

Water, Sanitation, Hygiene and Health Studies Project  
Aga Khan Health Service  
Northern Areas and Chitral

ISSUE PAPER 9

**A STUDY ON BEHAVIOURAL AND MICROBIOLOGICAL  
ASPECTS OF HANDWASHING IN NORTHERN PAKISTAN**

The development of appropriate handwashing messages



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## ABBREVIATIONS

AKDN	Aga Khan Development Network
AKHS	Aga Khan Health Services
EPI-INFO	Software for Epidemiology and Disease Surveillance
ICDDR	International Centre for Diarrhoea Disease Research
KAP-survey	Knowledge Attitude and Practices-survey
LHV	Lady Health Visitor
WSHHSP	Water Sanitation Hygiene and Health Studies Project

## INTRODUCTION

The promotion of handwashing is often included in water and sanitation programmes. Hands are one of the main routes for faecal-oral disease transmission and research by Sprunt et al. (1973), Black et al. (1981) and Khan (1982) has shown that handwashing is associated with a reduction in the incidence of diarrhoea. The WSHHSP<sup>1</sup> whose aim is, among others, to reduce the incidence of diarrhoeal diseases, planned to develop a policy on handwashing for the proposed AKDN Water and Sanitation Extension Programme.

This report describes the results of an applied anthropological and microbiological research on handwashing in Northern Pakistan. The research consisted of two phases which took place during 1994-1995 in the regions Gilgit, Chitral and Baltistan. During the first phase structured observations of handwashing practices in households of nine villages and a KAP-survey in 30 villages were carried out. The second study phase focused on microbiological tests taken from hands of in total 132 respondents in three communities in Gilgit district in 1995.

The overall aim of the study was to identify realistic target behaviours and to develop appropriate hygiene education messages.

### About this report

The first Chapter presents the qualitative and quantitative results of the first study phase. Chapter 2 describes the microbiological research methodology, including the pre-testing and the development of a research protocol. Chapter 3 presents the results of the microbiological study. Finally in Chapter 4 the conclusions and recommended messages on handwashing are presented. This last Chapter also include suggestions for further research.

The authors would like to thank Dr. Muhammad Yonus, Dr. Bilqis Amin Hoque and Utam Kumar at the Matlab Centre, ICDDR Bangladesh for sharing their experience on the subject. We thank Bulbul Nisa, Jahan Noor and Dilferoze for their help during the fieldwork in Gilgit.

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1. The Water, Sanitation, Hygiene and Health Studies Project (WSHHSP) is working in the five Northern Districts of Pakistan. It has carried out pre-implementation investigations with the aim to develop locally appropriate technologies and participatory implementation strategies. The Project also aims to design area specific communication and education materials and methods. The WSHHSP commenced in 1993 and is envisaged to transform into WASEP during 1996.

## CHAPTER 1 QUALITATIVE AND QUANTITATIVE STUDY ON HANDWASHING THE FIRST STUDY PHASE

### 1.1 VARIOUS RESEARCH METHODOLOGIES

The WSHHSP carried out different studies to handwashing in 1994 and 1995. They were part of a much wider study on water, sanitation and hygiene behaviour of the target population in North Pakistan<sup>2</sup>. For the first phase of the handwashing study in particular the following techniques were applied:

- structured handwashing observations in households;
- spot-checks;
- a set of questions in a KAP-survey.

#### Structured handwashing observations

Structured observations on hand cleanliness were made during an observation study of five days in nine villages. In each village three to five households were selected for handwashing observations and in total 39 households were included. In this part of the study four persons were included from each household<sup>3</sup> and eventually the hands of over 150 people were observed. Every time the concerned person cleaned or washed his or her hands during a nine hour observation period this was noted on a specially designed format (see Annex 1). On the format it was specified who, when (the occasion) and how the hands were cleaned (the quality).

A special feature of the study were observations of occasions that the observed person could have cleaned hands but did not. The addition of this aspect allowed us to analyze at what occasions people do not wash their hands. For this, nine possible handwashing occasions were pre-defined:

- i. before preparing food;
- ii. before eating;
- iii. before feeding children;
- iv. when visibly dirty;
- v. after working outside;
- vi. after handling animals;
- vii. after sweeping;
- viii. before going for a visit;
- ix. changing nappies/contact with faeces.

As handwashing after defaecation can normally not be observed, this occasion was not included in the observations. Also handwashing before praying was not included because it is always practised in the same prescribed manner.

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2. The data of the hygiene behaviour are described in great detail in Issue Paper 6.

3. Where possible the observations included three women: the mother, daughter-in-law and/or the eldest daughter(s), and one older son or husband. The latter were often not present inside the house and could only be observed infrequently.

## Spot-checks

A spot-check is a structured observation whereby the presence or absence of signs of behaviour is recorded. A pre-defined spot-check format was developed. During the observation study in the villages the spot-checks were carried out daily. Immediately upon arrival in each of the households, the researcher noted down her observations on personal and domestic hygiene.

## The KAP-survey

A KAP-survey questionnaire was developed after completion of the in-depth observation studies. It consisted of a format<sup>4</sup> with a section of nine questions on handwashing.

In each of the three regions 10 villages were selected; seven villages were chosen at random and the three villages where the in-depth studies were carried out were also included. This allowed triangulation of data from the studies. In each village ten males and ten females were interviewed, bringing the total respondents to 600.

