

# The value of hygiene promotion: cost-effectiveness analysis of interventions in developing countries

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Hygiene promotion can greatly improve the benefits of water and sanitation programmes in developing countries at relatively limited costs. There are, however, few studies with hard data on the costs and effectiveness of individual programmes and even fewer have compared the cost-effectiveness of different promotional approaches. This article argues that objectively measured reductions of key sanitation and hygiene risks are better than DALYs for evaluating hygiene and sanitation promotion programmes. It presents a framework for the cost-effectiveness analysis of such programmes, which is used to analyse six field programmes. At costs ranging from US\$1.05 to US\$1.74 per person per year in 1999 US\$ values, they achieved (almost) complete abandonment of open defecation and considerable improvements in keeping toilets free from faecal soiling, safe disposal of child faeces, and/or washing hands with soap after defecation, before eating and after cleaning children's bottoms. However, only two studies used a quasi-experimental design (before and after studies in the intervention and – matched – control area) and only two measured costs and the degree to which results were sustained after the programme had ended. If the promotion of good sanitation and hygiene is to receive the political and managerial support it deserves, every water, sanitation and/or hygiene programme should give data on inputs, costs, processes and effects over time. More and better research that reflects the here-presented model is also needed to compare the cost-effectiveness of different promotional approaches.

**Keywords** Hygiene promotion, behaviour change, costs, effectiveness, social research, public health policy, water sector policy, developing countries

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## KEY MESSAGES

- Effective hygiene promotion is important for public health in the developing world.
- Cost-effectiveness studies of field programmes help to account for investments, find more effective approaches and allocate sparse resources optimally.
- Policy makers, programme planners and managers should include cost-effectiveness assessment routinely in all policies and programmes related to improved water supply, sanitation, hygiene and health.
- More research is needed on the cost-effectiveness of different promotion methods, and when collecting cost-effectiveness data, the full range of input, processes, outputs, effectiveness and impacts should be looked at.

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## Introduction

The Millennium Development Goals (MDGs) represent a renewed commitment to address the most enduring failures of human development. For the water and sanitation sector, the goal is to halve the proportion of people without sustained access to safe drinking water and basic sanitation by 2015. At mid-term, numerous initiatives were under way to report progress. However, while huge investments are made, little is known about whether the resulting facilities are used effectively and good hygiene habits have developed. Only through this can the goals benefit health and reduce poverty; access alone is not enough (Boot and Cairncross 1993). Moreover, under the prevailing resource constraints the cost-effectiveness of the interventions is especially important. A cost-effectiveness analysis can reveal the effects resulting from an investment and compare different interventions on their relative merits.

The focus of this article is the assessment of the cost-effectiveness of hygiene promotion interventions for improved health in developing countries. The specific objectives are to review the existing methodologies for such assessments, to identify the strengths and weaknesses of the existing methods and to suggest how cost-effectiveness analyses can be improved.

## Cost-effectiveness and cost-benefit analysis

Cost-effectiveness is defined as the cost, in monetary terms, of producing a unit of effect through an intervention. Cost-effectiveness analysis allows programme managers, governments, donors and researchers to compare programme costs with performance. A programme may, for example, spend US\$10 000 on interventions and reduce the number of diarrhoeal cases from 10 000 to 8000. Its cost-effectiveness is then expressed as US\$5 per case of diarrhoea averted (Varley *et al.* 1998).

Hygiene promotion programmes generally aim at improving specific behaviours, such as human excreta disposal and handwashing. Performance is measured in terms of the expected outcomes, e.g. the increased percentage of household members having access to and effectively using sanitary latrines, or the increased percentage of child caregivers washing hands properly after handling children's excreta. Some programmes also use the term effectiveness in relation to health impacts, e.g. a lower number of diarrhoeal cases or deaths. Here, effectiveness is defined as the measured change in sanitation and hygiene conditions and behaviour resulting from a promotional programme. Effects on morbidity and mortality are defined as impact.

Cost-effectiveness analysis (CEA) differs from a cost-benefit analysis (CBA). In a CEA, only the costs are expressed in monetary units, whereas in a CBA both costs and benefits are thus expressed. The outcomes of CEAs and CBAs are very useful for planners and policy makers with limited resources to allocate. Hutton and Haller (2004), for example, converted all benefits of five different types of water programmes into monetary values, including that of the number of avoided

deaths. All five interventions proved cost-beneficial. The return on US\$1 investment was in the range of US\$5–28.

Although Hutton and Haller's CBA outcomes are very interesting, their validity can be criticized, because the many assumptions were not all equally justifiable and the value to put to human life is debatable. CEAs are a good alternative and one way of measuring effectiveness is through disability-adjusted life years or DALYs.

