

Paraffin (kerosene) poisoning in childhood — is prevention affordable in South Africa?

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Paraffin (known in some Western countries as kerosene) ingestion is the most common form of acute childhood poisoning in most developing countries. South African black communities reflect a similar pattern, yet the true size and cost of the problem are not known. Without such baseline data the effect of interventions cannot be evaluated.

The aim of the study was to determine the incidence and treatment cost of paraffin poisoning in the Cape Peninsula, to identify high-risk areas and to discuss which measures offered the most economical and best preventive potential for this paediatric hazard.

A 12-month retrospective study was undertaken in 1990. Relevant patient data were extracted from the files of 6 major Cape Peninsula hospitals. Treatment costs were calculated based on differential hospital costs per inpatient per day, with outpatient costs at one-third of the costs per day. Age-specific rates for affected residential areas were calculated to identify high-risk areas. A total of 436 children (62,5% male), mostly between the ages of 12 and 36 months, were treated at an estimated cost of R111 673. This amount would have been sufficient to provide 95% of households in the 8 identified high-risk areas with child-resistant paraffin containers. In these areas age-specific paraffin poisoning rates ranged from 1,8/1 000 to 7,7/1 000. Strategically planned interventions can be cost-effective when weighed against the treatment cost of cases of paraffin poisoning.

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Paraffin (kerosene) poisoning occurs mainly in small children. They drink it mostly during summer months, mistaking the paraffin for water or lemonade. It exercises its noxious effect not by direct toxicity but by causing bronchopneumonia.

Paraffin ingestion is the most common form of childhood poisoning in most developing countries.¹ The aetiology of acute poisoning in black communities in South Africa reflects this pattern,²⁻⁴ where paraffin accounted for between 61%¹ and 82%² of recorded poisonings in childhood. The pattern differs slightly in those hospitals serving a wider mix of population groups, where paraffin poisoning typically ranks second to drug-related poisoning, i.e. all types of medicines found in the home. At Red Cross War Memorial Children's Hospital, for example, medicines accounted for 40% of all poisonings seen in 1990, while paraffin accounted for 30%.

Whereas Western countries report a steady decline over the last 18 years in the deaths of children under 15 years from poisonings in general,^{5,6} the true size of the problem of paraffin poisoning is unknown in South Africa. Since the plea for action by the Child Accident Prevention Foundation of Southern Africa, supported by the SAMJ in 1986,⁷ some preventive actions such as radio broadcasts, poster campaigns and pamphlet distribution have been undertaken, yet no baseline data exist to evaluate such intervention strategies.

In this article the size and treatment cost of paraffin poisoning in the Cape Peninsula in 1990 are described. The aims are to identify those residential areas with particularly high risks and to weigh up treatment cost against the cost of targeting prevention to such areas.

Materials and methods

A retrospective study was done to determine the incidence of paraffin poisoning in the Cape Peninsula during 1990. Six hospitals were visited and relevant data collected from their patient records — Tygerberg Hospital and Red Cross Hospital (academic hospitals), and Victoria, False Bay, Conradie and Woodstock Hospitals (secondary level service hospitals). Groote Schuur Hospital was omitted as its childhood poisonings are routinely transferred to Red Cross.

Tygerberg Hospital data were accessible from a register of all poisonings. We noted the race, sex, age and length of hospitalisation of patients treated for paraffin poisoning.

Red Cross Hospital provided patient data only and extrapolation therefore had to be made in order to facilitate comparisons with other data. Length of hospitalisation, for instance, was estimated at 1 day only for all inpatients as this information was not available. At the remaining hospitals all poisoning case folders had to be drawn manually to determine whether poisoning was due to paraffin and in which urban area the incident occurred.

Although great care was taken to trace patients, the total reached is a conservative figure. It is known that many cases are erroneously diagnosed as straightforward pneumonia. This happens particularly where delay occurs between paraffin ingestion and hospital attendance. Furthermore, parents do not necessarily associate subsequent respiratory problems with the paraffin incident and may even be unaware that paraffin has been ingested. In such cases the clinical and radiological picture would be one of pneumonia and the diagnosis would have been recorded as such.

To determine rates for specific areas, the 1990 population estimates based on the 1985 census for the Cape Town municipal area were used in conjunction with 1990 Regional Services Council figures for the metropolitan area of Cape Town. The criterion was that the population figures for the local authority closest to the specific area were given preference, e.g. Lingeletu Town Council figures for Khayelitsha. Furthermore, only areas that had recorded 11 or more paraffin poisoning cases were included in screening for high-risk areas.

The cost of treatment was calculated, based on the general average day cost per patient for 1990 per specific hospital as determined by the Directorate of Hospital Services of the Cape Provincial Administration. Outpatient cost was calculated at one-third of the inpatient cost at each particular hospital.

