns.

# Community education

Participants offered a number of suggestions for community education on paraffin safety. They advocated a multi-pronged education strategy using various media. Some participants recommended holding discussions with community members to overcome the literacy barrier. They added that traditional media such as radio were no longer used as extensively as in the past; hence discussions led by community members would be more appropriate. Other participants recommended the widespread distribution of information leaflets including at the point of sale. They felt that this strategy should be supported by discussions held on radio and television. Some participants felt that manufacturers and retailers, who benefit from paraffin sales, also bear a responsibility

towards the consumers to ensure the safe use of paraffin and to warn the public on the dangers of its use.

Participants felt that school-going children were an important target group for education on paraffin safety as circumstances often require them to make use of paraffin stoves. Parents are generally away at work when children return from school and young girls take on the responsibility of cooking for the household.

"...When the child uses paraffin he has no clear knowledge, we really wish that the things that bring information to the community not only targets us but also our children in schools. We (mothers) now have moved away from our homes because of work or something and the children have become the new mothers and she has to cook for her father and others..." (FGD 3 H Clinic)

But the discussion was taken beyond community education. Participants strongly recommended that paraffin should be sold in prepackaged units of various sizes with child resistant caps. They went on to suggest that it become mandatory for paraffin to be labeled as a harmful chemical. Some even suggested that paraffin sales should be restricted to garages where its sale could be strictly regulated. Participants also recommended that paraffin stoves, similar to the sale of other household appliances, should be sold with an information brochure that outlines directions for its use and warnings about the dangers associated with its use.

#### Alternate fuels

Participants were asked to consider the potential motivation to make the transition to alternate fuels. Many indicated that their primary concern was health and safety. As the use of paraffin is inherently dangerous, participants indicated that they would weigh up the health and safety benefits of alternate products. They went on to emphasize that cost could not continue to be a determining factor at the expense of health and safety. In this regard, participants were very reticent about the use of gas as an alternate fuel as they considered it an even greater risk than paraffin use.

Accessibility of new products was also a deciding factor. Participants explained that currently paraffin was more readily accessible in the community than electricity, hence its widespread use.

Despite contestations about cost versus safety, a few participants emphasized the reality that as much as they would like to use safer products like electricity or ethanol gel, they are still far too expensive to warrant a complete switch over. So affordability remains a determining factor.

"I like electricity because of the importance of safety, but I wouldn't want to leave paraffin because we don't have the same monetary strength." (FGD 3 H Clinic)

Some participants felt that, despite the dangers of paraffin use, it is unlikely that they would discontinue its use because of the versatility of the product. Several participants recommended that rather than phasing out paraffin, its chemical composition should be adjusted to improve its safety profile.

"It is difficult to say we can just cancel paraffin. However it has these negatives that it messes the house, may make you sick, it may kill your children but it is useful. They must just remove this bad thing that we don't know." (FGD 3 H Clinic)

# Discussion

The Paraffin Safety Association of Southern Africa has adopted a multi-faceted strategy to promote the safe use of paraffin in South Africa. While attempts to regulate the supply chain and improve the design of paraffin stoves are ongoing, community education also remains a critical component of the strategy. In this regard, the Human Sciences Research Council was commissioned to conduct an exploratory study to establish knowledge levels on and strategies to promote the safe use of paraffin. The findings of this study will inform the design of a comprehensive community education programme.

## **Limited Choices**

The most poignant finding of the study is that of 'limited choices'. Participants are aware of the dangers of paraffin use and its consequences – as part of their lived experience - yet they see themselves as having little choice. In fact paraffin is the least-liked but most widespread fuel used by low income households because users see themselves as having no alternative (National Treasury Report, 2003; Annecke, 1993; Paraffin Safety Association Southern Africa, 2005). Paraffin use is, and will continue to be underpinned by prevailing conditions of poverty. And poverty is unlikely to be resolved in the near future. With an unemployment rate of 27 percent (Statistics South Africa, 2005) and the depth and severity of poverty increasing amongst the poorest sectors of the population (Hoogeveen et al., 2004) – who tend to be the primary users of paraffin – paraffin is likely to be used for many years to come. Instituting steps to break the cycle of poverty amongst its users is as critical an intervention as steps to improve the safety profile of paraffin.

## Multiple fuel use

Even when most homes are electrified, as is the case in our study, participants indicated that they continue using multiple sources of fuel because of the opportunity costs (indirect or additional costs) associated with electricity use. Lee (2006) in an anthropological study on energy use demonstrated that multiple fuel use is a historical practice dating as far back as the 1950s to compensate for high costs. Similarly, a follow

up study in rural Bushbuckridge, South Africa reported that between 1991 and 2002, over 50 percent of participants continued to use four or more fuels to meet their domestic energy needs despite widespread electrification in the area over the same time period (Madubansi & Shackleton, 2006). So paraffin use does not decline when electricity becomes available. Rather, the availability of electricity shifts the end use of paraffin from lighting to thermal applications such as cooking and heating water ((Wentzel, Manzini, Mulaudzi, Sehlapelo, & Wood, 1997) in (National Treasury Report, 2003)).

