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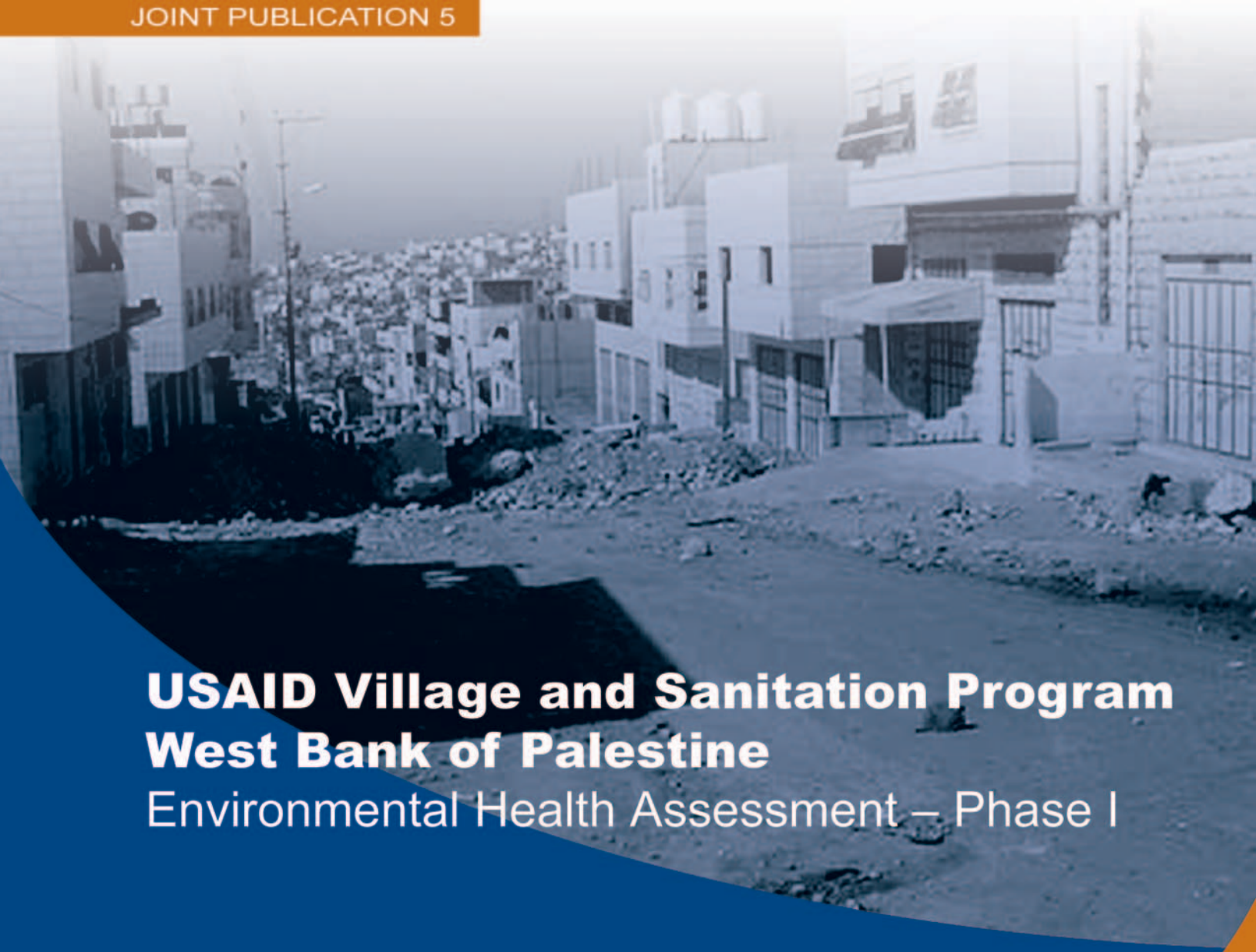

USAID Village and Sanitation Program West Bank of Palestine

Environmental Health Assessment – Phase I

Ali Sha'Ar, Patrick Kelly, Eckhard Kleinau

Environmental Health Project
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Bureau for Global Health
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Washington, DC 20523

ENVIRONMENTAL HEALTH PROJECT

Save the Children

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID

USAID Village and Sanitation Program
West Bank of Palestine

Environmental Health
Assessment — Phase I

by
Ali Sha'Ar, Patrick Kelly, Eckhard Kleinau

July 2002

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Abbreviations

ANERA	American Near East Refugee Aid
CFU	Colony Forming Units
EHP	Environmental Health Project
FC	Fecal Coliforms
MOH	Ministry of Health
NIS	New Israeli Shekels
NTU	Nephelometric Turbidity Unit
PCBS	Palestinian Central Bureau of Statistics
PWA	Palestinian Water Authority
SCF	Save the Children Federation
TC	Total Coliforms
UPMRC	Union of Palestinian Medical Relief Committees
USAID	United States Agency for International Development
WHO	World Health Organization

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Save the Children Federation hopes that the survey and the information included in this report will help in the development of high quality community programs and will lead to the improvement of the quality of life of children in Palestine.

Executive Summary

A. Introduction and Background

Insufficient water quality and quantity and poor sanitation and hygiene have a negative health impact and account for much of the infant and child morbidity and mortality in poor rural communities in developing countries, with fecal-oral contamination usually being the major causal factor. WHO estimates that between 1.3 and 1.9 million children under five die annually from causes related to diarrhea. EHP's response to this public health tragedy is governed by the Hygiene Improvement Framework. Hygiene Improvement is a comprehensive approach to reduce diarrheal disease by promoting good hygiene practices, improving access to safe water and adequate sanitation and providing an enabling environment. Research by Esrey et al. (1991) and Hutley et al. (1997) has clearly shown that diarrhea prevalence can be reduced by an average of 25% through these interventions.

To meet the need for Hygiene Improvement, USAID has financed a two-year Village Water and Sanitation Program in the West Bank of Palestine to provide safe and sustainable water and sanitation services to an estimated 140,000 people living in 50 villages; 28 west of Hebron and 22 southeast of Nablus. Improvements in infrastructure will be accompanied by interventions that better hygiene practices.

This Environmental Health Assessment is the first in a series of operational research activities, which are intended to provide information for the design phase of the project and to identify appropriate indicators for evaluating program outputs and impact on behaviors and possibly health. The field work was implemented over a two-week period from January 18–31, 2002.

For operational reasons, this study had to be conducted during the Palestinian winter months when it rains frequently as compared to the dry summer months. This is likely to impact on the findings in several ways:

The water supply questions are more likely to have more accurate responses for the wet than for the dry season;

Although no other studies of diarrheal disease prevalence in Palestine were found, some previous research may suggest a seasonal pattern in the incidence of intestinal parasites with higher rates in summer than in winter. However, additional research would be needed to confirm the seasonality of acute diarrhea in children under five.

B. Study Methods

The design for the environmental health assessment is a household cross-sectional survey. This assessment is part of a panel and time series research design that may be implemented over the coming years as infrastructure improvements and hygiene behavior

changes occur. The sampling method consists of random sampling with an equal probability selection method (EPSEM) and stratification by province—Nablus in the north and West Hebron in the south. The estimated sample size for each province was 300 heads of household and 300 caretaker interviews of children 12–47 months, interviews of one school age child in each household where they are present, stool samples from 300 children 12–47 months, and two water samples from 100 households (point of entry and point of use). Data collection instruments for each component and protocols, including quality control, were prepared, pretested, revised and translated into Arabic. Training consisted of several phases including general orientation of all survey personnel, training of trainers, and training of data collectors (interviewers and stool and water sample collectors). Due to the unpredictability of travel possibilities between the north and the south, a separate data collector workshop was conducted in each province. To react to the difficult and unpredictable conditions in the field, organizational systems were decentralized allowing field coordinators and supervisors to respond quickly and efficiently to the ever-changing needs of data collection, supervision, logistics and communication. Strict attention was paid to quality assurance at all phases of the study. This included reviews of all questionnaires by interviewers and field supervisors, random checking of 30% of the questionnaires by the regional coordinator and random rechecking of a subset of the stool and water analyses.

C. Summary of Findings

Table 0.1. Percentage Distribution of Key Indicators by Province

No.	Key Indicator	Nablus	W Hebron	Total
	Household Water and Sanitation			
1	Usually sufficient piped water	7.0	64.5	35.4
2	Drinking water of acceptable quality	0.0	44.2	23.9
3	Access to a sanitation facility	99.7	99.3	99.5
4	Access to a hygienic sanitation facility	74.7	80.1	77.6
5	An appropriate handwashing area	73.9	66.7	70.2
	School Children (6–12 years)			
6	Appropriate handwashing technique	49.4	60.2	53.6
7	Schools with appropriate handwashing area	20.2	5.2	14.8
	Children			
	12–47 months			
8	Prevalence of amebiasis	16.0	14.0	14.8
9	Prevalence of giardiasis	5.9	14.0	10.4
	0–59 months			
10	Two-week prevalence of diarrhea	12.2	11.1	11.6
11	Appropriate home care for diarrhea	18.5	20.5	19.2

- **Household Water and Sanitation**

  Domestic water supplies are limited in quantity and quality with striking differences between the provinces. The typical household in the north is served by unimproved sources (tanker trucks) with quantities that are usually insufficient and quality that is unacceptable for drinking. In the south, water is usually piped and although often irregular is much more likely to be sufficient and of acceptable quality.

  Since the beginning of the current Intifada, the economic situation has worsened to crisis levels. Unemployment and severe difficulties to conduct business due to travel restrictions have resulted in median monthly household incomes dropping from 2000 to 500 NIS. Looking at the poverty index, we see that in the richest category almost two-thirds of households are below the poverty level (1600 NIS) and one-fourth are below the hardship level (500 NIS). Thus it is not surprising that when we asked piped water users if they were up to date on paying their water bills, only 30% answered "Yes."

  According to WHO standards, only about one in four households has drinking water of acceptable quality, ranging from over two in five in the south down to zero in the north. Compared to West Hebron, Nablus water supplies have an odor, are one and a half times as likely to be turbid and over two times as likely to contain contamination from fecal coliform bacteria.

  We found median daily per capita levels of consumption to be 60 liters for piped water and 34 for tanker water. Household cost of water per month was 50 NIS for piped water and 108 for tanker water. In sum, those who use tanker water pay more for less.

  Almost all households have sanitation facilities and designated handwashing areas. Three-fourths of the former are hygienic and soap is present in seven-tenths of the latter. The common drainage systems are the unlined soak-away pits. They are a potential source of contamination of cisterns and ground water, especially since most of them have never been evacuated. We did not ask about willingness to pay for improved services.

- **School Children and Schools**

  With soap being used by seven out of ten, about one-half of the school children observed demonstrated appropriate handwashing technique.

  Schools all had theoretical handwashing areas, but water was usually present in only one-half and soap in only one-fifth.

- **Children under 5 years**

  The search for intestinal disease was restricted to children because they are the most vulnerable of the family members to the acquisition and pathological effects of intestinal diseases from fecal-oral transmission.

12–47 months

Microscopic examination for ova and parasites in stool specimens from children 12–47 months found 15% amebiasis and 10% giardiasis but no worms. Infestation by these protozoa went up directly with increasing age, with the likelihood of amebiasis reaching a high of one-fourth in three-year olds in Nablus and giardiasis a high of one-fifth in three-year olds in West Hebron. Both protozoa were found simultaneously in only 2% of the children. The presence of ameba or giardia was not correlated with prevalence of diarrhea.

0–59 months

Information about the presence of diarrhea during the two weeks prior to the survey was asked for all children under 5 years in the households. Overall, it was present in 12% of children, reaching a high of 20% in children from 12–23 months.

One-fifth of children with diarrhea received appropriate home care management, defined as more liquids being given than usual and at least as much food.

- **Hygiene Knowledge and Behavior**

  Although educational levels are relatively high for rural communities, there is evidence of lack of awareness of the risks of inadequate water quality and sanitation and personal hygiene. For example, even in the north, where the drinking water quality is not acceptable, 85% of households felt that the water was safe for drinking.

  The results of the survey and discussions with community members and stakeholders, clearly indicate an interest in the education component of the project. Everyone would like to receive more information regarding family health and drinking water quality. We also found that depending on the subject, different sources of health education were most useful and may include the mass media, mothers and mothers-in-law, schools, written materials and mosques.

- **Relationship Between Environmental Factors (Hygiene, Sanitation Water Source, Quality and Quantity) and Health Outcomes (Intestinal Parasites, Diarrhea)**

  To facilitate program design and to identify indicators that could serve as a measure of program effectiveness, the relationship between environmental and behavioral factors and health outcomes was tested. Some important associations between these factors and health outcomes were identified with a probability of error of 0.1 or better using contingency table analysis and chi-square test statistics. Not having an appropriate handwashing area with water and soap available and not practicing appropriate handwashing techniques for children between 12–47 months were associated with significantly greater risks of amebiasis, giardiasis or both. In households where caretakers do not mention handwashing of children 12–47 months after defecation as being important these children are almost twice as likely to have

amebiasis. Insufficient water supply to meet daily needs and not having access to piped water also increased the risk of amebiasis, giardiasis or both substantially. Likewise, children 12–47 months in households without a hygienic sanitation facility were much more likely to have these parasites in their stools. The fact that the relationships were in the direction expected based on findings reported from other studies strengthens the confidence in the quality of the data collected during the first environmental health assessment.

D. Conclusions and Recommendations

Despite the difficult conditions prevailing during the survey, the survey was conducted as planned in almost all locations, and as various consistency checks confirmed, data are of high quality.

The data support the hypotheses that severe poverty is widespread and worsening in the selected communities. Beside its broad impact in people's livelihoods, it reduces demand for improved water and sanitation services. Either subsidies or lower-cost solutions are required to make better services available to the majority of households, which live below the poverty level.

Lack of household access to piped water and poor water quality suggests that the use of untreated water, from tanker and other sources, has a considerable health risk. Basically four programmatic options are available to address this quality problem:

- Routine water quality monitoring
- Water treatment in households using chlorine or filters
- Provision of reliable and treated piped water
- Chemical or mechanical purification of tanker water.