Results

Size of the problem in the Cape Peninsula

In 1990, 436 children were treated for paraffin poisoning at 6 Cape Peninsula hospitals. The majority of patients (308) attended Red Cross Hospital, a figure 2,7 times higher than that recorded during 1983. Tygerberg Hospital recorded 102 cases. Victoria Hospital treated 13 patients, False Bay 7, Conradie 5 and Woodstock Hospital 1.

Race and sex distribution

Of the 436 children with paraffin poisoning, 288 (66%) were black and 99 (23%) coloured. Only 4 patients (1%) in the series were white. Paraffin poisoning occurred more frequently (62,5%) in boys.

Age distribution

From Fig. 1, it is clear that paraffin poisoning in the Cape Peninsula occurred mainly in children under 3 years of age and notably in the 12 - 36-month-old group. This trend is confirmed by data from other sources^{1,4} and has important implications for preventive measures.

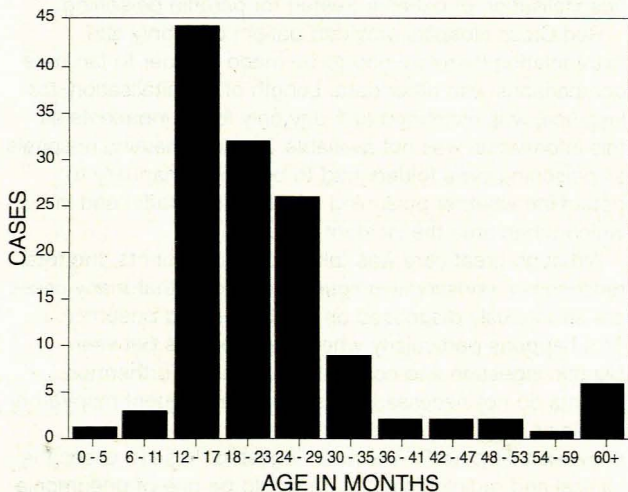


Fig. 1. Ages of patients in months.

Seasonal distribution

Paraffin poisoning in the Cape Peninsula occurs mainly during the summer months: Fig. 2 shows marked peaks during January, March, November, April and October. With the exception of July, the winter months showed a lower frequency. Other researchers have recorded the same phenomenon.^{1,2,4}

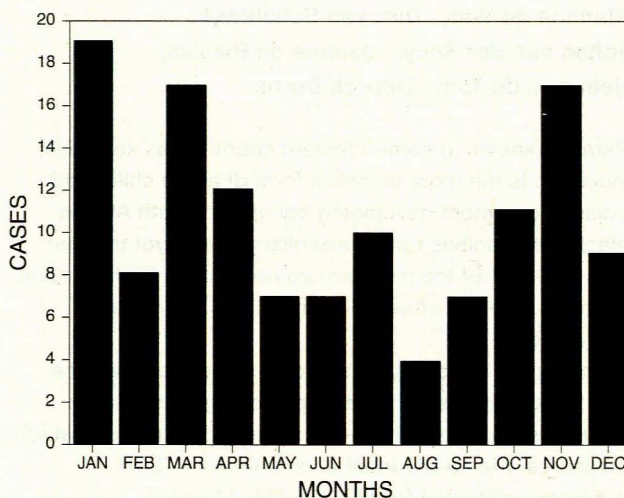


Fig. 2. Seasonal distribution of paraffin poisoning.

Geographical distribution and specific rates in high-risk areas

In all, 47 residential areas yielded cases of paraffin ingestion. Paraffin poisoning is a childhood problem and almost exclusively limited to those under 5 years of age; the age-specific rate for areas which recorded 11 or more cases was therefore computed (Table I). The population of children aged under 5 years had to be calculated from the information of the 1985 census. The extrapolation was based on the assumption that the proportional population structure (and therefore also the proportion of those aged under 5 years) had remained the same since 1985. The data show that 8 areas have particularly high age-specific rates for paraffin poisoning and these areas alone accounted for 284 (65%) of the 436 cases of paraffin ingestion recorded in 1990.

Table I. Age-specific rate of paraffin poisoning per 1 000 children under 5 years of age

Area	Population < 5 yrs	No. of cases	Rate
Kraaifontein	1 420	11	7,7
Uitsig	1 562	11	7,0
Guguletu	8 320	46	5,5
Nyanga	21 376	57	2,7
Manenberg	4 568	12	2,6
Khayelitsha	44 012	107	2,4
Langa	9 284	21	2,3
Elsies River	10 661	19	1,8
Total		284	

Cost of treatment

Our data showed fairly short hospital stays. No fewer than 199 (47%) of the patients were treated on an outpatient basis. Fifty-four per cent required admission to hospital, the majority staying for only 1 day. A smaller number — 31 (7%) — was admitted for 2 days or longer. Admission periods recorded in the literature vary between 2 and 5 days,² and are generally shorter than 1 week.⁴

The daily cost per patient varied between R144,00 and R410,00 during 1990, depending on the type of hospital (e.g. teaching/ non-teaching) where the patient was treated. The estimated total cost of treating the 436 patients in the Cape Peninsula in 1990 amounted to R111 673. This means that hospital treatment alone cost an average of R256,13 per patient with paraffin poisoning. Even this is an underestimate as it excludes the costs of subsequent follow-up attendances at outpatient departments and day hospitals.

