Sustainability of hygiene behaviour and the effectiveness of change interventions: Findings of a multi-country research study and implications for water and sanitation programmes

From 2000-2003 six research teams from six different countries in Asia and Africa undertook a research study into the effectiveness of hygiene promotion interventions and the sustainability of changes in hygiene behaviour. The experiences and findings gained through this research study are worth sharing. Not only because they give insight in these areas, but also in do's and don'ts when undertaking a longitudinal behavioural study.

The experiences and findings have therefore been brought together and made accessible to people interested in hygiene promotion and behavioural research. We made two booklets. This booklet (booklet 2) describes the research findings and the implications these findings have for water and sanitation programmes. Booklet 1 describes methodological issues related to the research. We sincerely hope they provide useful reading and that you won't hesitate to let us know your experiences.

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ISBN 90-6687-048-6

Booklet 2

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ISBN 90-6687-048-6

Design & printing: Meester en de Jonge, Lochem, the Netherlands

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Sustainability of hygiene behaviour and the effectiveness of change interventions

Findings and implications for water and sanitation programmes from a multi-country research study

Booklet 2

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Preface

This booklet is one of two produced as a result of an international research project on the sustainability of changes in hygiene behaviour. The study was carried out in 6 countries by: Network for Water and Sanitation, Kenya (**NETWAS**); WaterAid Uganda (**WAU**) working in collaboration with Uganda Association for Socio-Economic Progress **(USEP)**; Volta Region Community Water Supply and Sanitation Agency, Ghana (**VRCWSA**); Nepal Water for Health (**NEWAH**); COSI Foundation for Technical Cooperation, Sri Lanka (**COSI**); and Socio-Economic Unit Foundation, Kerala, India (**SEUF**). IRC International Water and Sanitation Centre, the Netherlands, coordinated the research and technical advice was provided by IRC and by the London School of Hygiene and Tropical Medicine, United Kingdom.

The study had the following objectives:

- To assess the level of sustainability of behavioural change one to three years after a hygiene promotion intervention;
- To develop a methodology for simple, cost-effective long-term monitoring of behavioural changes;
- To gain insight into relationships between project approaches, external conditions and sustainability of changes in hygiene behaviour;
- To determine the policy and programming implications of the study findings as a basis for influencing future policy and increasing the effectiveness of programmes.

The study lasted for three years. At various points along the way interesting findings and experiences were shared with outsiders.

Our practical research experiences and the lessons learned are recorded here in the form of two booklets rather than as a detailed, academic account. We believe this will best serve the interests of busy people requiring an easily accessible reference to the study and its outcomes.

This booklet (2) describes how the study was undertaken and its findings. Booklet 1 outlines the methodological lessons learned.

Should you wish to discuss any aspect of this work or share your own experiences, please contact us. Our contact details are at the back of the booklet.

Delft,
March 2004

Acknowledgements

Support for the research and for the publication of these booklets was provided by the European Commission and the Netherlands Department for Development Cooperation. Their support is gratefully acknowledged.

These booklets could not have been written without our research colleagues:

- Emmanuel Nyavor from Ghana
- Joan Awunyo-Akaba from Ghana
- Palitha Jayaweera from Sri Lanka
- Beena Govindan from India
- Suma Zachariah from India
- Beth Karanja from Kenya
- Vincent Njuguna from Kenya
- Renuka Rai from Nepal
- Saraswati Khanal from Nepal
- Joyce Mpalanyi from Uganda
- Brenda Nahindu from Uganda

They gave much of their energy to the research, wrote research reports and gave us feed-back about the management of the research. For the authors it was just a matter of compiling, organising and consolidating the data and information provided by them.

We are also grateful to the directors of the organisations that participated in the research. They acknowledged the value of the research for their own programmes and allowed their staff to put in much more time than anticipated and budgeted for.

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Introduction

Why study hygiene behaviour?

Diarrhoea, worm infestation and eye and skin infections are diseases related to water and sanitation. About three million children die from diarrhoea each year. Each of the three common worms (roundworms, whipworms and hookworms) is estimated to infect more than 500 million people. Roughly 6 million people have become blind from trachoma, an eye disease[1]. Good hygiene can help prevent much of this, saving lives and preventing illness. For example, it is estimated that washing hands with soap can reduce the risk of diarrhoea by more than 40%. Programmes to promote handwashing might save a million lives each year[2].

Simple hygiene behaviours – that is what people do, their practices for cleanliness – are key to improving health. Hygiene promotion is therefore recognised nowadays as an essential part of water and sanitation programmes if the maximum health benefits are to be gained from provision of improved facilities.

The challenge within programmes is to ensure that the necessary new, improved hygienic behaviours are developed and sustained and it follows that we need to assess the results of hygiene promotion efforts if we want to:

- Learn how to do it better. For example, the results of a study in a few communities can be useful in improving these activities in other communities that come into the programme later on.

1 Dr D.A.P. Bundy, Welcome Trust Research Centre for Parasitic Infections, Department of Biology, Imperial College, Prince Consort Road, London SW7 2BB, UK; and Dr E.S. Cooper, Tropical Metabolism Research Unit, Faculty of Medicine, University of the West Indies, Kingston, Jamaica.

2 Curtis, V., and Cairncross, S. (2003).'Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. In: *The Lancet infectious diseases*, vol. 3, no. 5, p. 275-281.

- Justify investments in hygiene promotion to funding bodies. A study showing improvement in behaviours can be used to advocate for hygiene promotion. This can be very useful if a programme tends to focus too much on construction and not enough on what people actually do, that is, their behaviours.

Studying sustainability of behaviours

From research we already know that hygiene behaviours do change as a result of hygiene promotion[3]. What is still largely unknown is which factors are more likely to determine change and the extent to which changes in behaviour are sustained over time. Do people retain newly acquired behaviour or do they slide back into 'old habits' when they are no longer in contact with or supported by programme staff?

This international study was undertaken to help fill this knowledge gap. In the accompanying volume we describe various methodological aspects of the work. This booklet is about the outcomes. It explains the research strategy and findings, and how these findings can be interpreted to inform best practice in hygiene promotion and education.

Why not study health impact?

Some people think that the effectiveness of hygiene and water/sanitation projects is best evaluated by studying changes in health or looking for a decrease in the prevalence of diarrhoea. Certainly one objective of these programmes is to improve health but studying health impact is not easy and does not usually lead to clear results.

A review of the published and unpublished results of the best health impact studies of the Water Decade stated that these health studies are not useful tools for project evaluation or for improving

3 Kanki, B. et al. (2004). 'An approach to studying hygiene behaviour in Burkina Faso'. In: Cairncross, S. Kochar, V.J. (eds). *Studying hygiene behaviour; methods, issues and experiences*. Delhi, India, Sage Publications. p. 189-201.

interventions. The results are unpredictable and unreliable[4]. For example, information about diarrhoea from clinic records is often inaccurate. It is also difficult to collect accurate information by asking mothers, who may not remember episodes of illness in their children or may have another understanding of what diarrhoea is.
In addition, disease patterns are affected by many factors other than hygiene, making a health impact study tricky to interpret. Such studies are also very expensive and they usually do not provide enough insight into how to improve interventions.

On the other hand we know that, if people begin practising safe hygiene, their health will usually be better protected. Therefore studying improvements in hygiene practices will also inform about improvements in health. Collecting information about behaviours is also usually easier than getting accurate information about health. For these reasons we opted for a behavioural study rather than looking at health impacts.