## 1.2 RESULTS OF THE OBSERVATION STUDY AND THE KAP-SURVEY

### When do people wash hands?

During the observation study in total 673 structured observations could be made. 515 of these were missed occasions and 158 were availed occasions (see Table 1 and 2). This signifies that one out of every four or five handwashing occasions (23%) result in actually washing hands.

Observation result	# of total observations	Not washed occasions	Washed occasions	% Washed
	n = 673	515	158	23%

Table 1: Total handwashing observations and not washed and washed occasions

Considering the presence of an investigator sitting inside the household, may have positively influenced the frequency of handwashing. We assume that the average figure of 23% is a high estimate.

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4. See Issue Paper 7: "Knowledge, Attitude, Practice survey: An intervention evaluation tool".

## The occasions that people wash their hands

STRUCTURED OBSERVATION RESULTS THE OCCASION THAT PEOPLE WASH THEIR HANDS				
		Total	No not washed	Yes, washed
i.	Before preparing food	118	56	62
ii.	Before eating	271	237	34
iii.	Before feeding children	10	9	1
iv.	After work outside	73	44	29
v.	When visibly dirty	58	51	7
vi.	After handling the cattle	31	23	8
vii.	After sweeping	25	17	8
viii.	Before going for a visit	30	23	7
ix.	Contact with faeces/nappy	26	24	2
	Other	31	31	16
		---	---	---
		673	515	158

Table 2

The results of four occasions are discussed in more detail as they are directly associated with faecal-oral transmission routes. These occasions are; washing hands before eating food, before preparing food, after contact with children's faeces and after defaecation. The data from the observation study and the KAP-results are described and compared with each other in the section below.

### *i. Washing hands before eating food and feeding children*

Observations showed that handwashing before eating food was practised in only 14% of the occasions (34 of the 271 occasions). The figure of 14% is surprisingly low considering the custom of offering guests a traditional wash-basin and a pitcher to wash their hands before a meal (see drawing 1). There were very few children, 3 out of 34 occasions, who washed hands before eating, unless after being asked explicitly by their parents. This indicates that children hardly ever wash their hands before eating, while their hands are usually dirty looking<sup>5</sup>. Another alarming result was that only one woman out of 70 occasions washed her hands before feeding a small child.

The KAP-survey (see Table 3, page 7) showed a totally different picture. 77% of the respondents said they wash hands before eating. This is in contrast with the observation result that only 14% of the people actually washed their hands before the meal. The difference between the two figures indicates that people may have the awareness and the intention to wash their hands but do not manage to do it.

5. Out of 206 spot checks on children's hands and faces, 63% were noted down as looking dirty!



## *ii. Washing hands before preparing food*

Handwashing before preparing food could be observed regularly. More than 50% of the occasions for handwashing were availed as 62 of a total of 118 women washed hands. This seems to indicate that it is a fairly normal custom to wash hands before food preparation, although this practice can be further encouraged.

The KAP-survey data also shows that a high percentage of female respondents (57%) who mentioned they normally wash their hands 'before preparing food'<sup>6</sup>.

## *iii. Handwashing after contact with (children's) faeces*

Only a limited number of observations were possible on washing hands after changing nappies or contact with children's faeces. Women often went outside to a separate place to change the dirty pants or the nappy and to clean the child's bottom. In only two out of 24 such occasions (8%) women washed their hands with water after this activity. It is a local belief that children's faeces are harmless. In the KAP-survey we included more specific questions on this topic<sup>7</sup>.

The KAP-survey also indicate a very low percentage of the female respondents who wash their hands after changing 'nappies' or contact with children's faeces. Only 12% of the female respondents mentioned this as a normal handwashing occasion.

## *iv. Handwashing after defaecation*

Handwashing after defaecation could not be observed and therefore the results are only based on a set of questions that was included in the KAP survey<sup>8</sup>. The answers of the KAP-survey indicate that on average 10% of the people do not wash their hands at all after defaecation. The main reason is that they use a stone for anal cleaning and they do not see any reason to wash their hands.

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6. In Table 3 it is mentioned that 29% of the informants has said to wash their hands before preparing the meal. This percentage includes the male respondents and is not surprisingly low compared to the answers of the female respondents (57%).

7. Respondents were asked 'at what age do children faeces become a possible way of spreading diarrhoea'. Many respondents, in particular from Baltistan had difficulties answering the question. The data from Gilgit and Chitral show that 20 % of the respondents believe that children faeces become harmful between the age of six months and a year, or when children start eating solid food. 26% believe that faeces become harmful when the child is between one and three years. 15% believe the child should be older than 3 years. The other 39% could not answer the question.

Considering these concepts it is not surprising that mothers after cleaning their babies bottoms were rarely observed to wash their hands. As most of them do not realize the possible contamination risk it is also not surprising that mothers are not very careful about washing stained clothes.

8. The possible bias of socially desirable answers was reduced by putting the questions in a careful sequence and creating an open atmosphere during the interviews. However it is assumed that the figures on the occurrence of handwashing are maximum scores.