Discussion

Despite the inherent weakness of this preliminary study, the findings are nevertheless highly relevant for the formulation of preventive strategies.

The data indicate that all black residential areas fell within the high-risk group, as did some of the poorer coloured areas. The high rates recorded for Kraaifontein and Uitsig may however have been boosted by population undercounts as a result of squatter influx and should therefore be interpreted with caution.

With 65% of all paraffin poisoning localised in 8 residential areas, intervention should strategically be targeted there. All other areas yielding cases of paraffin poisoning accounted for only 35% of the patients.

Paraffin poisoning is commonest in areas with limited or no access to electricity. It consequently means that mass media campaigns on television or radio are unlikely to reach parents or caregivers.

The typical victims of paraffin poisoning are under 3 years of age. They cannot read pamphlets or comprehend posters. Consequently these will not change their behaviour. This criticism has also been raised by others,⁸ and authoritative studies have shown that the educational approach, at all ages, is ineffective in reducing the incidence of and mortality from poisoning.⁵ The development stage of the victim also limits active experiential teaching and learning because taste and smell are known to be poorly developed at this age.

Some concerned authors^{7,9} have advocated mandatory labelling of paraffin bottles, *inter alia* with skull and crossbones. However, in other countries, controlled field trials¹⁰ and research aimed directly at determining the deterrent effect of poison hazard labels¹¹ have yielded most discouraging results. For example, the target age group appeared to be attracted, rather than deterred, by the labels. In their final conclusion the National Committee for Injury Prevention and Control recommended that such stickers not be used as a means of poisoning prevention.⁸

At this early age full protection is required. Methods that aim to achieve behavioural change are not the solution. Passive protection is necessary.⁵ *The measure with the best potential therefore remains a paraffin container which is*

difficult for the young child to open. This single measure is claimed to yield dramatic and permanent results with regard to childhood poisoning,^{5,6} and warrants serious consideration. We have a commercial tender indicating that R256,13 (the average treatment cost of 1 patient) can buy 300 child-resistant 1-litre containers. Total treatment costs furthermore equal the alternative expense of providing enough child-resistant paraffin containers for roughly 95% of all households (affected or unaffected) in the 8 areas of highest risk. If all areas where at least 1 child was poisoned by paraffin are taken into account, the treatment cost could still have provided 40% of households within that area with safe containers. Furthermore, if containers were durable and returnable, full coverage of all areas should theoretically be achieved over time. These conservative calculations have excluded parents' related transport costs and wage losses as a result of absence from work. Were these relevant expenses included, the financial case for safe containers would be beyond any dispute.

It must be kept in mind that arthritic or elderly people may also find safe containers too difficult to open; this in turn may lead to consumer resistance. On the other hand, no child-resistant container has been proven 100% childproof, i.e. given time, a young child may well succeed in opening it. The delay in access to the toxic substance may, however, be all that is needed for an adult to detect and stop the potential poisoning. It is clear that research into an acceptable design of child-resistant container is needed.

Given the immediacy of the problem on the one hand and the time needed to develop child-safe containers on the other, education of the potential victim cannot be shelved; it is best limited to puppet shows, however, where imitation of correct behaviour is age-appropriate and may have a positive effect. The outcome of such programmes should nevertheless be evaluated.

Because of the known positive effect of education, but the limited duration thereof, pamphlet and poster campaigns in the interim should be timed strategically for the early summer months when the risk of paraffin ingestion is at its peak. Such measures can be directed at parents, caregivers and older siblings.

Conclusion

Paraffin poisoning interventions, if strategically planned, can be cost-effective when weighed against the cost of treating cases of poisoning.

The most economic long-term intervention is to enforce legally the retailing of paraffin in reusable child-resistant containers. These should be SABS-approved and standardised across the whole paraffin industry. The interim use of child-safe tops to fit the glass bottles which the consumers offer to the retailer should be investigated. Consumer resistance needs to be addressed by pretesting the opening mechanism and design of tops and containers at community level, before large-scale distribution thereof. To date, all other campaigns, despite their cost and good intentions, have not had any proven success in reducing paraffin poisoning in childhood. It is therefore imperative that consumers' knowledge, attitudes and practice be tested pre- and post-campaign and that paraffin poisoning admissions for the area be monitored at the same time.

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