

The questions were supplemented by a spot observation of the household environment and latrine, a demonstration of handwashing technique requested of the main respondent, and an exercise known as “pocket voting” (Srinivasan, 1990), in which all household members present were asked to declare their normal handwashing practice and latrine use when at home, by placing voting papers into labelled pockets fixed to a portable board. The “votes” were cast inside the house while the field workers were observing the condition of the household environment and latrine, so that the voting was not observed. However, men, women and children used voting slips of different colours, so that their votes could be distinguished at the count.

The questions put to the vote were:

When you are around the house, do you always use a good latrine?

Do you always wash both hands with soap?

For the sanitation vote, four pockets were provided, each with an illustrative photograph; these showed, respectively, a field with bushes, the sea shore, an overhang latrine built over water, and a sanitary latrine. For handwashing, the four options were: washing one hand only, washing both hands with soap and water, washing both hands but with water only, and not washing hands at all.

Pocket votes were cast by 515 women, 315 men and 223 children in the 345 study households.

Exposure to various aspects of the awareness campaign was assessed by a short series of questions. Respondents were asked whether the women or men of the house had participated in the sanitation awareness campaign, and to mention at least three of the activities; health education classes, a video or slide show, street drama presentations, and competitions were most frequently mentioned. They were also asked whether women had been involved in organising some of these, and how many home visits they had received from community workers.

In addition, key informants in each locality (past and present panchayat presidents and water committee members at the time of the project) were interviewed about the activities of the project in their area. Additional secondary data, particularly regarding sanitation coverage before and after the intervention, were collected from the records of panchayats, SEUF and the Kerala Total Health and Sanitation Mission (KTHSM).

Data analysis

Comparison between panchayats

The key informants were asked several questions about the project activities. The ward water committee in place at the time of the intervention was asked to list

the types of health promotion activities in their wards, and the panchayat presidents at that time to list the different government and non-governmental groups actively involved and trained. Their responses were given a score (no. of types of activity 0–5; number of groups 0–6). SEUF staff also scored the relative intensity of the project intervention and support for it in the study panchayats on a scale of 0–8; this was derived as the sum of the following four scores, each ranging from 0 to 2:

1. intensity of inputs by SEUF,
2. degree of support by different groups in the ward where the research took place,
3. degree of support from the panchayat Government and political parties,
4. level of involvement of the Ward Water and Sanitation Committee.

We now had three different scores, indicating for each panchayat the intensity of project interventions and local support for them. These were:

- (a) number of types of activity implemented,
- (b) number of groups trained,
- (c) the total of items 1–4 above.

With only two exceptions, the ordering of the ten panchayats according to all three scores was the same, indicating good agreement. The exceptions were two panchayats, each of which scored one point less for the number of types of activity than was required to maintain the ranking from the other two scores. As the agreement was so close, only the SEUF staff score was used as a general measure of intervention intensity in each panchayat.

The relative socio-economic status of each panchayat was established (on a scale of 0–5) using the Kerala State Government’s official socio-economic rating and also a rating by the staff, which ranked them in the same order, and was supported by other indicators such as the level of latrine coverage at the beginning of the programme.

Associations between the characteristics of the ten panchayats in the sample were examined by linear regression. An association was considered as significant when the 95% confidence intervals for r^2 and the β coefficient did not include zero. The method was analogous to that followed by Haggerty, Muladi, Kirkwood, Ashworth, and Manunebo (1994) who looked for associations between measured indicators of behaviour change and a scored measure of the efficacy of the hygiene promotion volunteer in each of their 18 village study sites.

Within panchayats

To control for confounding by the differences between localities, the analysis was stratified by panchayat. A Mantel–Haenszel weighted odds ratio (OR) was calculated for each association tested, with its 95% confidence interval (CI). For the number of home visits made, a variable which could take three values (0–5, 6–10 and 11+), a χ^2 test for trend, stratified by panchayat, was used.

Results

Descriptive statistics

Handwashing

Of a total of 515 women voting, 297 (57.7%) reported that they always wash both hands with soap. In 199/345 of households (or 57.7%), all the women present reported this. This was very similar to the proportion of households (197/345) in which the respondent volunteered “before eating” as a time when it was important for health reasons to wash hands, although more (315/345, or 91.3%) mentioned “after defecation”. When asked to demonstrate handwashing technique, 280/345 (81.2%) respondents rubbed both hands together with soap and water. Of the 266 women respondents, 225 (84.6%) used this correct technique. Handwashing by children and by men was less common; it was reported by 55.2% of girls, 47.7% of boys, and by only 126 (40%) of the 315 men who voted.

