Paraffin-related injury in low-income South African communities: knowledge, practice and perceived risk

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Introduction

Paraffin, also known as kerosene, is among the most frequently used fuels for cooking, lighting and heating among people living in low-income communities lacking electricity in low- and middle-income countries. Paraffin is relatively inexpensive to produce and consume and a wide range of appliances are equipped to burn it, but it can endanger human health from burns and poisoning.

Risks

Paraffin is highly flammable and can lead to fires originating from malfunctioning paraffin appliances; improper placement of appliances (e.g. near curtains or tablecloths); use of polluted paraffin (since paraffin is highly explosive when mixed with water or other fuels); use of paraffin by children or intoxicated individuals; homicide, assault, suicide or arson attempts; and many other causes. Fires can be particularly dangerous in low-income urban communities, where dwellings are densely located and constructed of flammable materials such as wood and cardboard.

Young children are at greatest risk of paraffin poisoning. Because paraffin has the consistency and appearance of water and in some places is stored in reused beverage containers without child-resistant

caps, unsupervised children are at high risk of consuming it.

Epidemiologists have long documented the risk of paraffin-related burns and poisoning. The earliest reports came from the United States of America in the 1940s;[1,2] however, as electricity became more widely available in that country and paraffin use dropped, poisonings and burn injuries decreased. In the 1980s, reports of paraffin-related injury were published based on data from Barbados[3] and Saudi Arabia.[4] Over the past 15 years, epidemiological data from Egypt,[5,6] India,[7,8] the Islamic Republic of Iran,[9] Jordan,[10] Kenya,[11] Malawi,[12] South Africa[13] and Sri Lanka[14] have shown that the risk may be greatest in Africa and southern Asia. In most cases, paraffin is cited as particularly dangerous to children; for example, it accounts for about 60% of paediatric poisonings in Kenya[11] and South Africa.[15]

Beliefs and behaviours

Little is known about the beliefs and behaviour of individuals at risk for paraffin injury. To develop safety-related interventions, it is critical to understand what people know about safety in a particular domain, how serious they perceive the risks to be, and what they do to protect themselves and their families from those risks. According to theories of health-related behaviour change, individuals change their behaviour only when they understand the existing risk, perceive it to be alterable, perceive few and manageable barriers to changing the risk, and believe the benefits to reducing it are worthwhile.[16] The most detailed information to date about these aspects of belief and cognition in populations at risk for paraffin-related injury was obtained through focus groups with parents and childcare professionals in low-income South African communities.[17] Participants recognized that the risks for injury were multifaceted. However, parents tended to focus on environmental risks, whereas childcare professionals suggested that poor parental supervision was to blame for many children's injuries. Safety-related knowledge and practice were not carefully explored.

The present study

This study was designed to extend the findings from the South African study[17] by posing four questions. First, what do at-risk individuals know about the risks of paraffin-related injuries? Do they know what to do to protect their families from paraffin-related burns and poisoning? Second, do at-risk individuals perceive a significant risk of injury, and how do they reduce that risk in their homes? Third, do individuals with greater knowledge and safer practices perceive a greater risk of injury? Finally, do basic demographic traits – age, sex, education and income –

influence knowledge, practice and risk perception in people at risk for paraffin injury? Although a few successful paraffin safety interventions have been implemented,[18,19] we believe that information about knowledge, safety and perceived risk among at-risk populations would be valuable in developing empirically supported intervention programmes.

Methods

Setting and participants

Participants were recruited from 2 July to 18 September 2007 from two low-income housing districts near Cape Town, South Africa – Phillipi (on the Cape Flats, a plateau area located east of Cape Town) and Du Noon (in the northern suburbs). These communities were chosen because they were receptive to the research and because they were at a distance from one another, so they represented two different subsamples near Cape Town. Each community had about 5000 inhabitants, and neither had any known history of organized paraffin safety interventions.

Data were collected verbally during visits to the participants' homes by teams of two trained researchers working together, at least one of whom spoke Xhosa, the primary language in the community. Homes were randomly selected within lower-income sectors of the communities, where paraffin usage was higher. Since women are more likely to be children's primary caregivers (and protectors from injury), the female head of the household was asked to participate. If she was not available or refused consent, the male head of the household was asked to participate, followed by other adults in the home. One adult in each household participated in the study; in the rare instance in which the head of the household was a minor (under 18 years of age by South African law), the household was deemed ineligible.