Electricity is not only too expensive to fulfill the range of daily chores for which energy is required, but the minimum threshold for electricity sales coupled with the price of related appliances is beyond the reach of many homes that operate on low and unpredictable income levels. A litre of paraffin costs literally half the amount of the minimum cost for an electricity card and together with its appliance is much more versatile in its range of uses particularly for repeated high energy demand tasks such as cooking and heating. Households are also able to purchase paraffin in small quantities depending on available income, making it a more attractive option.

The indirect costs associated with accessing electricity also make it a less viable option. Electricity cards are generally sold at urban centres requiring users to pay additional transport costs to purchase them. Paraffin, on the other hand, can be bought at 'spaza shops' within the neighbourhood. However, users do pay a premium for the convenience of purchasing paraffin in their immediate vicinity through markups at 'spaza' shops. In April 2001 illuminating paraffin was zero-rated for VAT and from April 2003 a single maximum retail price was set (National Treasury Report, 2003). A study on behalf of the Treasury Department showed that retailers increased their prices of paraffin before and after the VAT zero-rating was instituted, so in effect did not pass on the potential savings to users and that the majority of retailers sell paraffin above the set retail price (National Treasury Report, 2003). In fact, the poorest users spend a larger proportion of their monthly income on fuel use because of their inability to buy in bulk (World Health Organization, 2006; Annecke, 1993; Mehlwana et al., 1996).

The perception of paraffin's affordability is further enhanced by the relatively low price of paraffin appliances, albeit of an inferior quality, and often with inordinate health, social and economic costs. A study in Zimbabwe reported that the cost of electrical appliances, as opposed to those required to cook on kerosene or wood, was a barrier to its widespread use (Campbell, Vermeulen, Mangono, & Mabugu, 2003). Studies have also reported that participants preferred coal and paraffin because of the multi-functionality of the appliances for cooking and space heating (White et al., 1997). Electrical appliances, on the other hand, are dedicated for a particular purpose and hence not cost-effective for low income households. However the efficiency of paraffin fueled appliances is generally poorer than most other forms of fuels. Tests on the efficiency of a range of fuels showed that paraffin fueled appliances lose more heat than gel fuel and electric stoves as significant quantities of heat are required to heat the shrouds around the burner (Lloyd & Visagie, 2007). Hence the cooking time is increased and greater quantities of paraffin are required.

Participants also referred to the cost of connection fees that served as a deterrent to electricity use. White et al., (1997) reported similar findings among residents in Chesterville who continued using paraffin for cooking and heating after 25 years of their homes being electrified because of fear of disconnection. The family did not want to run the risk of high electricity bills which they could not afford to pay (White et al., 1997). Households living on unpredictable income sometimes do not have the income to sustain connection to electricity and cannot accumulate the lump sums of money required to pay reconnection fees. However, cheaper forms of fuel such as coal and paraffin can be purchased in small quantities to get them through these low periods (White et al., 1997).

So poverty alleviation is not only about gaining physical access to basic services but also about continuing to access the resources necessary to pay for services. While there have been massive increases in access to basic services since the 1990s, ability to pay for services has severely constrained low income households from continued use (McDonald, 2002). Refuting the thesis of a culture of non-payment among low income users, a survey on the affordability of services reported that 17 percent of respondents had to 'cut back on other essential goods like food and clothing' to pay for services and a further 18 percent indicated that 'they cannot pay for services no matter how hard their try' (McDonald, 2002). These figures do not include the increasing number of homes that make use of pre-paid services, similar to homes in our study, who consume water and electricity to the extent that they can afford – often way below the amount that they need to live 'healthy and productive lives' (McDonald, 2002).

## Hierarchy of fuel use

The hierarchy of multiple fuel use reported in our study is indicative of the varying levels of poverty experienced in homes with very poor households still relying on biomass fuels (wood and coal) for most household chores supplemented with liquid fuel (paraffin) for lighting. At the next level, most households in our study use liquid fuel for domestic chores and electricity for lighting. At the tail end of the poverty spectrum, a few participants reported using electricity as a primary source of fuel. This hierarchy of fuel use is in part reflective of the energy ladder, a framework that asserts that as access to income improves, households will transition to cleaner, more efficient and convenient fuels.

What is evident in our study, as in others (Madubansi et al., 2006), however, is that the climb up the energy ladder is gradual and not always linear (World Health Organization, 2006), probably because of reliance on fluctuating and unpredictable income levels as well as other social factors motivating energy choices. Hence most low and middle income households will continue to use a combination of fuels. It is for this reason that Madubansi and Shackleton (2006) question the applicability of the energy ladder framework, particularly in rural contexts, where a combination of fuels including fuelwood for thermal applications continue to be used despite increase in income and widespread electrification over an 11 year period. They showed that electrification, in all likelihood because of the high costs of electricity and related appliances, merely shifted some of the end uses of fuel, such as lighting, powering, entertainment appliances and refrigeration but not for high energy demand end uses such as cooking and heating. The energy transition is much more complex than the linear model offered by the energy ladder and is perhaps better represented by an 'energy web' (Madubansi et al., 2006). While the move up the web is towards more efficient and cleaner fuels, transition pathways can be less direct for the various end uses of the fuel.

