Health Systems Research

Competition: winning article

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Increasing the effectiveness of a latrines programme

As Mozambique's Improved Latrines Programme grows, careful analysis of its operations is necessary to ensure that the intended benefits are being achieved. Surveys conducted mainly by people directly involved in the Programme have produced useful information and helped to define priorities for future action. They have also contributed towards strengthening links between the health authorities and the manufacturers and distributors of latrines and their components.

A national campaign was launched by Mozambique's Ministry of Health in 1976 with the aim of encouraging people in peri-urban areas and villages to build latrines. Large numbers of latrines were built but insufficient account was taken of the difficulties faced by communities where ground conditions were difficult and construction materials were scarce. Furthermore, it was felt that the rudimentary nature of many of the latrines discouraged their use, and that this diminished the potential health benefits of the campaign.

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The establishment of a latrines project in the National Directorate of Housing in 1978, as part of a broader urban upgrading programme, initiated the development of technically and hygienically adequate latrines. The technical solution, based on the use of a simple unreinforced concrete slab, has proved successful in that there has been a consistent demand for the product. What is important from the health standpoint is the close-fitting lid, which keeps insects out, and the smooth, easily cleaned concrete surface. More than 30 000 improved latrines have been sold and installed, benefiting over 150 000 people. More than 350 latrine constructors have already been trained in a pilot workshop.

The Programme relies on a high degree of community participation in both the

Table 1. Usage of latrines in relation to proximity of production cooperatives

Latrine type	Distance from production cooperative		Total
	> 1 km	⩽ 1 km	
Traditional	193	169	362
Improved	46	104	150
Others [a]	92	38	130

[a] Buckets, etc.

organization of workshops and the promotion of the use of the latrines. All running costs in local currency have been met from latrine sales.

Certain questions arise concerning the coverage, acceptability and impact of the Programme.

- Does it benefit only people who are relatively well off?
- Is the improved latrine accepted by all sections of the community?
- Why do people buy the improved latrine and what do they think they are getting for their money?
- Is the community's behaviour significantly altered by the Programme?
- Do the improved latrines result in better health?
- Are the latrines foci of infection?

The ways in which these questions were tackled are described below.

Methods

In order to monitor latrine usage, surveys were conducted which employed reliable secondary indicators rather than direct observation. Community sanitary surveys in a number of cities considered:

- types of sanitation system in use;
- knowledge of the Programme;
- sources of information;
- attitudes towards the improved latrine;
- latrine use and maintenance;
- children's use of latrines.

Among the factors affecting each variable the most important to be examined were:

- economic status;
- educational status;
- number of adults and children in family;
- area of origin of family;
- length of time for which family had lived in city;
- religion;
- type of urban settlement (planned/unplanned, dense/sparse);
- distance to the nearest latrine workshop.

The sanitary impact of the latrines was assessed by means of parasitological indicators of faecal contamination of the environment. The object of a sanitation technology is to prevent the spread of pathogens from people to the environment rather than to prevent the transmission of environmental pathogens to people; but there is no technical indicator of efficacy

Table 2. Latrine usage in relation to economic status of households

Latrine type	Economic index[a]							Total
	1	2	3	4	5	6	7	
Traditional	4	46	114	102	71	22	3	362
Improved	0	11	32	58	35	12	2	150
Others	1	12	39	22	30	20	6	130
None	1	8	7	4	2	0	0	22

[a] Based on housing conditions and consumption patterns.

comparable to, say, coliform counts used for the quality control of drinking-water. There are, however, organisms that can serve a comparable purpose. One is the parasitic worm *Ascaris lumbricoides,* the life-cycle of which is effectively restricted to humans. It resists extreme conditions and persists in the environment. Its stages in the soil can help to indicate the date of a contamination and the contaminant's subsequent pathways. Furthermore, *Ascaris* is one of the most widespread parasites in humans.

We studied the distribution of *Ascaris* eggs in the soil of 97 households by taking samples in their yards. The aim was to discover the burden and distribution of the parasite in each yard and so to obtain an indication of the efficacy of the existing sanitation system and the degree to which it was used.

Results

The results, except where otherwise stated, come from the largest survey, which covered 650 households in Maputo. Here the Programme has been operating for the longest period and the highest number of improved latrines exists.

Table 3. Reasons for replacement of previous latrine

Reason for replacement	Previous latrine			Total
	Traditional		Improved (all types)	
	Simple	Lined		
Full	222	43	14	279
Cover deteriorated	6	0	0	6
Lining failure	0	0	1	1
Pit failure because:				
too big	3	0	1	4
by bathing area	15	0	0	15
flooded	40	4	1	45
soil unstable	87	6	5	98
collapsed	0	3	0	3
Others[a]	*8*	*0*	*1*	*9*

[a] Mainly drains or septic tanks

Table 4. Life of latrines

Latrine type	Life (years)				
	< 1	1–2	2–5	5–10	> 10
Traditional	136	175	66	24	33
Improved	6	9	9	0	0
Others	7	3	3	2	2
Total	149	187	78	26	35

Who buys the improved latrine?