Approaches to measuring hygiene behaviours

There are basically two approaches to evaluating hygiene behaviour:

- **The summative or survey oriented approach** aims to assess, often at the request of a funding agency, whether (or to what extent) project targets have been achieved. It is the more traditional, quantitative approach where a researcher or a research assistant visits communities and households to collect information. The collection can be done in various ways, for example, asking questions from a questionnaire, carrying out group discussions, making observations, pocket voting. The results are written onto data sheets and then analysed in a central office. The information is used in the central office or by project managers.

4 Cairncross S. (1990). 'Health impacts in developing countries: new evidence and new prospects'. In: *J. Inst. Water & Environ. Man,* vol. 4, no 6, p. 571-577.

World Bank (1976). *Measurement of the health benefits of investments in water supply.* (Report; no. PUN 20). Washington, DC, USA, The World Bank.

In general, the benefits of this approach are that it is well-known, it is quick to enter the information on data processing sheets and the information can be collected by a research assistant with only a few days training. On the downside the answers to questions may not always be accurate and the information is not always given back to the community. We also sometimes hear that community members are 'over-surveyed' and become disinterested from repeated questioning.

- **The formative or participatory approach** is a community-oriented approach in which the researcher and research assistants are more like facilitators. They help the community to collect and discuss its own information about water, sanitation and behaviours. The data collection can be done in several ways. For example, people from the community may make maps or use rating scales. They can have group discussions, make observations of households, do pocket voting. Many of the collection tools are similar to those used in the survey approach, but the people in the community take the lead in collecting and analysing information, supported by the research assistants.

  The major benefit of this approach is that it is motivational. Community members learn to look at their own community in new ways and want to take action. It can also be more accurate as the people involved check each other when they collect and discuss information.

  One drawback is that the research assistant needs careful training and practice because facilitation is more difficult than just asking questions and writing answers. This approach also involves more time in the communities and can therefore make this stage of the study more expensive.

  Ten years ago the results of participatory activities could not be quantified because the gathered information could not be recorded

in a numerical form convenient for analysis. Fortunately practical means are now available to 'quantify qualitative data'[5].

The precise balance between the two approaches depends on the objectives of the specific study and the preferences of the researcher. But there is wide agreement that it is best to combine several methods so that the results can be checked for consistency between them.

Collecting both quantitative and qualitative data is useful.

In our study we used a summative, survey-oriented approach but mixed with elements of the participatory approach. For example, in several countries the information from the survey was fed back to the projects and to the communities. This helped check the data and also helped motivate people for action to improve their projects.

5 Postma, L, Wijk, C. van, and Otte, C. (2003). 'Participatory quantification in the water and sanitation sector'. In: PLA *Notes*, no 47. p. 13-18.

Our study framework

We used a simple framework for the study. This framework helps to explain the nature of the booklets and their interrelationship. The framework is as follows:

Through a first round of data collection we established the **starting points** in which:

- people perform a certain level of hygiene behaviour and a certain level of sanitary conditions is in place;
- in and around the community the resources are identified that make this level of behaviour and sanitary conditions possible, such as local construction materials for latrines, a shop that sells soap, and people's knowledge.

We looked at **inputs** brought into the community through project interventions. These inputs included:

- hardware to improve availability and accessibility of water supply as well as availability of materials and knowledge for latrine construction;
- provision of training and mobilisation for hygiene promotion, either directly to the target group or indirectly through women's groups, youth clubs or teachers;
- peer motivation to encourage (or discourage) the community or family members in behaviours relating, for example, to handwashing or latrine use.

These inputs were aimed at improving hygiene behaviour. Improved hygiene behaviours, such as handwashing, construction and maintenance of latrines are called **outputs**.

By doing a second round of information collection we were able to determine whether outputs (i.e. behaviours) were sustained and which of the inputs (i.e. project interventions) were most effective in bringing about behavioural change.

Booklet 1 is about lessons we learned regarding methodological aspects of the study.
Booklet 2 is about how we did the study, the findings and their implications for future water, sanitation and hygiene programmes.

Who are the booklets for?

The booklets are intended primarily for practitioners wanting to set up a similar study. Booklet 1 provides useful information on how to do so and on how to avoid some mistakes of earlier studies. Booklet 2 is for those wanting to become more effective in their hygiene promotion efforts. It refers to the hygiene promotion methods seen to be most effective in bringing about behavioural change.

Those responsible for setting up a monitoring framework can also benefit from reading Booklet 1, since it provides ideas for monitoring indicators and for implementation of monitoring activities. That booklet will be useful also for water and sanitation programme managers and donors wishing to understand the challenges faced by researchers. For the same audience Booklet 2 will be of interest with regard to justifying investments in hygiene promotion.

How to use the booklets?

The booklets have been written in such a way that each can be read on its own, depending on your interest. Should you want to set up a behavioural study, the first booklet is most useful. If you are most interested in impact data and designing a hygiene promotion programme, the second is best for you.

Should you wish to order more copies you may do so by contacting IRC by mail, phone or fax or through our website (http://www.irc.nl/content/view/full/167). The booklets have been produced in such a way that they may also easily be photocopied. Should you do so, please acknowledge the source.

A note about statistics

The benefits of studies such as this depend, in the end, on being able to understand the messages contained in the considerable amount of data that has been gathered. Sometimes that can be done by a simple comparison of numbers or percentages but on other occasions more sophisticated approaches, involving some statistical analysis, are needed if a meaningful interpretation of the data is to be obtained.

Both booklets refer at various points to some of the terms and techniques used in statistical analysis. These are fully explained in an Appendix (3), common to both booklets. Readers may find it useful to read that short section before studying the relevant parts of the main documents.

Correct handwashing is a rather complex behaviour.

Behaviours we studied

There are many hygiene behaviours, but if there are too many in a study it becomes too complicated and gives rise to too much data. It makes sense to study those behaviours that are most important in preventing illness. According to WHO they include: handwashing, having and using latrines, safe disposal of infant excreta and storing drinking water safely. Our research therefore studied those behaviours.

Handwashing

Having clean hands is important to prevent disease. For example, one common way to get a cold, or serious diseases such as hepatitis A or diarrhoea is by rubbing your nose, mouth or eyes after your hands have been contaminated with germs.

Handwashing is a complex behaviour, for which several things are needed such as knowledge, skills and an enabling environment. Four elements that one can use as approaches to measure handwashing are:

- **knowledge** of handwashing times that are important for health reasons. These 'critical' handwashing times are usually considered to be: before eating, after defecation, after handling excreta of infants.
- **skills** in washing hands correctly. In practice this means rubbing both hands with a cleaning agent like soap or ash and using enough water.
- **enabling environment**, for example existence of a convenient location with soap and water for handwashing in the household.
- the person's **actual practice** of handwashing. Do people actually wash hands correctly at the most critical times?

Toilet use is an important hygiene behaviour.

Latrine use

Having and using a latrine can help prevent diarrhoea and worm infections. Most of the agents – bacteria, viruses and parasites – that cause these illnesses cannot, of course, be seen. These agents get into the body through the mouth or skin and are passed out in excreta. They can be passed from one person to another through unclean hygiene practices. One purpose of having and using a latrine is to remove human excreta from human contact.

Valerie Curtis of the London School of Hygiene and Tropical Medicine describes the problem this way: All people pass germs out in their excreta. Not all of it is dangerous but one gram of excreta can contain 10,000,000 viruses, 1,000,000 bacteria, 1,000 parasite cysts and 100 parasite eggs[6]. A low infective dose (only about 100 viruses or 10,000 bacteria) can make another person ill if it is passed to them via food, fingers, water or flies[7].