## Paraffin – a versatile product

Census (Statistics South Africa, 2001) and survey data (Biggs et al., 2001; Statistics South Africa, 2006), generally report on the traditional uses of paraffin for cooking, lighting and heating. The findings of our study show that paraffin is in fact used for a wide variety of purposes and has become entrenched in domestic life well beyond a source of energy. Over and above a range of cultural uses of paraffin, that of themselves carry inherent risks of poisoning and burn, participants have discovered a viable alternative in paraffin for domestic purposes. Living under condition of poverty and essentially limited choices, they reported that paraffin offers their homes 'dignity'. Paraffin is used among others to make floor polish, clean floors and windows, remove stains and as an insect repellant. In fact participants have become reliant on paraffin to the extent that the discussion on alternate fuels elicited a strong response against its discontinuation because of its versatility. Similarly, an anthropological study among residents in Duncan Village, East London reported that the dangers associated with paraffin use were not related to paraffin itself, but to the poor quality of appliances and particularly to the lack of responsibility and discipline amongst township youth living in urban areas (Bank, 1997). In contrast, they indicated that paraffin had a long history of use in rural areas without causing 'pain and misery' and attributed this to the 'stability and moral integrity of rural life'. The energy transition is not only influenced by the safety, accessibility, and affordability of alternative fuels, but also by the ability of households to replace the social and domestic functions that paraffin fulfils.

## Stigma associated with paraffin use

Such extensive use of paraffin in the home poses a number of threats. Not only does it exacerbate health risks and general flammability of the home - often made up of combustible and toxic material - it also poses psychological threats to users. Paradoxically, the very product that offers dignity to their homes strips away their personal dignity through social stigma. The distinctive smell of paraffin – used for cooking, lighting, heating and cleaning - becomes a marker of poverty. Paraffin has come to be known as the 'poor man's fuel' (Truran, 2004) as opposed to electricity and electrical appliances that are 'markers of status and upward mobility' (White, 1997;

Bank, 1997). Users of other biomass fuels such as dung and wood are also stigmatized because the distinctive smell is an indicator of severe poverty (Griffin, Banks, Mavrandomis, Shackleton, & Shackleton, 1192) in (Madubansi et al., 2006). White and colleagues (1997) in a four metropolitan study reported that gas and coal were the main alternatives to electricity in Gauteng because paraffin carries the stigma of the rural, of being 'backward'. Similarly Bank (1997) reported that although paraffin is associated with the role of women as mothers and homemakers, it is not an association that they are proud of, as they regard paraffin as a dirty fuel. Unlike electrical appliances, paraffin appliances are not displayed in the home and generally stored out of public view. While studies in South Africa have reported on the social role of paraffin, the exchange of which has been used to establish and cement social and economic networks (Meintjes, Aitken, White, & Jones, 1996; Lee, 2006), there is limited literature on stigma related to energy use.

However, Meintjies et al., (1996) did allude to stigma at a social level. The study reported that in some social contexts in South Africa paraffin exchange facilitated the sharing of other goods (such as food and money), but in other contexts paraffin exchange was considered shameful. She went on to explain that paraffin was considered an expensive product and when borrowed in small quantities (a cupful), lenders felt unable to ask for it to be returned in the same way that money could be returned. Hence a request to borrow paraffin was considered 'rude' and out of place.

Exploratory studies are required to understand the effects of stigma and the extent to which it stifles social interactions. This is especially important for young people living in conditions of poverty but who frequently travel to better resourced neighbourhoods to engage in educative and other socioeconomic activities.

# An ecological approach

The second major finding of the study is that despite the near non-existent level of public education on paraffin safety, save for a few anecdotal cases, participants reported a sufficiently wide knowledge base on the dangers of paraffin use and associated safety practices that could provide the basis for behaviour change. Yet the innumerable paraffinrelated incidents reported and the daily risks taken indicate that behaviour change is not taking place. Four to five decades of research, has demonstrated that knowledge is essential for but not sufficient to produce behaviour change (National Cancer Institute, 2005). There is no 'magic bullet' to promote paraffin safety. Given the complex interplay of factors that influence paraffin use, a wide array of strategies are required. In fact contemporary health promotion goes beyond addressing individual level factors (attitudes, beliefs, knowledge etc.) to include efforts to change the social and physical environments of communities. Interventions at the individual, family, school, community and organisational levels are also enabled by advocacy for supportive social and economic policies. Termed an ecological approach, this genre of behaviour change programmes employs a range of strategies that operate at multiple levels (National Cancer Institute, 2005). Support for the ecological approach is also forthcoming from the injury prevention fraternity, that acknowledges the limitations of individually focused health messages (Cohen & Swift, 1999). Instead they advocate for a more comprehensive approach involving multidisciplinary collaboration using a range of strategies including: individual knowledge and skill building, community education, educating providers and key gatekeepers, fostering coalitions and networks to build 'critical mass' behind community efforts, influencing policy and legislation and using data and evaluation to identify areas of intervention (Cohen et al., 1999).