The first and the second options can be available immediately and are relatively low cost. Household chlorination could be very cost-effective if applied only to drinking water and not to water for other uses. Point-of-use or cistern water treatment also would improve the quality of rainwater collected during winter months. The other options are likely to require much longer to be implemented, and given the level of economic hardship, many households may not be able to afford the costs of improved piped or tanker water supplies without subsidies.

Households with limited amounts of water available, barely exceeding the daily minimum of 20 liters per person, are more likely to ration its use for hygienic purposes, which may impact children's health and partly explain inappropriate handwashing practices. Availability of soap and a lack of knowledge are other contributing factors. The situation in schools is even more disconcerting with a majority having no or no regular supply of water and soap. Based on these findings a survey of schools—and perhaps health facilities as well—seems urgent to assess the adequacy of water and sanitation

facilities. UNICEF together with other organizations is currently promoting school hygiene and sanitation worldwide and could provide the necessary assistance to improve this situation.

While access to private sanitation facilities is high, there are considerable risks of contaminating drinking water with fecal matter associated with sanitation infrastructure and maintenance. Households are unlikely to be able to invest in upgrading sanitation facilities until economic conditions improve substantially. This argues in favor of point of use water treatment suggested above. This is especially important, because infants seem to be given liquids using household water at an early age when exclusive breastfeeding is recommended.

Prevailing practices to dispose of young children's feces are another important source of contaminating water and food with fecal matter. Few children use potties, but about a third use disposable diapers, which usually end up in the trash. While there is a form of regular waste disposal available in Nablus and West Hebron, garbage is left unprotected in some households and potentially in municipal collection containers, although this will need to be confirmed.

Caretakers of children under five and school children have limited knowledge about hygiene and its role in disease prevention. A majority did not cite handwashing after defecation when asked about appropriate times. This clearly indicates a knowledge gap, and additional formative research such as part of trials for improved practices (TIPs) will be needed to identify specific barriers to better behavior and the most effective ways to change hygiene practices. Topics to be addressed could include:

1. The importance and the tools for identification of the various forms and sources of fecal-oral transmission

2. The knowledge and tools for home prevention of contamination and management of contamination when present

3. Multi-sectoral cooperation at the community level to ensure that basic hygiene behaviors are promoted at household and community levels. For example, assurance that soap and hygienic handwashing areas are present in homes and at school

4. Knowledge about timely and appropriate handwashing as a critical behavior related to health

5. Promotion of home care and less dependence on health facility care and medication for children with diarrhea

6. Support of water and sanitation related behaviors and other key behaviors related to health, such as solid waste management, appropriate child nutrition, personal hygiene, etc.

In order to achieve the best possible impact on behaviors and health in target communities, the sources of information and methods for message dissemination should

be planned and implemented creatively to suit the cultural norms so that they are attractive to the audience.

With a two-week prevalence of diarrhea and intestinal parasites ranging from 12% to 15%, these could serve as measurable impact indicators with greater precision using a larger and more expensive prevalence survey. It may be worthwhile to measure these indicators again in future to monitor whether any dramatic changes have occurred, which are detectable with samples sizes such as those used for this EH assessment. Substantial changes might be expected during humanitarian crises such as what is happening in the West Bank.

Diarrhea cases were not appropriately managed at home or by medical personnel in the study areas. Only a minority of children received the recommended increase in fluid and similar amounts of food than normal, but over half of the children received medical treatment with mostly inappropriate antidiarrheals. In addition to improving diarrhea prevention, these findings have two implications related to case management:

- Caretakers need better information and education about appropriate home care of children with acute watery diarrhea

- Medical professionals and pharmacists need education about appropriate case management including oral rehydration therapy and new forms of treatment as they become available, for example, the use of zinc supplementation during an acute disease episode, which reduces the severity and length of diarrhea and seems to lessen the inappropriate use of antibiotics. Zinc supplementation is currently undergoing testing through the USAID funded Child Health Research Project.

1. Introduction

1.1. Background

"All peoples, whatever their stage of development and social and economic condition, have the right to access to drinking-water in quantities and of a quality equal to their basic needs."

Such was the vision of the United Nations in 1977 as it inaugurated the International Drinking-Water Supply and Sanitation Decade (1981–1990), dedicated to the surveillance and improvement of small community water supplies. A year later an adequate supply of safe water was declared at Alma Ata to be one of the eight components of Primary Health Care. (WHO 1997)

Insufficient water quality and quantity and poor sanitation and hygiene have a negative health impact and account for much of the infant and child morbidity and mortality in poor rural communities in developing countries, with fecal-oral contamination usually being the major causal factor occurring via five principal transmission routes: feces, food, fingers, flies and fomites (inanimate objects such as clothing and dishes). WHO estimates that between 1.3 and 1.9 million children under five die annually from causes related to diarrhea. EHP's response to this public health tragedy is governed by the Hygiene Improvement Framework. Hygiene Improvement is a comprehensive approach to reduce diarrheal disease by promoting good hygiene practices, improving access to safe water and adequate sanitation and providing an enabling environment. Research by Esrey et al. (1991) and Hutley et al. (1997) has clearly shown that diarrhea prevalence can be reduced by an average of 25% through these interventions.

The scientific literature has shown that improvements in water and sanitation infrastructure alone, without behavioral changes in the household, do not usually produce much health improvement. Commonly demonstrated significant risk factors include the age of the child, appropriate handwashing, hygienic feces disposal and the educational level of the mother.

1.2. USAID Water Project

To meet the need for Hygiene Improvement, USAID has financed a two-year Village Water and Sanitation Program in the West Bank of Palestine to provide safe and sustainable water and sanitation services to an estimated 140,000 people living in 50 villages; 28 west of Hebron and 22 southeast of Nablus. Improvements in infrastructure will be accompanied by interventions that better hygiene practices and strengthen institutional capacity.

The components of the project consist of the following:

- Institutional Development and Finance (governance),
- Environmental Health, and
- Waste water reuse.

Each of these three components includes an assessment and design phase, followed by implementation. The feasibility studies for infrastructure improvements have now been completed for the participating villages.

This Environmental Health Assessment is the first in a series of operational research activities, which are intended to provide information for the design phase of the project and to identify appropriate indicators for evaluating program outputs and impact on behaviors and possibly health.

2. Survey Objectives and Conceptual Framework

2.1. Objectives

The specific objectives of this survey include the following:

- Specific knowledge and practices that affect household/community water and sanitation management,
- Key financial questions that explore the affordability of new infrastructure to communities,
- The prevalence of water and sanitation borne disease among children, and
- The quality of domestic drinking water supplies.

2.2. Conceptual Framework (Hypotheses to be tested)

The development of this project was guided by a conceptual model linking water quality to health. (Billig 1999)

2.2.1. General hypotheses

1. Adequate water quality and quantity, improved hygiene practices and access to hygienic sanitation facilities
2. Decrease pathogen exposure, which
3. Reduces diarrheal disease and the risk of severe dehydration and intestinal parasites, which increases nutrient absorption and improves diseases resistance,
4. Which reduces mortality and morbidity.

In addition to these general guidelines were added specific hypotheses related to this project.

2.2.2. Specific project hypotheses

1. Poverty is widespread in the selected communities.

2. Lack of access to adequate water quantity and quality results in a high burden for diseases related to water use.

3. Specifically, there is a high prevalence of intestinal disease caused by fecal-oral contamination transmitted via water, food and hands.

4. Improvement in water and sanitation infrastructure will reduce the prevalence of these diseases and improve the quality of life.

5. For the impact to be maximized, the improvement of water and sanitation infrastructure must be accompanied by health education targeted to changes in knowledge and behavior at the household level.

3. Study Methods and Preparations

3.1. Design

As is true with any survey, this one required a combination of science and art, in the face of limited resources and an extremely difficult working environment. The challenge was to provide data and analyses that will allow understanding and inferences to be made about the reference population that are relevant, valid, reliable and precise enough to be useful for programmatic needs.

For operational reasons, this study had to be conducted during the Palestinian winter months when it rains frequently as compared to the dry summer months. This is likely to impact on the findings in several ways:

1. The water supply questions are more likely to have more accurate responses for the wet than for the dry season.

2. Although no other studies of diarrheal disease prevalence in Palestine were found, some previous research may suggest a seasonal pattern in the incidence of intestinal parasites with higher rates in summer than in winter. However, additional research would be needed to confirm the seasonality of acute diarrhea in children under five.

3.2. Study Type

As previously stated, infrastructure are planned in communities in the northern and southern zones in the West Bank. Thus this survey is stratified by two provinces—Nablus and West Hebron.

The design for the environmental health assessment is a household cross-sectional survey. This assessment is part of panel and time series research design that may be implemented over the coming years as infrastructure improvements and hygiene behavior changes occur. The advantages of this design over repeated independent random samples are that changes for specific households can be measured, changes can be measured more precisely due to a reduction in variance and sampling is less costly (each wave of data collection only requires updating rather than an entirely new sample). One of the major disadvantages of panel surveys is the risk of attrition (families move and cannot be found again). However, since the majority of Palestinians do not have the option of moving, this is not considered to be a major problem for this design.

3.3. Sample Selection

3.3.1. Reference Populations

Classically, health outcomes in children are measured in those less than five years of age. Since children from the ages of 12–47 months have the highest risk of acquisition of and vulnerability to intestinal diseases from fecal contamination, we have limited the sampling frame to households with at least one child in this age group. Since most Palestinian families will fall into this category, the results will not be significantly biased vis-à-vis those with children from 0–59 months.

How did we identify the reference populations? There were 2 options:

1. Conducting a mini-census and upgrading available maps in each community for the identification of households, head of household, family size and number of children from 12–47 months.

2. Using population estimates for 2001 extrapolated by the Palestinian Census Bureau from the 1997 census.

Given time, budgetary and other constraints, we chose the second option, augmented by upgrading of the maps in collaboration with the participating communities.

3.3.2. Sample Size

Necessary sample size is a function of the study type, disease prevalence, the units of analysis, the significance criterion (α), the power ($1-\beta$), the effect size (ES) of the intervention and the types of analysis.[1]

For separate analyses to be done for the 2 zones, a total of at least 300 children per zone was needed: 12–23 months (100), 24–35 months (100) and 36–47 months (100). Assuming at least one child per household, we planned for completed questionnaires and specimen collections in 300 households in each zone for a total of 600. A water sample was to be collected from two sites in 100 households in each zone for a total of 400 (external or point of entry into the household and internal or point of use for consumption).

3.3.3. Primary Sampling Units

Using the reference population estimates and the desired sample size of 300 households per zone, we calculated the number of completed interviews needed in each community using a random Equal Proportional Selection Method (EPSEM) (see Appendix A for the specific number of households to be chosen in each village).

A few households were skipped for any of three reasons:

[1] We chose a 2-tailed $\alpha=0.05$, $\beta=0.2$ (Power=0.80), and effect size = small.

1. No child from 12-47 months in the household

2. Key adults are absent—head of household and/or child caregiver

3. Rare refusal to participate.

In these cases, the random selection continued to find replacement households.

3.3.4. Secondary Sampling Units

- **Selection of children from 12–47 months**

  What was to be done in cases where there is more than one child in the target age group in the household? We chose one randomly. Why not include all of them? This can be done, but since household and caregiver characteristics may be identical for all the children, the statistical assumption of independent observations is violated when one does analysis of risk factors.

- **Selection of school age children from 6–12 years**

  When there was more than one child in the household, we chose the oldest one with the objective of getting more reliable data concerning the child's knowledge and practices.

3.4. Data Collection Instruments and Protocols

The data collection instruments included the following:

3.4.1. Questionnaires

1. Head of household or alternative knowledgeable person

2. Caretaker of child 12–47 months

3. School child (6–12 years) .

3.4.2. Sample collection

1. Stool samples from one child 12–47 months in each household

2. Water Samples—External and internal sources from 200 households.

- **Questionnaire Development and Testing**

  Preliminary participatory qualitative surveys were conducted in villages to guide the development of the questionnaires and ensure that they were culturally appropriate.

The draft versions were pre-tested in 18 households in small, medium and large villages in both the northern and southern regions and necessary changes were made.

Translation into Arabic was done, and questionnaires for the actual data collection were printed in colors with unique serial numbers to avoid duplications and missing data.

- **Stool Samples / Examination**

Microscopic examination focused on intestinal parasites that are both connected with water pollution and those expected to be detected in poor communities with inadequate water supplies, specifically pathogenic protozoa (amoebae and giardia) and intestinal worms (ascaris, hookworm, strongyloides, pinworm and dwarf tapeworm).

The analyses were done by the Union of Palestinian Medical Relief Committees laboratory on samples that had been collected as follows:

– A fresh stool sample was put into a clean container by the mother/caretaker after defecation by the child.

– Portions of the stool from different areas of the specimen were then placed into a tube containing a solution for fixation and staining (Merthiolate, Iodine, Formalin—PARA-FIXTM).

The laboratory test included the examination of five fields for the detection of parasites and/or ova. Quality control consisted of random selection of thirty samples for independent duplicate examination by another laboratory.

- **Water Samples / Testing**

Water samples were to be collected from one-third of the households from two areas:

– An external source: water delivered to the household

– An internal source: water from the last container before drinking.

The analyses were conducted by the Palestinian Water Authority, following the standard WHO guide lines as follows:

– Visual inspection for color and odor

– Testing for turbidity, chlorine, pH and nitrates

– After incubation, reporting of total and thermotolerant (fecal) coliforms in number of Colony Forming Units.

Duplicate samples were taken from each tenth household for quality control.

3.5. Training

- **Orientation**

  An introduction of the water project and survey was provided to all survey personnel through orientation workshops in the north and south with the following agenda:

  Introduction of the water project and environmental assessment

  1. Linkages between infrastructure, capacity building and health hygiene education components
  2. Survey locations
  3. Survey components
  4. Questionnaires
  5. Logistics.