The KAP-survey study indicate that handwashing practices after defaecation vary between Gilgit and Chitral and Baltistan. In Table 4 it is shown that in Gilgit and Chitral over 50% of the respondents wash their hands with ordinary water, while this figure is much higher in Baltistan (83%). Nearly a quarter of the respondents in Chitral and Gilgit say they wash with water and sometimes with soap. 18% of the people in Chitral and Gilgit say they always wash with soap. The figures for washing with water and sometimes soap, and always with soap are lower in Baltistan, respectively 6% and 5%.

KAP-SURVEY RESULT (n = 600)	HOW DO YOU WASH YOUR HANDS AFTER DEFAECATION ?			
	do not wash	wash with water	with water and sometimes soap	with water and always soap
Chitral	7 = 13%	109 = 55%	48 = 24%	36 = 18%
Gilgit	13 = 6%	105 = 53%	46 = 23%	36 = 18%
Baltistan	12 = 6%	166 = 83%	12 = 6%	12 = 5%

Table 4: The method people wash their hands after defaecation (per region)

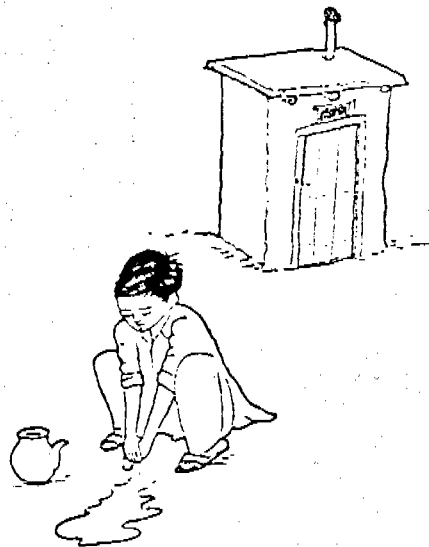


Drawing 1: Washing hands with the use of a lota and wash basin

It was anticipated the KAP survey results show higher percentages of people washing their hands than actually could be observed. This is not surprising as people generally give social desirable answers which means that they know it would be good to wash hands before or after certain occasions. Table 3 shows the KAP-survey results.

KAP-SURVEY RESULT			
WHEN DO YOU WASH YOUR HANDS?			
(multiple answers)			
(n = 600)			
		#	%
i.	Before eating	462	77
ii.	Before prayers	312	52
iii.	After waking up	283	47
iv.	After work outside	202	34
v.	Before preparing food <sup>9</sup>	173	29
vi.	When visibly dirty	155	26
vii.	After defaecation	142	24
viii.	After eating	120	20
ix.	After cleaning utensils	85	14
x.	After work with animals	73	12
xi.	After changing nappies	36	6
xii.	Before feeding children	31	5
xiii.	Before visiting others	20	3

Table 3: When people say they wash their hands



Drawing 2: Boy washing hands after coming from the latrine

<sup>9</sup> Occasions: v, ix, xi and xii were mainly answered by women.

### 1.3 HOW DO PEOPLE WASH HANDS?

#### *Use of clean water*

For handwashing people use clean and preferably clear water, i.e. water that has not been used before. In a few exceptional cases it has been observed women washed their hands with dish water. Hands are often washed in a way that somebody else, often a child, pours water with a lota over the hands. The amount of water used for handwashing is relatively small; less than 100 ml.

#### *Thoroughly rubbing hands*

A very important observation was made during the 158 observations of handwashing (Table 1). In 151 cases the people washed their hands completely and did not leave a single spot unwashed. They washed hands with clear water and thoroughly rubbed both the right and the left hand together at least three times. Only very few persons (7 out of 151 observations) were observed who did not wash their full hands. They either washed only the palms or the finger tips of their hands.

#### *Drying hands*

After washing most people let their hands dry naturally in the air or keep them near the fire. Also women quickly used a piece of cloth or their chadder to dry their hands. An interesting point made by Hoque is that women who used their clothes to dry their hands after handwashing, had higher contamination levels after drying the hands than before drying.

Using a towel to dry hands is not a custom. However, in Ghizer and Chitral it is a common practice to use a towel directly after the meal to wipe off the food remnants from the hands. These towels are often multi-purpose and used for bathing, to clean noses, faces and even children's bottoms. Such towels are washed occasionally and are a possible route of contamination.

#### *The use of soap*

Soap is not commonly used in the area. This is reflected in the observations on the quality of handwashing. Out of the 156 people who were observed washing hands only 5% i.e. 8 people used soap! Soap is very often not even available in households. Four of these people washed with soap after coming with dirty hands from the fields, three after waking up in the morning and one before going visiting.

#### 1.4 THE ACCEPTABILITY OF WASHING HANDS WITH OTHER ALTERNATIVES TO SOAP

Besides using soap for handwashing the Project wanted to assess the acceptability of other cleaning agents. During the observation studies two women were observed using flour and water to clean their hands. Apart from the cost, the smell of soap is one reason why women prefer not to use it. Observations and personal experience of the investigators also show that washing hands with soap needs quite a lot of water to rinse it off. Without running water or a tap it is difficult to remove all traces of soap.

In the KAP-survey four questions were posed to assess the acceptability of handwashing agents other than soap, such as flour, ash and soil.

##### *Flour*

Generally people thought that flour would be the most acceptable alternative to soap (46 %). 29% of these respondents added that women already have the custom of using flour for handwashing. It is important to add that several of the male respondents considered the use of flour as an old fashioned practice and it was regarded as a more acceptable alternative by women than by men.