The severity of risk also differs for subgroups of paraffin users. Interventions need to match their needs along a continuum of care. The public health approach segments users into three phases, primary prevention, early detection, and treatment, care and support. Primary prevention is applicable to the majority of users who have not necessarily experienced adverse consequences and should form the thrust of intervention strategies through among others awareness raising, knowledge transfer and skill building. Early detection is aimed at users who use paraffin in risky ways - store paraffin on ground level, leave stoves unattended, move and refill stoves while in use etc. – but who are yet to experience the full extent of adverse events. Treatment, care and support are relevant to those who experience adverse events (indoor air pollution, poisoning, burns, fires etc.) as a result of paraffin use.

# Prepackaging of paraffin

The findings of this study support the ecological approach adopted by the Paraffin Safety Association of Southern Africa. There is ample empirical evidence to show that 'requiring safe practices, implementing safety standards and encouraging the use of safety equipment can prevent unintentional injury' (Cohen et al., 1999). It is clear that many of the dangers associated with paraffin use emanate from the inadequacy of the storage containers used and the poor quality of paraffin appliances. Dating back to the early 1990s, a number of studies have outlined the extent to which paraffin ingestions are responsible for poisoning particularly amongst children under five (Krug, 1994; Malangu et al., 2005; Violari et al., 1991). Failure to prepackage at the point of manufacture also results in contamination of paraffin with other products (such as petrol) due to multiple points of decanting along the supply chain. This contamination inevitably increases the potential for the rapid spread of fires.

More than a decade has passed since public health specialist began advocating for the prepackaging of paraffin in child resistant containers with adequate labeling. In 1994, Yach (1994) concluded that efforts to prevent paraffin ingestions needed to go beyond education. He indicated that partnerships were required between consumers, producers and public health officials to lobby for legislation that mandated the prepackaging of paraffin. In fact an intervention study in South Africa has demonstrated that the distribution of child resistant containers can reduce the incidence of paraffin ingestions by almost half (Krug, 1994). Similar evidence from the US and the UK in the 1970s has demonstrated that the introduction of child resistant containers and legislation that mandates their use can reduce incidents of poisoning by up to 70 percent (see (Medical Research Council & University of South Africa, 2003).

Participants in our study reported multiple incidents of paraffin poisoning and strongly supported the need for prepackaging of paraffin. While legislation needs to balance safety against affordability, any subsidization for the prepackaging of paraffin will dwarf the externality costs of paraffin use, currently conservatively estimated at R104.564 million – 50 times higher than the turnover of R2.1 million in annual paraffin sales (National Treasury Report, 2003). One of the recommendations of the Treasury Report of (2003)

on energy use and a recent MRC–UNISA Policy Brief on safe packaging (Matzopoulos, Carolissen, Jordaan, Austin, & Jamieson, 2007), is that paraffin should be prepackaged in child resistant containers to prevent contamination through decanting, and decrease accidental ingestions and other negative health effects. And SABS safety standards do exist for the packing of paraffin in dedicated containers with child resistant safety caps and appropriate labeling of hazardous material. However, these standards have not been legislated and hence are not enforceable by law.

## Safety standards for paraffin stoves

Participants in the study were well informed of the inefficiencies of and dangers associated with paraffin stoves. They spoke elaborately of their frustration, inconvenience incurred and social, health and economic consequences of using paraffin stoves. Against their better judgement, users are forced to place affordability above safety concerns. Weighed up against the immediate risk of ruining a meal and in some cases going hungry, participants underplay the potential risks associated with paraffin stoves (such as moving or refilling the stove while burning). Yet they have intimate knowledge of the devastation caused by them.

Participants related innumerable incidents of burns and runaway fires as a result of exploding stoves, often resulting in injuries and loss of property. They were critically aware of the inefficiency and poor quality of wick stoves but had little choice in using them because of affordability reasons. In fact, a study on burn injuries at a hospital in the Western Cape reported that paraffin stoves, particularly wick stoves, were implicated in 25 percent of admissions to the burns unit (Steenkamp, van der Merwe, & de Lange, 2002). Twenty four of the thirty eight cases reported were as a result of flame stoves (non-pressure or wick stoves) exploding. Similarly, participants in a study in rural South Africa expressed concerns about accidents due to malfunctioning paraffin appliances (Madubansi et al., 2006).

Tests conducted on the most popular paraffin stoves showed that they do not meet South African Bureau of Standards (SABS) safety recommendations (Paraffin Safety Association, 2006). Six of the nine stoves tested emitted between two to four times the amount of carbon monoxide deemed safe. All wick stoves burst into flames when knocked over, five of them leaked paraffin when lying on their side, and some even leaked paraffin during normal use. Temperature of paraffin in the stove exceeded 80 degree Celsius, well above its flash point (43 degree Celsius), creating conditions for paraffin to ignite easily. Stoves were also not accompanied by instructions or directions for their use.

Similarly, experiments conducted by Lloyd (2002) on wick stoves showed that within an hour of use, the temperature in the fuel tank easily exceeded the flashpoint of paraffin and that only gentle movement was sufficient to produce fire. Furthermore, when the stove was knocked over, it resulted in a massive fire. Attempts to douse the fire with water merely exacerbated the fire. The stove used in the experiments contained less than a litre of paraffin but was consumed by the fire in the first 30 seconds after the appliance was knocked over, probably because of paraffin's low viscosity.