- **Training of Trainers**

  Field supervisors and regional coordinators then participated in two two-day training of trainers workshops. The first, conducted from December 25–26, covered these objectives:

  1. Improved understanding of the project and the survey
  2. Clarification of the methodological approaches related to sampling and data collection
  3. Identification of linkages and coordination among survey elements (questionnaire, stool testing and water testing)
  4. Plans for pre-testing
  5. Clarification of supervisory and logistical issues related to survey implementation.

  The second workshop held from December 30–31 focused on the following objectives:

  1. Revision of the questionnaires as indicated by the results of pre-testing
  2. Review and finalization of the interviewer manual
  3. Review and finalization of the training agenda for data collectors
  4. Finalization of logistics related to field work.

- **Training of Data Collectors**

  Data collectors consisted of interviewers who administered the questionnaires and those who collected the stool and water samples. With the goal of providing them with the knowledge and the practical tools for conducting a survey of the highest possible quality, the training incorporated communication skills, team building and specific issues related to the data collection process.

  Objectives of this training were:

  1. Familiarization with the survey objectives, locations and approaches

  2. Provision of basic skills needed for interviews and communication with the household members

  3. Assurance of good understanding of the function of each survey element to enhance the coordination among the data collectors

  4. Support and encouragement of team spirit of the workers at all levels.

  The agenda of the training program is attached as a separate document in the Appendix. While ideally all of the data collectors would have been trained together, travel constraints between the north and the south required that training be conducted in two separate regional workshops.

  - **West Hebron: January 14–17, 2002**

  - **Nablus: January 21–24, 2002**

4. Survey Implementation

- **Overall Organization**

  The field work was implemented over a two week period from January 18–31, 2002 in the extremely difficult conditions prevailing in the Palestinian territories. Restrictions to mobility, the large number of communities to be visited and complexity of the survey elements necessitated a high level of coordination and flexibility in the implementation process.

  To ensure the completion of collection of data of the highest possible quality, the following steps were taken:

  1. The survey was implemented in the two regions separately with special management and logistic systems adapted to the local situation.

  2. Field data collectors were recruited from the survey communities to eliminate the access problems and minimize movements across the checkpoints.

  3. More data collectors and field supervisors than originally planned were recruited to ensure that the survey be accomplished in the shortest possible time.

  4. Separate but coordinated systems were developed for the different elements of the survey (questionnaires, water and stool collection) to facilitate the smoothness of the operation.

  5. High levels of responsibility were delegated to regional coordinators and field supervisors for decision-making and logistic operations in the field.

  6. Complete transportation telephone communication networks ensured coordination among survey workers at all levels.

- **Supervision and coordination**

  Coordination of the survey functioned at three levels:

  1. **Central:** The project manager coordinated activities with representatives from the EHP, UPMRC, PWA and a professional statistician to ensure that all survey elements were conducted according to planned protocols.

  2. **Regional:** Regional coordinators and field supervisors facilitated smooth implementation of the data collection process through communication with relevant regional bodies and village councils to ensure community acceptance and support for the survey activities.

3. **Field:** Field supervisors coordinated the implementation of the survey activities at the field level and facilitated coordination among the activities of the different elements.

- **Logistics and Communication**

1. **Transportation:** Eight vehicles were needed for the survey. One was designated for central and regional supervision, two in each region for the movement of data collectors and supervisors to and from the communities, one for the PWA to transport water samples and one for the transportation of stool samples to the laboratory in each region.

2. **Communication:** A communication network of mobile phones was set up in the field to ensure active follow-up and communication among survey personnel. A total of seven mobile phones were distributed for this purpose (one centrally and three in each region). Data collectors and field supervisors were authorized to use their own mobile phones for this purpose with SCF covering the expenses incurred.

- **Problems and Solutions**

Despite the detailed planning prior to the initiation of the fieldwork, severely changing environments and strict closures imposed daily changes in plans.

Field supervisors, with help from the local community members and councils, were able to identify alternative plans and solutions for fieldwork to be accomplished on time. Major constraints were due to closures and mobility restrictions and were described in incident reports.

- **Methods of Implementation**

Regional coordinators organized the activities of field supervisors, each of whom was responsible for three teams of two female interviewers each. The supervisors' role was to introduce the teams to the village, update the village maps, make the random selection of the households to be interviewed, enlist the services of local guides to find the households, resolve any problems encountered by the interviewers and control the quality of their work.

In the south, ten teams worked on the data collection. The work plan was organized to proceed from the largest to the smallest villages. This model could not function in the north because of the fact that villages were on both sides of checkpoints, the daily crossing of which would have caused severe delays and uncertainties.

In the north, 13 teams were formed and were assigned to two functioning systems—one for villages on each side of the checkpoints. People who did have to cross the checkpoints were assisted to ensure their safety and efficiency of the work.

Quality control of the questionnaires in the field consisted of the following activities:

- Checking and revision of the questionnaires by interviewers immediately after leaving the house

- Checking of each completed questionnaire by the field supervisor

- Random checking of about 30% of questionnaires by the regional coordinator.

The collection of stool and water samples was done by independent teams on the day following the interviews.

- **Data Computerization and Verification**

The completed questionnaires and laboratory reports for the stool and water samples were delivered to Alpha International for the computerization, verification and cleaning necessary to prepare the data for analysis using SPSS.

- Data entry modules were written using Microsoft Access

- Data were entered into five separate files: Household census, questionnaires I and II, Diarrhea, Stool and Water

- Unique identification codes assured that the separate files could be properly linked (For example, the stool sample to the child, the child to the mother and the mother to the household)

- Quality control were to be assured by systematic checking for outliers, coding errors and impossible results.

5. Characteristics of Households and Respondents

5.1. Sample Sizes

In spite of the implementation difficulties previously mentioned, Table 5.1 shows that the survey conducted came very close to being the survey that was planned.

Refusals to cooperate were very rare due to good communication and collaboration with the community councils.

Blocked access to certain villages prevented collection of all of the designated samples. For example, no water samples could be collected from the communities of Beit Furik and Beit Dajan.

Table 5.1. Survey plans compared with results

Results	Nablus	West Hebron	Total	%
Household interviews (goal = 600)	300	300	600	
Visits	300	304	604	
Completed	300	296	596	99.3
Stool Samples (goal = 600)				
Permission given	289	297	586	97.7
Samples collected	280	240	520	88.3
Water samples (goal = 100 X 2 = 200)				
Permission given	94	96	190	95.0
Water samples collected	77	93	170	85.0

5.2. Household Heads and Respondents

Close to 100% of the households were headed by males. Three of the nine women identified as household heads were also caretakers of children 12–47 months, and of the six who were not, the median age was 75.

We had expected that the respondent for the household questionnaire would in most cases be the male head of household. In fact, 94% of the respondents were not household heads. Including the three women mentioned above, 91% of the respondents to both questionnaires were the caretakers of the child 12–47 months of age who was chosen for the survey and stool sample. Table 5.2 summarizes these results.

Table 5.2. Percentage Distribution of HH heads and Respondents

Results	Nablus	West Hebron	Total	n
Head of Household				
Male	100.0	96.9	98.5	580
Female	0.0	3.1	1.5	580
Respondent to HH questionnaire				
Head of household				
Male	8.9	1.7	5.3	580
Female	0.0	1.7	0.9	580
Not head of household				
Caretaker	89.1	92.0	90.5	580
Not caretaker	2.0	4.5	3.3	580
Total caretakers responding *			91.0	580

* Including 3 caretakers who were also household heads

5.3. Household Demographics

Table 5.3 categorizes the household populations by sex and five-year age groups for the two provinces. The percentage of children in the 0–4 age group is higher than the 1997 census results because household eligibility for this survey was limited to those that had at least one child 12–47 months old.

Although the over-all sex ratios are one to one in the provinces, we find significant variation within certain age groups. For example, from the ages of 20–29, the women outnumber the men by a ratio of about 1.5. The dependency ratio, defined as the number of household members younger than 15 or older than 64 divided by potentially economically active members 15 through 64 is 1.5.

Table 5.3. Percentage distribution of Household Populations by Age and Sex

Age Group Years	Nablus					West Hebron				
	Male	Female	Total	Census 1997	Sex Ratio	Male	Female	Total	Census 1997	Sex Ratio
0-4	24.5	24.2	24.3	16.6	1.0	23.5	22.8	23.2	19.8	1.0
5-9	17.4	19.3	18.3		0.9	17.9	20.4	19.2		0.9
10-14	14.8	16.1	15.4		0.9	14.7	14.2	14.4		1.0
15-19	7.7	5.4	6.5		1.4	7.8	7.0	7.4		1.1
20-24	4.3	7.3	5.8		0.6	5.9	8.8	7.4		0.7
25-29	6.2	9.7	7.9		0.6	7.4	8.4	7.9		0.9
30-34	8.8	7.7	8.3		1.1	7.5	6.6	7.0		1.1
35-39	6.7	3.8	5.3		1.8	6.4	4.7	5.5		1.4
40-44	4.9	2.8	3.8		1.8	3.2	2.3	2.7		1.4
45-49	1.6	0.9	1.2		1.8	2.1	1.4	1.8		1.5
50-54	1.1	0.7	0.9		1.6	0.7	0.5	0.6		1.4
55-59	0.4	0.4	0.4		1.0	0.7	0.5	0.6		1.4
60-64	0.4	0.2	0.3		2.0	0.4	0.7	0.5		0.6
65-69	0.2	0.2	0.2		1.0	0.5	0.4	0.5		1.3
70-74	0.3	0.7	0.5		0.4	0.6	0.4	0.5		1.5
75-79	0.3	0.3	0.3		1.0	0.2	0.2	0.2		1.0
80+	0.6	0.3	0.5		2.0	0.5	0.4	0.5		1.3
0-14	56.7	59.6	58.0	42.5	1.0	56.1	57.4	56.8	49.9	1.0
15-64	42.1	38.9	40.4	53.4	1.1	42.1	40.9	41.4	47.2	1.0
65+	1.4	1.5	1.5	4.1	0.9	1.8	1.4	1.7	2.9	1.3
Total	100.2	100.0	99.9		1.0	100.0	99.7	99.9		1.0
Dependency Ratio	1.4	1.6	1.5			1.4	1.4	1.4		
Number	1092	1077	2169		2169	1097	1125	2222		2222

Dependency Ratio =	(<15 years + >64 years) / (15-64 years)

Source for 1997 Census = Palestinian Central Bureau of Statistics

We see in Table 5.4 that the median family size was 7 in both provinces, identical to the 6.9 result from the Palestinian Census of 1997.

Table 5.4. Percentage distribution of households by size

No. of members	Nablus	West Hebron	Total
1	0.0	1.0	0.7
2	0.0	0.0	0.0
3	3.0	3.7	3.3
4	15.8	11.0	13.4
5	14.9	15.3	15.0
6	13.2	14.7	14.0
7	12.9	12.0	12.4
8	12.2	12.3	12.2
9	8.6	9.3	8.9
10+	19.5	20.7	20.0
Total %	100.0	100.0	100
Median	7.0	7.0	7.0

Tables 5.5–5.7 show the age distributions found of children 12–47 months, their caretakers and children 6–12 years old. We remind the reader that when there was more than one eligible individual in the household for the interview, the 12–47 month old child was picked randomly. The chosen school child, however, was the eldest.

Table 5.5. Age distribution of caretakers of children 12–47 months

Age Group	Nablus		West Hebron		Total	
Years	N	%	n	%	n	%
15-19	3	1.0	5	1.8	8	1.4
20-24	58	19.9	59	20.8	117	20.3
25-29	90	30.9	82	28.9	172	29.9
30-34	77	26.5	65	22.9	142	24.7
35-39	36	12.4	48	16.9	84	14.6
40-44	24	8.2	21	7.4	45	7.8
45-49	3	1.0	4	1.4	7	1.2
Total	291	99.9	284	100.1	575	99.9
Median		29		29		29

Table 5.6. Age distribution children 12–47 months by sex

Age Group	Male		Female		Total		M/F
Years	N	%	N	%	n	%	Ratio
1	88	30.2	98	34.3	186	32.2	0.90
2	87	29.9	99	34.6	186	32.2	0.88
3	116	39.9	89	31.1	205	35.5	1.30
Total	291	100.0	286	100.0	577	100.0	1.02
Median (m)		30		25		28	

Table 5.7. Age distribution of school children interviewed by sex

Age Group	Male		Female		Total		M/F
Years	N	%	N	%	n	%	Ratio
6	12	7.6	10	5.4	22	6.4	1.20
7	16	10.1	10	5.4	26	7.6	1.60
8	10	6.3	18	9.7	28	8.1	0.56
9	23	14.6	25	13.4	48	14.0	0.92
10	28	17.7	36	19.4	64	18.6	0.78
11	31	19.6	47	25.3	78	22.7	0.66
12	38	24.1	40	21.5	78	22.7	0.95
Total	158	100.0	186	100.1	344	100.1	0.85
Median		10		10		10	

These tables show that in the median household we chose a 28 month old child with a 29 year old caretaker and a 10 year old school child when available. The age distributions of the caretakers in the two provinces are not significantly different. Given that the two groups of interviewers were trained separately and had little communication during the data collection, this result serves as a quality control check for lack of caretaker age bias when comparing results from Nablus and West Hebron. There was also no systematic significant sex bias among the children.

As seen in Table 5.8, half of the caretakers interviewed had completed schooling beyond the primary level and almost all were the mothers of the chosen 12–47 month child. Most of the fathers were living in the household and they also were highly educated, with 10% at the university level. Only 40% of the fathers were working full-time now, a major drop from close to 70% before the current Intifada[2]. And of those without full-time work, the percentage with part-time jobs dropped from 85% to only 55%.

[2] The beginning of the current or second Intifada was September 28, 2000.