##### *Ash*

Using ash for handwashing has been promoted in hygiene education programmes in other parts of the world. In the Project area this is not a traditional practice. When asked if ash would be an acceptable device for handwashing some people clearly expressed they could not wash with ash as it makes their hands rough. Nevertheless 57% of the respondents in Baltistan thought that ash might be an acceptable alternative to soap. In Gilgit and Chitral this was much lower, about 25% on average. In the latter two regions people mainly use ash for cleaning utensils and as an insect repellent for vegetable gardens.

##### *Soil*

The use of soil was the least acceptable alternative for soap. Particularly in Chitral this was considered unacceptable by 80% of the people. Also in Gilgit most people (66%) do not think it is a good washing agent. Still one fifth of all the women said they sometimes use soil for washing hands. In Baltistan the response was slightly more favourable, with about 40% of the people responding that mud can be used for handwashing. Several respondents added that soil was only good for washing very greasy hands. But most of the respondents were surprised about the question, wondering how a dirty matter as soil could make hands clean.

##### *Other agents*

A few people mentioned apricot nuts as a possible hand cleaning agent and 22 respondents mentioned a variety of substances which included shampoo, leaves, snow, Dettol, paper tissues, oil and white spirit.

## 1.5 CONCLUSIONS OF THE FIRST STUDY PHASE

The main conclusions drawn from this first study phase are:

- People eat with their hands and often do not wash them before taking a hot meal or before feeding their children. This observation is surprising because there exists a socially desirable practice of offering guests a portable washbasin and a pitcher for washing hands before having a meal. Thus it is recommendable to target this behaviour.
- Women usually wash their hands before the preparation of food. This behaviour can be encouraged further but does not need to be a target behaviour.
- People have little awareness that children faeces are harmful and only a small percentage of the female respondents consider washing hands after contact with children's faeces a normal handwashing occasion. Within the AKHS' PHC-programme this behaviour should get more emphasis.
- People use their left hand for anal cleansing and usually wash their hands with water. About 10% of the people do not wash their hands as they use stones or mudlumps or sand for anal cleansing. Within the latrine promotion programme of the WASEP, this behaviour might be focussed on.
- When people wash their hands they thoroughly rub both the right and left hand together. This latter point attracted our attention as recent studies in Bangladesh have shown that rubbing is a very important factor in the reduction of E.coli on hands (Bilqis A. Hoque 1991 and 1995).
- During handwashing people use a relatively small amount of water; less than 100 ml.
- Even when people wash hands, very few use soap or any other cleaning agent like ash or flour.

Based on these conclusions we assume that it would be easier to encourage an existing, and perhaps modified, practice than to promote a new behaviour such as washing hands with the use of soap. Although it is very common in health education programmes worldwide to promote washing hands with soap there are additional reasons for not promoting this behaviour. Our studies indicated a number of constraints that would probably inhibit the adoption of such behaviour. These factors include:

- Cultural objection to eating with soapy smelling hands;
- Soap is a relatively expensive product (average cost of body soap is Rs.6 about 0.20 US\$) which is seen as a luxury product;
- People do not realize the hazard of contaminated hands as they have limited understanding about the risk of bacteria;
- It is not easy to rinse off soap lather from hands without running water.

Also it is our opinion that in numerous health education programmes too many messages are used or that the messages conveyed are too complicated. To introduce, change and maintain these behaviours will be too difficult and may result in little impact on peoples practices. We thus suggest to focus on one or a limited number of simple behaviours in order to have a bigger impact on people's actions.

### **The second study phase**

Based on these conclusions and suggestions a study was designed that would assess the effectiveness of 'traditional' handwashing practices, i.e. washing hands with water only, from a microbiological perspective. The objective of the second phase of the study was to test the microbiological efficacy of the simple and practical message:

***'Wash your hands before taking your meal'***

This message was chosen as it builds on the local tradition of washing hands before a meal (at least when guests are present), and on the normal custom of thoroughly rubbing hands while pouring water from a pitcher. The efficacy of this message was tested by taking samples and measuring the microbiological reduction of E.coli bacteria on the hands of a study and a control group. The second phase took place in the summer and autumn of 1995 and included 132 respondents from two villages in Gilgit district.

## CHAPTER 2 MICROBIOLOGICAL SAMPLING: THE SECOND STUDY PHASE

### 2.1 PREPARATION OF THE RESEARCH METHODOLOGY

The second phase of the handwashing study was designed and carried out by the social scientists and the microbiologists of the WSHHSP. Two of the microbiologists had made a visit earlier in 1995 to the ICDDR (International Centre for Diarrhoea Disease Research) in Bangladesh. Based on their findings and an additional literature survey the appropriate study design and microbiological method were selected. Research reports from experiments in Thailand (Pinfold 1993), Zimbabwe (Kaltenhaler et al. 1988) Peru (Hutley 1993) and Bangladesh (Hoque 1993 and 1995) were consulted and in April-June 1995 a research protocol was developed and pre-tested.

#### *Modifying the Bangladesh method: three rounds of pretesting*

The initial pre-test took place using the method the microbiologists had observed at ICDDR-B. After procuring the necessary chemicals from down-country trials were carried out on the hands of five office staff. The left and right hand were rinsed separately in a liquid consisting of Ringer solution (quarter strength) and Tween 20. Samples were processed with a membrane filtration apparatus and incubated in Membrane Lauryl Sulphate Broth at 44°C for 15-24 hours. Using this technique it was impossible to enumerate the E.coli colonies because a variety of other organisms had grown on the media.