There was a strong association between knowledge of handwashing times, demonstrated handwashing skills and self-reported practice. Respondents were more likely to demonstrate handwashing correctly in households where all the women reported the practice (OR 13.4, CI 6.3–28.3), and also mentioned that it is important, for health reasons, to wash hands before eating (OR 2.4, CI 1.32–4.2).

Latrine use

Of 515 women, 461 (89.5%) reported by pocket vote that they always use a good latrine (i.e. one with a pour-flush pan, superstructure and double pit) when they are at home. Households in which all women did this were no more likely than others to have a clean and well-maintained latrine. More than 90% of latrines were clean and functioning in all major respects except the door, which was defective in 39.4% of households. On the other hand, the households where all women reported handwashing both hands with soap were significantly more likely to be among the 82% of households keeping soap and water near the latrine (OR 3.3, CI 1.52–7.1). Latrine use was reported by 80.0% of girls, 72.7% of boys, and 74.9% of men voting.

Exposure to awareness campaign

Of the 345 study households, there were women in 336; in 74.1% of these, the women remembered participating in the awareness campaign; however, of the 227 households where there were men, only 18.5% said that the men had done so. Health education classes were recalled by 83.2% of households, and by 96.8% of those where the women reported having participated in the awareness campaign. The association between these two measures of exposure was significant, but was not found among the men; those who participated in the campaign were not more likely to remember the health education classes. A video or slide presentation was recalled by 27.5% of households, though the distribution of this latter was patchy, with no households recalling it in one panchayat and all of them in another. Less than 10% recalled dramas or competitions. Most (88.4%) remembered the involvement of women in organising the activities, and half (53.6%) said that project masons had given out health messages. Two households in three (65.5%) had received more than five home visits, and 41.2% had received more than ten.

Comparison between panchayats

Overall data for the ten panchayats are shown in Table 2. These include scores for socio-economic status and for the intensity of intervention, as well as the duration and end date of the intervention and the latrine ownership rates for the panchayat as a whole before and after its implementation. The table also shows the prevalence of latrine use and handwashing with soap among men and women, self-reported by pocket voting. Note that every household in the pocket voting sample *owns* a latrine, though not all members of the family are necessarily using it consistently when around the home.

There was a close correlation between the combined score representing the intensity of interventions and strength of local support for them and the prevalence of handwashing among women, and also among men ($r^2 = 0.82$ and 0.88 , respectively). The self-reported prevalence of latrine use among women and girls was also strongly associated with this score ($r^2 = 0.65$, Fig. 1). By contrast, the use of latrines by men showed no discernible association with the intensity and support of the project activities, but was closely correlated with the socio-economic score of the panchayat ($r^2 = 0.85$, Fig. 2). There was no association between socio-economic score of a panchayat and its score for intensity of project activity.

The other factor which is closely associated with socio-economic status at the panchayat level is the initial latrine coverage; that is the proportion of households owning a latrine at the start of the project (Fig. 2).

It seems that the project had little impact on the habit of latrine use by males, as their rate of latrine use is still

Table 2
Characteristics of the ten study panchayats

Panchayat	Anjuthengu	Kadappuram	Kadakkavoor	Puthanchira	Neendakara	Mararikulam	Alappad	Kaipa-mangalam	Koippuram	East Kallada
SE status	0	1	3	2	2	4	2	3	5	5
Intervention										
End date	1993	1996	1995	1995	1998	2000	2000	1993	1995	1998
Duration (yr)	5	1	3	3	2	5	4	7	3	4
Intensity	3	3	1	4	4	4	8	8	5	7
Panchayat sanitation coverage (%)										
Initial	15	18	39	32	41	43	24	38	55	52
Final	41	55	72	87	87	75	71	100	85	72
Latrine use (%)										
Men	48	59	88	60	69	85	76	96	100	100
Women	68	81	72	85	97	92	99	100	100	100
Handwashing prevalence (%)										
Men	16	32	10	40	38	42	58	77	44	56
Women	22	45	13	48	38	68	82	84	69	75

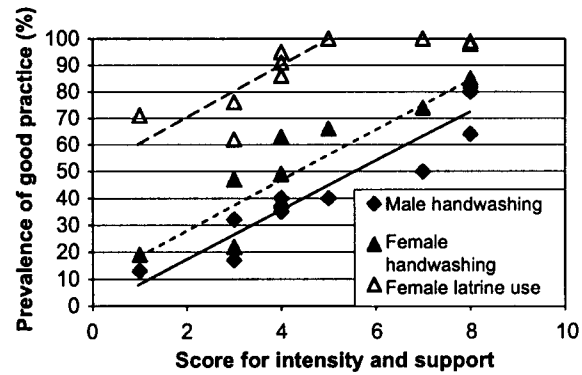


Fig. 1. Effect of intervention intensity on self-reported hygiene practices; 10 panchayats in Kerala, 2003.