The weaknesses of stoves reported by participants in our study offer 'real life' testament to the 'official' tests conducted on paraffin stoves. The SABS standards to regulate the safety of stoves, drawn up almost two years ago, were promulgated in November 2006 and became compulsory on the 01 January 2007 (Department of Trade and Industry, 2006). SABS standards as outlined in SAN 1906:2006 Edition 2.1 sets the following standards for wick stoves: prevention of leakage of fuel, self-extinguishing within 30 seconds if knocked over, fuel tank should not overheat, restriction of harmful emissions, durability of the appliance, prohibition of filling when in use, appliance cannot burst into flames when knocked over and, the appliance must be accompanied by safety instructions concerning its assembly, safe use, maintenance and operation.

The enactment of legislation to enforce safety standards for wick stoves represents one of the most viable and perhaps cost-effective strategies to improve the safety of paraffin use. And SABS have signaled their intention to enforce the legislation through a 'name and shame' campaign if manufacturers fail to adhere to the compulsory safety standards (Paraffin Safety Association of Southern Africa, 2007). None of the wick stoves currently in the market meet the safety specification and thus their sale is illegal but they continue to be available in major retail and smaller stores. Pressure groups such as the Paraffin Safety Association of Southern Africa must continue to advocate and lobby for resources to be made available to create awareness of the law and monitor its implementation. Furthermore, despite the availability of safety specifications for pressure stoves (SANS 1243), manufactures have not self-regulated to ensure the health and safety of users (Paraffin Safety Association of Southern Africa, 2007). Hence advocacy and lobbying is also required to enact safety standards for pressure stoves.

## Partnerships for health education

Interventions to regulate the supply chain, need to be supported by a comprehensive education campaign undertaken in partnership with consumers, retailers, health workers, schools and other key stakeholders. Such partnerships are not only vital because of the diversity and unregulated nature of the supply chain, but also as a mechanism to provide consistent and correct information to end-users. These partnerships also support the notion that health and social challenges are best addressed when all sectors of the community share responsibility for the solutions (Cohen et al., 1999).

#### Community education

In spite of the failure of institutions and systems to educate the public on paraffin safety, participants have over the year's accumulated substantial knowledge on the dangers of paraffin use as well as safety practices. Through personal experience – sometimes with deleterious consequences - and that of family, friends and neighbours in the community, participants have learnt to prevent and mitigate the risk of paraffin use. In the face of poverty, they have come up with creative solutions to optimize the longevity of paraffin appliances and even offered viable ways to improve the design and safety of paraffin stoves.

Given the level of interpersonal and intrapersonal learning that has taken place, many participants recommended discussions led by community members as the most appropriate strategy to provide paraffin safety education. In fact several studies have reported on the effectiveness of community education, involvement and mobilization as a health promotion strategy for a range of health behaviours (Ramirez-Valles, 2002; Tate et al., 2003; Marsh, Mutemi, Some, Haaland, & Snow, 1996; National Cancer Institute, 2005). Such community education not only provides new information to individuals but also rallies the community to adopt healthy behaviour, change norms and advocate for

policy shifts (Cohen et al., 1999). In addition, as significant knowledge transfer takes place through the influence of significant others (parents, family, friends and neighbours) and through vicarious learning, some of the constructs of the psychosocial theories (National Cancer Institute, 2005) focusing on the importance of social influences through social norms, direct pressure or support and perceived behaviour of significant others, would also provide a useful theoretical framework for programme development.

Participants also indicated that community education should be supported by more traditional awareness raising through various media such as radio, television and information leaflets. In fact, mass media is widely used for community education and can be used to build support for injury prevention issues by capturing community involvement (Cohen et al., 1999). Such media advocacy could play a critical role not only for individual and community level behaviour change but also for advocating changes in policy.

## Health education supported by home visits

Despite awareness of the risk of ingestions, most participants in our study indicated that they store paraffin on ground level. An intervention study to prevent paraffin ingestion also reported that 85 percent of participants continued to store paraffin on the floor even after receiving health education messages (Krug, 1994). Similarly, many participants in our study left stoves unattended despite awareness of the risks involved and in fact experiencing adverse events. Low income households are often overcrowded, have limited infrastructure, and may face practical constraints in translating their concern into action (Krug, 1994). Mothers living in these circumstances - who bear the primary responsibility for purchasing and using paraffin - are also under significant pressure to meet multiple priorities.

Studies have shown that chronic depressive symptoms and particularly deprivation amongst mothers may influence their adoption of safety practices in the home (Leiferman, 2002; Mulvaney & Kendrick, 2006; McLennan & Kotelchuck, 2000). Under these circumstances, as an early detection strategy, health education may be more effective when accompanied by home visits to reinforce implementation and to devise creative but safe alternatives to overcome infrastructural and other barriers. In fact studies have shown that home visiting programmes can have sustainable effects in reducing the rate of childhood injuries (Elkan et al., 2000; Roberts, Kramer, & Suissa, 1996; King W et al., 2005). But health education needs to go beyond information dissemination to include skill building to institute safety practices. An intervention study in low-socioeconomic homes demonstrated that home visits to build maternal self-efficacy and modification of the home environment can decrease children's access to hazards (Hendrickson, 2005).