Consequently for further tests the Lauryl Sulphate Broth was substituted with mFc agar, a more selective medium for E.coli. For the second round of trials five samples were again taken from office staff. Results were much better and counting of E.coli colonies was easy. A new problem occurred however; one of the samples was taken from muddy hands and it was very difficult to filter it through the membrane with the suction pump. Also this sample resulted in a layer of soil on the membrane that made it impossible to identify the colonies. To overcome this problem the microbiologists decided to take smaller samples (between 2 and 50 ml) and to dilute them with sterile distilled water.

For the third round of pre-testing a small questionnaire was developed (see Annex 1) on which sex and age was noted and whether and when the respondent had washed his/her hands; what activities took place after washing; and if the person was caring for young children. The social scientist and a Lady Health Visitor went to a nearby neighbourhood to ask the questions and to take the samples of the hands of five women and children. The microbiological method worked well as the microbiologists used their judgement to decide about the sample volume after looking at the turbidity of the Ringer solution and at the background questionnaire. It was concluded that duplicate samples would lead to even more reliable results. These duplicates with variable volumes were recorded and calculated per 100 ml.



### *Impossibility to carry out 'before and after' tests*

Besides the above mentioned practical constraints with the handwashing methodology, two other important methodological problems were anticipated. The first is that it is not easy to compare the effect of handwashing on one and the same person. By carrying out the rinsing test with a solution some of the contamination will be washed in the water. To assess this reduction, tests were carried out with five respondents.

The table below shows the results of five respondents that were tested twice without washing in between. This indicates that the mere contact with Ringer solution gives a reduction of about 75%.

1st rinsing test	2nd rinsing test	Reduction of contamination due to rinsing (percentage)
# of E.coli/100ml	# of E.coli/100ml	
40	15	62%
1935	352	82%
60	0	100%
37	8	84%
0	0	-

Figure 1: The effect of the rinsing methodology on the contamination of hands

It was concluded that if a second sample is taken of the same hands (after washing with water or soap) it is difficult to indicate how much of the reduction of E.coli is due to the rinsing in the solution or due to the washing. Ideally we would have preferred to take a 'before and after'-test of the same person. We subsequently decided to sample the hands of two separate groups; one group that was sampled without washing and another that was sampled after they had washed their hands with water or water and soap. Both groups would be compared for average contamination.

A second, and related problem is that the level of contamination on hands varies strongly. This variance will effect the comparison between the study and control group. One option was to take a very large sample but this was impossible considering the limited time and resources. We decided that the best we could do was to try to include as many respondents as possible and base our analysis on this evidence.

### *Taking one sample of both hands*

It is commonly believed that people in the region only eat with their right hand. However, observations had shown that people also use their left hand for eating or touching food. Considering the objective of the study it was decided to take samples from both hands and calculate an average amount of E.coli instead of sampling each hand separately. After microbiological testing it was concluded that rinsing ten times with each hand in the same container produced the most reliable samples. Taking separate samples from the right and left hand would have been very demanding on time and resources, particularly considering the need for duplicates.

### *Number of samples, location of processing*

The processing of the test liquid by the microbiologists was labour intensive and required a large incubator. Considering the sample size (between 40 and 80 duplicates per batch) it was impossible to process the tests in the field. It was decided that the social scientists would take the samples and transport the samples within six hours to the laboratory in the Gilgit main office for processing by the microbiologists.

### *Selection of test persons and test method*

During pre-testing the social scientists pretested the collection of the samples. Taking samples from hands was considered as rather intimate act. Therefore a Lady Health Visitor of AKHS was asked to accompany and give an explanation about the aim of the test.

Earlier fieldwork had shown that during normal days many men and women are not available in their house. The friday was selected for taking samples as more people were expected to be present.

Plastic containers with lids and an opening of 150 mm diameter were procured from down country. These containers proved to be practical and large enough for people to rinse their hands.



Photograph 1. Microbiologists preparing materials for fieldwork

## 2.2 MICROBIOLOGICAL METHODOLOGY

After pre-testing the following final research protocol was developed.

### Preparation in the laboratory:

1. Prepare required amount of sterile Ringer solution (quarter strength) mixed with 1 ml. of Tween 20 per liter.
2. Sterilize the required number of plastic containers.
3. Fill the required plastic containers with 100 ml. of the solution. Usually 20 containers were used at a time.
4. Place containers in a cool box and transport these to the field.
5. Prepare the required amount of mFc-agar.
6. Pour 8-10 ml. of the media on 50 mm. glass petri-dishes and keep refrigerated for later use.

### In the field:

7. While walking through the village select five to ten households at random. Explain the study and ask up to four respondents of each household to participate. Answer the background questionnaire (see Annex 2), give the test person a number and write the corresponding number on the container.  
Ask half of the respondents to wash their hands with sterile water before giving the sample. Ask an equal number of other people (that served as a control group) to rinse directly.
8. Demonstrate and assist the respondents to rinse first the right and then the left hand in the container. Let them make ten rinsing movements with each hand.
9. Place containers back into the cool box and transport to the lab within six hours.