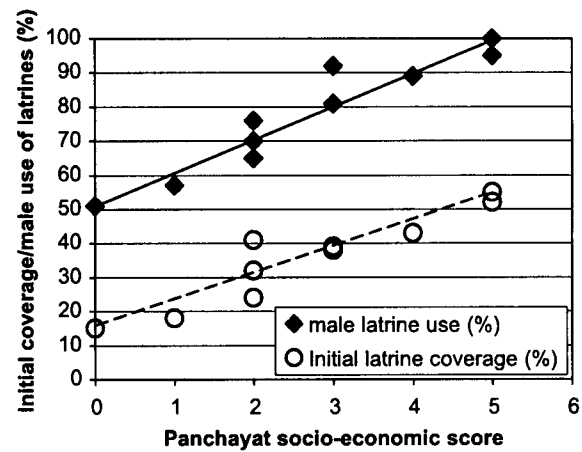


Fig. 2. Association of initial latrine ownership and male latrine use with socio-economic score; 10 panchayats in Kerala, 2003.

largely determined by the coverage with sanitation several years ago. Even now, they are more likely to use a latrine if they had one in the past.

Analysis within panchayats

All eight of the recalled measures of exposure to the intervention (household women’s participation, classes, video/slide shows, drama, competitions, women involved in organisation, masons giving messages, and the number of home visits) showed a positive association with handwashing reported by all the women of the household, although only one of these (health education classes, OR 2.04, CI 1.05–3.96) was statistically significant. That these associations are all in the expected direction is itself significant; the probability of it arising by chance is $2^{-8} = 0.004$. Handwashing by men, however, did not show any significant association with

any measure of exposure to the intervention, and such associations as were apparent were not so consistent.

Recall of health education classes was significantly associated with a number of other indicators of hygiene in addition to handwashing reported by women; knowledge that washing hands before eating is important for health reasons (OR 2.9, CI 1.43–6.0) and the observation that the household surroundings were free of faeces and other waste (OR 2.8, CI 1.22–6.6).

Since home visits are a particularly labour-intensive component of any hygiene promotion, their impact on knowledge as well as behaviour was tested. The number of such visits was significantly associated with awareness of the need for handwashing before eating (OR for > 10 visits 3.4, $\chi^2_{\text{trend}} = 5.59$, $df = 2$, $p = 0.018$), but not with other hygiene outcomes.

Discussion

The close association between three measures of handwashing prevalence—knowledge of appropriate times for health reasons, demonstration of technique, and self-reporting by pocket voting—lends support to their validity. Of these three, the voting gave the lowest estimate of prevalence. Since most measures are likely to overestimate prevalence rather than to underestimate it (Kanki, Curtis, Mertens, Cousens, & Traoré, 2004), we conclude that household pocket voting came nearest to the truth. Pocket voting has been used as a participatory tool at public meetings for many years (Srinivasan, 1990), but the extension of the method for use within the privacy of the home was developed for this study. The measurement of hygiene behaviour is difficult (Cairncross & Kochar, 1994; Almedom, Blumenthal, & Manderson, 1997). It is even more difficult to find quick and simple methods for use in the field evaluation of interventions, but it would seem that the three methods used here—or better, a triangulated compound of all three—could meet that need.

There can be no question that the knowledge and practice of handwashing with soap is far more common in the study population than in adjacent communities which have not benefited from hygiene promotion. In 2001, the same survey team, using the same field methods, had studied 120 households in Panmana, a nearby panchayat of higher than average socioeconomic status which had been chosen as a control because the sanitation promotion had involved no hygiene promotion component (Zacharia & Shortt, 2003). Only 7% of women and girls, and 3% of men and boys had reported handwashing with soap by pocket voting, and only 10% of household respondents had demonstrated correct handwashing technique (using soap and water and rubbing both hands together) on request. That half the population in the study areas report handwashing, and

that most can demonstrate it correctly, is a measure of the effectiveness of the interventions in changing hygiene behaviour.