Table 5.8. Percentage distribution of child caretaker and father characteristics

Characteristic	Nablus	West Hebron	Total	N
Caretaker of child 12-47 months				
Age (Range 16-47 years)				
Median	29.0	29.0	29.0	581
Caretaker's relationship to child				
Mother	99.3	97.9	98.6	583
Years of schooling completed by caretaker (Median)	9.0	9.0	9.0	588
Highest Educational Level Completed				
None	18.9	10.5	14.8	583
Primary	33.4	29.3	31.4	583
Preparatory	34.8	41.8	38.3	583
Secondary	7.1	9.8	8.4	583
University	3.7	5.2	4.5	583
Father of the child				
Living in the house	95.9	96.9	96.4	564
Years of schooling (Median)	10.0	10.0	10.0	570
Highest Education level Completed				
None	12.1	6.8	9.4	563
Primary	24.8	28.8	26.7	563
Preparatory	28.4	31.0	29.7	563
Secondary	16.3	13.2	14.7	563
University	10.6	8.9	9.8	563
Working full-time now (30+ hours a weekly)	44.6	33.3	38.9	570
If no, working part-time now	55.5	55.0	55.2	344
Working full-time before the Intifada	73.1	63.6	68.4	572
If no, working part-time before Intifada	85.7	84.5	85.0	180

6. Household Environment and Possessions

6.1. Housing Characteristics

Tables 6.1–6.3 show the distribution of housing characteristics and possessions that are indicators of socio-economic level. It is no surprise that the building materials of choice are bricks, cement and tiles.

Table 6.1. Percentage distribution of HH by Housing Characteristics

Characteristic	Nablus	West Hebron	Total	n
House Materials				
Wall				
Brick or cement blocks	86.0	73.3	79.7	596
Stone	13.3	26.7	20.0	596
Other			0.3	596
Floor				
Tile	83.4	75.3	79.4	591
Concrete	15.9	24.4	20.1	591
Earth	0.0	0.3	0.2	591
Roof				
Cement	99.3	100	99.7	595
Other			0.2	595
Type of Dwelling				
6 House	82.4	96.4	89.2	565
Apartment	17.6	3.6	10.8	565

Access to electricity was noted to be present in almost all households both in the south and the north. The supply is available through different communal networks including municipality sources, Israeli sources and locally established generators. The last form of supply tends to be the least reliable for domestic needs.

Table 6.2 shows that the ability to pay for electricity is one of the economic indicators adversely affected by the Intifada. With a median monthly cost of 100 NIS, the percentage of households able to pay the bills on time has dropped from 86% to one-half. It is only one-third in West Hebron compared to over two-thirds in Nablus.

Thus municipal and village councils find it increasingly difficult to pay the electricity companies, which in some cases respond by cutting off the grid in those locations.

Table 6.2. Percentage of households with electricity

Characteristic	Nablus	West Hebron	Total	n
Electricity available	98.7	98.6	98.7	594
Continuous	92.2	99.0	95.6	585
Electricity can support large appliances	93.9	88.3	91.1	587
Median cost per month (Shekels)	100.0	100.0	100.0	564
Up to date on paying bill				
Yes	69.7	32.3	51.2	582
No	30.3	67.7	48.8	582
Months since paying last bill (Median)	3.0	3.0	3.0	263
Could pay bill on time before Intifada	91.2	80.6	86.0	584

6.2. Household Economics

The striking finding in Table 6.3 is the precipitous drop in household monthly incomes since the beginning of the Intifada, from a median of 2000 down to 500 NIS. Loss of jobs in Israel due to travel restrictions has been the major causal factor. The percentage of households under the poverty line has doubled to almost 80%, and those below the hardship level have gone up eight times to almost 50%. Over half of the households claim to have borrowed money to support their families.

Most households own their dwellings, and half own agricultural land and fruit or olive trees. About one in five have livestock and one in four have poultry and vegetable and flower gardens. Over three-fourths of families have refrigerators, washing machines, television and telephones. One-third has a car or truck.

Table 6.3. Household income, agricultural activities and possessions

Characteristic	Nablus	West Hebron	Total	N
Number of household members working				
Full-time (>= 30 hours/week) Median				
Now (Range = 0-6)	1	0	0	556
Before Intifada (Range = 0-6)	1	1	1	577
Part-time (< 30 hours/week) Median				
Now (Range = 0-8)	0	0	0	554
Before Intifada (Range = 0-8)	0	0	0	545
Median monthly income before Intifada	2000	2000	2000	536
Below poverty line (1600 NIS) before Intifada	36.8	36.7	36.8	536
Below hardship line (500 NIS) before Intifada	4.5	7.5	6.0	536
Median monthly income last month	900	200	500	507
Below poverty line (1600 NIS) last month	76.5	80.4	78.5	507
Below hardship line (500 NIS) last month	38.9	56.2	47.7	507
Sold property for HH support since Intifada	16.5	17.7	17.1	591
Borrowed money for HH costs since Intifada	50.8	61.1	55.9	590
Household possessions				
Family or spouse's family owns dwelling	96.6	89.8	93.2	591
Agricultural land	35.4	53.7	44.5	591
Farm animals				
Livestock (cows, sheep, goats)	25.4	16.0	20.7	593
Median number	4.0	4.0	4.0	120
HH water supply = main source of water	84.2	91.5	87.0	123
Poultry (chickens, ducks and geese)	28.1	21.8	25.0	593
Median number	10.0	9.5	10.0	147
HH water supply = main source of water	90.4	95.3	92.5	147
Fruit or olive trees	40.9	52.4	46.6	592
They are watered	58.7	40.9	48.7	275
HH water supply = main source of water	69.0	74.6	71.6	134
Gardens				
Flower	23.2	26.6	24.9	591
HH water supply = main source of water	69.6	88.3	79.5	146
Vegetable	16.7	36.1	26.3	593
HH water supply = main source of water	65.2	71.7	68.8	154
Durable goods				
Refrigerator	87.5	87.8	87.6	591
Washing machine	88.9	87.4	88.2	591
Television	92.6	91.8	92.2	590
Regular telephone	33.8	33.3	33.6	590
Mobile telephone	68.7	57.5	63.1	591
Car or truck	30.3	33.7	32.0	591

6.3. Poverty Index

Given the importance of understanding the role of socio-economic levels in the quality of life of the households in the survey, we have constructed a poverty index, using a method introduced by the World Bank. (Gwatkin et alia 2000) From the above tables in this chapter we chose 19 indicators to derive an index divided into terciles, using a statistical method known as Principal Components Analysis.[3] Table 6.4 shows the distribution of the indicators by the three levels of the index: poorest, middle and richest.

In the poorest households, almost all fall below the poverty level and three-fourths below the hardship level. Even among the so-called richest households, two-thirds still fall below the poverty line and one-fourth below the hardship line.

Table 6.4. Household Distribution of Assets in the Poverty Index by Tercile

Variables	Poorest	Middle	Richest	Total
Wall (Cement or Stone)	100.0	100.0	100.0	100.0
Floor (Tile)	73.9	80.0	81.8	78.6
Roof (Cement)	100.0	99.4	100.0	99.8
Income last month (Median NIS)	0.0	700.0	1200.0	500.0
Below poverty level last month	95.2	77.0	63.6	78.5
Below hardship level last month	74.5	42.4	24.2	47.7
Sold to support household	35.2	10.9	6.1	17.4
Borrowed to support household	83.0	54.5	37.6	58.4
Own Building	93.9	92.1	90.9	92.3
Own Agricultural Land	24.8	43.0	63.6	43.8
Refrigerator	70.3	93.3	98.8	87.5
Washing Machine	69.1	93.3	100.0	87.5
Television	82.4	93.9	99.4	91.9
Regular Telephone	7.3	32.1	60.0	33.1
Mobile Telephone	46.7	64.8	73.3	61.6
Car or Truck	7.9	20.6	63.6	30.7
Livestock	10.9	17.0	31.5	19.8
Poultry	14.5	23.0	36.4	24.6
Olive-Fruit Trees	21.2	40.6	74.5	45.5
Flower Garden	7.9	21.8	43.6	24.4
Vegetable Garden	7.3	26.1	46.1	26.5

[3] PCA is a type of factor analysis that is widely used for the construction of indices. It reduces a large number of variables, which are often correlated, to a smaller linearly combined set that are uncorrelated and explain most of the variance in the original variables. (Dunteman 1989)

6.4. Household Water Supply

Table 6.5 shows that overall about half of the households claimed to have a usually sufficient water supply. Half also were supplied by piped water networks, but this average hides the tremendous differences between the two provinces: 90% in the south and only 9% in the north. A key indicator, defined as access to piped water of usually sufficient quantity, shows West Hebron at 65% to be nine times better off than Nablus.

Table 6.5. Percentage distribution of Households by Water Supply

Characteristic	Nablus	West Hebron	Total	n
Quantity available usually sufficient				
Yes	29.7	66.2	47.7	593
Insufficient at times	28.7	17.1	22.9	593
Covers only basic needs	5.7	1.0	3.4	593
Totally insufficient	35.7	12.6	24.3	593
Piped water	9.0	90.5	49.3	594
Piped water of usually sufficient quantity	7.0	64.5	35.4	593
Cistern	84.7	59.5	72.2	594
Roof tank	92.3	93.9	93.1	594
Tanker Water	90.3	49.7	70.2	594
Other sources	13.0	9.9	11.5	593
Roman well				
Protected	0.0	0.0	0.0	68
Unprotected	0.0	0.0	0.0	68
Spring				
Protected	94.9	13.8	60.3	68
Unprotected	0.0	10.3	4.4	68
Borehole or tube well	0.0	6.9	2.9	68
Public standpipe	0.0	6.9	2.9	68
Surface water	2.6	3.4	2.9	68
Other	2.6	69.0	30.9	68

Some of the piped networks were reported to be more than 25 years old. They suffer from an irregular supply from the Israeli water network and/or are unable to deliver an adequate per capita volume. Furthermore, the old network leads to considerable losses through leakage, which was estimated in a number of locations to exceed 23% of the water amount.

Because of irregularity of water supplies, many households depend on multiple alternative sources. This is particularly true in the north where over 90% of households use tanker and spring water.

- **Households using piped water** (see Table 6.6)

  The per capita volume of water used per household per day and the household median monthly cost of 50 NIS did not show major differences between the north and south. This is expected, considering the fact that in both provinces, we are talking about rural communities with major similarities in life styles, including patterns of water use for domestic purposes. As was the case for electricity, households in West Hebron are less likely (29%) to be up to date on paying the water bills than those in Nablus (48%).

Table 6.6. Households Using Piped Water

Characteristic	Nablus	West Hebron	Total	n
Piped water connection				
Yes	9.0	90.5	49.3	594
All water from piped source				
Yes	65.4	63.2	63.4	292
No	34.6	36.8	36.6	292
At least 1 month/year with no water	100.0	94.8	95.3	106
Median months/year with water	0.0	4.0	4.0	102
Continuous during months received	57.7	50.4	51.0	286
If No				
Water frequency during these months				
Irregular	70.0	14.0	18.0	139
When on, no regular pattern of hours	77.8	21.1	24.8	137
Med. cubic meters per month when used	13.8	12.5	12.5	233
Median liters per HH per day	452.0	411	411	233
Median liters per capita per day *	65.0	59.0	59.0	233
Piped water cost per cubic meter (Med)	4.0	4.0	4.0	191
Cost/month for water when received (Med)	55.0	50.0	50.0	233
Up to date on paying bill	48.0	29.4	31.0	290
If No, months since paying last bill (Med.)	6.0	4.0	4.0	161
No piped water connection			50.5	594
No network in the village	98.5	10.7	90.4	301
Too expensive	0.7	32.1	3.7	301

* Estimated median household size = 7

- **Households using tanker water** (see Table 6.7)

Table 6.7. Households Using Tanker Water

Characteristic	Nablus	West Hebron	Total	n
Household used tanker water in last year	90.3	49.7	70.2	594
Winter (November 2000 - April 2001)				
Median cubic meters per month	3.3	3.2	3.3	77
Median liters per HH per day	110.0	104.0	110.0	77
Median liters per capita per day *	16.0	15.0	16.0	77
Median cost per cubic meter (Shekels)				
10 cubic meter load	10.3	12.0	10.5	51
3 cubic meter load	15.0	16.7	16.7	29
Median cost per month	40.0	67.0	50.0	77
Summer (May - October 2001)				
Median cubic meters per month	8.3	5.0	6.7	413
Median liters per HH per day	274.0	164.0	271.0	413
Median liters per capita per day (HH size=7)	39.0	23.0	34.0	413
Median cost per cubic meter (Shekels)				
10 cubic meter load	12.0	18.0	12.0	243
3 cubic meter load	16.7	16.7	16.7	138
Median cost per month	100.0	122.5	108.0	413
Cost ratio (winter 2000-2001/summer 2002)	2.5	1.8	2.2	

As already shown in Table 6.5, almost all households in the north and only half in the south claim to have used tanker water in the last year. When comparing these households to those with piped water, we see two important effects—the quantity per capita goes down and the cost goes up. Thus we might expect these households to have a higher probability of health problems related to poor hygiene. We shall find in Chapter 10 that the water quality also decreases dramatically.

Seasonal variation in tanker water use is based on the fact that during winter (the rainy season), people tend to use the cistern water collected from rain. As indicated in table 6.5, 85% from households in the north and 60% in the south use cisterns to ensure water availability for some months after the rainy season is finished.

- **Drinking Water Beliefs and Practices** (See Table 6.8)

Most households (85%) in both provinces believe that their water is safe for drinking. Those who do not, perceive a variety of causes for unsafe water: bad taste, lack of clarity and color being the most commonly cited problems.

Of the one-fourth of households that treat their drinking water, boiling is the method of choice for almost half. Chlorination and filtration are less common treatment

methods (20% and 12% respectively). This might be related to the cost of filtration and the availability and knowledge about use of chlorine preparations.

About one in ten households claims treatment of drinking water for children under five years by boiling.