### Processing in the laboratory:

10. Take duplicate or triplicate samples of the liquid with a volume ranging between two and 50 ml. (depending on the likelihood of contamination) and by diluting the solution with sterile distilled water. Use a membrane filtration technique. (See photograph 4 on page 23).
11. Place each membrane on a petri-dish with mFc agar media. 30 respondents requires a maximum of 60 petri-dishes.
12. Incubate samples in an incubator at 44.5<sup>o</sup> C for 18-24 hours.
13. Count and report colonies.
14. Enter data in the EPI-INFO computer programme or another D-base or spreadsheet software.

The preparation of the Ringer solution, the media, containers and petri-dishes took the microbiologists about a half a day. Taking duplicates or triplicates and applying it on a petri-dish took about an hour per seven containers. Due to practical constraints of taking the samples in the field and travel time the processing usually took place in the early evening. The next day reading and reporting of results took about three hours per group of samples.

### 2.3 FIELDWORK

The first set of samples were taken in a village that was included in the indepth household study. 10 households were selected at random. For example in a village of 40 households every fourth household was chosen. Although we had planned to carry out the study on a friday and thus when most of the men would be at home, a lot of people were absent. They were visiting their relatives in another quarter or in one of the surrounding villages. When nobody was at home we selected the next house where somebody was present. In each household the LHV gave an introduction about the aim of the study and a demonstration how to rinse in the container. It also happened that a local boy who helped carrying the containers took over the explanation of the procedure. We made sure that people would not wash their hands. Usually three or four family members were asked to participate. Half of them, ideally a woman and a man were asked to rinse their hands directly. The other half (another woman and man) were asked to wash their hands and rub in the normal manner<sup>10</sup> and then rinse. For handwashing sterile water was provided by the investigators.



Photograph 2: Woman washing hands with sterile water

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10. In the study of the ICDDR people were asked to rub during 10 seconds (B.A. Hoque 1991:62) or rub six times (1995: 15). We consider this unrealistically long rubbing. In Northern Pakistan people rub thoroughly but this is no longer then about five seconds or three to four times.

Generally the explanation of the test, filling the background form and the sampling took more time than expected. In the first village the social scientist and the Lady Health Visitor of AKHS tried to take samples before lunchtime (between 11.00 and 14.00 o'clock) but did not succeed. One and an half hour later than planned the samples were ready. Transport problems with the samples and the risk that the samples would not arrive within 6 hours as a consequence of the frequent roadblocks due to landslides forced us to take the other samples in a community nearer to the office. The total number of respondents was 40 in the first village and this was reduced to 20 people during the other visits. This not only shortened the fieldwork time it also took of some tension of the microbiologists who had to process the samples and the duplicate samples within six hours.

During the study three different ways of handwashing were tested. At first people washed hands like they normally do with little water (less than 100 ml.). A second group was tested that used plenty of water (between 150 and 200 ml.)<sup>11</sup>. Finally a few people were tested after they had washed their hands with a soap bar. For this a very common clothes-washing soap was used which the majority of people would use if they wash their hands with soap.



Photograph 3: Woman rinsing her hands in test container

11. In a study on handwashing of the ICDDR (B.A. Hoque 1995:15) two litres of tube-well water were used per respondent. To use a similar amount of water per person in the Northern Areas would not be appropriate. If, for example, a group of people wash their hands before a hot meal about ten people are able to wash their hands by using a pitcher of a content of one and a half or two liters i.e. every person uses about 100 - 200 ml. of water.

## CHAPTER 3 RESULTS OF THE MICROBIOLOGICAL STUDY

The handwashing study was carried out in the period between June and November 1995. During six trips to the villages Salmanabad and Oshikhandass in Gilgit District a total of 132 people participated in the test. Of another four persons the container leaked and we were unable to recover enough liquid to use the membrane filter technique. A total of about 300 samples from duplicates and triplicates were processed in the laboratory.

### 3.1 CONTAMINATION LEVELS OF UNWASHED HANDS

In total 82 tests were carried out of the hands of people who did not wash their hands before rinsing them in the solution. The contamination levels of these unwashed hands varied considerably between zero and 2,000 E.coli per sample. The average contamination level of unwashed hands was 260 E.coli<sup>12</sup> per 100 ml. solution. The results have been placed in four categories;

Clean hands:	0 - 20 E.coli
Lightly contaminated hands:	21 - 100 E.coli
Contaminated hands:	101 - 500 E.coli
Grossly contaminated hands:	> 500 E.coli