Recall of health education classes was associated with outcomes assessed using very different tools: questionnaire relating to knowledge, and spot observation and household pocket voting relating to practice. This lends support to the conclusion that these classes are important to the effectiveness of the intervention. Another recent study (Waterkeyn & Cairncross, 2005) has pointed to the effectiveness of such classes when given as a programme of instruction fostering a collective commitment to put them into practice.

The home visits seem to have been less effective, with a significant impact on households' knowledge, but not on their practice. It is well-known that in hygiene as in other fields, knowledge alone does not determine practice (Pittet et al., 2004). However, hygiene promotion was not usually the principal objective of these visits, most of which were had other purposes such as collecting money, to checking the delivery of latrine materials, monitoring the quality and timeliness of construction, and so on. It would therefore be unwise to conclude from our study that home visits are less effective than classes as a means of hygiene promotion. Home visits have been an important component of a number of apparently successful hygiene promotion programmes (Dieleman, de Groot, & Nahayo, 1994; Bajracharya, 2003).

A similar caveat must apply to the awareness campaign. Many such campaigns are organised in Kerala, not always to promote hygiene, and some respondents may have recalled one of these rather than the one organised by SEUF.

The comparison between panchayats and with Panmana shows that the interventions had nearly as great an impact on the handwashing behaviour of men as on women. The lack of significant associations between male handwashing and exposure to the interventions at the level of individual households within each panchayat suggests that their effect may have been indirect, possibly via women and other members of the community. In any case, the interventions do not appear to have affected latrine use among men.

This appearance may be deceptive; latrine coverage increased by an average of 39% during the interventions in the ten study panchayats (Table 2), which must itself have increased usage to some extent. Since initial latrine coverage was associated with socio-economic status, the increase among the target group (poor households) must have been considerably greater. Nevertheless, it is not surprising that the impact of the interventions on male behaviour is harder to detect, as the interventions were largely directed at women, and key informants said that the population saw it as a women's project. A finding from this study is therefore that, in order to be fully

effective, such interventions need to be aimed at both men and women.

Our most important findings relate to sustainability. The difference in handwashing with Panmana mentioned above, and the association found between the prevalence of handwashing in each panchayat and the intensity of the interventions support the view that not only have the interventions caused a change in behaviour, but also that this behaviour change has been sustained since the interventions were concluded.

The lack of association between handwashing prevalence and the time elapsed since conclusion of the intervention—up to nine years in some panchayats—provides additional evidence of the sustainability of the hygiene behaviour change. Our findings agree with the results of the two previous studies of this topic of which we are aware. In the first, Wilson and Chandler (1993) found that 79% of mothers in a village in Lombok, Indonesia continued to wash their hands with soap, two years after a four-month intervention to promote the practice. The second was a follow-up study of a water, sanitation and hygiene promotion project in Bangladesh by Hoque, Juncker, Sack, Ali, and Aziz (1996), who found that hygiene practices in the intervention area were still poor after five years, but better than in the control area. In the latter case, it is difficult to say whether the sustained improvement in hygiene was the result of the hygiene promotion, or of the presence of the hand pumps and latrines (Curtis et al., 1995), most of which were still functioning; knowledge of the transmission of diarrhoea was similarly poor in both the intervention and the control areas.

Similar evidence of the sustainability of hygiene changes has recently been found in parallel studies in Ghana, Kenya, Nepal and Uganda (Cairncross & Shordt, 2004). The sustainability of hygiene behaviour change has important implications for the cost-effectiveness of hygiene promotion. Estimates of the cost-effectiveness of hygiene promotion (e.g. Varley, Tarvid, & Chao, 1998; Borghi, Guinness, Ouedraogo, & Curtis, 2002) have treated it as a continuous activity. Our finding that behaviour change is sustained implies that a hygiene promotion intervention can be of finite duration and still produce a benefit stream continuing for many years after its conclusion. It follows from this that hygiene promotion is far more cost-effective, in terms of DALYs per dollar, than such estimates would suggest, and several times more cost-effective than the promotion of oral rehydration therapy (Cairncross & Valdmanis, 2004). In view of the importance of this point for public health policy, further studies such as ours are needed.

Finally, this example shows that the local bodies which implement hygiene promotion in developing countries can, with appropriate technical support, carry out simple but rigorous studies of the impact of their own interventions, and develop new tools for the

purpose. The measurement of behaviour change has long been advocated as an appropriate means of project evaluation (Boot & Cairncross, 1993). We conclude that it is also a feasible one.

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