Table 6.8. Drinking Water Beliefs and Practices

Characteristic	Nablus	West Hebron	Total	n
Belief that water supply is safe for drinking	84.9	84.0	84.5	592
If No, why isn't water considered safe				
Not clear	31.0	23.4	27.0	89
Bad taste	19.0	31.9	25.8	89
Dirty	23.8	17.0	20.2	89
Unspecified reasons	23.8	14.9	19.1	89
Color	14.6	21.3	18.2	89
Contains bacteria	14.3	8.5	11.2	89
Chemical pollutants	9.5	8.5	9.0	89
Contact with animals	9.5	0.0	4.5	89
Salty taste	2.4	2.1	2.2	89
Drinking water is treated	28.4	24.5	26.5	593
If Yes, Types of water treatment				
Boil	41.2	48.6	44.6	157
Filter	15.3	6.9	11.5	157
Chlorination	16.5	25.0	20.4	157
Where added				
Cistern	100.0	61.1	78.1	32
Tank	0.0	33.3	18.8	32
Treatment at least once a month	7.1	22.2	15.6	32
Added during rainy season	28.6	33.3	31.3	32
Other	27.1	19.4	23.6	157
Children < 5 years = same water as adults	95.3	94.5	94.9	593
If No, water is boiled	92.9	93.8	93.3	30

- **Drinking water storage**

One of the objectives of this survey was to determine if water contamination was occurring in the household. This probability is minimized when storage containers are narrow mouthed, covered and water is removed by pouring rather than dipping.

Table 6.9 shows that half of the containers were narrow mouthed and almost all were covered. Pouring occurred in about one-fourth of Nablus households and three-fourths of those in West Hebron. What does this mean? Do Nablus water jars have faucets? An analysis of the specifics of the "other" answer given in 43% of cases will be necessary to answer this question.

Table 6.9. Drinking water storage

Characteristic	Nablus	West Hebron	Total	n
Permission given to see storage	87.3	96.9	92.1	593
Type of opening of containers				
Narrow mouthed	45.8	53.9	50.0	546
Wide mouthed	51.1	40.5	45.6	546
Both	3.1	5.6	4.4	546
All are covered	96.6	96.5	96.5	544
How is water removed				
Pouring	22.9	73.7	48.1	590
Dipping	6.4	8.9	7.6	590
Both	1.3	0.7	1.0	590
Other	69.4	16.7	43.2	590

7. Household Sanitation

7.1. Sanitation Facilities (see Tables 7.1 and 7.2)

Table 7.1. Percentage of Households with Access to Sanitation Facilities

Characteristic	Nablus	West Hebron	Total	N
Access to a sanitation facility	99.7	99.3	99.5	591
Private	93.6	96.2	94.9	588
On the premises	92.6	89.5	91.0	581
Type of facility				
Flush	22.4	36.6	29.5	587
Pour flush	71.9	60.6	66.3	587
Simple pit latrine	0.7	1.0	0.9	587
Ventilated improved pit latrine	0.0	1.4	0.7	587
Sanitary facility drainage				
Soak-away	90.8	95.9	93.3	584
Via pipe	94.4	94.2	94.3	544
Private	61.4	71.9	66.8	544
Evacuation frequency				
At least once a year	5.6	43.8	24.3	527
Less than once a year	1.9	5.8	3.8	
Never	92.6	50.4	71.9	535
HH with soak-away and cistern				
Permission to measure distance	92.8	90.7	91.7	314
Distance between them (meters)	17.5	17.5	17.5	289
Soak-away is uphill from cistern	17.0	20.9	18.1	280
Cesspit (lined)	5.4	2.8	4.1	584
Public sewer	2.0	0.0	1.0	584
Down hillside	0.7	1.0	0.9	584
Septic system	0.7	0.3	0.5	584
Emptied manually	0.3	0.0	0.2	584
Drainage system is causing problems for HH and neighbors	12.3	5.6	8.9	571

* Key Indicator: A sanitation facility is a toilet or latrine

Unlike the situation in typical rural communities in developing countries, almost all of the households have access to sanitation facilities, most of which are private water-

flushed toilets. Very few instances of outdoor latrines were found in dwellings with extended families and with poorer isolated peripheral dwellings that were slightly more prevalent in the southern West Bank.

As seen in Table 7.2, when the criteria of superstructure and cleanliness are considered, the percentage of households with access to a hygienic sanitation facility falls slightly to 78%.

In almost all cases, drainage of the sanitary facility is via pipe to a soak-away (an unlined seepage pit), two-thirds of which are private. While one-fourth of the soak-aways are evacuated at least once a year, three-fourths have never been evacuated.

In households where there is a soak-away and a cistern, the median distance between them is 17.5 meters, with the soak-away being uphill from the cistern in almost one-fifth of the time. Problems with neighbors caused by the drainage system were reported by less than one in ten households.

The public health implications of these findings are that although sanitation facilities are widespread, there may often be a significant risk, of which many are unaware, of contamination of cisterns and ground water from the soak-aways.

Table 7.2. Percentage of Households with Access to Hygienic Sanitation Facilities

Characteristic	Nablus	West Hebron	Total	N
Sanitation facility (toilet or latrine)	**99.7**	**99.3**	99.5	591
Permission given to see it	97.3	97.6	97.4	585
Adequate superstructure	86.0	92.3	89.1	570
No fecal matter on walls and/or floor	82.1	85.3	83.7	570
Access to a hygienic sanitation facility *	74.7	80.1	77.6	575

* Key Indicator: Household access to hygienic sanitation facility

Access to a toilet or latrine, the superstructure is adequate for privacy and protection from the elements, and the facility is clean (no fecal matter on floor or walls).

7.2. Garbage Disposal

All of the surveyed communities appear to have a garbage collection system in place. Garbage collectors are most common in the north (82%) and a network of municipal boxes in the south (67%). Overall one in twenty households burns garbage and only 3% throw it away in a distant place. Both of these practices are more frequent in the south.

Garbage was seen in front of the house in only 12% of cases, but occurred almost three times more often in the north than in the south.

Table 7.3. Household Garbage Disposal

Characteristic	Nablus	West Hebron	Total	N
Where garbage is kept before disposal				
Get rid of it immediately	40.6	78.5	63.8	426
In kitchen	59.4	21.5	36.2	432
Type of disposal				
Garbage collector takes	81.8	18.4	50.3	591
Municipal box	15.8	67.3	41.5	591
Burn	1.3	7.8	4.6	591
Throw in distant place	0.7	5.4	3.0	591
Other	0.3	1.0	0.7	591
Permission given to see garbage container	91.9	81.2	86.6	589
Garbage container is covered	66.5	65.7	66.1	514
Garbage seen in front of the house	17.4	6.3	11.8	575

8. Intestinal Parasites, Diarrhea and Infant Feeding

8.1. Intestinal Parasites

Intestinal parasites have been a major health problem in Palestine related to inadequate water supplies and sanitation. Ascaris, for example, was a common problem in the seventies. The qualitative research in selected communities prior to this survey found that this issue was frequently mentioned by both families and community health professionals, with pinworm being the most commonly cited pathogen.

Table 8.1 shows the results of microscopic examination of stool specimens from children 12–47 months for ova and parasites. Amebiasis (cysts and/or trophozoites) was found 15% and giardiasis (cysts and/or trophozoites) in 10%. Infestation by these protozoa went up directly with increasing age, with the likelihood of amebiasis reaching a high of one-fourth in three-year olds in Nablus and giardiasis a high of almost one-fifth in three-year olds in West Hebron. Both protozoa were found in only 2% of the children. Surprisingly worms were conspicuous by their absence. There was only one case of ascaris and two of pinworm.[4] The under-reporting of pinworms may be due in large part to the methodology used. Female pinworms emerge from the anus and lay their ova on the perianal area during the night. The best way to find them is to do microscopic examination of transparent adhesive tape that has been pressed on the perianal skin in the morning before defecation.

[4] Four cases of dwarf tapeworm (Hymenopolis nana) ova were reported, but this result should be verified to be sure that what was seen was not an artifact.

Table 8.1. Prevalence of Intestinal Parasites in Children 12–47 months

Results	Nablus	West Hebron	Total	n
Protozoa				
Amebiasis (Entamoeba histolytica)	16.0	14.0	14.8	520
12–23 months	9.2	11.9	10.6	
24–35 months	15.1	15.3	15.2	
36–47 months	26.2	15.5	19.6	
Giardiasis (Giardia lamblia)	5.9	14.0	10.4	520
12–23 months	2.6	8.3	5.6	
24–35 months	9.6	12.9	11.4	
36–47 months	6.6	17.5	13.3	
Amebiasis and Giardiasis	0.0	3.2	1.7	520
Roundworms				
Ascaris (Ascaris lumbricoides)	0.4	0.0	0.2	519
Hookworm (Ancyclostoma duodenale)	0.0	0.0	0.0	519
Pinworm (Enterobius vermicularis)	0.8	0.0	0.4	519

Although we did not find any recent publications, intestinal parasites have been studied by Palestinian researchers in the past. Abed (1979) found prevalence rates of 62.3% Ascaris lumbriciodes, 17% Giardia lamblia and 3.7% Ancylostoma in a field survey of preschool children that was conducted in Jabalia village including 411 children. Associations were found between prevalence rates and a number of environmental variables. Assuming that sanitation and hygiene were much worse over 20 years ago, one would not expect similarly high prevalence rates now, which is the case for Ascaris. However, infections with Giardia seem to be very similar between now and then.

In a more recent study Ali-Shtayeh et al. (1989) report 32% of stool samples were positive for one or more intestinal parasites including 22.9% Entamoeba histolytica, 7.3% Giardia lamblia and 5.7% Ascaris lumbricoides. A total of 22,970 stool specimens collected from patients attending the Central Medical Laboratory in the city of Nablus between 1981 and 1986 were examined. Based on an apparent seasonal pattern in the number of positive cases, it is suggested that parasitic incidence is higher in summer than in winter. The possibility of seasonal patterns in reporting to the lab is not discussed.

A third study by Condie and Kaspari (1986) reported results consistent with findings reported here although samples were obtained from school children. A study of intestinal parasitism and anemia in pupils at a school in Birzeit village was conducted. A total of 193 stool samples were collected from children between the ages of six and 11 years. Twenty-three percent were infected with one or more intestinal parasite. The main parasites were Giardia lamblia (15%) and Entamoeba coli (8%), the latter being included as a non-pathogenic indicator of contamination. Twenty percent of the sampled children living in Birzeit were infected as compared with 41% in children sampled from outlying villages.

Similar results were reported by Kaspari and Condie (1986) from a survey that was conducted of intestinal parasitism in schools in four West Bank refugee camps: Dayr 'Ammar, Jalazon, Al-Am'ari and Al-'Oja. In each school, pupils in the 6–7 and 11–12 years age groups were sampled to provide a measure of variation with age. A total of 455 stool samples were analyzed, of which 48% were positive for one or more intestinal parasite. Main parasites found were Entamoeba coli (21%), Giardia lamblia (16%), Hymenolepis nana (11%), Trichuris trichura (6%), Entamoeba histolytica (4 %), Ascaris lumbricoides (2%) and Enterobius vermicularis (1%).

8.2. Diarrhea

Respiratory tract infections and diarrhea are the two major health problems among children under five years of age. Children have an average of 3–4 diarrhea episodes per year, with the risk being greatest in the summer season. A study conducted in the summer of 1998 at Alia Governmental Hospital found acute diarrhea to be the diagnosis for 66% of hospitalized children. In spite of relatively low mortality due to diarrhea and dehydration, the economic and social burden of this disease is high both at the family and at the healthcare provision levels.

Information about the presence of diarrhea during the two weeks prior to the survey was asked for all children under five years in the households (see Table 8.2). Overall, it was present in 12% of children (during the low risk winter season), reaching a high of 20% in children from 12–23 months, the age of increasing contact with the household environment.

Table 8.2. Two-Week Prevalence of Diarrhea for Children < 5 years

Results	Nablus	West Hebron	Total %	n	P
Age (Months)					
0–11	13.8	11.5	12.6	143	
12–23	23.5	15.7	20.2	228	
24–35	9.6	11.4	10.5	219	
36–47	7.7	6.6	7.1	266	
48–59	0.0	6.8	3.5	85	
0–59 *	**12.2**	**11.1**	**11.6**	**941**	**0.00**
Ever had jaundice					
Yes	10.0	20.0	12.3	81	
No	12.2	10.6	11.5	862	0.82
Worm medicine in past 6 months					
Yes	27.1	16.7	21.6	125	
No	10.1	9.9	10.1	821	0.00

* Key Indicator: 2 week diarrhea prevalence in children under 5 years of age

The characteristics of the diarrhea are presented in Table 8.3. Mean duration of the episodes was four days and the reporting by the caretakers of blood and mucus in 7% and 44% of cases respectively, suggests that there also may be a problem of bacillary dysentery consistent with giardia and Entamoeba histolytica infections.

Home management of diarrhea is perceived as a critical issue in diarrhea in children. Over one-half of the children received more liquids than usual and less food. One-fifth received appropriate home care management, defined as more liquids being given than usual and at least as much food. From the programmatic point of view, this is a crucial subject for the health education to be developed for the project.

Table 8.3. Characteristics of Diarrhea*

Results	Nablus	West Hebron	Total	n
Duration in Days (Median)	4.5	4.0	4.0	73
Diarrhea the day of the visit	14.8	25.5	19.4	98
Blood in the stool	3.8	11.4	7.1	98
Mucus in the stool	34.6	55.9	43.8	96
Liquids given to child				
Less than usual	7.4	13.6	10.1	99
Same as usual	33.3	38.6	36.4	99
More than usual	59.3	47.7	53.5	99
Food given to child				
Less than usual	59.3	47.7	54.5	99
Same as usual	29.6	45.5	36.4	99
More than usual	11.1	6.8	9.1	99
**Appropriate home care ** **	**18.5**	**20.5**	**19.2**	**99**
Child received diarrhea treatment	59.6	51.2	56.3	96

* Denominator = children reported to have had diarrhea in the last 2 weeks

** Key Indicator: Appropriate home care = More liquids than usual and food at least the same as usual

Access to health care in the Palestinian community is generally easy and over half of children with diarrhea received some sort of health care. The distribution of the sources is seen in Table 8.4. Almost four out of five consulted a physician and the majority received medications. While it is not known from this survey whether or not the treatments prescribed were based on laboratory findings, we do know that the overuse of diarrhea medication is widely present in Palestine. This finding underlines the importance of health education aimed at reinforcing appropriate home rather than medication-based management.