## Role of health workers

Despite awareness of the correct course of action when children ingest paraffin, mothers continue to feed children milk because of the logistic difficulties of getting to a hospital or clinic immediately. Paraffin ingestions rarely result in death, but only a small quantity (1 ml) is required to produce chemical pneumonitis (Govender, 2006), often resulting from aspirations because of induced vomiting. Despite the expansion in access to healthcare since 1994, with over 4 350 primary health care clinics now available (Policy Co-ordination and Advisory Services, 2003), patients still have to travel substantial distances to get to a health facility. Given these circumstances and the immediate need of parents to relieve distress amongst their children, healthcare workers must offer parents practical first aid strategies that can be implemented in the home without exacerbating paraffin-related injuries.

Pockets of misinformation still exist regarding the course of action when incidents occur. Yet it is also clear that increasing interaction with health personnel is impacting positively on help-seeking behaviour. Participants indicated that all victims of paraffinrelated injuries were taken to a clinic or hospital for treatment. However, this may not always be the case on a national level. A Markinor survey in 2001 (Biggs et al., 2001) reported that only 50 percent of children who ingested paraffin were taken for medical treatment, despite awareness thereof. As part of treatment, care and support, a more rigorous and sustained programme of action is required to dispel myths of the benefits of home remedies to treat paraffin-related injuries and reinforce the need for help seeking.

## Role of schools

Children are particularly at risk for paraffin-related injuries and despite parents' best attempts to protect them from paraffin use; they inevitably become users when they take on care giving roles in the home. Hence participants advocated that health education on paraffin use should begin in school. Discussions on paraffin use in school also present a viable opportunity to begin to destigmatize its use and its relation to poverty. Comprehensive interventions that include school-based programmes and community and policy level interventions have been shown to have long-term effects for various health-related behaviours (Bracht, 1999; Biglan, Ary, Smolkowski, Duncan, & Black, 2000; Perry, Kelder, Murray, & Klepp, 1992; Williams, Perry, Farbakhsh, & Veblen-Mortenson, 1999). The Life Orientation learning area within the South African school curriculum creates space for learners to be taught practical skills to cope with everyday life. As a primary prevention strategy, health education on the safe use of paraffin should be integrated into this learning area especially for learners from low socioeconomic areas.

#### *Role of retailers*

Participants in our study believe that retailers bear a responsibility towards consumers to ensure the safe use of paraffin. Yet retailers are regarded as callous and disinterested in the safety of consumers – trading a known hazardous product as routinely as any other regular consumable. A number of studies have shown that retailers can in fact become a useful access point for behaviour change programmes (Wildey, Woodruff, Keay, Kenney, & Conway, 1995; Dovell, Mowat, Dorland, & Lam, 1996; van der Feen de Lille et al., 1998). Education of retailers on the importance of safety caps, labeling of containers and correct storage of paraffin in the home, together with the distribution of safety material at the point of sale, can serve as an important interim measure before legislation for the prepackaging of paraffin is promulgated.

## **Alternate fuels**

A medium to long-term strategy to alleviate the externality costs associated with paraffin use is to transition users to safer, cleaner and more efficient fuels. Given the dangers associated with paraffin use, participants indicated that the transition to alternate fuels would be heavily influenced by the products safety profile. In addition, accessibility and affordability were also considered as important deciding factors.

## Liquid Petroleum Gas

A number of alternative fuels are being considered that address the concerns raised by participants in our study. The Minister of Minerals and Energy, in her budget speech of March 2005, indicated that government planned to transition both 'poor and rich' to using Liquid Petroleum Gas (LPG) for cooking and heating to reduce the demand for power generation (Mlambo-Ngcuka, 2005). Similar strategies are being promoted in a number of developing countries (Brazil, China, Sri Lanka, India) including African countries (Senegal, Botswana and Mali) through subsidization, establishing appropriate distribution networks and developing affordable appliances (National Treasury Report, 2003). In fact one of the kingpin factors for the success of a programme in Brazil to promote the widespread use of LPG was the provision of affordable appliances (National Treasury Report, 2003).

LPG is considered a viable alternative because it is clean, delivers energy efficiently and burns without releasing smoke or producing residual particulate matter (The Liquefied Petroleum Gas Safety Association of Southern Africa, 2005). Used in combination with electricity for lighting and powering other essential equipment, LPG can provide a cost effective, efficient and safe alternative energy supply (The Liquefied Petroleum Gas Safety Association of Southern Africa, 2005). In fact, the Energy Research Centre in Cape Town has indicated that promoting LPG as an alternative to electricity for thermal applications (such as cooking and heating) maybe more cost effective and sustainable for low income households (Howells, Victor, Gaunt, Elias, & Alfstad, 2006).