People living near a production cooperative and people of relatively high economic status were more likely than others to possess improved latrines (Tables 1 and 2), and these were more likely to be present in households whose members were of relatively high educational level than elsewhere. The type of latrine in use did not vary with the duration of residence in the city, nor with the number of people in the household. A survey on latrine ownership in the northern city of Pemba showed no significant difference between Muslims and persons of other religions.

Why buy an improved latrine?

In most cases, people had been using traditional latrines, which were replaced because they had filled up or because poor soil conditions had led to pit failure (Table 3). Traditional latrines were very short-lived, most having to be replaced less than two years after construction (Table 4). Few problems were reported with the cover of the traditional latrine. A good cover may help to protect a latrine pit from collapse by

Table 5. Sources of information

Source	Number of people
Radio	129
Newspaper	16
Poster/leaflet	15
Latrine workshop	177
Existing users	284
Health workers	83
Grupo dinamisadore	204
Others	18
No information	188

reducing the infiltration of water around the lid. Since, however, the majority of traditional latrines were replaced because they had filled up, one clear advantage of the improved latrine slab is that it can easily be moved and reused.

Sources of information

It was important to discover the most effective channels of communication through which the improved latrine was promoted, with a view to guiding both sales promotion and health education. It emerged that people most commonly learned of the improved latrine from existing users. Also significant was the high number of people who mentioned the *grupo dinamisadore,* the local political authority. Only 12.5% of respondents cited health workers as a source.

Table 6. Age at which children started using latrines

Latrine type	Numbers of children first using latrine at			Never using latrine	Total
	0–2 years	2–4 years	> 4 years		
Traditional	2	72	211	11	296
Improved	1	36	88	6	131
Others	0	10	43	5	58

The 28% of the sample that had no knowledge of the improved latrine lived mainly in areas not served by latrine cooperatives (Table 5).

In Nacala the proportion of houses with latrines ranged from 37% in one *quarteirao* (the smallest administrative unit) to 79% in another. There being no socioeconomic differences, the explanation for this seemed to lie in the varying extent to which the *quarteirao* heads promoted environmental hygiene.

Usage and maintenance

Among the factors that determined whether latrines were kept clean and covered, the most significant was the type of latrine. Households with improved latrines scored better than those with traditional latrines, mainly because they used the purpose-made covers.

Unfortunately, children did not start using the improved latrines at a significantly younger age than they did the traditional ones, even though the former were promoted as being easy for children to use (Table 6).

In households of relatively well-educated people, the age at which children began to use latrines was significantly lower than elsewhere. There was only a weak correlation with economic level and none with the duration of residence.

In households with traditional latrines, but not in ones with improved latrines, the number of family members correlated significantly with improved behaviour by children, suggesting that, as claimed, it was easier for young children to use the improved latrines without help.

Table 7. *Ascaris* contamination

Site	Positive samples	No. of sites sampled in positive households[a]	% of sites
Latrine entrance	6	35	17
House entrance	10	44[b]	23
Road entrance	6	50[b]	12
Kitchen	3	25[c]	12
Water point	4	34[c]	12
Chicken coop	1	15[c]	7
Total	30	203	15

[a] Any household with at least one positive result was considered positive.
[b] Some houses and yards had more than one entrance and in others there was more than one sampling point adjacent to a single entrance.
[c] Not all households had a clearly defined cooking area, water point or chicken coop.

Soil contamination and human infection

Despite problems with the preservation and analysis of soil samples, which led to underreporting of the numbers of eggs, nearly 5% of samples were found to contain *Ascaris* eggs. The distribution of the eggs suggested that contamination of the environment resulted from defecation away from the latrines rather than their poor maintenance. The number of positive samples from latrine entrances was less than that found at house entrances and was not significantly greater than that at other locations in household yards (Table 7).

A subset of the first 45 households (out of a total of 97) was considered, with a view to reducing the effects of false negatives caused by poor preservation of the latter half of the soil samples analysed. Improved latrines were apparently more likely than others to be associated with faecal contamination in the yards (Table 8). This probably arose because the mean number of children in households with improved latrines was 3.35 whereas it was only 2.26 elsewhere, rather than because of any difference due to the

Table 8. Soil contamination with *Ascaris* associated with traditional and improved latrines

Soil samples	Latrine type	
	Traditional	Improved
Positive	8	19
Negative	11	7

latrines themselves. No difference in soil contamination seems probable between different latrine types, given the evidence of a general failure to use latrines by young children, and the lack of differences in infection rates between latrine types as shown by faecal examinations (Table 9).