Table 8.4. Source of Treatment for Diarrhea

Results	Nablus	West Hebron	Total	n
Doctor	80.0	72.2	77.6	49
Medication prescribed by doctor	83.3	47.1	68.8	48
Other health professional	10.0	5.9	8.3	48
Pharmacist or neighbor	3.3	5.9	4.2	48
Medicine already in house	27.6	44.4	33.3	48

Exploration of caretaker knowledge about the causes of diarrhea (Table 8.5) revealed the north to be consistently more aware than the south of the causal links between diarrhea occurrence and poor hygiene and sanitation. Contact with fecal matter was rarely mentioned, while dirty water was cited by 44% of northern households and by only 12% in the south. Over half of the households gave "other" as a perceived cause of diarrhea, which was found in most cases to be cold temperature.

Table 8.5. Caretaker Knowledge of Causes of Diarrhea for Children < 5 years

Characteristic	Nablus	West Hebron	Total	n
Poor hygiene	26.4	19.9	23.2	587
Contact with fecal matter	3.1	1.0	2.0	587
Dirty water	44.1	12.0	28.1	587
Dirty hands	24.7	11.0	17.9	587
Dirty food	52.5	30.1	41.4	587
Uncooked or incompletely cooked food	2.7	2.4	2.6	587
Flies	8.1	2.4	5.3	587
Dust	3.3	5.5	4.4	587
Eating too much fruit	5.1	1.0	3.1	587
Contact with animals	0.7	0.3	0.5	587
Other *	46.8	62.3	54.5	587

* Over half of the responses were "other".

This table provides many important themes to be included in a health education program aimed at maximizing the health impact of improved water and sanitation.

8.3. Infant Feeding

Breastfeeding promotion has been an important topic for many years in health education programs in Palestine. Due to this fact and cultural and economic factors, the practice is widespread. A survey conducted by Save the Children Federation in 2000–2001, found that 95% of respondent mothers had breastfed their children, compared to 92% in the current survey (see Table 8.6), 86% of whom claimed they had exclusively breastfed their infants.

The controversial issue in the Palestinian community is to what extent the exclusive breastfeeding really means the infant received no liquids other than breastmilk. Generally it is common practice to give infants, even in younger ages, some additional fluids, but not as a replacement of a meal.

The survey also found that children often drink water from a baby bottle. Even if the water is of acceptable quality, inadequately sterilized nipples can be a source of contamination.

Table 8.6. Infant Feeding (0–11 months)

Results	Nablus	West Hebron	Total	n
Child ever breastfed				
Yes	98.2	86.2	92.0	113
Exclusive breastfeeding	86.3	86.0	86.1	101
Duration in months (median)	7.0	4.0	6.0	75
Child drinks liquids from bottle	29.6	53.6	41.8	110
Child drinks water	59.3	64.9	62.2	111
Water from a baby bottle	40.6	54.1	47.8	69

9. Hygiene Knowledge and Practices

9.1. Feces Disposal

- **Children 12–47 months** (see Table 9.1)

  About half of the children use the sanitation facility day and night. Diaper use is one-third by day and 43% by night, and about 90% are disposable. This finding is of economic and environmental sanitation significance. One-third of the feces go into the trash. An assumption is that this is where the disposable diapers are put.

  Potty use during the day and/or night was only 12%. Permission to see it was given 81% of the time, and when seen, 93% of the potties were clean.

Table 9.1. Children (12–47 months)

Characteristic	Nablus	West Hebron	Total	n
Daytime defecation				
Place				
Sanitation facility	52.0	57.0	54.5	589
At what age did child begin to use it	24.0	20.0	24.0	275
Potty	14.5	8.2	11.4	589
Diapers				
Washable	5.1	2.4	3.7	589
Disposable	27.7	29.4	28.5	589
In clothes	0.0	1.7	0.8	589
On the ground	0.0	1.7	0.8	589
Child accompanied (SF and Potty)	77.2	62.3	69.8	388
By Caretaker	94.1	95.4	94.8	271
Where are feces usually disposed of				
Uses sanitation facility	53.2	58.6	55.9	590
Put into sanitation facility	14.5	7.9	11.2	590
Rinsed away	0.3	1.4	0.8	590
Thrown into trash	26.9	27.4	27.2	590
Buried	0	1.4	0.7	590
Night time defecation				
Place				
Sanitation facility	42.6	48.3	45.4	588
Potty	11.5	3.8	7.7	588
Diapers				
Washable	7.4	2.1	4.8	588
Disposable	35.8	40.8	38.3	588
In clothes	0.3	1.7	1.0	588
On the ground	0.3	1.7	1.0	588
Child accompanied (SF and Potty)	85.6	85.5	85.6	312
By Caretaker	97.8	96.9	97.3	264
Where are feces usually disposed of				
Uses sanitation facility	44.6	48.8	46.7	589
Put into sanitation facility	10.8	7.2	9.0	589
Rinsed away	0.7	2	1.4	589
Thrown into trash	31.8	33.8	32.8	589
Buried	0.3	1.4	0.8	589
Potty is used during the day and/or night	15.9	8.9	12.4	589
Permission given to see it	93.6	57.7	80.8	73
Seen and clean	90.9	100.0	93.2	59
Seen and not clean	6.8	0.0	5.1	59
Not seen	2.3	0.0	1.7	59

- **School Age Children (6–12)** (see Table 9.2)

  About 70% of boys and girls use the household sanitation facility. A few used the sanitation facility at school when school was open. Exploration of the 27% "other" response did not reveal any other significant places.

Table 9.2. School Age Children (6–12)

Characteristic	Nablus	West Hebron	Total	n
Boys				
Where do they usually defecate				
Household sanitation facility	62.1	76.9	69.1	527
Sanitation facility at another house	0.7	0.4	0.6	527
Sanitation facility at school	5.0	0.0	2.7	527
Outside of school days/hours	0.0	0.0	0.0	13
Other	31.4	21.9	26.9	527
Girls				
Where do they usually defecate				
Household sanitation facility	62.8	74.6	68.3	530
Sanitation facility at another house	1.4	2.8	2.1	530
Sanitation facility at school	3.9	0.0	2.1	530
Outside of school days/hours	0.0	0.0	0.0	10
Other	31.9	21.4	27.0	530

- **Adults** (see Table 9.3)

  Almost all men and women (98%) use the household sanitation facility.

Table 9.3. Adults

Characteristic	Nablus	West Hebron	Total	n
Defecation usually in sanitation facility				
Men	98.7	97.3	98.0	589
Women	99.3	97.3	98.3	589

9.2. Handwashing

Table 9.4 shows the results of observing household handwashing facilities in the 96% of households granted permission. Over three-fourths were in or near the sanitation facility, and 95% had water available through the faucet and/or water container. Fewer had soap (72%) and only two-thirds had a towel or cloth to dry. Seventy percent of households had an appropriate handwashing area, defined as one that has soap and water, with no significant difference between the two provinces.

Table 9.4. Household Handwashing Facilities

Characteristic	Nablus	West Hebron	Total	n
Permission to see handwashing area	95.3	96.9	96.1	589
In or near the sanitation facility	82.6	71.5	77.0	565
Soap present	75.1	68.4	71.7	566
Faucet and/or container with water	94.4	94.0	94.7	565
Basin or sink	89.3	85.6	87.5	566
Towel or cloth to dry hands	61.8	66.1	63.9	563
Towel or cloth is clean	94.2	97.8	96.1	359
Appropriate handwashing area *	73.9	66.7	70.2	568

* Key Indicator: Appropriate handwashing area has soap, water available and appropriate drying

Handwashing practices were also observed for children 12-47 months old, as seen in Table 9.5. The caretaker assists the child 88% of the time in the north compared to 75% in the south. Only 70% of the handwashings observed used soap. Half the time the child stands on a chair or stool, which is a potential risk for falls.

Table 9.5. Handwashing practices for children 12–47 months

Characteristic	Nablus	West Hebron	Total	n
Permission to watch child handwashing	95.9	97.9	96.9	548
Who is doing the handwashing				
Caretaker	87.5	74.8	80.9	529
Child alone	7.5	19.3	13.6	529
Both caretaker and the child	5.1	5.8	5.5	529
Is soap used	69.9	70.3	70.1	529
Are both hands washed	93.3	96.0	94.7	527
Are hands rubbed three times	77.0	92.3	84.9	529
How are hands dried				
Towel	79.6	78.6	79.9	526
In the air	15.7	19.6	17.7	526
Can the child reach the water and the soap alone	17.6	23.5	20.7	527
Caretaker holds the child	39.0	32.7	35.5	93
Stands on chair or stool	43.9	55.8	50.5	93
Other	17.1	11.5	14.0	93

9.3. Knowledge and Practices — Caretaker of child 12–47 months

Table 9.6 explores the caretaker's knowledge about the critical times for handwashing. The most frequent responses were related to eating—before (61%) and after (53%)—followed by after defecation (47%). Only about one-fifth mentioned before food preparation or after changing the baby. The 51% "other" responses need to be examined for specific details.

The Palestinian community in general and mothers with children in particular have been exposed to different health education programs throughout the last twenty years. Community health organizations have focused on providing information as a tool for health promotion and protection, especially during periods when poor rural communities have not had access to healthcare facilities. Health education programs, both individual and group centered, have stressed the importance of personal hygiene and environmental sanitation especially when talking about diarrhea, which has been the major cause of morbidity among children.

Table 9.6. Caretaker Hygiene Knowledge and Sources

Characteristic	Nablus	West Hebron	Total	n
Critical times for handwashing				
Before preparing food or cooking	24.2	13.0	18.6	590
Before eating	73.1	48.1	60.7	590
Before feeding children	20.9	6.8	13.9	590
After changing baby	26.9	8.2	17.6	590
After defecation	56.2	37.2	46.8	590
After eating	65.7	41.0	53.4	590
Other	47.8	53.9	50.8	590
Source of hygiene information				
Radio or TV	67.6	47.8	57.7	589
Health outreach worker	19.2	14.7	16.9	590
Clinic staff	22.9	19.1	21.0	590
School	18.2	16.0	17.1	590
Work	1	1.4	1.2	590
Mother and mother in-law	21.2	19.1	20.2	590
Other family members	11.8	11.3	11.5	590
Friends	8.1	4.8	6.4	590
The Mosque	2	0.3	1.2	590
Koran	5.1	1.4	3.2	590
Book, Posters and brochures	26.2	22.2	24.2	590
Nobody	6.7	4.1	5.4	590
Other	11.8	7.2	9.5	590
Benefited from health education	95.8	97.8	96.8	567

For programmatic reasons, this survey tried to identify the sources of caretaker knowledge of hygiene and health (see Tables 9.6 and 9.7).

- **Hygiene**

  At almost 60%, radio or television is by far the most important source of information. Books and other written materials are in second place at 24% followed closely by mothers and mothers-in-law at 20% and health outreach workers and schools at 17% each.

- **Health**

  – Treatment of a sick child

    Doctors are the principal source of information at 90% followed by mothers and mothers-in-law at about 40%. Books are only mentioned 3% of the time.

– Child Health

When the subject becomes disease prevention rather than treatment, radio or television is cited over half the time. The next most frequent sources are schools at 28%, mosques at 23%. Doctors and other health workers fall to 18%.

Regardless of the sources of information used, almost all caretakers said that the information was useful and that they are interested in learning more about the issues of family/child health and drinking water quality.

Table 9.7. Caretaker Health Knowledge Sources

Characteristic	Nablus	West Hebron	Total	N
Source of advice for sick child				
Doctor	83.5	88.4	85.9	590
Other health workers	13.5	6.8	10.2	590
Friends	4.4	1.0	2.7	590
Own family	21.9	8.5	15.3	590
Husband's family	22.6	4.8	13.8	589
Books and magazines	4.7	1.0	2.9	590
Other	5.4	3.8	4.6	590
Source in family or husband's family				
Mother	41.0	40.9	41.0	100
Mother-in-law	35.9	31.8	35.0	100
Husband	17.9	18.2	18.0	100
Source of information for child health				
Radio or TV	56.9	47.4	52.2	590
Doctor or other health workers	19.9	16.4	18.1	590
School	34.7	20.5	27.6	590
At work	8.4	13.4	11.0	590
Friends or family	2.0	0.7	1.4	590
Mosque	24.6	21.5	23.1	590
Koran	10.4	11.6	11.0	590
Books, posters or brochures	8.1	4.8	6.4	590
Nobody	2.4	1.0	1.7	590
Other	1.7	1.0	1.4	590
Getting useful information form these sources	97.2	98.9	98.1	567
Interested in getting more information				
Regarding family / child health	98.0	99.0	98.5	588
Regarding drinking water quality	97.3	98.3	97.8	586

9.4. Knowledge and Practices — School Children

Tables 9.8–9.10 summarize the results of interviews of 344 school children, only 37% of whom where from the south. Many children were missed in the south because they were at school at the time of the visit, whereas in the north, field supervisors managed to create a system to bring the school child for the interview while the household questionnaire was being answered. The median age of interviewed school children was ten years with a median of school years completed of four.

- **Hygiene Practices**

  With regards to household practices, almost two-thirds had fed a baby, one-third had prepared food and almost one-fourth had changed a baby's diapers. Virtually all used the household sanitation facility, and almost three-fourths of those observed washing their hands demonstrated appropriate technique defined as both hands rubbed together at least three times with soap and water and dried with a clean towel or air. The major problem observed was the lack of soap in one-fourth of the handwashing areas.