The current price of LPG and the start up costs of purchasing the cylinders are not conducive to the low cost environment, especially the need to purchase fuel in small quantities because of unpredictable income patterns. The Minister indicated that discussions were underway with the LPG association and steel producers to reduce costs (Mlambo-Ngcuka, 2005) and in fact a pilot project has been set up to test supply of LPG to 250 000 low income homes using subsidization models (The Liquefied Petroleum Gas Safety Association of Southern Africa, 2005). However, given the level of fear expressed

by participants towards the use of gas in our study and in others (Madubansi et al., 2006; White, 1997; Bank, 1997), coupled with their desire for a 'safer' product than paraffin (participants in our study believed that gas was more dangerous that paraffin), government's plan to promote LPG gas would need to be accompanied by an extensive education campaign and repeated demonstrations of its enhanced safety profile to encourage wider use. Furthermore, an extensive distribution network would need to be set up to ensure ready availability and accessibility. LPG gas is currently being imported into the country; alternative sources would have to be explored to guarantee constant supply and mitigate prohibitive costs of importation.

#### Ethanol gel

As part of an Africa-wide plan to provide sustainable energy sources, the Millennium Gelfuel Initiative was launched (Boris, 2004). Ethanol gel – commonly known as e-gel – is produced from sugar cane extracts and has been shown to be a safe alternative to paraffin use as it is non-toxic, non-explosive and renewable (Byrd & Rode, 2005). Because of its high viscosity, it also avoids the danger of rapid spread of fire when large quantities are ignited. Consumer acceptability studies of the gel and related stoves have been positive overall (Byrd et al., 2005). Participants reported that the gel emitted negligible quantities of smoke, did not have a strong odour and provided sufficient warmth for cooking and heating (Byrd et al., 2005). However, strategies will need to be devised to enhance the efficiency of the stove and the speed of cooking, expand distribution networks and possible subsidization will have to be considered to reduce the cost of e-gel and related appliances (Tanton, 2006). Lloyd and Visagie (2007) were not as optimistic about the potential of gel fuels to replace other low cost fuels. Through a series of tests comparing gel fuels to other cooking fuels, they reported that gel fuels showed little potential as a cooking fuel because they release significant amounts of pollutants and that they carry much less energy than other fuels thus requiring three times more gel for cooking than alternate fuels.

## Conclusion

As part of a national plan of action to promote development in the country, South Africa has expanded access to basic services. The supply of clean, safe, efficient and more convenient energy in the form of electrification is part of that plan. As such, electrification of homes have improved from 32 percent in 1994 to 70 percent by 2001 (Policy Co-ordination and Advisory Services, 2003). Government has also rolled out a plan to deliver 50kWh of free basic energy to low income households on a monthly basis. As a result, the use of other forms of fuel such as wood, coal and paraffin have been declining over time. Yet the bulk of research, tells us that a substantial percentage of low income households, continue to rely on a combination of fuels to meet their basic energy requirements. Chief among the determinants is the opportunity costs related to using electricity. Poverty alleviation is not only about providing access to services but also about enabling users to access the resources necessary to sustain usage. The unemployment rate and the depth and severity of poverty in the country are indicators that inefficient and unsafe fuels such as paraffin will continue to be used well into the future. While medium to long-term strategies are being investigated to transition the 'poor and the rich' to safer and more efficient forms of energy such as LPG, strategies also need to be put in place to enhance the safety profile of paraffin use.

Users are well aware of the dangers of paraffin use and associated safety practices but in an environment of limited choices see themselves as having no alternative but to use paraffin – often in risky ways. In a context of an unregulated supply chain and a complex interplay of determining factors, what are some of the strategies that can have wide-scale impact on enhancing the safety profile of paraffin use? Four to five decades of public health research tells us that there is no 'magic bullet' and that education alone is insufficient to produce sustainable behaviour change. Studies have shown that an integrative or comprehensive approach that also changes the social, physical, policy and economic environments maybe more effective.

The bulk of the externality costs associated with paraffin use can be attributed to the failure to prepackage paraffin in child resistant containers and to regulate the standards of paraffin appliances. The evidence for the link between paraffin poisoning and failure to

prepackage are clear, as is the evidence for the link between the innumerable incidents of burns and fires and the poor design and quality of paraffin stoves. SABS standards to regulate the packaging of paraffin exist, but remain as recommendations and as such cannot be enforced. As an urgent public health policy intervention, perhaps one of the most cost effective strategies, extensive advocacy and lobbying is required to promulgate legislation that mandates the prepackaging of paraffin in child resistant containers.

Legislation to regulate the design and quality of wick stoves and heaters were promulgated in November 2006 and became compulsory on 1 January 2007. To date none of the wick stoves or heaters meets SABS standards. Hence, for all intents and purposes, the market remains flooded with illegal appliances. Continued advocacy and lobbying is required to create awareness of the legislation amongst community members and to ensure that resources are made available to enforce and monitor implementation of the legislation, as manufactures have been timeously informed of the impending legislation.