The consent and participation rate among the randomly selected homes was 95.2% (238/250 homes). As shown in Table 1, the sample was 81.5% female, had a mean age of 30.2 years (range: 18–65) and had a mean of 9.3 years of formal education (range: 0–12). Many homes (65.3%) included children, and the number of children in those homes ranged from 1 to 7 (mean: 2.0; standard deviation, SD: 1.2). All participants identified themselves as black apart from one, who identified himself as "coloured", a term that usually refers to mixed black and white ancestry in South Africa. (Note: The formal division of South African citizens into racial categories was repealed by the national Parliament in 1991, and the authors of this article strongly support

equality between individuals of all racial and ethnic backgrounds.) Participants were given the option to complete the research in English, Afrikaans or Xhosa; all chose Xhosa except for two, who chose English. Materials were translated using standard translation and back-translation procedures.

Table 1. Demographic and household data for participants (*n* = 238) in a study of paraffin-related knowledge, practice and perceived risk of injury, Cape Town, South Africa, 2007html, 4kb

After the study was completed, participants were given a small financial compensation (about which they were not informed until the end of the study for ethical reasons). All research was approved by appropriate institutional review boards, and all participants gave informed consent to participate.

Measures

Demographics

Participants responded to a brief demographic survey.

Knowledge assessment

We developed and used an 18-item questionnaire to assess knowledge about the dangers of paraffin, the ways to prevent paraffin-related injury, and the first aid to be applied in response to paraffin-related injury. Because some participants were not fully literate, the questionnaire was administered orally. The number of correct items was summed to obtain a score ranging from 0 to 18 (for some items, “partial” credit – e.g. 0.5 points – was awarded for answers that were correct but not optimal).

Home inspection

To assess paraffin safety practices, researchers thoroughly inspected participants’ homes and collected information on 17 practices related to how paraffin, paraffin appliances and paraffin-related materials were stored and placed in the household. This inspection, to which all participants consented, was conducted at the same time as other data collection and by the same trained research team. The researchers used a check sheet on which they checked “yes” or “no” for each safety practice. Sample items include the type of vessel(s) used to store paraffin in the home (e.g. jugs with child-resistant caps versus reused beverage bottles); whether paraffin appliances were on stable surfaces out of reach from young children; and whether rooms where paraffin appliances operated were properly vented. When information could not be obtained through visual inspection (e.g. if paraffin was stored in

closed cabinets), researchers queried participants to gather more information. All items were objective and straightforward to score. For every item, 1 point was given for the presence of a safe situation and 0 points for its absence; points were then summed to yield a total score ranging from 0 to 17.

During the inspection, researchers also collected basic information about the physical structure of the home (e.g. number of rooms and beds).

Perceived risk

Perceived vulnerability to paraffin-related injury was explored through three items. Perceived fire risk was queried through the item, “In your opinion, what is the likelihood that a fire might occur in your neighbourhood over the next 6 months?” Perceived poisoning risk was queried through the item, “What is the likelihood, in your opinion, that a child might discover and accidentally drink paraffin in your home?” Both those items were answered on a 7-point Likert scale that ranged from “impossible” to “definite”. Finally, participants were asked, “What do you think is the leading cause of death for toddlers in your community?”

Statistical analyses

Statistical analyses proceeded in three steps. First, we examined the descriptive data surrounding paraffin-related safety knowledge and practice and the perceived risk of paraffin-related injury. Second, we considered bivariate relations between knowledge, practice and perceived risk using Pearson correlation. Third, we determined whether knowledge, practice and perceived risk varied across demographic subgroups using Pearson correlation.

Results

Table 1 presents descriptive data. As expected, participants were predominantly female, poorly educated and living on a low income (the mean income of 2.7 on the 8-point scale reflects an average of about 1000–1500 South African rands per month, equivalent to US$ 150–200 at the time of the study). An average of 2.3 adults and 1.3 children lived in the participants’ homes.