## Measuring cost-effectiveness using DALYs

Murray and Lopez introduced the concept of DALYs in 1996 to get a single index for all lifetime lost through disability and death from different diseases. Cairncross *et al.* (2003) summarized the composition and calculation as follows:

$$\text{DALYs averted} = \text{number of deaths averted} \times \text{YLL} \\ + \text{number of cases of illness averted} \times \text{YLD},$$

in which:

DALY = Disability-Adjusted Life Year

YLL = Years of Life Lost due to premature mortality

YLD = Year of Life spent with a Disability

YLL and YLD each have their specific formulae, which can be easily programmed in a spreadsheet or calculator. It would go too far to specify them here. Instead, we cite only the values and factors implicit in the calculation:

- *Disease burden.* For each disease the total number of years of healthy life lost can be estimated. Diseases causing death contribute more than those causing mild or temporary disability. Lower respiratory infections and diarrhoeal diseases ranked 1 and 2 among the causes of worldwide DALYs lost in 1990 (Murray and Lopez 1996). The transmission of both can be reduced by adequate sanitation, hygiene and the supply of sufficient and safe water (Cairncross *et al.* 2003; Cairncross and Valdmanis 2006). Even taking medicines for non-water-related diseases with unsafe water may result in a higher water-related disease burden.
- *Value of life with disability.* The authors devised a system of weighted DALYs for 22 disability conditions, using a factor ranging from 0 to 1.0 to express the degree of disability. 0.02 indicates a slight disability, 1.0 a severe disability such as total paralysis. Diarrhoeal diseases ranked 0.02–0.12 or more, depending on their severity.
- *Ideal lifespan.* This was needed to define the age before which death could be regarded as premature and years of life considered lost. It was set at 82.5 years for women and 80 for men using the Japanese averages, because Japan has the longest average lifespan worldwide.
- *Value of a healthy year of life.* Not all years were considered of equal value. Value was taken as 0 at birth, rising steeply to a peak of 1.5 times the average at age 22 and gradually declining to 0.5 at age 80/82.5.
- *Effect of socio-economic or ethnic status.* A decision was taken to value all people's health equally, except for the age and sex effects mentioned above.

- *Value today vs. value in the future.* A 3% discount was applied to account for interventions with delayed effects. For example, hepatitis immunization reduces deaths from liver cancer 20 to 30 years later. For hygiene-related disease, a higher rate could be argued, given that Cairncross and Valdmanis (2004) rate water and hygiene improvements as capital improvements.

In three large desk studies, researchers have used DALYs to analyse how cost-effective hygiene promotion is in comparison with hardware interventions in water supply and sanitation. The outcomes show large differences in findings, as detailed in Table 1. Varley *et al.* (1998) give only a 10% reduction in incidence of diarrhoea from improved water supply and sanitation hardware and the estimated costs per averted death are high: US\$39 720. By using actual hardware costs, Larsen (2004) found that the cost per averted death of a child under the age of five, not only from diarrhoea, but from all diseases, was only one-third of this amount. However, Cairncross and Valdmanis (2006) arrived at a three times higher reduction in incidence of diarrhoea than Varley *et al.* by looking at the combined effects of improved water quality and quantity. Having access not only to safer but also to more water can reduce the incidence of diarrhoea further, when people use this water for better hygiene, with or without hygiene promotion. This is clearly illustrated by the high drop in incidence of diarrhoea (63%) in families that had water right inside their homes or yards. Cairncross and Valdmanis also found much lower costs per DALY averted than Varley *et al.* by utilizing real costs and bringing in different service levels. Both Larsen (2004) and Cairncross and Valdmanis further show higher costs for sanitation than for water supply, but because Larsen includes the costs of sewerage, which is not a realistic option for the large majority of low-income settlements, his costs are many times higher than that of basic sanitation for all that human health and dignity require.

All authors agreed, however, on the high cost-effectiveness of sanitation and hygiene promotion, both as a stand-alone intervention and in addition to or as part of hardware. Larsen (2004) and Cairncross and Valdmanis (2006) demonstrated further that hygiene promotion, even as a stand-alone intervention, and in the absence of water supply and sanitation hardware, will still reduce diarrhoea incidence by 10%.

While helpful for global comparisons, DALY measurements are too crude, however, to be helpful for outcome and impact measurement of specific water, sanitation and hygiene programmes. First, they require health statistics that are not normally available to such programmes. Second, there is no single calculation method which can be easily applied and whose data can be easily verified. Third, improved water supply, sanitation and hygiene have a range of potential health impacts which are locally specific and for which different data would have to be compiled. Fourth, non-health benefits with monetary value, such as time savings and their effects on income, education and hygiene, are only partially included. Finally, and here most important, general analyses do not give the cost-effectiveness of particular interventions at programme level, while it is extremely important to learn more about which methodologies are most cost-effective under which circumstances. A more appropriate approach is needed for

analysing and comparing cost-effectiveness of individual programmes.