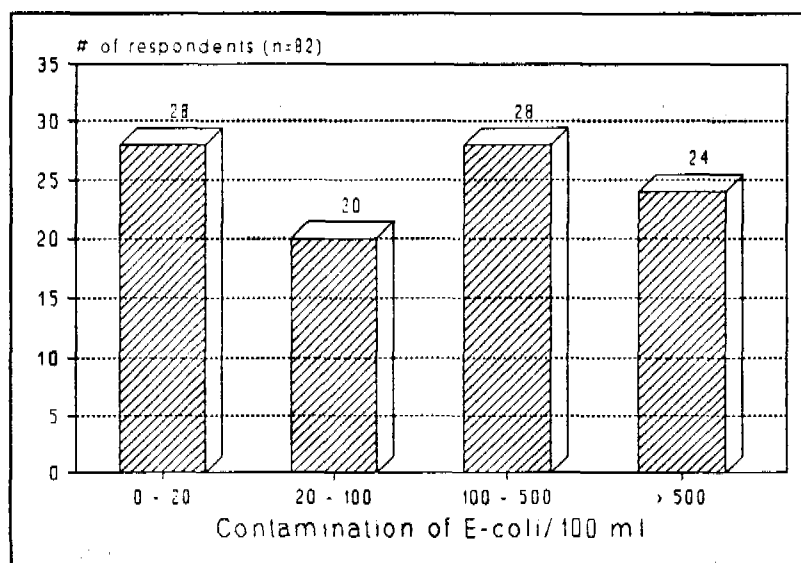


Figure 2: Contamination levels on unwashed hands

12. This average result of 260 E.coli per 100 ml. (i.e. 130 E.coli per hand) is fairly similar to the coliform counts in the ICDDR study which ranged between 89 and 269 E.coli per hand.

Figure 2 shows that nearly a quarter of the respondents had clean hands. More than half of the people had contaminated or grossly contaminated hands. In three cases the colonies were too numerous to count.

There was little indication that handwashing prior to the test had significantly influenced the results. Of a group of people who had washed their hands less than 30 minutes before nearly 40% had (again) contaminated hands.

We had assumed that women who look after young children would have more contaminated hands due to contact with children's faeces. Indeed caretakers of children scored higher in the contaminated categories than non-caretakers. The relationship however, was less significant than expected. For example 11 caretakers had grossly contaminated hands (more than 500 E.coli) but another 11 caretakers had a contamination of less than 20 E.coli.

### 3.2 CONTAMINATION LEVELS OF HANDS WASHED WITH WATER

#### Group A: Hands washed with a small amount of water

At first the hands of 15 people who washed with a normal amount of water were tested. A 'normal' amount varies per person but is generally less than 100 ml. The results of this relatively small group were compared with a control group. From the figure below it is clear that no correlation was found. This indicates that washing hands with a small amount of water does not lead to a significant decrease of E.coli on hands.

E.coli/100ml	Respondents who did not wash before test (n = 14)	Respondents who washed hands before the test with a 'normal' amount of water (n = 15)
0 - 20	5	4
20 - 100	3	2
100 - 500	1	3
> 500	5	6
p = 0.3		

Figure 3: Comparison between washing with a 'normal' amount of water and control group

**Group B: Hands washed with plenty of water**

In a second round of tests 39 people were included who had washed their hands with plenty of water (between 150 and 200 ml.). Again the test was repeated with a control group. Figure 3 shows that a significant reduction of E.coli on their hands was measured as compared with the non-handwashing group ( $P = 0.009$ ).

E.coli/100ml	Respondents who did not wash before test (n = 42)	Respondents who washed hands before the test with plenty of water (n = 39)
0 - 20	13	23
20 - 100	8	8
100 - 500	11	1
> 500	10	7
$p = 0.009$		

Figure 4: Comparison between washing with plenty of water and control group

As the figure shows the hands of some of the participants remained grossly contaminated after thorough washing with plenty of water. Thus, washing hands is not enough to completely eliminate contamination but does have a positive effect on the general reduction of contamination on people's hands.

### 3.3 CONTAMINATION LEVELS OF HANDS WASHED WITH WATER AND SOAP

Unfortunately only a few 'washing hands with soap'- tests were carried out at the end of the study. For these tests a slightly different method was used. Only double tests were carried out, i.e., first rinse in Ringer solution, then wash with soap, and again rinse in solution. It is very likely that this double rinsing has increased the decontaminating effect of the soap. As we explained in Chapter 1 the mere rinsing in the Ringer solution resulted in a reduction of E.coli of about 75%.

Figure 5 shows the results of the double tests with 10 participants. The limited results showed that contamination levels after washing with soap are lower than after washing with water but total decontamination of hands did not occur in all cases.



First sample	Second sample	Reduction
5	1	80%
930	99	81%
370	450**	(22% increase)
0	0	-
40	13	68%
156	0	100%
243	0	100%
103	12	88%

Figure 5: Contamination levels of people who washed hands with soap and rinsed two times

One person had a higher level of contamination after washing with soap than before this action (370 E.coli/100ml to 450 E.coli). After analyzing the results, we recalled what had happened in this particular case. The social scientist remembered that this woman briefly did dry her hands on her shawl. From the observations studies we had learned that these shawls are used for multiple purposes and usually look very dirty. Probably the woman had recontaminated her hands with the shawl. This scant evidence points at the important risk of recontamination from dirty towels, shawls or other pieces of cloth<sup>13</sup>. It also points at the need for a general improvement in the hygiene situation of households and that only washing hands will have a limited effect. Washing hands needs to be embedded in a larger programme promoting the use of clean water, hygienic sanitation and a clean living environment of the household.

13. On a recent health education video prepared by the AKHS-P Health Education Unit in Karachi handwashing with soap and drying on a towel is promoted. For reasons mentioned in this paper we suggest that washing with plenty of plain water is more appropriate. We strongly disagree with the message that people should dry their hands on a dry towel. A dry cloth is not necessarily free of bacteria and could recontaminate the hands similar to what has happened during our study with one of the respondents.

## CHAPTER 4

### CONCLUSION AND RECOMMENDATIONS

#### Conclusions

From the first study phase, consisting of an extensive observation study and KAP-survey, it was concluded that the promotion of a hygiene message: 'Wash your hands before the meal' would be locally appropriate. This message builds on the local tradition of washing hands before the meal (at least when guests are present), and on the normal custom of thoroughly rubbing hands. Also it would be easier to promote an existing and perhaps modified practice rather than a 'new' behaviour like washing hands regularly with soap. For reasons as cost, smell and the need for large amounts of water for rinsing off lather, we believe it will be very difficult to change people's behaviour towards a regular use of soap (i.e. two or three times a day). In line with other studies (Sprunt et al.(1973), Black et al.(1981) and Udin Khan(1982), our limited data also showed that the contamination level of people who have washed their hands with soap had the lowest level of contamination; although not all respondents had absolutely zero-counts after washing with soap. We believe that given the hygiene situation in the majority of the households, it is not realistic to aim for completely uncontaminated hands. Most impact can be expected from a simple and realistic message instead of an 'ideal message'. Thus, we suggest to promote a handwashing message that everybody can practise rather than a message that few people can and will actually follow up.

Based on these conclusions a microbiological study was designed that would test the efficacy of 'traditional' handwashing. The results of the microbiological samples indicate that washing hands with a small amount of water (50-100 ml) does not have a significant effect on the contamination level on hands. After washing hands with plenty of water (150 ml or more) a significant reduction of E.coli was found as compared with the non-handwashing group. Washing with plenty of water, however, did not produce totally germ free hands. Based on this result another message related to faecally contaminated hands should be included in the WASEP programme.

#### Recommendations

- ▶ We suggest that the following message is adopted for the WASEP programme:

***'Wash your hands with plenty of water before the meal'***

- ▶ Besides this message a second handwashing message can be included in the latrine promotion programme. We suggest not to make the use of soap compulsory and phrase a message like:

***'Wash your hands after defaecation with plenty of water, if possible with soap'***

- ▶ For the PHC-Programme of the AKHS it is recommended that Doctors and LHVs will further promote the message:

***'Wash your hands after changing 'nappies' or contact with children's faeces, with plenty of water and if possible with soap'***

In the communities it should be explained that children's faeces can be as harmful as faeces of adults.

- ▶ Considering the importance of the risk of recontamination of hands after drying with a dirty shawl or towel we suggest that a brief study will be carried out to confirm this risk. Ten double tests could be carried out in a one day study. After rinsing for the first time respondents can be asked to dry on a worn chaddor or used towel and then rinse for a second time. If our assumption is correct then the second test will not give significant lower levels of E.coli (like the 75% reduction found in the initial pre-test, see page 13) and in some cases even higher levels of colonies on hands. In that case the existing practice of drying hands naturally in the air should be emphasized as a good habit.



Photograph 4: Microbiologist using the membrane filtration technique

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**ANNEX 1 FORMATS USED DURING THE HANDWASHING OBSERVATION STUDY**

**SHEET 1: NOT USED HANDWASHING OPPORTUNITIES**

If several people are present in the household select maximum 5 persons. Try to observe them while you are inside the house. Select one older woman (mother), one man (father or his married son), two younger women (daughter-in-law, daughter who are cooking food or have children) and one child.  
Every time when there is an opportunity for handwashing but the selected people do not wash their hands, please mention this in the table.

Village name :  
Household name :  
First visit date : morning/afternoon  
Second visit date : morning/afternoon

OPPORTUNITIES (First visit)	(please give number of occasions that hands were <u>not</u> washed)					TOTAL
	PERSON NAME :	mother	father/son	daughter	daughter	
1- before preparing meal						
2- before eating						
3- before feeding children						
4- visible dirty hands						
5- before going out of house						
6- after sweeping house						
7- after handling cattle						
8- after changing nappies						
9- other						
TOTAL OBSERVATIONS PER PERSON						

**SHEET 2: HAND CLEANING OBSERVATION**

All the people present in the household can be included in this observation. Please note the occasion on which handwashing takes place, use the same categories as in sheet 1. Also mention the person who is washing hands, or use categories like 'everybody', 'all the women', '3 guest who drink tea', 'only myself'.

Village name :  
Household name :  
First visit date : morning/afternoon  
Second visit date : morning/afternoon

Occasion	Person	with water	water & soap	other specify	fingers	hand palms	full hand	Used with? specify	remarks
TOTAL numbers:									

**ANNEX 2 BACKGROUND QUESTIONNAIRE FOR MICROBIOLOGICAL SAMPLING**

Village:

Container No:

Date:

No. h.h.members:

No. of children:

Sexe: 1. Male 2. Female 3. Child

Age respondent:

Are you caretaker for children (under 2 years): 1. Yes 2. No

1. When was the last time you washed your hands?

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2. What activities did you do between washing your hands and now?

**Inside the house**

**Outside the house**

cleaning/sweeping: \_\_\_\_\_

work in the field: \_\_\_\_\_

feeding children: \_\_\_\_\_

visit other people: \_\_\_\_\_

preparing the meal: \_\_\_\_\_

going for defaecation: \_\_\_\_\_

eating: \_\_\_\_\_

handling the cattle: \_\_\_\_\_

changing nappies: \_\_\_\_\_

playing outside: \_\_\_\_\_

3. Hands washed with mineral water? 1. Yes 2. No

4. Hands washed with mineral water and soap? 1. Yes 2. No

5. Microbiological contamination level .....