The homes themselves were modest. Almost none had running water and most were constructed of some combination of tin and wood. They averaged 2.0 rooms and 1.4 beds. Although more than 80% of participants had electricity in their home – often through illegal tapping

of community electricity sources – they also reported paraffin as their primary fuel for cooking (36.6%), lighting (27.4%) and heating (95.6%). Most (92.8%) participants reported daily paraffin use, and all but one reported at least occasional paraffin use.

On the knowledge questionnaire, participants answered a mean of 11.5 of the 18 items correctly, suggesting that they knew, on average, 64% of the basic facts about paraffin safety. Scores on the paraffin-related safety practice measure, as assessed by a home inspection, were less encouraging. On average, participants had in place only 6.3 (37%) of the 17 safety practices.

Participants perceived modest risk of a fire in their neighbourhood over the next 6 months (mean: 4.8, based on a 7-point scale in which a “4” refers to “possible” and a “5” to “likely”). They perceived some risk of a child being poisoned in their home (mean: 3.6, based on a 7-point scale in which a “3’ refers to “unlikely” and a “4” to “possible”).

When asked what the leading cause of toddler death in the community was, participants overwhelmingly (62%) cited the poverty and filth present in their environments, with paraffin the second most frequent response (17%) (Table 2).

> Table 2. Leading cause of toddler deaths in the community, according to participants (*n* = 238) in a study of paraffin-related knowledge, practice and perceived risk of injury, Cape Town, South Africa, 2007html, 2kb

Table 3 shows the results of Pearson correlations between paraffin-related safety knowledge, practice and perceived risk of injury. As expected, knowledge and safe practice were positively correlated with each other; more knowledgeable individuals engaged in safer practices. The perceived risks of fire and of poisoning were also positively correlated with each other. Knowledge was negatively correlated with the perceived risk of both fire and poisoning.

> Table 3. Pearson correlations between paraffin-related knowledge, practice and perceived risk of injury among participants (*n* = 238) in a study in Cape Town, South Africa, 2007html, 2kb

In our final analysis we explored how the demographic characteristics of the sample were related to knowledge, practice and the perceived risk of paraffin-related injury (Table 4). Several statistically significant Pearson correlation results emerged. Knowledge about paraffin safety

was positively correlated with years of formal education, number of children in the home and extent of use of paraffin. Surprisingly, paraffin-related safety practices did not correlate significantly with years of education, number of children in the home or paraffin usage. Instead, they were most closely related with participants' income.

Table 4. Pearson correlations between paraffin-related knowledge, practice and perceived risk of injury and demographic characteristics and paraffin use among participants (n = 238) in a study in Cape Town, South Africa, 2007html, 3kb

The perceived risk of paraffin injury was related to only one demographic variable: the frequency of paraffin use. The perceived risk of fire and the perceived risk of poisoning were both negatively related to the frequency of paraffin use. This suggests that the more participants used paraffin, the lower their perceived risk of injury.

Discussion

Knowledge, practice and perceived risk

We chose to study knowledge, practice and perceived risk because understanding these factors is essential for developing interventions. The finding that people at risk of injury from paraffin know relatively little about paraffin safety is important because it suggests that interventions must not only change behaviour, but also educate individuals. Without basic knowledge about safe practices, people cannot possibly engage in them.

Paraffin safety practices were quite poor in the sample. This is not surprising because knowledge about safety was low, but safe practices lagged substantially behind knowledge. In other words, participants did not always practice safe behaviours even when they knew the safe thing to do. This result, similar to findings in other health-related research areas, suggests that people do not always practice healthy or safe behaviours, even when they know what they should do.[20,21] Health-related behaviour is difficult to change, but paraffin safety interventions should comprise the various mechanisms that have proved effective in other domains of injury prevention and health behaviour change. For example, early paraffin safety interventions have focused on normalizing safe paraffin practice (e.g. storage of the fuel on upper shelves) and making people feel more vulnerable to the threat of injuries in their own home.[18,19]

Perception of risk must be a primary target for behaviour change because people are only likely to change when they feel vulnerable. We

found that those at risk for paraffin-related injury perceive some degree of risk, which is promising, although perhaps still less than the actual threat, especially for fires.[13] Health-related behaviour change to increase paraffin safety is feasible if the perception of risk can be built on by giving individuals the requisite knowledge and resources to make suggested changes and by convincing them that change will be beneficial.