Faecal contamination was not simply a problem within individual households. Positive soil samples were found in households with no infected family members and vice versa. There was an association between the presence of infected persons in families and the faecal pollution of yards, but it was not statistically significant (Table 10). The picture was very similar when only the presence of infected children was considered (Table 11).

For households with traditional latrines there was a significant association between the presence of infected children and *Ascaris* contamination of the soil. This did not hold in the yards with improved latrines,

Table 9. *Ascaris* infection in relation to age group and latrine type

Age group	Improved latrines			Traditional latrines		
	No.	infected	%	No.	infected	%
Adult	63	11	17.5	51	9	17.6
5–15 years	61	20	32.8	27	11	40.7
0–4 years	26	4	15.4	16	1	6.3
Total	150	35	23.3	94	21	22.3

Table 10. *Ascaris*-infected persons in households in relation to soil contamination

Household	Soil	
	Positive	Negative
At least one person positive	20	8
All persons negative	7	10

suggesting that there were differences in children's defecation behaviour between the two types of household (Table 12).

Conclusions

The Programme has been successful in that the community has been persuaded by its own organizations to build improved latrines. Unfortunately, the impact on health has so far been relatively small, apparently because young children do not use the latrines. There is clearly a need to place the solution of this behavioural problem at the forefront of efforts in health education.

The parasite survey demonstrated that the method used could be valuable in assessing the impact of sanitation technologies. Future studies should be planned and executed with clear objectives and an understanding of the limitations of the approach. Further work is needed to simplify the laboratory procedures used, to ensure a reasonably constant rate of recovery, and to achieve adequate preservation of samples.

It is vital that the Programme maintain the viability of its cooperatives and other production units. Without these, the community cannot act upon the health education messages it receives. The survey has given valuable insights into the promotional approaches that the cooperatives must use to sell their products.

Table 11. *Ascaris*-infected children in households in relation to soil contamination

Children	Soil	
	Positive	Negative
At least one positive	13	5
All negative	8	11

It is important to note that although most people bought the improved slabs, they had problems with the latrine pits. Emphasis must be placed on the facts that the slabs are cheap, convenient to acquire, and easy to maintain; that they can be reused on new pits when old ones fill up; and that they can protect the pits from erosion. While health workers know the importance of covering the pits to reduce fly and insect nuisance, this advantage of the improved slabs, while it must be promoted, is apparently a secondary consideration for consumers.

The surveys also reinforced the Programme's policy of establishing small cooperatives in each area and involving local organizations in their management, in community education and in mobilization. The wide knowledge and acceptance of the slab were encouraging, and it was particularly gratifying that in Maputo the existing users were the most important source of information about it, together with the political structures and the cooperatives themselves. The fact that better-off families were more likely to have improved latrines is a positive sign, provided that poorer families can also afford them: the poor are more likely to imitate the rich than vice versa.

By replacing traditional latrines with improved ones, the community has shown a clear preference. The popularity of the improved latrines has reinforced the policy of the Programme not to adopt more advanced latrines for the time being; these are considerably more expensive and would not meet any apparent felt need in the community. There is, on the other hand, an

Table 12. Numbers of *Ascaris*-infected children in relation to soil contamination in yards with traditional or improved latrines

No. of children	Soil contamination			
	Positive		Negative	
	T[a]	I[b]	T[a]	I[b]
Positive	8	18	4	6
Negative	8	48	23	15

[a] Yards with traditional latrines
[b] Yards with improved latrines

obvious need to focus more on health education in this field.

The low proportion of interviewees who cited health workers as a source of information may raise doubts about the effectiveness of the health education methods in use. It can, however, be argued that the frequent reference to the *grupos dinamisadores* is a reflection of the health authorities' success in using the communities' own organizations as a medium for promotion.

The surveys have strengthened collaboration between the Programme and the Ministry of Education on the development of a suitable low-cost design for a school latrine, and have prompted a review of the sanitation component of primary school curricula. A strategy for reaching preschool children is also required.

It is essential that initiatives in the schools be coordinated with the overall Programme. Just as, in the community, households must have latrines before their members can practise improved sanitation, education must be accompanied by hardware. It is pointless teaching children to use latrines and wash their hands afterwards if the schools do not have latrines, if the latrines are too dirty to use, or if there is no water.

Perhaps the most important result of our research has been to reinforce cooperation between all those involved in working towards the goal of a healthy environment. □

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