## An alternative approach to cost-effectiveness analysis

To develop a more realistic method to assess and compare the cost-effectiveness of hygiene promotion programmes, we developed first a framework outlining a typical hygiene promotion sequence. In Figure 1, hygiene promotion inputs become processes, leading to outputs and the effectiveness of outputs, which in turn lead to impacts.

Inputs (I) represent activities, materials and methods, and resources, with their costs. Leading questions are: What activities have been done? Who carried them out? What materials, methods and tools were used? At what costs were the inputs provided? Processes (II) describe the ways of working. They may deviate from designs, because ground realities often necessitate adjustments. Outputs (III) are described in numbers, such as numbers of sessions held, men/women educated/trained, promotion materials produced and facilities installed. Effectiveness (IV) measures the extent to which objectives such as certain hygiene conditions and practices are achieved. Preferably, effectiveness data give information on quality of process (IVa) as well as outcomes (results), which can be direct (IVb) and sustained (IVc). Quality of process (IVa) involves not only process descriptions, but also assessments by outsiders, alone or together with local people, of how good they were, relating to, for example, the degree of participation of different user categories, the relevance and applicability of the promoted improvements, and the degree of democratic decision-making and accountability. Direct results (IVb) show behaviour change, answering questions like: Are latrines used as latrines? By whom (not) and why? Are they well-maintained without exposed excreta and other safety risks? Has open defecation ended completely? Are both hands washed, with soap/soap substitutes, at all critical times and by all? Sustained results (IVc) reflect the time aspect, since over time effects can decline or increase, for example through local spread and management. Health impacts show the effects of good hygiene on mortality and morbidity patterns for specific diseases. Finally, cost-effectiveness (VI) relates public and household costs to quality of processes, direct and sustained results and impacts.

To validate the framework, we identified 10 field studies on the cost-effectiveness of hygiene programmes from the literature. They should in any case have data on inputs, costs and impacts in terms of changed conditions and practices. The selection is presented in Table 2. Three studies without cost data (shaded grey) were included nevertheless for having measured quality of intervention processes (IVa) or sustained behaviour (IVc). None of the others had measured the full sequence either; at best they had addressed six of the 10 components.

Data on inputs are common. They are easily counted and verified, if planning vs. implementation data are kept. Allan (2003), Aziz *et al.* (1990), Curtis *et al.* (2001), Borghi *et al.* (2002), IRC (2006) and Sijbesma and Koutou (1995) also included descriptions of promotion materials and methods.

**Table 1** Cost-effectiveness of different hygiene-related interventions to reduce diarrhoeal disease

Intervention	Effectiveness (% reduction in diarrhoea cases) <sup>a</sup>	Cost per averted case of diarrhoea, in US\$	Cost per averted death from diarrhoea, in US\$	Cost per averted death of child under 5, in US\$		Cost per DALY averted, in US\$	Author(s) and year
				Range	Average		
Only hardware (water supply + sanitation, all types)	10% 30%	168.81 <sup>b</sup>	39720 <sup>b</sup>			1152 <sup>b</sup>	Varley <i>et al.</i> (1998) Cairncross & Valdmanis (2006)
Only water supply hardware				1000–32 000 <sup>c</sup>	13 167 <sup>c</sup>		Larsen (2004)
Only water supply hardware, by service level: –handpump/standpost –house connection	17% 63%					94 <sup>c</sup> 223 <sup>c</sup>	Cairncross & Valdmanis (2006)
Only sanitation hardware, all types				3000–57 000 <sup>c</sup>	18 667 <sup>c</sup>		Larsen (2004)
Only sanitation hardware, basic types (sanitary latrines)	36%					<270 <sup>c</sup>	Cairncross & Valdmanis (2006)
Only sanitation promotion						11.25 <sup>c</sup>	Cairncross & Valdmanis (2006)
Hygiene promotion added to hardware	20%	2.93 <sup>b</sup>	689 <sup>b</sup>			20 <sup>b</sup>	Varley <i>et al.</i> (1998)
Hygiene promotion and hardware provided concurrently	30%	6.58 <sup>b</sup>	14253 <sup>b</sup>			413 <sup>c</sup>	Varley <i>et al.</i> (1998)
Only hygiene promotion	10% 33%	6.46 <sup>b</sup>	1520 <sup>b</sup>			44 <sup>c</sup>	Varley <i>et al.</i> (1998)
	[25–48% reduction in child deaths]			567–917 <sup>c</sup>	742 <sup>c</sup>	3.35 <sup>c</sup>	Cairncross & Valdmanis (2006) Larsen (2004)

<sup>a</sup>Effects on reducing cases of mortality can be 65% or more.

<sup>b</sup>Based on cost estimates.

<sup>c</sup>Based on real cost data.

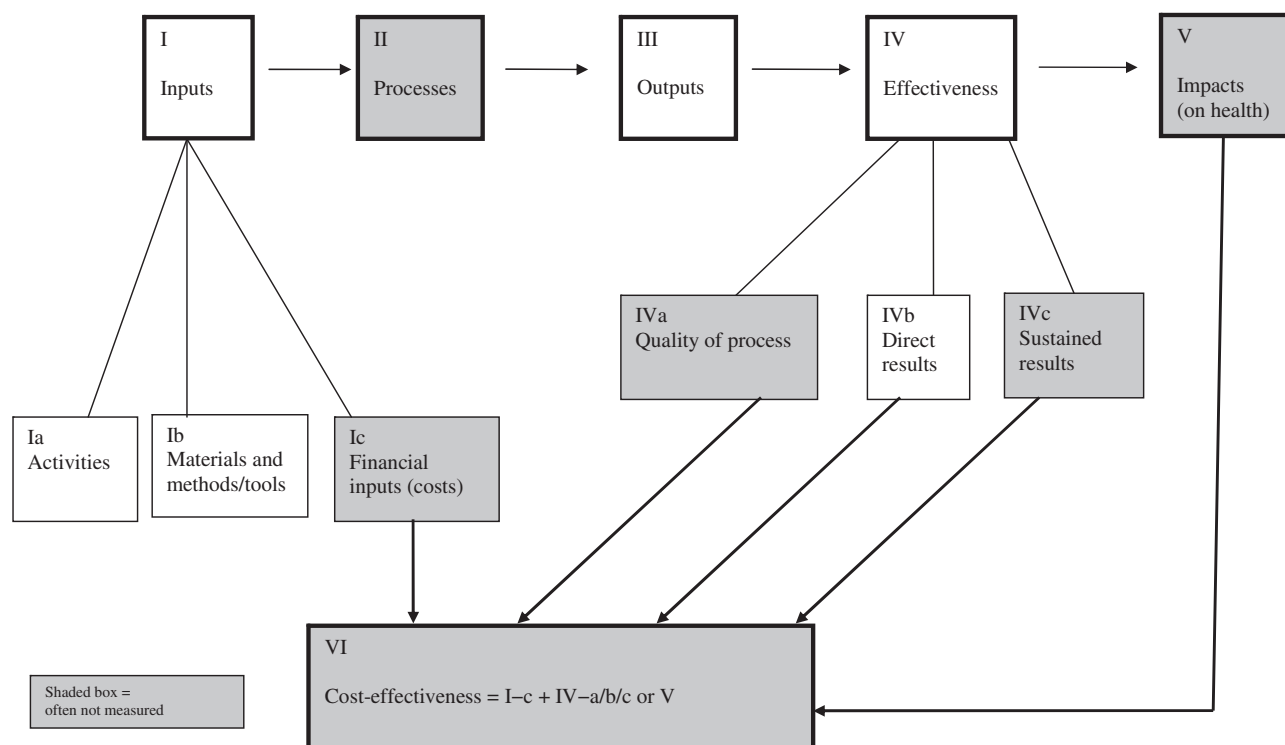


Figure 1 Position of cost-effectiveness analysis in a hygiene promotion intervention

Table 2 Overview of cost-effectiveness analysis data collected and analysed in 10 field studies

Study	Inputs			Processes	Outputs	Effectiveness			Health impacts	Cost-effectiveness	Research quality criteria met <sup>c</sup>
	Activities	Costs	Materials & methods			Quality of processes	Direct results (behaviour change)	Sustained results			
Allan (2003)	X	X	X	X		X	X		X	1, 2, 4	
Aziz <i>et al.</i> (1990)	X	X	X		X	X		X	X	1, 2, 3, 4	
Curtis <i>et al.</i> (2001), Borghi <i>et al.</i> (2002)	X	X	X		X	X		X	X	1, 2, 4, partial 3	
Colin <i>et al.</i> (2004)	X		X	X	X	X	X			1, 2, 4	
IRC (2006)	X	X	X		X	X			X	1, 2, 3, 4	
Shayamal <i>et al.</i> (2008)	X	X <sup>a</sup>		X		X	X		X <sup>b</sup>	1, 4	
Shordt & Cairncross (2004)	X		X			X	X			1, 2, 4, partial 3	
Sijbesma & Koutou (1995)	X	X	X	X	X				X	1, 2, 4, partial 3	
Waterkeyn (2003, 2005)	X	X	X		X	X			X	1, 2, 3, 4	
Wilson & Chandler (1993)	X		X	X		X	X	X		1, 2, 4	

<sup>a</sup>Only construction/upgrading costs, not promotion and other institutional costs.

<sup>b</sup>Household savings on health costs from investments in latrines.

<sup>c</sup>1: sufficient detail for replication; 2: objective measurement of outcomes; 3: sufficient sample size and control group; 4: clear relevance for target group.

Cost data are also common, but many studies give budgets or forecasts, not actual expenditures, or lack specifications. Sijbesma and Koutou (1995), for example, gave expenditures on sanitation and hygiene promotion and resulting changes in 150 villages, but no details on how expenditures were subdivided. In integrated programmes, there is further the problem of apportioning a realistic part of administrative and logistic costs to hygiene promotion. Household time and expenditures are part of the costs, but only two studies included them partially and then only for constructing a toilet (Allan 2003) and buying soap (Borghi *et al.* 2002).

Although Curtis *et al.* (2001) reported that home visits by community volunteers tailed off after the first year, only one study (Colin *et al.* 2004) accounted for the quality of the process with which outcomes were achieved. Using quantified participatory methods with poor women and men, the authors revealed that in half of the 171 villages, the promoters had not reached the poorest groups or had only delivered set messages without heeding people's interests and constraints. Another limitation was that hygiene programmes seldom conceptualize their approaches. Loevinsohn's review of 67 studies of health promotion in the South revealed that only 12% were based on an explicit theory of behavioural change (Loevinsohn 1990). The present studies all used person-to-person approaches and/or group approaches for behaviour change; only Sijbesma and Koutou (1995) compared the cost-effectiveness of two approaches based on different theories of behaviour change (social marketing vs. community-managed projects).

Measuring effectiveness is not simple. Loevinsohn (1990) applied four criteria to determine methodological soundness: sufficiently detailed description of the intervention to allow for replication; objective outcome measurements of behaviour change or health impacts; a control group and a sample size greater than two clusters or 60 individuals; and a description of the target population adequate to judge the relevance of the programme. In the literature, Cairncross and Valdmanis (2004) found only three studies that had met these criteria and were also reliable. Cave and Curtis (1999) reviewed over 200 studies of environmental health promotion and found that only 15% had measured effects on local conditions and practices, and of this 15% only five, or 16%, were methodologically sound. Of the 10 studies reviewed here, only two studies (Aziz *et al.* 1990 and Waterkeyn 2003, 2005) met all four criteria; the others all had a weaker research design.

Long-term measurement of behavioural change is rare. It is, however, very important, since changes may not be sustained over time or take longer to materialize. Four studies in Table 2 collected such data. In the Community Led Total Sanitation (CLTS) campaign in Bangladesh, open defecation had continued to be abandoned completely (Allan 2003). The findings stemmed, however, from a small and non-representative sample (4% of 100 villages), which included frequently visited pilot locations. Shamayal *et al.* (2008) reported not only that open defecation had not returned, but that over time, 61% of the households which had installed a toilet had upgraded it. However, as data on sampling are missing, the representativeness of these results remains unclear. Shordt and Cairncross (2004) reported on behavioural impacts studied in six countries

(India, Kenya, Nepal, Sri Lanka, Uganda and Ghana) 1–9 years after the programmes had finished. Out of 46 before-after comparisons made, only 7% showed a significant drop over time; in all others, improved practices had been sustained. The study also showed that more personal methods had better effects. Proper samples with control groups were used (Bolt and Cairncross 2004), but there were no cost data and the distinction of conceptual approaches was rather weak. In Lombok, Indonesia, 79% of the sampled women who had adopted handwashing with soap still practised the habit 2 years later, now buying their own soap. There was, however, no control group (Wilson and Chandler 1993).

Finally, three studies assessed health impacts. However, measuring health impacts is generally not very useful for promotion programmes, because of the methodological problems and high costs (Aziz *et al.* 1990; Cairncross 1990). CEAs calculating per capita costs of measurably improved and sustained hygiene conditions and practice are more realistic, but they are still rare. Moreover, none of the studies reviewed here covered the full sequence in a rigorous manner.

## Findings from six programme-specific studies

The previous section showed that none of the reviewed CEA combined comprehensive analysis with scientific rigour. This section presents the findings from the best six studies. Table 3 gives an overview of their main characteristics. In spite of their weaknesses, the outcomes are still interesting, given the shortage of cost-effectiveness data on hygiene and sanitation promotion programmes and approaches.

The strength of the study by Allan (2003) in Bangladesh is that she measured three types of costs: the investment and recurrent costs of the programme agency and the investments of the households, in cash and kind, but not in time and only in latrines and not for other promoted hygiene practices. At a cost of £0.83/pp, or US\$1.10 in 1999 values, and an average household investment of £3.50 in 2002 (US\$0.77/pp in 1999), villages free of open defecation were reached through the CLTS approach. This was at least half the programme unit cost of other sanitation programmes. It does not take into account, however, that many CLTS toilets are of a lower quality (though sufficient to meet its objectives) than the toilets with which they are compared. Furthermore, the village sample (4 of 100 villages) was small and the villages were not representative.

Also in Bangladesh, Aziz *et al.* (1990) found that in their study and control areas of almost 5000 people each, initially 60% of the men, 55% of the women and some 80% of the children practised open defecation. This practice dropped to 2% of the adult population, against 20% in the matched control group, at a cost of US\$0.90/pp/yr over 4 years. Assuming a 5% cost increase per year, this would have been US\$1.31 in 1999. Effects on handwashing habits and handling of water in the home were not investigated. Observations at handpumps showed, however, that water use increased by 50%. This may be an indicator of better hygiene, but as water use from other sources was not investigated, there is no data on an increase in total amounts of water used for hygiene (Curtis *et al.* 2001; Borghi *et al.* 2002).

Table 3 Findings from six cost-effectiveness studies of hygiene promotion programmes

Author and year	Type of study	Location and size	Study design	Key indicators to reduce faecal-oral disease transmission risks					Cost per person for programme/household in US\$	
				Handwashing by all at critical times with soap/substitute and flowing water	No more open defecation and no toilets with faecal/oral transmission risk (open excreta)	Safe collection, storage & drawing of drinking water from safe sources	In study year	At est. 1999 value		
Allan (2003)	Desk + field study	Bangladesh, 100+ villages, purposive selection	Post study, one approach tested (CLTS), 20% random household sample, no control group		No more open defecation		1.30/0.91	1.10/0.77		
Aziz <i>et al.</i> (1990)	Field study	Bangladesh, two sets of matched villages	Baseline and interval studies in all 799 intervention and 713 control households, with latrine use sub-study in all that built one, and KAP study in 20% random sample of households with children under 5		Latrine ownership and use by different household members, observed absence of disease transmission risks, disposal of child excreta	Safe collection of drinking water from safe sources only	0.90/no data	1.31		
Curtis <i>et al.</i> (2001)	Field study	Burkina Faso, 1 city, est. 40000 mothers with children 0-35 months	Before-after survey of 7286 mothers from 37319 households (20%), one approach tested, no control group	No. of times mothers washed hands with soap after using the latrine/cleaning their child's bottom	No. of mothers using latrines; no. of children defecating in potities; disposal children's stools in latrines; babies' bottom's washed		1.17/1.00	1.05/0.90		
Borghi <i>et al.</i> (2002)	Field study	One poor section in one town each in Bangladesh, Kerala, Sri Lanka	Before-after study with matched control areas, all or randomly sampled households	% household members wash hands with soap before eating, after defecating, cleaning children's bottom	% of households install toilets/upgrade/replace unsanitary models at own cost; % members always defecate in toilet; % safe disposal of children's faeces		7.37/no data	4.79		
Sijbesma & Koutou (1995)	Field study	54/150 villages, social marketing in 50, pilot community management approach in 4 villages	Before-after study, all households, no control areas		Installation of toilets, and showers <sup>a</sup> by project households	Safe water sources	1.45/no data	1.74		
Waterkeyn (2003, 2005)	Field study	One of 3 project districts, 265 health clubs, 11 450 members	Post study in 9% random sample of 25 clubs and 15 members/club, control area with 100 non-members	Presence of facility to pour water and soap for handwashing	Use of: pit latrine with cover/VIP latrine or cat method (defecate in small hole and cover); observed latrines without faecal smears/bad smell	Covered storage of drinking water, ladle for drawing, observed safe handling, individual cups	0.63 <sup>b</sup> /no data (1.40 with staff costs) <sup>c</sup>	0.60 (1.33)		

<sup>a</sup>Lack of enough, nearby and safe water gave high incidences of water-washed diseases.

<sup>b</sup>This included start-up costs. Recurrent costs/pp/yr were only 0.22.

<sup>c</sup>Latrine subsidy was US\$2.24/pp.

The researchers in Bobo-Dioulasso, the second town of Burkina Faso, calculated the programme's annual investment and recurrent costs and the households' yearly expenditures on soap, water and other necessities of improved hygiene. To measure hygiene impacts, they carried out structured observations of excreta disposal and handwashing practices of a cluster sample of 37 319 mothers of young children before and after 3 years of hygiene promotion, which ended in 1999. Because of the size of the programme, no experimental design was used (Curtis *et al.* 2001). At a cost equal to US\$1.17/pp/yr, or an estimated US\$1.05 in 1999, mothers' handwashing with soap after latrine use increased from 1% to 17%. Handwashing with soap after cleaning a child's bottom rose from 13% to 31%. Altogether, the programme improved the hygiene practices of 18.5% of the mothers. The complying households spent some US\$8 per year or US\$1/pp (US\$0.90 in 1999) on hygiene, of which 90% was for buying soap. Without research costs, the costs of hygiene promotion were US\$0.65/pp, of which 63% were administrative and undifferentiated start-up costs. Only 15% of the costs were for direct interventions. Roughly equal amounts went to home visits, group discussion at dispensaries, hygiene lessons in schools and popular theatre. Each may have contributed differently to the results. Health impacts were not measured, but an estimated 42% reduction in child diarrhoea may have saved compliant households US\$15 per year (Borghini *et al.* 2002). The programme was thus highly cost-effective and replication without start-up and international research costs would be considerably cheaper.

Comparative action research with a quasi-experimental design was carried out in three towns and three control communities in coastal Bangladesh, Kerala (India) and Sri Lanka (IRC 2006). It tested the effectiveness of a small enterprise model with poor urban women promoting and building sanitary latrines and recycling solid waste, for which the households paid the direct cost. The programme's costs covered also training, administration and research and were US\$4.79/pp/yr in 1999 values. Overall, improvements of hygiene and sanitation were much higher in the intervention than the control households, although the latter had also partly improved, possibly influenced by the baseline survey. Sanitary latrine ownership in the intervention communities increased to 100%, 91% and 89%, respectively, 33–41% better than the control groups. Only in Kerala did intervention and control groups hardly differ, because a state-wide sanitation programme had started meanwhile. Moreover, 55% of the project households in Morrelganj, Bangladesh and 29% in Allepuzha, Kerala had renovated their toilets.

The post-study showed also that of those without toilets, 27% more families had taken up sharing their neighbours' toilet, against an increase of 8% in the control areas. Observed absence of faecal smears in toilets increased by 24% and 32% in the Bangladesh and Sri Lanka locations, respectively. This was 20–28% better than in the control households. In the Kerala community, toilet hygiene was 14% worse than in the control area, not because practices had worsened (observed hygiene was actually 7% better), but because control households had improved even more (+21%). Use of potties increased especially in the Bangladesh case: from 0% to 61%, while remaining at 0% in the control town. In 94% of

households with young children, their stools ended up in the latrine, a rise of 50%, against 33% for the control group. The approach, with community management, women's small enterprises and participatory promotion methods, was 31%, 20% and 12% less costly, respectively, than that of the existing government programmes in the three countries (IRC 2006).

The study in Dosso, Niger, gave the cost of the existing promotion programme and compared the cost-effectiveness of two new approaches: social marketing and community-managed sanitation and hygiene promotion, both with participatory methods. After 21 months and at equal recurrent inputs and cost, but excluding costs of training and research, the second approach had 5% higher observed improvements than the first, in terms of percentage of households having private latrines and bathing facilities. The programme served 150 villages with an average population of 365 inhabitants at a cost of US\$1.45/pp/yr in 1995, or, with an assumed 5% annual increase, US\$1.74 in 1999. Overall, the cost of sanitation and hygiene promotion was only 2% of the hardware costs. Households contributed time, local materials and soap, but their value was not calculated (Sijbesma and Koutou 1995).

Finally, in the programme in Zimbabwe, Ministry of Health staff helped villagers form and run Community Health Clubs, addressing 50 improvements in 25 sessions in 1999–2000. A survey of 9% and 3% random samples of clubs and member households in one of the three districts and a control group of 100 households (one-third of the study group) showed that club households had better scores for clean latrines, no open defecation, covered storage of drinking water, ladles for drawing, no communal cups and plates, handwashing provisions, soap, kitchen gardens, refuse pits and clean, faeces-free yards. Member households did 40% better on washing hands under poured water instead of in communal basins and 33% better on individual cups and plates, but presence of soap improved by only 6% versus 1%. On a total of 18 indicators, club households performed 16% better than control households. Assuming an average household size of six, programme costs were US\$0.91/pp/yr in 1999. After programme expansion they fell to US\$0.35, with an average of US\$0.60 in 1999 values. However, costs of staff salaries and allowances, research and administrative overheads were not included (Waterkeyn 2002, 2005). Including salaries would have raised programme costs to US\$1.40/pp/yr (Cairncross and Valdmanis 2004). An additional cost of US\$2.24/pp was a subsidy of three bags of cement for latrine promotion at US\$15 per household (Waterkeyn 2005).

Comparing studies that greatly differ in locations, objectives, approaches and results is not easy. Two main findings do emerge. The first is that none of the programmes and studies covered all key behavioural indicators for reducing faecal-oral diseases, which are the most prevailing and serious health risks addressed through hygiene promotion programmes. As listed in Table 3, these indicators are: (1) handwashing by all at critical times and in effective ways; (2) a sustained end to open defecation with all toilets free from faecal-oral disease transmission risks; and (3) using only safe, and safely stored and handled drinking water (Shordt and Cairncross 2004;



Cairncross and Valdmanis 2006). The second finding is that, if the programme with solid waste recycling is excluded, the costs of the other hygiene promotion activities did not vary very widely. Irrespective of their results, their costs ranged from US\$1.05 to 1.74/pp/yr, with an average of US\$1.31.

## Conclusions and recommendations

Four global studies have demonstrated that hygiene promotion programmes can significantly reduce water, sanitation and hygiene related mortality and morbidity. Varying costs of US\$3.35 to US\$413 per DALY averted reflected differences in interventions, cost measurements and problems in health impact measurement. In comparison with hardware investments, the costs of hygiene promotion are low. Hygiene promotion can avert the death of a child under the age of five at 4–6% of the unit cost of an improved water supply or sanitation facility (Larsen 2004). To give that child or anyone else 1 year without water and sanitation related diseases, countries need to invest only 4% of the cost of a water supply with public water points on hygiene promotion, and these ratios drop to 1.5% if that service provides private connections, and 1.2% if households build latrines. Investing in hygiene promotion is thus highly cost-effective.

The six field studies confirmed that a critical mass of good practices for three key behaviour categories can be achieved at low promotional costs, although only Waterkeyn (2002, 2005) had data from all three categories and even she did not cover all key risky practices. When the outcomes in Table 3 are compared, the community health clubs were the most cost-effective, as they achieved the most improvements in all three categories at US\$1.33/pp/yr. The subsidy cost for latrines is a disturbing factor, however, and Allan showed that at US\$1.10/pp/yr promotion of self-construction can be cost-effective. Remarkably, no clear differences emerged between the different approaches: community-management and personal and small group discussions. This clearly needs a truly comparative study, which tests them at the same time in comparable locations and for the same practices.

Studies measuring the cost-effectiveness of individual hygiene promotion programmes or comparing the cost-effectiveness of different promotional approaches are still too rare. Water, sanitation and hygiene related field programmes have so far mostly analysed inputs, costs and outputs, and not quality of processes and outcomes in terms of objectively measured hygiene conditions and practices. Analysis of promotion concepts, methods and adherence to design were seldom included. Doing so is important for learning more about the cost-effectiveness of different promotional approaches, and for replication and scaling-up of a proven programme. Including full CEA studies is very important when planning and implementing hygiene programmes. Their data can convince policy makers and programme planners and managers to budget for effective hygiene promotion and can improve the quality of programming and education.

More research is needed, especially on the cost-effectiveness of different promotion methods. The least effective methods, such as general information diffusion, are increasingly replaced

by better ones, such as inter-personal and group communication, social marketing and programmes planned and managed by communities themselves. No clear conclusions on cost-effectiveness of approaches can be drawn from the reviewed studies, since all but one of them looked at one type of programme only, their study locations, times and methods differed, and their research designs were relatively weak. Future research four types of cost-effectiveness studies on hygiene promotion are needed:

- Before-after studies measuring the effects of certain hygiene promotion interventions with certain methods and costs, with control groups;
- Longitudinal studies with study and control groups, measuring changes over time;
- Studies that assess also the effectiveness of processes, such as the participation of women and men and the poor in planning, implementation and management;
- Comparative studies with study and control groups that assess the cost-effectiveness of different promotion approaches.

When collecting cost-effectiveness data, the full range of input, processes, outputs, effectiveness and impacts should be looked at. Longitudinal studies are important to see if and when improvements are sustained, and programmes and adoption continue without external support. Including local health impacts is often complex and costly. This only makes sense under four conditions: a 'critical mass' of good hygiene habits is present; good health statistics are available or can be collected easily; the study adds to already existing knowledge; and community health researchers will be involved. For good CEA studies, it is further extremely important that all hygiene promotion programmes have detailed plans and accounts of all their costs and expenditures.

Future studies should further have a more rigorous and preferably quasi-experimental design, and be better documented, so that findings can be validated and studies replicated. Besides conventional survey methods, more participatory evaluation methods exist, which allow community members to learn from the research (Narayan 1993; Almedom *et al.* 1997; Sijbesma 2001; Bolt and Cairncross 2004).

Hygiene promotion deserves more recognition, as equivalent to water supply and sanitation programmes for better health, economies and livelihoods for the poor. By measuring the cost-effectiveness of the intervention as a standard part of every programme and comparing the cost-effectiveness of different approaches, we can ensure that more people get the best 'value for money' in their efforts to achieve basic services, good health and human dignity for all.

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