Health risks to toddlers

When asked about the leading cause of toddler deaths in their communities, most participants mentioned poverty and filth. Data from Statistics South Africa support participants' impression. Intestinal infections are the leading cause of death among children aged 1–4 years in South Africa (23.6% of deaths in this age group), followed by influenza and pneumonia (12.8%) and then by non-natural causes, most of them unintentional injuries (9.5%).[22]

Interelationships

We found that individuals with a greater knowledge of paraffin safety had safer practices and perceived less risk, but that safer practices were not significantly related to changes in perceived risk. In one way, these findings are logical – one might imagine that greater knowledge leads to safer habits and to a concomitant perception of reduced risk, probably accurately so. On the other hand, the association between greater knowledge and a lower perception of risk is contrary to leading theories of health-related behaviour change, such as the health belief model.[16] Such theories suggest that greater knowledge will lead to a greater perception of health-related risk. There are several possible explanations for this. First, the health belief model was developed and tested primarily in people from developed countries and may not apply as strongly to those from less developed ones, such as South Africans whose native language is Xhosa. For example, native South African populations are more likely than people from other cultures to have an external locus of control.[23] If paraffin-related injuries are perceived, at least partially, to be due to external, uncontrollable causes, then safety-related knowledge may have a lesser effect on the perception of vulnerability to injury. A second possible explanation is that the health belief model was developed and tested primarily for explaining behaviour around disease prevention rather than injury prevention. It is unclear whether the model applies to injury prevention as strongly as it does to disease prevention.

Research is needed to explore more carefully the relations between

knowledge, practice and perceived risk of paraffin-related injury. In particular, researchers should consider the extent to which increased knowledge leads to changes in perceived risk, and whether those changes are helpful in developing effective intervention strategies.

Demographic correlates

As expected, individuals with higher levels of formal education knew more about paraffin safety practices. In addition, individuals with greater income had safer paraffin-related habits, perhaps because financial resources are needed to implement many safety practices (e.g. using proper storage containers for paraffin; using well-functioning appliances; and having flat, elevated surfaces on which to place appliances and store paraffin). We also found positive correlations between knowledge about paraffin safety and both the use of paraffin and the number of children: that is, individuals who used paraffin more often and had more children had a better understanding of safety practices. This is encouraging because these individuals are also those at greatest risk. Unfortunately, those same variables did not correlate with safer practices, perhaps because families who use paraffin more often and who have more children are also more likely to lack financial resources and are thus unable to implement the safety-related changes they know they should adopt.

We found negative correlations between paraffin use and the perceived risk of paraffin-related injury. Individuals who used paraffin more often perceived less risk from its use. For interventions to succeed, ways of changing the perceived vulnerability of individuals to paraffin-related injury must be found. Such change might occur through the sharing of paraffin-related injury experiences by neighbours and friends, through strategies designed to increase at-risk individuals' sense of control over the perceived risks, or through changes in community norms.[18]

Implications for policy

Paraffin safety is a significant public health problem in South Africa and much of the world. Our results suggest that at-risk people know little about how to keep themselves safe and that they engage in many unsafe practices in connection with paraffin use. Policymakers should develop strategies to educate citizens through curricula and programmes at schools and adult education centres,[24] through mass media outlets (e.g. radio advertisements, posters) and through investment in empirically supported, community-based educational campaigns.[18,19]

At the same time, we must recognize that it is very difficult to change the behaviour of all individuals. Therefore, there is a need for government-level interventions on the ways paraffin and paraffin-powered appliances are manufactured, processed, packaged and used. Standard SANS 1906:2006 for non-pressure paraffin appliances, which was made compulsory in South Africa in 2007, offers an example of legislation that can have a broad-ranging effect on paraffin safety.[25]

Conclusion

To our knowledge, this report represents the first exploration of the knowledge, practice and perceived risk of paraffin use among a sizable sample of low-income individuals who use paraffin. We discovered relatively low levels of safety-related knowledge and even lower levels of safety-related practice in our sample. These findings emphasize the urgent need for intervention development and implementation. ■

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