Table 9.8. School Children's Hygiene Practices

Characteristic	Nablus	West Hebron	Total	n
School	63.1	36.9	100.0	344
Age (Median)	11	10	10	342
Years of schooling completed (Median)	4.0	3.0	4.0	318
Household practices				
Ever cooks or prepares food	28.5	39.5	32.4	321
Ever feeds a baby	60.4	71.3	64.3	322
Ever changes a baby	23.6	20.9	22.7	322
Defecation practices				
Household sanitation facility	91.2	96.5	93.1	320
School sanitation facility	6.8	1.7	5.0	320
HH facility outside of school hours	100.0	100.0	100.0	15
Can show handwashing area	87.4	96.5	90.7	321
Type of place				
Sanitation facility	22.8	21.6	22.3	291
Bathroom	11.7	11.7	11.7	291
Kitchen	8.3	8.1	8.2	291
Room of interview	3.3	14.4	7.6	291
Other	53.9	44.1	50.2	291
Observation of handwashing area				
Soap present	77.2	70.0	74.5	290
Faucet and/or container with water	95.6	90.9	93.8	290
Basin or sink	92.2	93.6	92.7	290
Towel or cloth to dry hands	71.1	73.6	72.0	290
Towel or cloth is clean	96.9	96.3	96.6	208
Appropriate handwashing area *	74.6	68.5	72.3	292
Agrees to handwashing demonstration	96.1	100.0	97.6	291
Uses soap or detergent	68.2	68.5	68.3	284
Washes both hands	98.3	99.1	98.6	284
Rubs hands together at least 3 times	76.3	95.5	83.8	284
Dries hands with clean towel	75.1	76.6	75.7	284
Dries hands in the air	16.8	20.7	18.3	284
Appropriate handwashing technique *	49.4	60.2	53.6	274

* Key Indicators:

Appropriate handwashing area: soap and water available

Appropriate handwashing technique: soap and water present, both hands are rubbed together at least 3 times, and hands are dried with clean towel or air

- **Hygiene Knowledge**

As found for the caretakers, the order of the frequencies of critical times for handwashing was first eating—before and after—followed by after defecation. The specifics of the over one-third "other" responses should be investigated.

Concerning the possible causes of diarrhea, children in the south gave very few responses while in the north dirty water and dirty hands were mentioned by 20% and dirty food by 29%. Again "other" was a response in almost one-third of cases.

Table 9.9. School Children's Hygiene Knowledge

Characteristic	Nablus	West Hebron	Total	n
Critical times for handwashing				
Before preparing food or cooking	5.8	1.8	4.4	321
Before eating	78.7	65.8	74.1	321
Before feeding children	5.8	2.6	4.7	321
After changing baby	2.4	2.6	2.5	321
After defecation	54.6	25.4	44.2	321
After eating	75.4	57.9	69.2	321
Other	35.3	36.0	35.5	321
Possible causes of diarrhea				
Poor hygiene	11.1	7.9	10.0	321
Contact with fecal matter	2.4	0.9	1.9	322
Dirty water	20.8	4.3	14.9	322
Dirty hands	19.8	5.2	14.6	322
Dirty food	29.0	8.7	21.7	322
Uncooked or incompletely cooked food	1.4	1.7	1.6	322
Flies	9.2	0.9	6.2	322
Dust	2.9	0.9	2.2	322
Eating too much fruit	1.0	0.0	0.6	322
Contact with animals	1.4	0.9	1.2	322
Other	22.1	36.5	29.2	322
Importance of handwashing after defecation				
Prevents disease	70.8	51.3	63.7	317
Good hygiene practice	29.7	22.6	27.1	317
General cleanliness	21.8	20.9	21.5	317
Religious reasons	7.9	1.7	5.7	317
Other	7.0	9.6	7.9	316

Table 9.10. Drinking water, subjects taught and handwashing at school

Characteristic	Nablus	West Hebron	Total	n
Drinking water				
Takes drinking water to school	32.4	53.0	39.8	319
Reasons				
School requires	6.1	4.9	5.5	127
Not always water in school	25.8	45.9	35.4	127
The water may not be clean	55.4	44.3	50.0	127
Source of the water (household water)	96.9	96.7	96.8	126
Difference between school and house water				
Water from the house is boiled	4.6	1.6	3.1	127
Water from the household is clean	69.2	66.1	66.7	127
Water from the house is filtered	1.5	3.2	2.4	127
Water from the household is chlorinated	1.5	1.6	1.6	127
Other	21.5	27.4	24.4	127
Getting education about hygiene at school	91.6	93.9	92.5	318
Getting education about diarrhea at school	37.1	34.8	36.3	317
Subjects taught at school				
Importance of handwashing after defecation	87.1	92.1	88.9	315
Handwashing area at school	98.0	98.2	98.1	317
Water available	63.3	41.1	55.3	311
Water is never available	1.5	1.8	1.6	311
Soap available	26.1	10.7	20.6	311
Soap never available	58.3	85.7	68.2	311
Less than 10 meters from sanitation facility	60.8	64.3	62.1	311
Appropriate school handwashing area *	20.2	5.2	14.8	318

* Key Indicator: Appropriate handwashing area = water and soap available

One-third of children in the north and over one-half in the south take household drinking water to school because school water is not available or clean. Almost all (93%) of the children said they got hygiene education at school, but only a little over one-third (36%) reported education about diarrhea.

Handwashing areas are theoretically present in almost all schools, but only a little over half (55%) usually have water and only one-fifth have soap. Thus, only 15% of the schools are considered to have appropriate handwashing areas, significantly less in the south (5%) than in the north (20%).

10. Water Quality

As previously mentioned water samples were planned to be taken from one-third of the households: from an external source and an internal one, the latter to be the last container used before drinking. Due to travel restrictions, samples were actually collected from only 170 households.

The testing was done according to WHO standards and the findings are summarized in Tables 10.1–10.4.

- **Physical and Chemical Characteristics**

  Almost all of the water was colorless but odor and turbidity were widespread. The striking finding was that odor was noted in 83% of samples from the north and none from the south. Turbidity, on the other hand, was more common in the south than in the north and was less in internal than external samples.

  The pH was less than eight in 80% of samples and the median level of residual chlorine was 0 mg./liter. Nitrates were found from 0–50 mg./liter, which is considered to be the acceptable limit.

Table 10.1. Physical and Chemical Characteristics of household water External and internal samples *

Results	Nablus	West Hebron	Total	N
Colorless				
External source	97.4	96.6	97.0	166
Internal source	94.7	96.7	95.9	169
Odorless				
External source	17.1	100	61.4	166
Internal source	17.1	100	62.1	169
Turbidity (Median NTU)				
External source	1.9	1.1	1.6	165
Internal source	1.6	0.7	1.1	169
Turbidity (NTU < 1)				
External source	17.1	45.5	32.1	165
Internal source	25.0	65.2	46.7	169
pH (Median)				
External source	7.7	7.6	7.6	164
Internal source	7.7	7.8	7.7	167
pH < 8				
External source	69.3	87.5	78.7	164
Internal source	77.3	81.3	79.6	167
Residual Chlorine - mg/liter (Median)				
External source (Range 0–0.9)	0	0	0	144
Internal source (0–0.75)	0	0	0	142
Nitrates (Range - mg / liter) **				
External source	0.1–45.0	0.8–23.0	0.1–45.0	129
Internal source	0.1–50.0	0.9–26.0	0.1–50.0	134
Nitrates (Median - mg / liter)				
External source	1.6	2.9	2.2	129
Internal source	1.4	2.9	2.5	134
Nitrates (<= 50 mg / liter)				
External source	100.0	100.0	100.0	129
Internal source	100.0	100.0	100.0	134

* External—point of entry: Water from delivery system to the house (faucet, cistern or storage tank)
Internal—point of use: Water just before drinking (faucet, jar or bottle)

** The WHO guideline for the nitrate ion is ≤ 50 mg/liter, to prevent methemoglobinemia in infants. Its sources may include the natural nitrogen cycle, runoff from inorganic fertilizer and human and animal wastes.

- **Bacteriological Characteristics**

  Thermotolerant and total coliforms are commonly used as microbial indicators for water quality screening. While both may come from other than fecal sources, the concentration of thermotolerant coliforms is usually highly correlated with that of Escherichia coli, which comes exclusively from human and animal feces. When indicated, specific confirmatory testing can be done for E. coli. Overall over half of the external and internal samples were free of thermotolerant (fecal) coliform colony forming units (CFU). However, the frequency in the south was only about half that of the north for external samples (38% compared to 73%) and about three-fourths of the north for internal samples (43% compared to 60%). Total coliforms showed greater provincial variation. External samples were free of CFU's in 53% of households in the south and only 4% in the north. For internal samples the frequencies were 45% and 5%.

Table 10.2. Bacteriological Characteristics of Household Water

Results	Nablus	West Hebron	Total	n
Thermotolerant Coliforms (CFU / 100 ml)				
External source				
No risk (0)	38.2	72.7	56.4	165
Low risk (1-10)	19.7	14.8	17.0	165
Intermediate risk (11-100)	28.9	9.1	18.8	165
High risk (101 - 998)	9.2	3.4	6.1	165
Very high risk (Too many to count)	3.9	0.0	1.8	165
Internal source				
No risk (0)	43.4	59.8	52.1	169
Low risk (1-10)	22.4	21.7	21.9	169
Intermediate risk (11-100)	25.0	10.9	17.8	169
High risk (101 - 998)	7.9	5.4	6.5	169
Very high risk (Too many to count)	1.3	2.2	1.8	169
Total Coliforms (CFU / 100 ml)				
External source				
No risk (0)	3.9	53.4	30.3	165
Low risk (1-10)	11.8	15.9	13.9	165
Intermediate risk (11-100)	31.6	20.5	26.1	165
High risk (101 - 998)	30.3	3.4	15.8	165
Very high risk (Too many to count)	22.4	6.8	13.9	165
Internal source				
No risk (0)	5.3	44.6	26.6	169
Low risk (1-10)	18.4	14.1	16.0	169
Intermediate risk (11-100)	32.9	15.2	23.7	169
High risk (101 - 998)	27.6	14.1	20.1	169
Very high risk (Too many to count)	15.8	12.0	13.6	169

- **Drinking water of acceptable quality**

  Table 10.3 shows the results of combining the physical, chemical and bacteriological characteristics of water into an acceptable quality indicator. It must be colorless, odorless, clear and have no fecal coliforms per 100 ml. Just looking at physical properties of the internal sources alone, quality is acceptable in only 39% of households: 7% in the north and 65% in the south. When we add the bacteriological data, these numbers fall to 0% in the north and 44% in the south.

Table 10.3. Percentage of households with access to water of acceptable quality

Results	Nablus	West Hebron	Total	n
External source				
Esthetic Quality				
Colorless	97.3	96.6	96.9	163
Colorless+odorless	17.3	96.6	60.1	163
Colorless+odorless+clear	5.3	46.0	27.2	162
Bacteriological quality (no FC/100 ml)	38.7	73.6	57.4	162
Chemical quality (nitrates <= 50 mg/l)	100.0	100.0	100.0	127
Esthetic+Bact.+Chemical quality	2.7	37.0	20.5	156
Internal source				
Esthetic Quality				
Colorless	94.7	96.7	95.8	166
Colorless+odorless	17.3	96.7	60.8	166
Colorless+odorless+clear	6.7	64.8	38.6	166
Bacteriological quality (no FC/100 ml)	44.0	60.4	53.0	166
Chemical quality (nitrates <= 50 mg/l)	100.0	100.0	100.0	132
Esthetic+Bact.+Chemical quality	0.0	44.2	23.9	159

This evidence indicates that there is a major water quality problem in both provinces and that it is critical in the north, where no households were found to have drinking water of acceptable quality. Since there is no apparent intra-household contamination, the problem must be in the water sources. Most households in the south get piped water, and most in the north purchase it from tanker trucks. Table 10.4 restricts the analysis to households that claimed to exclusively use piped water or tankers.

Acceptable water quality at the internal sources is found in over half of the households using piped water (55%) and none using tankers. This is a public health problem that needs investigation. If the tankers are confirmed to be the source, is the problem in the water source, the hygienic standards of the trucks or the pumping process or any combination of these factors? Another interesting clue is that the presence of total coliforms is significantly higher than fecal coliforms, suggesting that the contamination may be of non-fecal origin.

When the exact nature of the problem is determined, the immediate solution should be accompanied by programs at the municipal and village council levels to establish a system for monitoring the water tankers and educating the suppliers and consumers.

Table 10.4. Comparison of HH Water Quality by use of only Piped or Tanker Water

Results	PW	TANKER
External source (%)		
Esthetic Quality		
Colorless	96.5	96.6
Colorless+odorless	87.7	27.6
Colorless+odorless+clear	50.0	6.9
Bacteriological quality (no CFU/100 ml)		
Thermotolerant – fecal coliforms	91.1	32.8
Total coliforms	60.7	6.9
Chemical quality (nitrates <= 50 mg/l)	100.0	100
Esthetic+Bact (FC)+Chemical quality	43.4	3.4
Internal source (%)		
Esthetic Quality		
Colorless	96.6	93.1
Colorless+odorless	88.1	27.6
Colorless+odorless+clear	69.5	8.6
Bacteriological quality (no CFU/100 ml)		
Thermotolerant – fecal coliforms	79.7	37.9
Total coliforms	57.6	6.9
Chemical quality (nitrates <= 50 mg/l)	100.0	100.0
Esthetic+Bact (FC)+Chemical quality	55.4	0.0
Number of households	185.0	241.0
Nablus	17.0	226.0
West Hebron	168.0	15.0
Respondent believes water is safe (%)	89.2	84.5
If no		
Claims water tastes bad (%)	23.8	26.5
Believes it contains bacteria (%)	0.0	11.8
Households with water sample data	59.0	58.0

11. Relationship Between Environmental Factors (Hygiene, Sanitation Water Source, Quality and Quantity) and Health Outcomes (Intestinal Parasites, Diarrhea)

The scope of the analysis reported here allowed mainly for descriptive statistics. However, a few relationships between the most relevant environmental factors and health outcomes were explored as well, because it facilitates program design and the selection of the most appropriate indicators to monitor program effectiveness. The association between environmental factors and health outcomes was evaluated based on a two-by-two contingency table analysis and chi-square and Cramer's V test statistics. Findings with strong statistical significance, usually reported with a probability of error of 0.05 or less, were expected in only a few instances, unless health outcomes vary substantially between people with and without the factor being present. For example, water tests were available from fewer than 100 households per town—Nablus and West Hebron, and relatively few cases of diarrhea and intestinal parasites were observed in either area. However, in several instances, associations between environmental factors and health outcomes were observed at levels of statistical significance with a probability of error varying between 0.01 and 0.10.