These policy level interventions need to be supported by a comprehensive education campaign at the individual, family, school, organizational and community levels. Community education and community mobilization, supported by traditional forms of awareness raising, maybe the most appropriate strategy to encourage intrapersonal and interpersonal learning and for the community to take ownership of the challenges associated with paraffin use. Given the stress associated with chronic condition of poverty, such education may be ably supported by home visits to reinforce implementation of safety practices within the constraints and available resources of users' living environment. But education needs to be taken beyond the home to include prevention education at the point of sale and in schools. The latter is particularly important to start to destigmatise paraffin use and its relation to poverty. At the treatment end of the continuum of care, a rigorous programme of action is required to correct misinformation on the benefits of some home remedies, to provide practical first aid that can be implemented in the home before patients can reach a health care facility, and to reinforce the need for help-seeking behaviour.

# Limitations

While the qualitative nature of the study facilitated the exploration of the range of responses on paraffin use, the study cannot offer generalisability. However, it must be noted that the validity of the findings are supported by the similarity of responses obtained across the nine focus group discussions and with the findings of other qualitative and quantitative studies conducted in similar settings. To generalise the findings, the study must be used to develop survey research instruments.

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# Appendix 1: Focus group discussion guide

# **Opening and Introductions**

- Welcome and introductions of key role players in the study and participants
- Provide a brief overview of the study
- Explain the purpose of the discussion and what will be done with the information
- Provide a brief overview of the process and invite questions
- Ensure that everyone understands about informed consent
- Emphasize group confidentiality
- Establish group rules e.g., respect one another, speak one at a time to capture information on tape, no right or wrong answers etc.

# **Opening question**

Tell us briefly about yourself and your family?

### Probe

- type of home
- how many people live in your home?(weekdays, weekends, different times of the day)
- no. of children and their ages

## 1) Types of fuels used

I want to begin by finding out about the range of fuels that you use in your home e.g., electricity, coal etc.

### Probe

- knowledge of range of fuels available (pros and cons of each)
- source of information on range of fuels
- purposes for which fuels used (e.g., heating, cooking, lighting)
- reasons for choice of fuel for a particular purpose (during typical month, season etc.)

# 2) Purposes for paraffin use

Now, let's focus on paraffin use. Tell us about the purposes for which you use paraffin in your home?

### Probe

- heating, cooking, lighting, hygiene, medical purposes, household cleaning purposes
- reasons for choice of paraffin over other fuels
- duration and frequency of usage

What do you regard as the advantages and disadvantages of using paraffin?

### Probe

- risks (fire, ingestion, burns, inhalation)
- stigma associated with use

## 3) Access to paraffin

Describe the procedure that you follow when you need to buy paraffin?

#### Probe

- where purchased, how decanted by wholesaler, quantity and frequency of purchase
- whose responsibility to buy
- type of container used (make e.g. coca cola bottle, type of cap used, clear labelinglanguage vs. signs)
- safety information given at point of sale
- storage procedure in the home (out of the reach of children)

# 4) Paraffin appliances

Let us now focus on the various appliances in your home that make use of paraffin?

### Probe

- type of appliance used e.g. stove, lamp, heater etc. and reason for choice
- where purchased
- cost and duration of usage/life span
- whose responsibility to operate and maintain

- special precautions taken when using appliance
- safety information provided with stove

### 5) Adverse consequences

I now want to discuss some of the difficulties that you've experienced or can expect when using paraffin?

### Probe

- past experiences with ingestions, fires, burns etc.
- awareness of risks and perceived susceptibility
- knowledge of steps to follow in case of paraffin injury
  - burns
  - ingestions
  - indoor air pollution (understanding of indoor air pollution)

### Risks associated with appliances

Let's now focus on a particular situation. Suppose you were cooking outdoors to prevent over-heating a small room, but it becomes cooler and you want to continue cooking inside the room. What would you do?

#### Probe

- move the stove while it is burning
- switch it off
- place the stove on board and move it

Let's look at another situation. Tell us how you go about refilling your stove when the paraffin is used up before the cooking process is complete?

#### Probes

- pour paraffin into the stove using a cup or funnel
- switch off and refill once stove is cold, using funnel

We know that paraffin appliances can be dangerous and sometimes explode. Can you think of ways in which we may redesign the stove to improve its safety?

#### Probe

• device to shut stove off when it is moved

## 6) Safety practices

As you mentioned earlier, paraffin can be a dangerous substance. Tell us about the things you do in your home to prevent paraffin-related accidents or injuries.

### Probes

- secure storage (place, container)
- only under adult supervision, extinguish when not in room
- only paraffin used on paraffin appliances, use a funnel, placed on level surface, no tablecloth
- sufficient ventilation, dry sand available to douse fire

# 7) Information about paraffin safety

Let's talk about safety information that you have received or seen on paraffin safety?

#### Probe

- usefulness
- source of information
- provider (person)
- delivery format

What would you suggest be done to educate the community on paraffin safety?

#### Probes

- health education campaigns (whose responsibility, best provider, delivery format)
- safety information at point of sale
- warning labels on containers and appliances
- better designed appliances
- alternative fuels

# 8) Alternative sources of fuel

Suppose an alternative to paraffin became available. What would convince you to switch over to this new source of fuel?

- awareness
- price
- accessibility
- safety

## **Summary and Closure**

Facilitator makes a summary of key points.

An opportunity to add or to change anything will be given before closure.

Facilitator emphasizes group confidentiality.

Facilitator thanks everyone for their participation.