To have a strong health impact, latrines must be used consistently by all children and adults in the household. In our research, four components were studied:

- Presence of a **proper latrine** with a superstructure and door.
- Evidence of **latrine use**. For example, is there a clear path to the latrine, is there excreta in the pit, is the environment free from excreta?
- Evidence of **latrine use consistently by each person** when they are around the household.
- **Latrine is maintained.** The floor is clean, the hole or trap and the walls are free from excreta. The hole of the pit latrine is covered.

6 Curtis, V. and Kanki, B. (1998). *Happy, healthy and hygienic: how to set up a hygiene promotion programme. 1. Planning a hygiene promotion programme.* (Water, environment and sanitation technical guidelines series / UNICEF; no. 5). New York, NY, USA, UNICEF, Water and Environmental Sanitation Section.

7 Idem

Storing drinking water safely

Safe storage of drinking water means at least keeping it covered. In the Ghana study safe storage also meant that the container and storage area should be clean, there should be no visible particles in the water and there should be a dipper near the water container.

We looked at behaviours of men, women, rich and poor.

Tools to collect information

There are many tools for collecting information and certain tools will give more accurate information than others. For example, if you are studying whether people have the necessary skills to wash hands correctly, asking them to show how they wash hands, to demonstrate, is better than asking them to describe what they do. Booklet 1 provides much more detail about the tools we developed and used and the lessons we learned. The following is a brief overview:

The tools to study handwashing were:

- **Questioning to measure knowledge**: People were asked when is the most important time, for good health, to wash hands.
- **Observation of handwashing skills**: One person from each household was asked to demonstrate how to wash hands correctly. The research assistant observed whether the person (a) used sufficient water (1 cup or more), (b) used soap/ash, (c) rubbed both hands.
- **Pocket voting to measure actual practice**: In some country studies this was done in small group meetings, in others it was done in the households. Each person present was asked to vote (secretly) in a pocket chart about whether they always washed both hands with soap and water. The answers were recorded separately for men, women, boys and girls.
- **Observation of the location of soap and water**: The research assistant observed if soap, water and container were placed conveniently for handwashing. In some country studies they observed whether soap and water was placed near the latrine, as a sign that people actually washed hands after defecation.

Latrine use and maintenance was measured in the following ways:

- **Observe if latrine exists**: The research assistant visited the latrine and observed if it had a superstructure and door. In one country this was done through community group discussion and mapping.
- **Observe if latrine is used**: Observation was made of whether there was a clear path to the pit, if there was excreta in the pit, if the

surrounding environment was free from excreta.

- **Observe cleanliness and maintenance**: The research assistant observed whether the latrine floor, the squat hole/pan and walls were free from excreta. Other things observed were: presence/lack of cover for hole in pit latrines, presence of holes in walls big enough to see through, whether the latrine had a roof and door.
- **Pocket voting to measure consistent latrine use**. Each person present was asked to vote (secretly) in a pocket chart on whether they always used a latrine when they were around the home.

Pocket voting

Learning about the hygiene activities

In order to see if the original project activities have had a lasting impact on behaviours, it is necessary to find out about those activities. This is usually done in two ways. First, people in households are asked questions about the hygiene activities they remembered or participated in. Secondly, key informants such as members of water committees or local government people are asked about the community project under scrutiny and the hygiene activities and training included in it. Each community will usually have had slightly different project inputs and experiences.

Methodological issues

Main research activities

In broad terms our research had the following steps:

Initial meetings with researchers to design the study, develop the hypotheses to be tested, and to make drafts of the collection tools and questionnaires. At this stage too the data input sheets were designed.

Preparatory field work, which included activities such as translating the questionnaires into local languages, training research assistants, field testing and amending the data collection tools. In our studies the training of the research assistants was combined with testing of the tools. Initially the research teams needed to get permission from communities and, in some cases, from the project principals, to carry out the research.

Field work, which included selecting the communities, sampling households, identifying community groups. Research assistants carried out the survey activities and recorded the data in the data sheets.

Analysing the information, which included checking the data sheets for mistakes and 'cleaning' the data, making totals for each question and item, entering these into spreadsheets for further analysis. Finally, potential associations between the results were analysed, for example: "Did people who remembered hygiene classes tend to perform handwashing better after the project had ended?"

Documenting, disseminating and promoting the use of research findings at the national and international levels.

Booklet 1 has more details on the research methodology and the lessons we learned about it.

Analysis of data

As we have said, many things can be analysed when studying hygiene promotion and education. Typical questions are:

- Did the hygiene behaviours change?
- Did the hygiene promotion and education have an impact?
- What kind of hygiene promotion activities are most effective?
- Are the hygiene behaviours sustained, that is, do they continue in the household and community after the project ends?

While our study focused primarily on the last question – sustainability – we also examined the first three questions. We needed evidence about the effectiveness of the original promotion effort and whether behaviours were changed in the first place, before we could study whether any changes were sustained. Detailed information about how we did this is given later in this booklet.

We organised the data and made totals using the standard Excel sheets in the Microsoft programme. Then, to keep the analysis simple, we used the EpiInfo programme (a free computer programme, EpiInfo2000, which can be downloaded from www.cdc.gov).

How to write and understand the data

Usually a researcher or a statistician does the analysis of a study. The worth of a study is much reduced if, as sometimes happens, people merely describe the numbers without really understanding them. It is important to know what the results mean. Therefore, before going into the actual research findings, this section looks at recording and understanding the data.

Graphs can be helpful to present data.

Percentages and numbers

Most studies show the total results for each question or item being studied. Often the results are in percentages, for example:
60% of the households stored drinking water safely.

However, only giving the percentage can be misleading. For example, saying "60%" can mean 3 of only 5 households visited (3/5 = 60%) or it could mean 300 out of 500 (3/5=300/500=60%).

It is more convincing to use percentages, numbers and definitions. This example from the Ghana study shows both the numbers and the definition: 59% (130/220) of the households stored drinking water safely (covered drinking water, no garbage or faeces around drinking area, no visible particles in water).

You can see the percentages and totals of the results for the main behaviours in our study in Appendices 1 and 2.

Is it significant?

As is noted in the Introduction to the booklet it is frequently necessary, when analysing data, to go beyond a simple comparison of numbers or percentages. We might wish for example to identify a trend from two sets of data collected at different times, as in our study when we asked: Did more people demonstrate correct handwashing skills the first time the information was collected (in 2001) or the second time (in 2002)?

In the case of Nepal we found that:

- 63% (147 out of 232) showed good handwashing skills in 2001 and
- 57% (137 out of 241) showed good handwashing skills in 2002.

We would like to be able to identify a trend over the time interval and it looks as if the skills are being lost, because 57% is less than 63%. However, the difference over the year is quite small and one wonders if it could have happened by chance.
The question then is: "Do the figures represent a real trend or is the difference between them just a random indication that might be reversed if another survey was made? Is the difference meaningful or, in mathematical terms, statistically significant?"
The answer here is that the change from 63% to 57% over the year was *not* significant; the numbers with skills were about the same. This is established by considering the mathematical concept of 'probability,' often represented by the letter 'p.'

A p-value of 0.05 or less is accepted as indicating that a difference between numbers is significant. A greater value indicates that the difference was more likely to be a random or chance happening that might go the other way in another survey. Here p=0.52.

(Further discussion of 'probability' and other statistical terms and approaches referred to in the booklet will be found in Appendix 3).

Sampling

In our study, random sampling was done in Ghana, India and Sri Lanka. In the other countries, Kenya, Nepal and Uganda, random sampling was not practical because in the communities concerned there were relatively few households with latrines. Therefore a purposive selection was needed to identify households with latrines so that an adequate sample size could be achieved. The sanitation data from these three countries therefore tells us about households with latrines rather than about all the households in the communities studied.

Table 1: Samples in the six-country study

Country	Institution carrying out research	Sample size	Remarks
Ghana	VRWSP	10 communities 2001: 220 households, 20 schools 2002: 220 HH*, 20 schools	Sample had 5 communities where intervention ended in 1998; 5 communities ended in 2000.
India	SEUF	2001: 3 communities, 346 HH 2002: 10 communities, 345 HH plus informant interviews	Intervention ended in different years from 1993 to 2000.
Kenya	NETWAS International	2001: 6 communities, 215 HH plus 6 women's groups 2002: 112 HH plus 6 women's groups plus one control group, 29 schools	One half of 2001 households were re-surveyed in 2002. Individual survey of women's group members in 2002; group interviews in 2001.
Nepal	NEWAH	6 communities 2001: 77 HH 2002: 150 HH 2003: 242 HH plus focus group discussions	73 HH in 4 hill communities were dropped from the study because of security problems. Two of the remaining 6 had 2-year interventions and were surveyed 2 times. Four had one-year interventions.

>

Uganda	WaterAid - Uganda	6 communities 2001: 221 HH 2002: 180 HH plus group and informant interviews	2 communities in each of 3 ethnic groups.
Sri Lanka	COSI	6 communities 2001: 110 HH 2003: 150 HH	In 2003, there were 4 project (100 HH) and 2 control communities (50 HH).

*HH = Household

More information about sampling is given in Booklet 1.

Were behaviours created: evidence of impact

Most research or monitoring studies of hygiene look for evidence that the intervention had an impact, that behaviours have improved as a direct result of the hygiene promotion. We did this by:

Comparing with control groups: Comparing communities or groups that had hygiene education/promotion with those that did not.

Using baseline data: Comparing hygiene behaviours before and later or after the intervention.

Looking for direct evidence: Assessing whether people who participated in project activities had better hygiene behaviours than those who did not.

Control Groups

In assessing impact by use of control groups we compare communities or groups that had hygiene education/promotion with those that did not. If the hygiene programme had an impact the recipient group(s) will perform better than the control group(s). The improved hygiene behaviours of the people who were in the programme will be evident.

One word of caution: It is important to select the sample carefully. The intervention communities should properly reflect the project population and not be 'showpiece' communities. The control communities should be like the intervention communities. They should have similar water and sanitation conditions and similar populations.

Using control communities helps in assessing the impact of hygiene promotion.

Example of results from the Indian study

In the Indian study, two large communities were selected[8]. The communities had similar access to water supplies and both had latrine subsidies. One had a sanitation and hygiene project intervention lasting 7 years, with a hygiene promotion campaign and education classes. The other had no hygiene promotion or education activities. Comparing the two communities showed:

- For **handwashing skills**; the demonstration of how to wash hands correctly (using soap/ash and rubbing both hands) was performed much better by the project group: 97% (113/117) versus 10% (10/102) for the control community.
- For **reported handwashing practice**; always washing both hands with soap and water was measured through pocket voting. This

8 Two wards in each of the two communities were surveyed. Each ward has about 500 households.

showed that the project households were significantly more likely to wash hands consistently: 86% (282/326) compared to 6% (14/222) for the control community.

- For **location of soap** (for handwashing) within the household; the premise was that, if the materials for handwashing are conveniently located, it is more likely that people will wash their hands. In this study only the project households were likely to have soap and water convenient for handwashing: 93% (113/121) versus 0% (0/102) for the control community.
- For **household environment**; the community with the hygiene project intervention had significantly cleaner household compounds than the control community. 97% (117/121) versus 35% (37/105).

An interesting finding was that there was no significant difference between the project community and control community in:

- Knowledge of critical handwashing times (before eating and after defecation): 120/120 (100%) in the project households and 81/105 (87%) in the control households. Knowledge was clearly not related to handwashing skills or practice.
- Latrine use and cleanliness: This was at the same level for the control and project community. Consistent latrine use was shown by pocket-voting: 95% (311/326) in the project community and 95% (211/222) in the control community. Latrine cleanliness was the same: 94% (117/121) and 92% (92/105 in the control households). This may indicate that promotional activities outside the project have been important.

In the Sri Lanka study, the intervention communities tended to perform better than the control communities in terms of:

- **Latrine cleanliness** (the floor free from faecal matter): 92% (72/79) for intervention communities versus 4% (1/22) for the control group.
- **Latrine shows signs of use:** 96% (75/78) for the intervention versus 77% (17/22) for the control communities.

- **Child excreta is put in latrine**: 47% (14/30) versus 17% (1 out of 6 households).

Only the first of these three sets of figures is significant; however, the trend of each is in the expected direction, with the intervention households appearing to perform better.

Baseline information

Baseline information is used to compare behaviours in a community before and after a project intervention. Baseline data is collected in a survey of the community before the project starts. That data is compared to data collected later or after the project, but using similar collection tools and questions. If the hygiene intervention had an impact, there should be a change over time.

Example: Number of households having and using a latrine before and after a project.

Baseline information for two communities in Nepal was collected during group discussions and group interviews. Community members counted the number of latrines in their village before and after the project.

Table 2: Latrine coverage Nepal

Community >	1	2
Initial latrine coverage (%)	0	1
Final latrine coverage (%)	43	55
Rise in coverage (%)	43	54

In the baseline study from India 'before and after' information was collected from several separate communities (next page).

Table 3: Latrine coverage India

Community >	Kal	Anj	Koip	Mara	Kavo	Kapu	Neen	Alap	Puth	Kaip
Initial latrine coverage (%)	52	15	55	43	39	18	41	24	32	38
Final latrine coverage (%)	72	41	85	75	72	55	87	71	87	100
Rise in coverage (%)	20	26	30	32	33	37	46	47	55	62

From these examples, we can see that the project made a difference in latrine ownership.

Direct evidence

Direct evidence of impact is identified by looking for links between particular hygiene promotion inputs and hygiene behaviour outputs. Hygiene promotion inputs are usually some combination of activities such as:

(a) mass activities (campaigns, drama, videos, camps, rallies, village councils), including the production and distribution of hygiene education materials;

(b) group activities (training classes, meetings, formation of women's groups); and

(c) personal communications (home visits, advice from a neighbour, advice from a child).

To find direct evidence, we look for answers to questions such as:

- Do the people who participated in project activities have *better* hygiene behaviours than those who did not?
- Did *more* people who participated in hygiene promotion activities practise the hygienic behaviour than those who did not participate?
- Did *more* people who remember particular hygiene promotion activities practise the hygienic behaviour than those who did not remember?

Answers to such questions can be of particular interest to programme leaders who often want to know which hygiene promotion activities have greatest impact.

Observing practices often tells you more than asking questions.

Examples

In our six country study, information was collected in communities where the project had ended two or more years earlier. We compared the hygiene behaviours of people and households that had or had not participated in certain hygiene promotion and education activities during the project[9].

9 N.B. In these examples and in succeeding pages extensive reference is made to the statistical mathematics terms probability (p), odds ratio (OR) and confidence interval (CI). The meaning of these terms and their significance to the analysis of the information recorded in our study is fully explained in Appendix 3.

Personal communication: In the Kenya study, people who said they had heard about latrines and handwashing from other trained women's groups and neighbours had significantly better handwashing practice (p=0.037, OR=1.5).

Attending meetings: In the Ghana study, attending small group meetings was one project activity that made a difference. People who reported to have attended meetings where hygiene was discussed were more likely to have better handwashing skills as shown by a demonstration (stratified by community: p=0.0014, OR=2.20, CI 1.33-3.88).

Attending required hygiene classes: The India study showed that women who remembered hygiene education classes between 2 and 9 years later were significantly more likely to

- have good handwashing practice (p=0.007, OR=2.04, CI 1.05 - 3.96);
- know that washing hands before eating is important for health reasons (OR 2.9, CI 1.43-6.0); and
- have household compounds that were clean, free of faeces and other waste (OR 2.8, CI 1.22-6.6).

This was not significant for men, as they did not usually attend the hygiene classes.

Overall exposure to hygiene promotion/education: In the India study, hygiene inputs were measured in 8 ways: participation in activities, remembering classes, video/slide shows, drama, competitions, women involved in organisation, masons giving messages, and the number of home visits. All of these were shown to have positive links with the handwashing practices reported by all the women of the household, although only one (health education classes, OR 2.04, CI 1.05-3.96) was statistically significant. That these linkages are all in the expected direction is itself significant; the probability of it arising by chance is only about 1 in 250.

From this we can see that project activities such as hygiene classes, group meetings or encouragement by people who had been trained, have had an impact on handwashing behaviour. We can be fairly sure of this since it was studied two or more years after the main project activities ended.

It was interesting to note that the more personal activities (attending meetings and classes, hearing from a neighbour) seemed to show more direct impact than the mass activities.

External variables

The researchers suggested that the eventual impact of a hygiene promotion programme might depend not only on the quality of the promotion effort itself but also on other associated variables such as the general level of education, or the socio-economic status or the access to water/sanitation within the community. Would a powerful promotion effort improve the hygiene behaviours of men and women, rich or poor, whatever the level of education in the community? Conversely, would less effective promotion, reaching only part of the population, produce a higher incidence of improved behaviours in the better educated or richer sectors of the community or in the households close to water points? Each variable (access, education, socio-economic status, length of hygiene promotion) is discussed below.

Access to water

It has been thought that providing water and sanitation services, including providing water in or close to the home, can in itself lead to better hygiene behaviours. In our study, we compared households with good and less good access to water. Access was measured in different ways such as the time needed to collect water (Kenya, Nepal), the distance to the source (Sri Lanka, India), the length of queues at water points (Ghana) or the reliability of the supply (Kenya, Ghana).

Access to good quality water does not necessarily mean that the water may not make you ill.

It should be noted that, in general, access to water supply was fairly good. However, in none of the six studies was there any significant relation between access to water and handwashing knowledge, skills or practice, or latrine cleanliness and maintenance. Only in one country study, Ghana, did households with worse access to water tend not to have water and soap conveniently located for handwashing (stratified by community: p=0.046, OR=0.57, CI 0.35-0.99).

This indicates that providing a convenient water service is probably not, in itself, a sufficient inducement to good hygiene practices.

Duration of the project

In the Indian project the duration of the intervention did not appear to be related to behavioural outcomes in the two communities where it was measured. Here it was suggested that the project should last as long as needed to mobilise the community, to organise groups and to carry out the work well.

Conversely the duration of the intervention did have some effect in the Nepal programme. The two-year intervention communities performed better than those with one-year interventions in some elements of domestic hygiene, such as covering food ($p< 0.009$) and in handwashing skills, specifically, rubbing both hands ($p<0.022$).

Education and socio-economic status

In two countries where it was measured, the education of women was related to hygiene practices. Women with more education tended to have healthier behaviours. In the Kenya study better educated women were more likely to have handwashing knowledge, skills and practice as well as consistent latrine use. The difference between women with more and less education was significant in all cases ($p<0.02$). In Nepal, women with more education tended to demonstrate better handwashing skills and more frequently located soap conveniently for handwashing in the household (in both cases $p<0.01$). The indication was that more educated women do better in adopting hygienic practices.

Socio-economic status and behaviours were compared in two studies: India and Sri Lanka. In the India study, the hygiene behaviours of women were found not to be related to the socio-economic status of the community. Their behaviours were linked rather to the hygiene classes included in the project. Those classes were positively associated with handwashing reported by women (OR 2.04, CI 1.05-3.96), with their awareness that washing hands before eating is important for health reasons (OR 2.9, CI 1.43-6.0), and with their knowledge of the importance of cleanliness of household surroundings, which were free

of faeces and other waste (OR 2.8, CI 1.22-6.6).

However, in the same study in India for men, the above findings were largely reversed. Their latrine or handwashing practices showed no significant linkages with previous hygiene promotion activities but were closely linked to the socio-economic status of the community (as rated by the project staff and the government). Apparently the project had little impact on the habits of handwashing or latrine use by males. The inference was that men who lived in richer communities were more likely to use the latrine consistently and to wash hands consistently.

In this (Indian) project women were more involved in hygiene promotion activities than men. So it appears that there is a gender issue. We think that if both men and women had been involved in the hygiene promotion/education activities, there might have been a measurable impact on both men *and* women. Variables such as socio-economic status would then have become less important.

As a result of the study the researchers suggested that, in general, if a hygiene (and community) intervention is intense, with a strong gender and poverty focus, these linkages to education and socio-economic status would be weaker. Thus answering this type of question (Do educated women do better? Are only women involved in hygiene activities?) may be helpful in assessing the extent to which an intervention has reached all the people and the poorest households.

Other interesting findings

In two country studies, Nepal and Kenya, latrines that were considered easy to use tended to be better maintained. (Nepal p=0.05, Kenya p=0.041).

Skills are related to practice. People who showed how to wash hands correctly also tended to have better practice. In all three relevant studies the demonstration of good handwashing skills was associated

with reported good handwashing practice (India p<0.00004, Kenya p=0.00002, Uganda for men only p=0.038 OR=1.93).

Knowledge is not necessarily related to skills. The relation between handwashing skills and knowledge of critical handwashing times (after defecation) was mixed. Handwashing skills were linked with the knowledge of the need for handwashing after defecation for health reasons in Ghana (p=0.00006) and India (p=0.002) but not in Kenya, Nepal, Sri Lanka or Uganda.

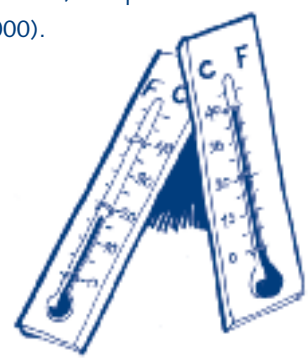
Were behaviours sustained?

To advocate for hygiene promotion or hygiene education it would be useful to know whether the new behaviours continue after the intervention ends. If the key behaviours are sustained, then we can probably argue that promoting hygiene in water and sanitation is worthwhile. Unfortunately the sustainability of behaviours is not usually studied. To do this, we need to look at changes in what people do over time, after a project has ended in their community or group. In other words: Do new hygiene behaviours decrease significantly over time, after the programme ends?

Our study looked at this in two ways:
End dates: A comparison was made of projects that ended in different years.
Study dates: A comparison was made of data that was collected at two different times, one year apart.

Comparison of intervention end dates

One way to study whether behaviours are sustained is to compare communities where the project ended recently, say in 2000, with communities where it ended earlier, for example, in 1998 or before. If behaviours *do* continue and *are* sustained, then the hygiene practices of people will be similar no matter when the projects ended. If behaviours *are not* sustained, we should find that fewer people are practicing safe hygiene behaviours where the interventions ended a long time ago (in 1998 or before) compared to where the projects ended more recently (in 2000).



'Behavioural temperatures' may go down with time.

In five countries, behaviours were surveyed in communities where the project interventions had ended 1 to 4 years previously. Specifically, data was collected in the Kenya, Nepal, Uganda and Ghana studies from communities where the interventions ended in 1998 and 2000. In one of these countries, Ghana, there were some follow-up visits to the communities by project staff so that the project did not fully 'end' at the specified date. In the sixth country, India, it was possible to collect data for 10 communities where the interventions had ended between 1 and 9 years previously. This study is dealt with at the end of the section.

A typical example, from the study in Kenya, is about handwashing practice. Members of women's clubs looked at posters/photos showing different handwashing practices. They then did secret pocket voting to answer the questions: "Do you wash your hands after using the latrine? After handling children's faeces? Before eating?"

For women's groups where the projected ended

- in 1998, about 66% (81/122) of the women voted to say that they did wash their hands at these critical times.
- ended in 2000, about 54% (50 out of 93) of the women washed their hands at critical times.

The former figure is greater but, in statistical terms, the difference is not significant: p=0.42, meaning that, if the pocket voting was done five times in the project area, in perhaps two of those times the results would be the opposite (0.42 is roughly equal to 4/10=2/5). For this reason we can say that the women's groups in the two years have about the same behaviour.

For the studies in five countries 25 comparisons were made between a behaviour and the end date of the project. The behaviours were: handwashing skills, handwashing practices (person washes hands with soap and water), location of soap/water in the household, latrine shows signs of use, person uses latrine consistently, latrine is

maintained and clean, water covered/stored safely. The end dates of the projects compared were 1998 and 2000. The results show that in only 2 out of 25 comparisons made did the people practice safe hygiene behaviours more where the projects ended in 2000 than where the projects ended in 1998.

This infers that the time elapsed after the projects ended did not make much of a difference. Hygiene behaviours were seen to be similarly sustained whether the projects ended 4 years or only 1 or 2 years before this study[10].

The table in Appendix 2 shows all 25 of the comparisons for selected behaviours and end dates of the project interventions.

Handwashing skills forgotten?

For one measurement – handwashing skills – scores were higher in all five studies where the intervention ended recently (2000) than where it ended a longer time ago (1998). The difference between the 2000 and 1998 communities was, however, statistically significant in only one country, Ghana. Nonetheless, the general trend here does seem to indicate some decrease over time in remembering how to wash hands correctly.

Other findings

Another interesting finding was that, in one country, Nepal, all the hygiene behaviours were more prevalent in communities where the

10 There were two exceptions: In Ghana, handwashing skills were significantly better demonstrated where the intervention ended in 2000 than in 1998: 64% (141/220) versus 54% (119/220): p<0.043, OR 1.51.

In Uganda, latrine maintenance was better in communities where the intervention ended more recently (2000) than where it ended earlier (1998): 70% (88/125) versus 54% (72/122). This was true for two out of the three districts surveyed. In one district the 2000 communities actually did worse (p=0.011, OR 2.02, CI 1.16-3.50).

intervention ended in 2000 rather than in 1998. Although none of the differences was significant, it appears that there was some deterioration in hygiene behaviours after the end of the project. The discussion groups in the Nepal communities said the same thing.

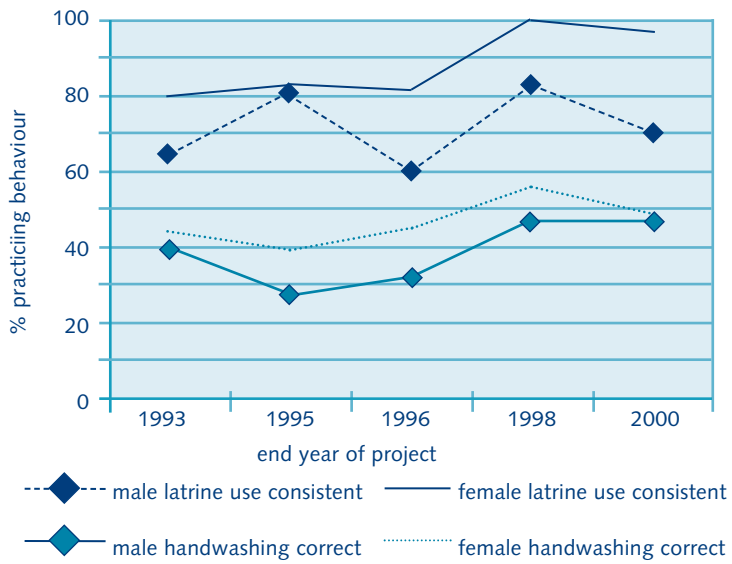
For the study in India, the end dates of the projects ranged from 1993 to 2000 in the 10 communities studied. The table below shows the numbers and percentages for latrine use ("Do you always use the latrine when around the home?") and handwashing practice ("Do you always wash both hands with soap and water?"). The information was collected by showing pictures and having pocket voting in the household.

Table 4: Handwashing and latrine use for men and women by end date of intervention

End date	**1993**	**1995**	**1996**	**1998**	**2000**
Number of men	80	89	22	32	30
Number of women	98	130	31	57	64
Number of males latrine use	52	72	13	27	21
% of males latrine use	65	81	59	84	70
Number of females latrine use consistent	77	109	25	56	61
% of females latrine use	79	84	81	98	95
Number of males handwashing correct	31	24	7	15	14
% of males handwashing	39	27	32	47	47
Number of female handwashing consistent	42	51	14	32	39
% of females handwashing	43	39	45	56	48

This graph displays the information from the table according to when the project ended in a community:

Graph of behaviours, India Study



We can see that each line 'bounces around' but has an overall direction. The change in the overall direction shows a small increase in all the lines, for male and female latrine use and handwashing over the seven to eight years from 1993 to 2000. For men, the change in male latrine use and handwashing was not significant.

For women the trend in both lines is significant. This means that women where the projects ended more recently were significantly more likely to wash both hands with soap and water (p=0.004) and were more likely to use the latrine when at home (p=0.00013). In other words, handwashing and latrine use practice seem to decrease as the years go by after the project ends.

However, the decrease is not very great. Even for projects that ended nine years before this survey, in 1993, about 80% (that is, four out of five) of the women were reportedly still consistently using their latrines. For these reasons we can still say that latrine use was fairly well sustained for both men and women.

Comparison of data collection rounds (study dates)

In addition to comparing behaviours following projects that ended at different times, sustainability can be checked by looking at the same community over an extended time. For example, surveys can be done twice in the same community or neighbourhood, one or two years apart. Reduced sustainability will be indicated if there is a fall-off in the improved behaviours between the two survey dates.

In our studies, surveys were made in 2001 and 2002, about one year apart. The behaviours compared were the same as before: handwashing skills, person washes hands with soap and water, location of soap/water in household, latrine shows signs of use, person uses latrine consistently, latrine is maintained and clean, water covered/stored safely.

The data was analysed for four countries. In 17 cases a comparison was made of hygiene behaviour changes between the two data collection dates. In only one of the 17 comparisons was there a significant change over the one year period, inferring that, in general, the improved hygiene behaviours were being sustained.

The one exception was in the Uganda study where handwashing skills decreased from 49% (42/86) in the 2001 survey to 35% (76/214) in the 2002 survey. This was significant at the 95% level (p=0.045 , OR=0.58 CI 0.33-0.99) with changes seen in two out of three districts[11].

Other findings

The prevalence of good handwashing skills was greater in 2001 than in 2002 in four countries (Kenya, Nepal, Sri Lanka and Uganda) but the difference was not statistically significant. Nonetheless there was once again a consistent trend, indicating some decrease in handwashing skills.

The only exception was Ghana where the trend was reversed (2002 results better than 2001). However, in this case field staff returned to the communities between the two surveys to renew their motivational activities. This might explain the contradictory results.

The table in Appendix 2 shows all 17 of the comparisons for selected behaviours for the two surveys (2001 and 2002).

11 Interestingly three variables were significantly worse in 2001 than in 2002. In one case, Ghana, this seems to be because field staff continued returning to the communities and provided continuing motivation for hygiene practices. The data for each country is shown in Appendix 2. In Kenya, two variables (handwashing skills and handwashing practice) were more prevalent in the 2001 than the 2002 survey. However, latrine being used and maintenance was greater in the 2002 survey. None of these differences were significant. In Nepal two behaviours tested were more prevalent in the 2001 group, but four were more common in the later 2002 survey. For Uganda this was two greater in 2001 and two in 2002, for Ghana it was two and one. Thus the data does not show deterioration in hygiene behaviours between the two collection periods of 2001 and 2002.

Conclusions

This paper records and discusses the outcomes of a research study into the impact of hygiene promotion/education efforts and the sustainability of new behaviours. All of the examples in the paper are taken from our six-country study of these two issues which took place some time after the end of the project interventions.

Except for lessons learned from the research outcomes, we also learned a lot about the research methodology and its implementation. These lessons include for example, the importance of planning from the beginning for sufficient time for data analysis. A less expected challenge was the need to ensure that those involved in the study understand the statistical aspects of the results. Booklet 1 provides many more lessons we learned about research methodology and research implementation.

About the impact of hygiene interventions: Four ways to study the impact of programme interventions on hygiene practices were examined:

- comparing results of intervention and control groups,
- showing changes over time, using baseline information,
- finding evidence of direct links between inputs during the project period in terms of hygiene activities and outputs after the project had ended in terms of hygiene practices,
- examining some standard external variables such as improved access to drinking water, education and socio-economic levels.

All of this was studied after the projects had ended. This is more difficult than determining the impact of the project during or near the end of the intervention when activities are still fresh in the minds of people. However, evidence of impact was still found even several years after the interventions had ended.

The results showed that hygiene interventions had an impact on aspects of handwashing skills/practice and latrine use/maintenance. Hygiene promotion activities associated particularly with engendering new behaviours were those involving personal contact, attendance at group meetings, required hygiene classes.

Duration: The number of years of the intervention did not appear to be related to behavioural outcomes in the Indian project where it was suggested that the project should last as long as needed to mobilise the community and to carry out the work well. Conversely, duration of the intervention did have some effect in the Nepal programme where two-year intervention communities were better than those with one-year interventions in some elements of domestic hygiene and in handwashing skills.

Access: The results indicated that just providing water is not enough to change behaviours, as there were no significant links between access to water and hygienic behaviours.

Education and economic status: The results suggested that, if the hygiene promotion and education efforts are intense and with a strong focus on reaching the poor and reaching both men and women (poverty and gender focus), then certain external variables may fade in importance. Specifically, the external variables that might then have less impact on performing hygiene behaviours may be: the education level of women, the socio-economic status of the community, the difference between women and men in hygiene practices.

About sustainability of hygiene behaviours: The research data demonstrated that hygiene behaviours are sustained beyond the end of an intervention. For the studies in five countries, 25 comparisons were made between a hygiene behaviour and the end date of the project. The behaviours were: handwashing skills, person washes hands with soap and water, location of soap/water in household, latrine shows signs of use, person uses latrine consistently, latrine is

maintained and clean, water is covered/stored safely. The end dates of the projects that were compared were 1998 and 2000. The results showed that in only two out of 25 comparisons made did the people practice safe hygiene behaviours more where the projects ended in 2000 than where the projects ended in 1998.

This infers that, in terms of behaviour sustainability, the amount of time since the projects ended did not make much of a difference. Hygiene behaviours were seen to be similarly sustained in projects that ended four years or only one or two years before the study.

For the study in India, where the projects ended later, women were significantly more likely to wash both hands with soap and water ($p=0.004$) and were significantly more likely to use the latrine when at home ($p=0.00013$). In other words, handwashing and latrine use practice did seem to deteriorate with time. However, the fall-off was not very great. Even where the project had ended seven or nine years before the survey, about four out of five (80%) of the women were reportedly still consistently using their latrines.

In 17 cases spread across four countries a comparison was made of hygiene behaviour changes between two data collection dates (2001 and 2002) about a year apart. In only one of the 17 comparisons was there a significant change over the one-year period.

In general the hygiene behaviours did not decrease between the two years. The time between surveys did not make much of a difference; the hygiene behaviours seemed to be sustained.

In summary

Although we did find that most behaviours, once changed, do sustain over time, it is not inevitable that new behaviours will fade as years go by so that people revert to earlier, less hygienic practices. Nor, in water and sanitation programmes, is continued access to services enough to sustain hygienic behaviour. It is the so-called 'software' aspects of the programme that are more important in doing so.

Thus hygiene promotion and education should not be low-visibility 'add-ons' to water and sanitation programming. Sustained behaviours result from giving high priority and adequate resources to hygiene promotion and education.

Project variables determine hygiene behaviours. This includes: intensity of the programmes, support from influential groups in the local community, attendance in hygiene classes, training.

Finally, this study shows that the local bodies implementing hygiene promotion in developing countries can carry out simple but rigorous studies of the impact of their own interventions. Measuring behaviour change is possible and it is very useful for project evaluation.

Appendix 1 Testing Sustainability:

Do interventions ending in 2000 do better than those ending in 1998?

		Handwashing	
Countries where study tested this	**Years when data collected (surveys carred out)**	**HW skills (demonstration)**	**HW practice self-report**
KENYA*	**Is 2000 better than 1998?**	n.s.	n.s. (HW after lat use)
	1998 project end	112/122 (92%)	81/122(66%)
	2000 project end	89/93 (95%)	50/93 (54%)
NEPAL	**Is 2000 better than 1998?**	n.s.	n.a.
	1998 project end	116/120 (97%)	
	2000 project end	238/240 (99%)	
SRI LANKA	**Is 2000 better than 1998?**	n.s.	n.a.
	1998 project end	12/25 (48%)	
	2000 project end	42/75 (59%)	
UGANDA	**Is 2000 better than 1998?**	n.s.	n.s.
	1998 project end	56/150 (37%)	192/369 (52%)
	2000 project end	62/150 (41%)	207/371 (56%)
GHANA**	**Is 2000 better than 1998?**	Significant p<0.043 OR1.51	n.a.
	1998 project end	119/220 (54%)	
	2000 project end	141/220 (64%)	

** determined by when latrine built. Data from 2001 collection only.*

*** determined by when water point constructed*

Latrines				
Location of soap + water in household	**Latrine use is consistent. Self-report**	**Latrine shows signs of use**	**Latrine maintained /clean**	**Water covered/stored safely**
n.a.	**n.s.**	n.s.	n.s.	n.a[12].
	110/122 (90%) 86/93 (93%)	118/122 (97%) 85/93 (91%)	79/122 (65%) 49/93 (53%)	
n.s.	n.s.	n.s.	n.s.	n.s.
92/120 (77%) 298/354 (84%)	1/2 (50%) 32/38 (84%)	7/9 (78%) 76/86 (88%)	4/9 (44%) 74/120 (62%)	15/51 29% 15/49 (31%)
n.s. 5/20 (20%) 5/58 (8.6%)	n.a.	n.s. 19/20 (95%) 56/58 (97%)	n.s. 15/20 (75%) 36/58 (62%)	n.s. 23/25 (92%) 61/75 (81%)
n.s. 10/204 (5%) 5/188 (3%)	n.s. 209/369 (57%) 200/371 (54%)	n.s. 10/133 (81%) 101/126 (80%)	Significant p = 0.011 OR=2.02 CI 1.16-3.50 72/122 (54%) 88/125 (70%) Mukono sign. better, Mpigi worse n.a.	n.a.
n.s. 109/220 (50%) 116/220 (53%)	n.a.	n.a.		n.s. 130/220 (59%) 110/220 (50%)

12 n.s. = not significant, n.a. = not applicable (meaning it was not measured)

Appendix 2 Testing Sustainability:

Do behaviours fade between 2001 and 2002 surveys?

			Handwashing
Countries where study tested this	**Years when data collected (surveys carried out)**	**HW skills (demonstration)**	**HW practice self-report**
KENYA*	**Is 2001 better than 2002?**	n.s.	n.s.
	2001 survey	90/ 215 (42%)	131/ 215(61%)
	2002 survey	38/110 (34%)	60/110 (54%) in 2002 (ns)
NEPAL**	**Is 2001 better than 2002?**	n.s.	n.s.
	2001 survey	147/232 (63%)	111/112 (99%)
	2002 survey	137/241 (57%)	241/241 (100%)
UGANDA	**Is 2001 better than 2002?**	n.a.	Significant p=0.045 OR=0.58 CI 0.33-0.99
	2001 survey		42/86 (49%)
	2002 survey		76/214 (35%) but not better in Mukono
GHANA	**Is 2001 better than 2002?**	Significantly worse p<0.009	n.a.
	2001 survey	116/220 (53%)	
	2002 survey	144/220 (65%)	

* In the 2001 study, this data was not collected in a way that was comparable to 2002.

** 93% and 85% high score for 2 year interventions in 2001 and 2002 versus 77% and 76% for one year interventions

83% food covered in 2- year intervention groups; 66% in one-year intervention groups.

Latrines				
Location of soap + water in household	**Latrine use is consistent. Self-report**	**Latrine shows signs of use**	**Latrine maintained /clean**	**Water covered/stored safely**
n.a.	n.s. 203/215 (94%) 107/110 (97%)	n.a.	n.s. 128/213(60%) 69/110 63%	n.a.
n.s. 196/232 (84%) 193/222 (87%)	n.s. 35/43 (81%) 76/86 (88%)	n.a.	n.s. 28/43 (65%) 50/86 (58%)	n.s. 23/90 (26%) 15/49 (31%)
Significantly worse p < 0.001 0/178 (0%) 15/214 (15%)	n.s. 115/139 (83%) 94/120 (78%)	n.a.	Significantly worse p=0.02 OR=1.90, CI 1.10-3.31 76/139 (55%) 84/120 (70%)	n.a.
n.s. 119/220 (54%) 106/220 (48%)	n.a.	n.a.	n.a.	n.s. 130/220 (59%) 110/220 (50%)

Appendix 3 P-value or Confidence level, Odds ratio and Confidence Interval

Commonly used terms in statistical research are p-value, odds ratio (OR) and confidence interval (CI). It is not necessary to know how these are calculated (computer programmes can do that for you), but some understanding of what they mean is important.

The simplest context in which they are used is when we are studying an association between two variables, such as (i) knowing how to wash one's hands correctly, and (ii) attending a hygiene education session. If the proportion of attenders who know how to wash their hands is the same as the proportion of non-attenders, there is no association. If there is only a small difference between the groups (say, 47% of attenders and 40% of non-attenders), the question comes up whether it has arisen by chance variation, or whether it represents a real association.

P-value

The p-value is the probability that the results could have arisen by chance. Probability is measured on a scale of 0 (complete impossibility) to 1 (absolute certainty), or 0% to 100%. If p = 0.1, or 10%, it follows that the probability that the difference is *not* due to chance (and therefore that there is a real association) is 90%.

Statisticians consider that an apparent association is 'significant' if the p-value is less than 0.05 (5%, or a chance of one in twenty). This does not mean that a p-value of 0.06 means that there is no association or that p=0.04 means that the association is proven. But this convention does help to focus our attention on the results for which the evidence is reasonably strong.

The p-value does not measure the strength of the association – only the strength of the evidence. For example, consider a sample of five men and five women, where three of the men had beards. In testing

this result for an association between maleness and beards, the computer would arrive at a p-value of 0.17, which is not significant. We would need a larger sample of men and women to show that the association was 'statistically significant'.

Odds Ratio

The odds ratio (OR) measures the strength of the association, by comparing the odds of something happening in two groups. To return to the example above on knowledge of handwashing, the odds of knowing among attenders are 47/53, because for every 47 attenders who know how to wash their hands, there are 53 who **don't** know. The odds among non-attenders are 40/60. That means that the odds ratio is:

$$OR = \frac{47/53}{40/60} = 1.33$$

The finding OR = 1.0 means that there is an equal proportion in each group. An odds ratio of 1.5 means the chance of good knowledge of handwashing is rougly 50% greater for attenders. If the odds ratio equals 4, the knowledge is several times more common in the people exposed to the classes than in those not exposed; in fact, the odds of their having that knowledge is four times greater.

Confidence interval (CI)

If the survey were repeated many times, we would expect the results to differ slightly each time. However one would also expect the results to fall near the "true value"… more or less. To assess the range of this chance variation, researchers use the *confidence interval* (CI). This is set so that the true value is 95% likely to fall within it. It is sometimes called the 95% CI. By calculating the OR and the 95% confidence interval around your result, you can say that there is a 95% chance that the survey result and **true** OR both are near each other in this interval. If 1.0 is outside the CI, there is less than 5% probability that the true OR is equal to 1. (If it were equal to 1, there would no real association.) Thus we know that our old friend the p-

value is less than 0.05. Thus, the following statements are all ways to say the same thing:

$p < 0.05$
There is a statistically significant association.
The confidence interval does not include 1.0.

For example, some corresponding data from the Ghana study will look like this:

$p < 0.02$
OR=2.2
Confidence interval, CI 1.36 - 3.70.

This means that we are 98% certain that attenders had better handwashing skills than non-attenders, and reasonably sure (95%) that the people who attended the small group meetings are at least 36% (1.36, the lowest number in the confidence interval) more likely to have better handwashing skills.

These statistics: the odds ratio, and confidence interval can be used to study many questions such as:

Did the households that performed better also have more project inputs?
Were poorer people reached?
Were people with less education involved?
Were behaviours sustained or did behaviours become worse (deteriorate) over time?

There are several free computer programs (such as EpiInfo 2000, which can be downloaded free from www.cdc.gov) and several websites (such as http://www.graphpad.com/quickcalcs/chisquared1.cfm) that can be used to analyse data.

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