Tests of association were performed for the following environmental factors and hygiene behaviors:

- Water Quality (internal): 0, 0–10 fecal coliform, and 0–10 total coliform bacteria
- Appropriate handwashing area (water, soap, basin present)
- Appropriate Handwashing for child 12–47 months (uses water, soap, both hands, rubs 3 times, dries hygienically)
- Appropriate times for handwashing for a child 12–47 months mentioned as being important (after defecation, after cleaning children's bottom, before food preparation, before eating, before feeding children)
- Water quantity sufficient to meet daily needs
- Access to piped water

- Access to hygienic sanitation facility.

Tests of association were performed for the following health outcomes:

- Diarrhea during the last 2 weeks (children under 5)
- Presence of ameba in stool (children 12–47 months)
- Presence of giardia in stool (children 12–47 months)
- Presence of ameba, giardia or both in stool (children 12–47 months).

Statistically significant test statistics of association were observed for the following.

- In households without an appropriate handwashing area children 12–47 months are almost twice as likely to have giardiasis (15% versus 8%)
- In households without an appropriate handwashing area children 12–47 months are almost 38% more likely to have amebiasis, giardiasis or both (29% versus 21%)
- In households without appropriate handwashing technique of children 12–47 months these children are about 50% more likely to have amebiasis (18% versus 12%)
- In households where caretakers do not mention handwashing of children 12–47 months after defecation as being important these children are almost twice as likely to have amebiasis (18% versus 9%)
- In households without sufficient water supply to totally meet daily needs children 12–47 months are about 53% more likely to have amebiasis, giardiasis or both (29% versus 19%)
- In households without access to piped water children 12–47 months are about twice as likely to have giardiasis (17% versus 9%)
- In households without a hygienic sanitation facility children 12–47 months are about 41% more likely to have amebiasis, giardiasis or both (31% versus 22%)

These findings allow a few preliminary conclusions. The availability of some basic infrastructure (a dedicated place for handwashing with soap and water) as a prerequisite for hygiene behaviors and observable practices such as washing the hands of young children correctly seem positively related to intestinal parasites. As expected, water quantity and the presence of a water source considered improved, as an approximation of water quality, were related to intestinal parasites. Especially tanker water, which was the main source for households without piped water, seemed to be linked with parasite prevalence. The beneficial role of sanitation facilities was apparent only for younger children between 12 and 23 months of age.

The fact that the relationships were in the direction expected based on findings reported from other studies strengthens the confidence in the quality of he data collected during the first environmental health assessment. This was further reinforced by observing similar associations after applying an analytic method that controls for other variables (multivariable logistic regression analysis).

The fact that similar associations as for the factors above were not found when testing water quality (absence of fecal coliform bacteria) as a factor or diarrhea prevalence as an outcome may be due to a combination of reasons including a low overall prevalence, which may be seasonal, reliance on caretakers' recall to assess diarrhea (as opposed to a more objective stool exam), and a relatively small number of observations (water tests). It cannot be concluded that such associations do not exist in the West Bank.

12. Conclusions and Recommendations

Despite the difficult conditions prevailing during the survey, the survey was conducted as planned in almost all locations. Data quality for all survey elements (household survey, stool testing and water quality assessment) is good based on the following checks:

- **Reliability:** re-analysis of a subset of stool and water samples matched in almost all cases results from the first analysis
- **Internal consistency:** values for certain variables behaved as theory would predict, e.g., ability to pay according to poverty level
- **External consistency:** demographic profile of the study population is very similar to other data sources; and data on costs and consumption of water from different sources are very close to those collected by ANERA and PWA.

The data support our hypotheses that severe poverty is widespread and worsening in the selected communities. Beside its broad impact in people's livelihood it reduces demand for improved water and sanitation services. Already as much as one fifth of monthly household income in the poorest households was spent on water based on averages provided by interviewees, which may not account for all household revenues. Either subsidies or lower-cost solutions are required to make better services available to the majority of households, which live below the poverty level.

The EH assessment confirmed the lack of household access to piped water in Nablus and unreliable water supply through the network in the West Bank. Poor water quality, especially in Nablus, suggests that the use of untreated water, from tanker and other sources, has a considerable health risk. Basically four programmatic options are available to address this quality problem:

- Routine water quality monitoring
- Water treatment in households using chlorine or filters
- Provision of reliable and treated piped water
- Chemical or mechanical purification of tanker water.

The first and the second options can be available immediately and are relatively low cost. Household chlorination could be very cost-effective if applied only to drinking water and not to water for other uses. Point-of-use or cistern water treatment also would improve the quality of rainwater collected during winter months. The other options are likely to require much longer to be implemented, and given the level of economic hardship, many

households may not be able to afford the costs of improved piped or tanker water supplies without subsidies.

Water quantity available to households is lowest during the dry summer months, especially in Nablus, and barely exceeds the 20 liters per person per day recommended by WHO, counting tanker water only without taking into account rainwater collected during the winter months. Households with such limited amounts of water available are more likely to ration its use for hygienic purposes, which may impact children's health. Further formative research will be needed to find out to which extent inappropriate handwashing practices observed are due to water scarcity, cost of soap and a lack of knowledge. The situation in schools is even more disconcerting with a majority having no or no regular supply of water and soap. This has not only direct health consequences, but it also fails to provide children with guidance that could influence the hygiene practices of their families as well. Based on these findings a survey of schools, and perhaps health facilities as well, seems urgent to assess the adequacy of water and sanitation facilities. UNICEF together with other organizations is currently promoting school hygiene and sanitation worldwide and could provide the necessary assistance to improve this situation.

While access to private sanitation facilities is high, there are considerable risks of contaminating drinking water with fecal matter associated with sanitation infrastructure and maintenance. Households are unlikely to be able to invest in upgrading sanitation facilities until economic conditions improve substantially. This argues in favor of point of use water treatment suggested above. This is especially important because infants seem to be given liquids using household water at an early age when exclusive breastfeeding is recommended. A considerable number of infants seems to be given liquids other than breast milk before the age of six months.

Prevailing practices to dispose of young children's feces are another important source of contaminating water and food with fecal matter. Few children use potties, but about a third use disposable diapers, which usually end up in the trash. While there is a form of regular waste disposal available in Nablus and West Hebron, garbage is left unprotected in some households and potentially in municipal collection containers, although this will need to be confirmed.

Caretakers of children under five and school children have limited knowledge about hygiene and its role in disease prevention. A majority did not cite handwashing after defecation when asked about appropriate times. This clearly indicates a knowledge gap, and additional formative research such as part of trials for improved practices (TIPs) will be needed to identify specific barriers to better behavior and the most effective ways to change hygiene practices. The EH assessment provides some indication as to what might be important channels of communication. For example, mass media such as television seem to be a very significant source of information. Close family members such as mothers and mothers in law, schools and mosques may play a central role as well.

Health hygiene education programs can expect to have an impact on knowledge and behavioral change when designed according to survey findings and when including clear messages about critical behaviors at household and community levels. Effective

community health hygiene programs should be able to target different audiences with creative communication and education materials. Topics to be addressed by such a program could include:

1. The importance and the tools for identification of the various forms and sources of fecal-oral transmission

2. The knowledge and tools for home prevention of contamination and management of contamination when present

3. Multi-sectoral cooperation at the community level to ensure that basic hygiene behaviors are promoted at household and community levels. For example, assurance that soap and hygienic handwashing areas are present in homes and at school

4. Knowledge about timely and appropriate handwashing as a critical behavior related to health

5. Promotion of home care and less dependence on health facility care and medication for children with diarrhea

6. Support of water and sanitation related behaviors and other key behaviors related to health, such as solid waste management, appropriate child nutrition, personal hygiene, etc.

In order to achieve the best possible impact on behaviors and health in target communities, the sources of information and methods for message dissemination should be planned and implemented creatively to suit the cultural norms so that they are attractive to the audience.

A review of the world literature has found that on average a water and sanitation project will reduce diarrhea prevalence due to fecal-oral contamination by about 25%. (Esrey 1991) With a two-week prevalence of diarrhea and intestinal parasites ranging from 12–15%, these could serve as measurable impact indicators with comparable precision using a larger and more expensive prevalence survey. It may be worthwhile to measure these indicators again in the future to monitor whether any dramatic changes well above 25% have occurred, which are detectable with samples sizes such as those used for this EH assessment. Substantial changes might be expected during a humanitarian crises such as that which is happening in the West Bank.

The absence of worms in stool specimens was surprising. Based on information from medical professionals and from villagers in a formative research preceding the EH assessment, it was expected to find roundworms (Ascaris lumbricoides) and pinworms (Enterobius vermicularis). The former are common throughout the world in poor, rural communities with inadequate water quantity and quality and sanitation (Esrey 1991). Available data cannot indicate whether the climatic condition are unfavorable, for example, soil-transmitted roundworms require a certain level of moisture and temperature, or whether treatment with readily available anti-helminths has virtually eliminated these parasites.

Fecal-oral transmission of intestinal microbes and parasites can occur in a variety of ways. The fact that diarrhea prevalence was highest in one-year olds and amebiasis and giardiasis were more common in three-year olds, but in different provinces, indicate that different risk factors are responsible in these three situations. Unfortunately, diarrhea cases were not appropriately managed at home or by medical personnel. Only a minority of children received the recommended increase in fluid and similar amounts of food than normal. Because access to medical services is relatively good in the West Bank, for over half of the children medical treatment was sought. Survey results seem to indicate that anti-diarrheal medicine was frequently given, which is usually inappropriate, as only a few cases of dysentery occurred where, for example, antibiotics are indicated. In addition to improving diarrhea prevention, these findings have two implications related to case management:

- Caretakers need better information and education about appropriate home care of children with acute watery diarrhea

- Medical professionals and pharmacists need education about appropriate case management including oral rehydration therapy and new forms of treatment as they become available, for example, the use of zinc supplementation during an acute disease episode, which reduces the severity and length of diarrhea and seems to lessen the inappropriate use of antibiotics. Zinc supplementation is currently undergoing testing through the USAID funded Child Health Research Project.

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Appendix 1: Basic Village and Household Data

Village	Popul. in 2001	No. of HH	No. of HH Surveys	Stool Samples	Water samples
West Hebron					
1 Al Bira	268	38	1	1	1
2 Al Burj	2,091	299	7	7	4
3 Al Kum	1,130	161	4	4	2
4 Al Majd	1,544	221	5	5	3
5 Al Muwarraq	496	71	2	2	1
6 As Simiya	1,146	164	4	4	2
7 Beit ar Rush al Fauqa	830	119	3	3	2
8 Beit ar Rush at Tahta	421	60	1	1	1
9 Beit 'Awwa	7,081	1,012	22	22	15
10 Beit Maqdum	606	87	2	2	1
11 Beit Mirsim and AS	284	41	1	1	1
12 Deir al 'Asal al Fouga	1,569	224	5	5	3
13 Deir al 'Asal at Tahta	518	74	2	2	1
14 Deir Samit	4,860	694	15	15	10
15 Idhna	15,973	2,282	51	51	34
16 Iskeik	143	20	0	0	0
17 Khirbet Salama	286	41	1	1	1
18 Sikka	684	98	2	2	1
19 Tawas	126	18	0	0	0
20 Al Jaba'	769	110	2	2	2
21 Beit Ula	8,039	1,148	26	26	17
22 Beit Ummar	10,742	1,535	34	34	23
23 Jala	215	31	1	1	0
24 Kharas	6,043	863	19	19	13
25 Nuba	3,799	543	12	12	8
26 Safa	938	134	3	3	2
27 Surif	11,404	1,629	36	36	24
28 Tarrqumia	12,465	1,781	40	40	26
Sub-Total	***94,470***	***13,496***	***300***	***300***	***200***

(Chart continued on next page)

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Village	Popul. in 2001	No. of HH	No. of HH Surveys	Stool Samples	Water samples
				0	0
South Nablus				0	0
29 Asira Al Qibliya	2,015	288	10	10	7
30 Burin	2,897	414	14	14	10
31 Einabus	1,957	280	10	10	6
32 Iraq Burin	679	97	3	3	2
33 Madama	1,462	209	7	7	5
34 Rujeib	3,452	493	17	17	11
35 Sarra	2,549	364	13	13	8
36 Tell	4,179	597	21	21	14
37 Urif	2,503	358	12	12	8
38 Aqraba	6,991	999	35	35	23
39 Awarta	5,123	732	26	26	17
40 Duma	1,957	280	10	10	6
41 Jalud	399	57	2	2	1
42 Jurish	1,219	174	6	6	4
43 Majdal Bani Fadel	1,926	275	10	10	6
44 Osarin	1,437	205	7	7	5
45 Qaryut	2,177	311	11	11	7
46 Qusra	3,916	559	19	19	13
47 Talfit	2,637	377	13	13	9
48 Yanun	133	19	1	1	0
49 Beit Dajan	2,700	386	13	13	9
50 Beit Fuik	8,000	1,143	40	40	27
Sub-Total	***60,308***	***8,615***	***300***	***300***	***200***
TOTAL	***154,778***	***22,111***	***600***	***600***	***400***

Appendix 2:
Village Water and Sanitation Project
Survey of Households in
Hebron and Nablus Provinces
Final Pretest Version
January 6, 2002

Appendix 3:
Interviewer Guide for an Environmental Health Assessment


ENVIRONMENTAL HEALTH PROJECT


Save the Children


USAID
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT