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ACCESS AND BEHAVIORAL OUTCOME INDICATORS FOR WATER, SANITATION, AND HYGIENE

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ACRONYMS

CBO	Community-Based Organization
CDC	Centers for Disease Control
CFU	Colony Forming Unit
CLTS	Community-Led Total Sanitation
DAWASA	Dar es Salaam Water and Sewage Authority
HIP	Hygiene Improvement Project
HWTS	Household Water Treatment and Storage
IRC	International Water and Sanitation Centre
JIRAMA	Jiro Sy Rano Malagasy
JMP	Joint Monitoring Programme
M&E	Monitoring and Evaluation
MDG	Millennium Development Goals
ml	Milliliters
MIT	Massachusetts Institute of Technology
NGO	Nongovernmental Organization
OD	Open Defecation
ODF	Open Defecation Free
PSI	Population Services International
POU	Point of Use
PPPHW	Public-Private Partnership for Handwashing
SANAA	Servicio Autónomo Nacional de Acueductos y Alcantarillados
SODIS	Solar Disinfection
TRaC	Tracking Results Continuously
TTC	Thermotolerant Coliform
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WSP	Water and Sanitation Program

GLOSSARY

Bivariate analysis. Analysis of data that includes two variables. It generally implies looking for relationships between the two variables. For example, whether sex and education are related or whether the practice of hand washing with soap is related to either sex or education.

Categorical variables. A dimension that organizes a phenomenon studied into simple classification groups such as "open defecators" vs. "sanitation facility owners" regarding access to sanitation. Categorical variables assume no intrinsic order of the categories. Also known as "nominal" variables.

Chlorine residual. The total amount of chlorine remaining in water at the end of a specified period following chlorination. A positive residual is an indication that water is still safe to drink since it would still have an acceptable level of chlorine remaining.

Chronbach's alpha. This is a statistical procedure that helps determine how well a set of variables measure a latent construct. It is commonly used as a measure of internal consistency in a scale constructed from different items that presumably measure one construct.

Coliform bacteria. A bacterial indicator of the sanitary quality of food and water. This bacterium is abundant in feces of warm-blooded animals and can be found in aquatic environments, in soil, and in vegetation. Coliforms may not be the cause of disease, but they can be easily cultured and may indicate that pathogens of fecal content are present.

Colilert test. A test for detecting coliforms and E. coli in water that produces results rapidly. The Colilert test suggested in this document is a presence/absence test. It is inexpensive and detects E. coli down to 10 coliform forming units (CFU) per 100ml, below which is considered low risk.

Community-led total sanitation. CLTS is a grassroots approach originated in Bangladesh and uses community involvement to increase sanitation coverage. Based on Participatory Rural Appraisal tools and approaches, CLTS emphasizes the importance of self respect and dignity to help communities achieve open defecation free status. Its application implies a shift from counting latrines to counting sanitized communities, abandoning the use of subsidies. CLTS was developed by Kamal Kar with support from WaterAid and the Bengali NGO Village Education Resource Center.

Continuous variable. These are variables that may be measured quantitatively and that can take an infinite number of values. The most commonly used continuous variables in social science are interval variables. In interval scales, differences between two values are meaningful and equivalent. For example, the difference between 100 and 90 and the difference between 90 and 80 are identical. In interval variables, there is no absolute zero value. Examples of interval scales include attitude and opinion scales requiring an individual to express a level of agreement regarding a statement such as "My husband wants me to wash my hands before I cook."

E. coli. *Escherichia coli* are a rod-shaped Gram negative bacteria named after its discoverer Theodore Escherich. A type of coliform bacteria, E. coli is commonly found in the lower

intestine of warm-blooded animals and comprises about 1 percent of the total fecal bacterial flora of humans. Sewage is likely to contain E. coli in relatively large numbers. As an indicator organism, its value is enhanced by the ease with which it can be detected and cultured.

Factor analysis. A statistical method used in social and behavioral sciences to reduce variables in a variable set by combining two or more variables into a single factor. Factor analysis assumes that data on different attributes can be reduced to a limited number of dimensions as the attributes may be interdependent.

Internal consistency. A measure that indicates whether items that are presumably part of a scale measure the same construct. It usually measures whether several items that propose to measure the same general construct would produce the same results. Internal consistency scores range from 0 to 1. An acceptable reliability score ranges from 0.65 to 0.70. Internal consistency scores of 0.95 or higher would mean that the items are redundant. Analysis may permit dropping items to obtain acceptable internal consistency scores.

Likert-type scales. The scale, named after Rensis Likert, requires respondents to a survey to indicate their level of agreement to a given questionnaire item. The scales use a bipolar scaling method, measuring positive or negative responses to the item. In its most typical form, it has five items: strongly disagree, disagree, neutral, agree, and strongly agree.

Logistic regression: A statistical analysis procedure used to make predictions. For example, using a five-point agreement-disagreement scale, the practice of hand washing may be predicted from the measure of a respondent's belief that other mothers of children under five in the neighborhood practice hand washing.

Multivariate analysis. Statistical analysis that studies more than one variable at a time. It is generally used to refer to analyses that include at least three variables. For example, how age and education have an impact on hand washing practices.

Sanitation marketing. An approach to increase sanitation coverage using the assumption that sanitation is a business where services and products can be sold by providers and retailers to interested consumers. It borrows from private sector experience to develop, place, and promote an appropriate product at the right price, which can be a latrine, toilet, or other excreta disposal system. It brings together supply and demand, and assumes that market research needs to be conducted to understand consumer demand, and that appropriate products and services need to be put in place to satisfy that demand. Program monitoring should be set up to keep the market operating effectively.

Thermotolerant coliforms. Coliform bacteria that can multiply at certain temperatures. Because some coliforms such as E. coli can be found in the lower intestines of humans, optimal temperature for growth is 37.5 degrees Celsius.

Triangulation. Triangulation is synonymous with cross-examination. It is a technique commonly used in social science research that uses different methods to obtain the same information. The assumption behind triangulation is that one can be more confident with the information obtained if different methods of inquiry lead to the same findings.

ACKNOWLEDGMENTS

The indicators presented here are the result of discussions held by different groups of practitioners and experts in each one of the water, sanitation, and hygiene (WASH) themes covered: hand washing with soap, household water treatment and storage (HWTS), and sanitation.

The indicators and questions in this document associated with hand washing reflect the agreement reached between UNICEF and ICF Macro to harmonize instruments for monitoring hand washing practices through the Multiple Cluster Survey and Demographic and Health Surveys, implemented respectively by these organizations. Participants in these discussions were Rolf Luyendijk, Attila Hancioglu, and Tessa Warlaw from UNICEF; Fred Arnold and Shea Rutstein from ICF Macro; and Pavani Ram from the Monitoring and Evaluation (M&E) Working Group of the Global Public-Private Partnership for Handwashing (PPPHW).

The household water treatment and storage indicators and questions were agreed upon by a task force convened by UNICEF to develop guidelines for their HWTS field programs. Contributors to this exercise include Susan Murcott from the Massachusetts Institute of Technology (MIT); Cecilia Kwak and Megan Wilson from Population Services International (PSI); Oluwafemi Odediran from UNICEF; Robert Quick from the Centers for Disease Control (CDC); Thomas Clasen from the London School of Hygiene and Tropical Medicine (LSHTM); Vicki MacDonald from Abt Associates; and Maria Elena Figueroa from the Center for Communication Programs at Johns Hopkins University.

The sanitation indicators presented here were reviewed by Mr. Luyendijk, Carolien van der Voorden from the Water Supply and Sanitation Collaborative Council, Peter Ryan and Christine Sijbesma from the IRC International Water and Sanitation Centre, and Steve Sugden, Mimi Jenkins, and Walter Gibson (on assignment) for the LSHTM.

Reviewers of drafts of the full document include Ms. Murcott, Justin Buszin from PSI, Merri Weinger from the Global Health Bureau at the U.S. Agency for International Development (USAID), Michael Favin from the Manoff Group, and Sandy Callier from the USAID Hygiene Improvement Project (HIP).

Our gratitude to all of these colleagues and to Patricia Mantey from HIP for diligently and patiently reviewing many drafts of this document and to Wendy Putnam from HIP for her assistance in the preparation of this document.

INTRODUCTION

The content of this document reflects the evidence that has accumulated to date on how to measure in a reliable and valid way hygiene practices that are critical for the prevention of diarrheal disease and the reduction of child morbidity and mortality. In the area of hygiene promotion, it represents a breakthrough given prevailing difficulties in coming to agreement about what aspects of hygiene practices should be measured and how they should be measured. The document is also significant in that the indicators presented were derived through a consensus building process that involved key players in the WASH field including academia, donor agencies, and implementation agencies working to improve access to water supply, improved sanitation, and hygiene promotion. Some of those institutions include: the Centers for Disease Control, UNICEF, the Water Supply and Sanitation Collaborative Council, the Global Public-Private Partnership for Handwashing based at the World Bank/Water and Sanitation Program, the London School of Hygiene and Tropical Medicine, the Massachusetts Institute of Technology, the IRC International Water and Sanitation Centre, Population Services International, the Academy for Educational Development, IFC Macro, the Manoff Group, and Abt Associates.

Purpose

This manual aims to help program planners, managers, and evaluators design, implement, and evaluate WASH interventions. It is intended for use either in programs and projects with a principal focus on WASH or with a broad child health agenda.

The manual may be used by program managers and other staff from USAID as well as by staff in different levels of government in developing countries, international organizations, NGOs, and community organizations involved in the design and implementation of WASH programs, projects, and activities.

Measurement of indicators plays an important role during the project and program management cycle, including baseline data collection, midterm, and final evaluations. It is also important to monitor the performance of pertinent indicators and the extent to which set targets are being met during the implementation phase of a project or program. The collection of quality data about access to water and sanitation and behavioral outcomes achieved through hygiene promotion can help inform and improve decision-making about program strategies, work plans, and funding allocations.

The indicators proposed here fit the general objectives and the measurement of outputs and outcomes commonly sought by international donors and development assistance interventions. Most of the indicators presented here track output and outcomes at the household level. However, community-based indicators associated with community-led total sanitation (CLTS) are included given the importance that CLTS is gaining in sanitation programs to help achieve the water and sanitation Millennium Development Goals (MDGs).

Organization of the Manual

The indicators proposed in this document, including access to household water and sanitation as well as the practice of key evidence-based hygiene improvement behaviors, are grouped into the following categories:

- Access to water supply and use of household water treatment technologies and safe storage
- The practice of hand washing with soap at critical moments
- Access to and use of sanitary facilities for the disposal of human excreta

There are two distinct categories of indicators presented in separate sections: the first one is defined as "Essential Indicators," which are recommended for all WASH programs. The second category of "Essential and Expanded Indicators" is a more comprehensive set of indicators, which is included for managers interested in tracking a larger set of issues in their programs.

This document begins with a list of all the indicators organized as described above. Descriptions of each indicator contain the following components, commonly found in other monitoring and evaluation (M&E) manuals used by international donors and development assistance agencies:

- **Rationale/Critical Assumptions for Indicator**: Presents why the indicator is useful indicating, when it's appropriate, and how and why it has been used before.
- **Data Source**: Lists what type of methods or procedures may be used to collect the information, and it may include surveys or water quality testing.
- **Data Analysis**: Suggests how the data can be used to reach conclusions, what cross-tabulations can be done, and what statistical analysis tools can be used.
- **Issues/Limitations**: Discusses how measures were developed for each indicator, under what context they should or should not be used, how they can be helpful to make inferences, and what inferences should not be made based on the indicator.
- **Example of Target Setting**: Provides concrete examples of how the information can be incorporated into annual target setting. Targets are limited to four years given that the life of development projects often ranges from three to five years; targets are constructed based on the assumption that more rapid annual changes should be expected in the case of measures of variables influencing household practices than in measures of household practices themselves. Targets are presented in two rows: the first one reflects actual data that may have been obtained through a baseline survey or any comparable study; the second one reflects planned targets for years two through four of an intervention.
- **Questions**: Includes questions that may be used and incorporated into surveys to gather data to measure the indicators.
- **Indicator Calculation**: Describes the procedures used to compute an indicator showing what numerator and denominator to use when the indicators are worded in terms of percentages.

These various components of the indicator description serve the interests of different users/readers. For example, managers of programs may be interested primarily in the rationale for the indicator as well as the issues and limitations associated with it. Evaluators, on the other hand, may want details on how to collect data, calculate indicators, and interpret results; while individuals involved in data analysis may target that component under each indicator. Someone who needs to put together terms of reference for evaluation contractors may want to peruse all

components of the indicator, whereas those responsible for reporting progress may want to focus on the section on targets.

Indicators and model questions are a guide, not a blueprint, and can be adapted for specific program needs. The indicators suggested in this manual may be used with indicators and survey guides for other health programs such as maternal child health, nutrition, or HIV/AIDS, as well as for surveys in other sectors such as education or agriculture.

Methodological Rationale

In general, there are three ways of collecting information about behaviors: self reports, spot checks via observations or specific objective tests, and actual observations of a practice. In this context, examples of objective tests would be a chlorine residual test or a test that checks for coliform content in hand rinse water. In both cases, these tests help infer that a given practice has been performed: the use of chlorination to treat drinking water for the first one, and hand washing after coming in contact with fecal matter in the second one.

The indicators presented in this manual favor the use of spot checks or specific objective tests to collect behavior data. Hygiene practices are often socially sensitive, so self reports via direct survey questions about them may generate respondent bias, making them unreliable and invalid. This is not to say that observation is bias-free. It may introduce other types of bias. For example, one of the more difficult practices to measure in the hygiene sector is hand washing. The once believed "gold standard" for measuring hand washing practices, structured observation, has been shown to generate respondent bias.[1] Those who are observed might wash their hands more frequently because they are being observed. Inferred measures obtained through spot checks or water quality tests may end up being more reliable and valid, even though more validation studies are needed for confirmation.

Hygiene promotion experts agree that there may not be one single best measurement per practice of interest to the sector. Consequently, this document suggests a combination of measurements to track behavioral outcomes. Triangulation—using different methods to obtain the same information—may prove to be the best approach to measure hygiene practices. The use of different measures is particularly crucial in the case of hand washing practices.

In the specific case of household water treatment and storage, experts and practitioners often argue that the most reliable measure of whether or not a water treatment practice is being performed is a water quality test. Two water quality indicators are recommended in this manual. The inclusion of these tests is possible because simple, low-cost, field-based chlorine residual and total coliform E. coli water quality tests that can be performed "off the grid" are now available in the market.

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[1] Cousens, S., B. Kandi, S. Toure, I. Diallo, and V. Curtis. (1996). Reactivity and repeatability of hygiene behaviour: structured observations from Burkina Faso. *Social Science and Medicine*. Vol. 43, No. 9, pp. 1299-1308.

Needless to say, the indicators and the data collection methods to measure the indicators included in this manual may change over time as new tools are developed or as new evidence is generated about which measures have been proven to be more valid and reliable.

As science advances and evidence accumulates about how to best measure hygiene practices within the context of household monitoring, this document will need to be revised. The reader should consider this manual a "living" document. It is offered in the spirit of being practical and sharing what is known at this time, with the hope that it will be improved over the years by taking into account the evolution of the field and the experience practitioners accumulate as they monitor and assess WASH interventions.

Process Used to Generate Indicators

The indicators presented in this manual were derived through a consultative process involving experts and practitioners associated with each of the issues regarding access and/or key behaviors cited above. Please refer to the acknowledgment section for the full list of participants for each category of indicators. The number and type of indicators associated with the different topics reflect the agreements arrived at by each of the different task forces involved.

The HWTS indicators, for example, reflect the suggestions made to UNICEF by a team of specialists convened to help UNICEF develop a document that would provide M&E guidance to its field programs implementing HWTS activities. There are a larger number of indicators for this category due to the fact that UNICEF was interested in a larger selection of indicators to choose from. HIP, funded by USAID, was invited to participate in that effort. The hand washing indicators, on the other hand, are the result of a consensus arrived at among staff involved in implementing the Demographic and Health Surveys, the Multiple Indicator Cluster Survey, and members of the M&E Working Group within the PPPHW Initiative regarding what indicators would best measure hand washing practices in the context of a household survey. HIP was also involved in that process.

Limitations of the Manual

The indicators presented in this manual will be useful to track WASH programs benefiting settled populations. Adjustments to the indicators will be required in the case of nomadic and displaced populations as well as for those living under emergency situations.

The manual does not include specific guidance about survey design, pretesting, and implementation. Neither does it address sampling issues and alternatives, training of supervisors and enumerators, and budgeting. Readers interested in these topics may consult the references suggested in Annex 2. Nevertheless, Annex 3 contains a brief description of commonly used sampling approaches.

The intent of this manual is to offer a set of indicators that may be applied to commonly used approaches to WASH interventions. There are certain approaches, such as sanitation marketing, that are being further developed. In time, when indicators for measuring these approaches are tested, this manual could be modified to include them.

Sharing Results from M&E Activities Using These Indicators

Program managers are encouraged to share results obtained from research conducted using the indicators in this manual with partners and communities involved in implementing WASH programs, which may contribute to accountability, learning, and action planning. In addition, dissemination events may be used to generate and/or validate recommendations emanating from research findings.

Readers may consult the following references, which provide a justification for the dissemination of research findings as well as general guidance about how to do so. These references provide guidance for health sector research findings and those specific to the water and sanitation sector.

Centers for Disease Control and Prevention. (2009). Disseminating Program Achievements and Evaluation Findings to Garner Support. *Evaluation Briefs.* February. http://www.cdc.gov/healthyyouth/evaluation/pdf/brief9.pdf

Fernandez-Peña, Jose et. al. (2008). Making Sure Research Is Used: Community-Generated Recommendations for Disseminating Research. *Progress in Community Health Partnerships: Research, Education, and Action*, Vol. 2, No. 2, Summer, pp. 171-176.

Fisher, Julie, F. Odhiamho, and A. Cotton. (2003). *Spreading the Word Further: Guidelines for Disseminating Development Research.* WEDC: Loughborough University. http://wedc.lboro.ac.uk/publications/pdfs/stwf/stwf.pdf

LIST OF INDICATORS

The indicators in this manual are broken down into two categories: Essential and Expanded. The list of Essential Indicators appears in Table 1, and a comprehensive list that includes both Essential and Expanded Indicators appears in Table 2. In the second list, the Essential Indicators appear in bold/red to be easily identified. They are all presented together to give the reader a sense of how the Essential Indicators fit a fuller list of aspects that need to be tracked and how they are part of a larger rationale addressing the effects of access and hygiene promotion.

For the purposes of this manual, Essential Indicators are indicators recommended for all hygiene promotion programs that focus on hand washing with soap at critical moments, household water treatment and storage, and hygienic disposal of human excreta. The expanded list includes additional indicators to assess access to water and infrastructure as well as behavioral outcomes of hygiene promotion programs, which may be incorporated into performance monitoring plans at the discretion of program managers.

The list in Table 2 is not intended to be comprehensive but rather to focus on water supply and three hygiene practices: household treatment and storage of water, hand washing with soap at critical moments, and hygienic disposal of human excreta. A more comprehensive list of indicators for the topics at hand may be available elsewhere. [2,3]

In addition to water and sanitation coverage, the primary focus of these indicators is behavior change at the household and community levels. These indicators may be modified to reflect program priorities of water and sanitation interventions that target specific groups (i.e., caretakers of children under five years of age, adults living with HIV/AIDS).

Other indicators may be added depending on the particular focus of a country program and the specific needs of an intervention (e.g., number of people with access to improved water sources, number of WASH-friendly communes). The Essential Indicators listed in Table 1 below should be considered as the minimum core set of measures for infrastructure supply and hygiene promotion programs.

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[2] Murcott, S. (2006). "Implementation, Critical Factors and Challenges to Scale-Up Household Drinking Water Treatment and Safe Storage Systems." Background paper prepared for the Hygiene Improvement Project's Household Water Treatment and Safe Storage E-Conference, 12-22 May. http://www.hip.watsan.net/page/1738.

[3] Ram, P. (2008). Recommendations for measuring hand washing behavior: practical guidance for a variety of scenarios. (Personal communication.)

Table 1: List of Access and Behavioral Outcome Indicators (Essential Indicators)

Hygiene Content Area	Indicator
Access to Water Supply and Use of Household Water Treatment Technologies and Safe Storage	**WA1.** % of households that use an improved drinking water source (urban and rural)
	WA8. % of households practicing correct use of recommended household water treatment technologies
	WA10. % of households storing treated water in safe storage containers
Hand Washing with Soap at Critical Moments	**HW2.** % of households with soap and water at a hand washing station commonly used by family members
	HW3. % of households with soap and water at a hand washing station inside or within 10 paces of latrines
Access to and Use of Sanitary Facilities for the Disposal of Human Excreta	**SAN1.** % of households with access to an improved sanitation facility (urban and rural)
	SAN5. % of households using the available (improved) sanitation facility
	SAN8. # of communities achieving open defecation free status

Table 2: List of Access and Behavioral Outcome Indicators (Essential* and Expanded Indicators)

Hygiene Content Area	Indicator
Access to Water Supply and Use of Household Water Treatment Technologies and Safe Storage	**WA1. % of households that use an improved drinking water source (urban and rural)**
	WA2. % of households with access to improved drinking water sources from a recommended provider
	WA3. % of households spending up to 30 minutes to collect drinking water from an improved source
	WA4. % of respondents who agree that their drinking water needs to be treated at home
	WA5. % of respondents who believe others treat drinking water at home
	WA6. % of respondents that feel confident they can improve the quality of their drinking water
	WA7. % of respondents who know at least one location where they can obtain recommended household water treatment product(s)
	WA8. % of households practicing correct use of recommended household water treatment technologies
	WA9. % of households practicing sustained use of recommended household water treatment technologies
	WA10. % of households storing treated water in safe storage containers
	WA11. % of households with negative test for E. coli in drinking water at the point of use
	WA12. % of households with positive chlorine residual in drinking water treated with a chlorine product
Hand Washing with Soap at Critical Moments	**HW1.** % of respondents who know all critical moments for hand washing
	HW2. % of households with soap and water at a hand washing station commonly used by family members
	HW3. % of households with soap and water at a hand washing station inside or within 10 paces of latrines
	HW4. % of households with soap or locally available cleansing agent for hand washing anywhere in the household
Access to and Use of Sanitary Facilities for the Disposal of Human Excreta	**SAN1. % of households with access to an improved sanitation facility (urban and rural)**
	SAN2. % of households with reliable access to sanitary facilities
	SAN3. % of households spending less than 10

	minutes to travel to public or shared facilities
	SAN4. % of children <36 (or 60) months whose feces were disposed of safely
	SAN5. % of households using the available (improved) sanitation facility
	SAN6. % of households with sanitary facilities that practice adequate cleanliness to encourage use
	SAN7. % of households with sanitary facilities that practice adequate maintenance to keep them operational
	SAN8. # of communities achieving open defecation free status
	SAN9. % of communities that are maintaining their open defecation free status

*Essential indicators marked in bold/red

ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Access to improved water sources is one of the indicators tracked by the Joint Monitoring Programme (JMP) to determine if the MDG target for water and sanitation is being met. JMP is the official United Nations mechanism in charge of monitoring progress toward the MDG target, which is to: "Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation." Indicators presented here reflect the MDG concerns and are included to help program managers determine how much their efforts may be contributing to these goals. Access to improved water sources should serve as a backdrop to understand the extent to which households are practicing water treatment and storage at the point of use for water obtained from this resource.

Household water treatment and safe storage requires two sets of practices, one connected to the treatment of drinking water and the other to the storage of that water. It is necessary to separate them because those who practice correct treatment may not store treated water properly, or vice versa. This is quite obvious in the case of boiling as suggested by Clasen et al. (2008).[4] The authors conducted a study in rural Vietnam and compared water quality at the source vs. water quality at the household level after boiling and in storage containers. They concluded that there is a 97 percent reduction of the thermotolerant coliform (TTC) count in boiled water compared to water at the source, which in nearly all cases was surface water. The TTC count in the boiled water was so low that the water was classified as no risk or minimum risk water for diarrheal disease according to international standards. However, contamination levels increased depending on the kind of vessel used for storage, the method of water retrieval, and/or the amount of time that elapsed between boiling and water sample collection. Apparently, depending on the vessel and the way in which water was retrieved from the vessel, the more time that transpired between boiling and water quality testing, the higher the chances the treated water was (re)contaminated.

Indicators included in this manual address **behavioral determinants** that may influence the adoption of HWTS practices, the delivery system that affects the ability to access a given HWTS product, as well as outcome indicators that take into account effective and consistent use and the **quality of water** once treated and stored properly.

The indicators presented below focus on the practices of female caretakers living in households with children under five years of age, as this cohort constitutes the focus of USAID's child survival programs. The cohort considered may be modified to fit the specific needs of given interventions. For example, in the case of Madagascar, one intervention focused on children seven to 24 months old, since this specific cohort has the highest incidence of diarrheal disease. Indicators were adjusted in that intervention to fit its specific target audience. Managers of other interventions may opt for the same strategy.

Many of the indicators in this section were identified after consultations with a group of HWTS experts organized in response to UNICEF's needs to provide HWTS guidance to its field offices.

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[4] Clasen, T. F., D. H. Thao, S. Boisson, and O. Shipin. (2008). Microbiological effectiveness and cost of boiling to disinfect drinking water in rural Vietnam. *Environmental Science and Technology*. American Chemical Society webpage release, February 5, 2008.

As a word of caution, depending on the response provided during interviews, some questions may need to be skipped. Interviewers will need to know when to skip questions, and instructions to that effect will have to be included. These instructions will be needed when putting the questions together into a single integrated questionnaire. This document specifies and describes when skips to skip questions are needed. When developing a questionnaire for actual use, questionnaire designers will need to decide how to handle these skips. In addition, as indicated in questions associated with observations of latrine facilities and hand washing stations near latrines, repetition should be avoided if proposed hand washing questions are used in conjunction with sanitation questions. Questions and answers proposed here have been pretested and used in different settings. However, local conditions vary and a newly constructed questionnaire using the questions proposed here will still need a field pretest. Maintaining the order in which the questions are listed here is optional.

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA1: % of households that use an improved drinking water source (urban and rural)

Rationale/Critical Assumptions for Indicator:
This is one of the indicators used by the United Nations system to determine if the MDG water and sanitation target is being met. It is usually referred to as the water coverage indicator. The United Nations system measures "use" as a proxy for access.

An improved water source is an infrastructure improvement to a water source, a distribution system, or a delivery point, which by the nature of its design and construction is likely to protect the water source from external contamination, in particular from fecal matter.[5]

Improved drinking water sources, according to the JMP, are:

Piped water into dwelling, plot, or yard
Public tap/standpipe
Tube well/borehole
Protected dug well
Protected spring
Rainwater collection

Unimproved drinking water sources, according to the JMP, are:

Unprotected dug well
Unprotected spring
Cart with small tank/drum
Tanker truck
Surface water (river, dam, lake, pond, stream, canal, irrigation channel)
Bottled water

According to the JMP, "Bottled water is considered to be improved only when the household uses water from an improved source for cooking and personal hygiene. Where this information is not available, bottled water is classified on a case-by-case basis." In some countries, bottled water is the best quality water available. This manual will have to be modified if the JMP definitions change.

Standpipes connected to water treatment plants that may be set up by government agencies as is the case in countries such as Pakistan and India would be considered improved water sources.

Data Source:
Household survey

[5] UNICEF and World Health Organization. (2008). Progress on Drinking Water and Sanitation. Special Focus on Sanitation, p. 39.

Data Analysis:
Break down information by geographic zone. A basic breakdown suggested is by urban and rural locations. However, based on the program, the breakdown also may be by administrative unit (region, municipality, and district).

Issues/Limitations:
Quality of water is not addressed, particularly based on how protection for protected sources is defined. See Indicator WA2. There are also limitations about reliability. For example, taps may exist in homes, but water may not be available daily or throughout the day, and families may need to store water or obtain water from other sources. WAQ2 and WAQ3 address reliability concerns and are taken together with WAQ1 to calculate coverage.

Water quality tests are to be encouraged. In this regard, see Indicator WA11 below, in the context of this manual.

The JMP definition described earlier has no bearing on the fact that for hand washing purposes water does not need to come from an improved source.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**43%**			
Actual		**48%**	**53%**	**58%**

Questions that may be used to measure the indicator include the following:

WAQ1. What is the main source of drinking water for members of your household?	Piped into dwelling……	1
	Piped into yard/plot……	2
	Public tap……	3
	Open well in dwelling……	4
	Open well in yard/plot……	5
	Open public well……	6
	Protected well in dwelling…….	7
	Protected well in yard/plot……	8
	Protected public well…….	9
	Tubewell/borehole…….	10
	Spring…….	11
	Protected spring…….	12
	River/stream……...	13
	Pond/lake……...	14
	Dam…….	15
	Rainwater harvesting……	16

	Water vendor…….. 17 Bottled water…….. 18 Other (specify)_____ 19
WAQ2. Is water normally available from this source?	Yes……..... 1 No……. 2
WAQ3. In the last two weeks, was water unavailable from this source for a day or longer?	Yes……... 1 No……. 2

Indicator Calculation:

Numerator:
# of households with answers 1 through 3, 7 to 10, 12, or 16 to WAQ1 AND answer 1 for WAQ2 and answer 2 for WAQ3

Note: Adjustments to this numerator may be required depending on where bottled water comes from.

Denominator:
All households visited

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA2: % of households with access to improved drinking water sources from a recommended provider

Rationale/Critical Assumptions for Indicator:

Shäfer, Werchota, and Dälle (2007)[6] argue that access to a protected water source per the JMP definition does not guarantee access to safe water, especially in urban settings. They suggest that the JMP definition of improved water sources includes protected boreholes, wells, and springs because there is some type of protection of this source. However, the type of protection often serves as a safeguard against sources becoming dustbins or prevents children from tumbling in, with no satisfactory impact on water quality. A concrete platform, a drainage channel, and a hand pump or mechanical pump associated with tubewells/boreholes are equated with sufficient protection.

This may prove to be an erroneous assumption. Water from a well that only has a lid may be polluted by nearby latrines or other sources of contamination that may not be controlled by the owner of the well. Mato (2002) found, for example, that about 60 percent of randomly selected boreholes in Dar es Salaam, Tanzania, contained fecal coliforms.[7] Studies conducted in Tajikistan[8] and in Kabul, Afghanistan, came to similar conclusions.[9] Informal water service providers may be selling water from water sources that are considered to be protected according to the JMP definition, but they may suffer from the same problems. This may happen not only in the case of boreholes, as indicated above, but also in the case of water piped into households. Households in informal settlements in urban settings may rely on water sold by neighbors or may steal the water from an existing network through illegal taps.

If water sources mentioned include water piped into a dwelling, yard, or plot; public tap; or protected borehole, it will be necessary to determine whether the water is provided by an unregulated provider. This determination will help address some of the issues about water quality discussed earlier. The water quality test suggested elsewhere in this document will help resolve this issue. The questions suggested below to measure the indicator under discussion offer an alternative.

The suggested response categories for the question inquiring who the water operator is may be modified to reflect specific names for water-utility agencies officially recognized and regulated, whether they are public or private. In some countries, national, state, regional, and/or local governments may have hired private businesses to provide water. Examples would be DAWASA in Dar es Salaam, Tanzania, JIRAMA in Madagascar, SANAA in Honduras, etc.

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[6] Shäfer, D., R. Werchota, and K. Dälle. (2007). MDG Monitoring for Urban Water Supply and Sanitation. Eschborn, Germany: GTZ.

[7] Mato, Rubhera. (2002). Groundwater Pollution in Urban Dar Es Salaam, Tanzania: Assessing Vulnerability and Protection Priorities. PhD Dissertation. The Netherlands: Eidenhoven Technical University.

[8] Aliev, S. et al. (2006). Rapid Assessment of Drinking Water Quality in the Republic of Tajikistan. UNICEF and WHO.

[9] UNEP. (2003). Post Conflict Environmental Assessment.

Data Source:
Household surveys

Data Analysis:
Analysis may be done by geographic area (urban and rural) or by administrative unit of interest (region, district, and municipality).

Issues/Limitations:
By 2008, this indicator had been mainly used in Tanzania. Providers authorized by the government may change from country to country, and the list of such providers in the response categories will need to be modified to fit the local context.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**57%**			
Actual		**67%**	**77%**	**87%**

Questions that may be used to measure the indicator include the following:

(*If source of drinking water is piped water into dwelling, yard, or plot, ask:*)	
WAQ4. Was the water connection to your house done by an agency authorized by the government to do so?	No…… 1 Yes…… 2 Not applicable……..…… 3
(*If source of drinking water is piped water into dwelling, yard, or plot, a public tap/standpipe/kiosk, or a borehole, ask:*)	
WAQ5. Who is providing water at your main source?	Government authority……..…… 1 CBO/NGO…… 2 Private operator……..…… 3 Other (specify) _____ 4

Indicator Calculation:

Numerator:
# of households where Question WAQ4=2 and Question WAQ5=1

Denominator:
# of households where Question WAQ1 = 1+ 2 put together as a single value

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA3: % of households spending up to 30 minutes to collect water from an improved source

Rationale/Critical Assumptions for Indicator:
The amount of time spent fetching water will have implications for the amount of water that a household makes available to its members. The longer the time invested in fetching water, the less chance a family has to acquire enough water to satisfy household water per capita needs. UNICEF and WHO (2008) suggest that when the time invested in going to the source, collecting water, and returning to the household is between three and 30 minutes, the amount of water collected may vary between 15 and 25 liters per person per day. This range is considered suitable for a person to meet basic needs. The international community assumes that if the time invested in fetching water is longer than 30 minutes, the satisfaction of basic water needs is compromised.[10] To follow international conventions, the 30-minute threshold is adopted here. Yet, the less time families take to fetch water, the better.

Data Source:
Household survey

Data Analysis:
Analysis may be done by geographic area (urban and rural) or by administrative unit of interest (region, district, and municipality).

Issues/Limitations:
The sense of time may vary from culture to culture and the concept of minutes may not be commonly used among informants.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**45%**			
Actual		**50%**	**55%**	**65%**

Questions that may be used to measure the indicator include the following:

[10] UNICEF-WHO. (2008). Progress on Drinking Water and Sanitation. Special Focus on Sanitation.

WAQ6. How much time does it take on average to go to the drinking water source, get water, and come back?	30 minutes or less……... 1 31 to 60 minutes…….. 2 61 to 180 minutes…… 3 More than 3 hours……... 4 Does not know……. 5
Indicator Calculation: **Numerator:** # of households providing answer 1 to Question WAQ6 **Denominator:** # of households with answers 1 through 3, 7 to 10, 12, and 16 to Question WAQ1	

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA4: % of respondents who agree that their drinking water needs to be treated at home

Rationale/Critical Assumptions for Indicator:
Promotional efforts focus on psychosocial motivators that play a role in determining the adoption of point-of-use (POU) practices. Recognizing that water consumed in a household needs treatment has been identified as an important behavioral determinant by different programs, particularly those advocating for chlorine products. Agboatwalla et al. (2005)[11] suggested, for example, that a POU program implemented in Pakistan demonstrated the presence of a relationship between household treatment of drinking water and the perception that "it is necessary to treat water even when it comes from the tap."

Data Source:
Household survey

Data Analysis:
Likert-type scales are described in the Glossary and defined below under Issues/Limitations. Using them as continuous variables permits sophisticated statistical analyses. An example of that analysis is logistic regression. This statistical procedure can be used to establish if respondents agreeing with the statement are more likely to be water treaters than non-water treaters. In addition, Likert-type scales are more sensitive than categorical measures and as such can capture relatively small changes in attitudes and beliefs (less than half a point) and yet show significant statistical differences. However, to calculate the indicator above, a dichotomy will need to be created. To create the dichotomy, responses up to 3 may be considered as disagreement and responses above a value of 3 can be considered as agreement with the attitude statement.

The continuous variable converted into a dichotomy may be cross-tabulated by variables that measure water sources (e.g., improved vs. unimproved), program exposure (e.g., no exposure, intermediate exposure, high exposure), water treatment in the household (e.g., treatment practiced vs. not practiced), and appropriate storage of household treated water (e.g., appropriate storage vs. inappropriate storage). A discussion of appropriate storage may be found under indicator WA10 below.

Issues/Limitations:
Attitude measurement relies on the use of adjectives (for example, good-bad, important-trivial) to qualify an "object of attitude." In this case, that "object" is treatment of drinking water at the household. Attitude measurement that generally requires the use of a Likert-type scale is based on asking respondents to express a level of agreement with a given attitude statement. For example, strongly disagree, disagree, neutral, agree, and strongly agree.

Likert-type responses may require special instructions for both interviewers and respondents plus a couple of trial questions related to culturally relevant issues to help respondents get a grasp of what the enumerator is asking. Depending on the cultural context, the use of faces showing

[11] Agboatwalla, M., M. E. Figueroa, F. Sarwari, A. Ahmed, Z. Khanum, and B. Nisa. *Household perceptions, beliefs and practice regarding safe water in Pakistan.* Bangkok, Thailand: International Symposium on Household Water Management, June 1-2, 2005.

different levels of agreement (i.e., frowns, grins, smiles) have been used in some research to help those being interviewed provide answers.

Some experiences have also shown that the questions may be broken down into two steps. During the first step, respondents are asked to express their level of agreement or disagreement with the statements. In the second step, they are required to indicate their level of agreement or disagreement by simply asking "Do you agree (or disagree) a little or a lot?" Further simplification of responses for less educated populations may be required.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**25%**			
Actual		**30%**	**35%**	**40%**

Statements that may be used to measure the indicator include the following:

Level of agreement with the statement: **WAQ7. It is necessary to treat my family's drinking water at home.**	Totally disagree……..…… 1 Partially disagree……..…… 2 No opinion……...…… 3 Partially agree……..…… 4 Totally agree…… 5

Indicator Calculation:
The formulation of the statement used to derive the indicator is similar to that used by Johns Hopkins[12] and PSI in Tracking Results Continuously (TRaC) surveys.[13] Yet, it adds precision by stating that the treatment of water in question is done at home, where the water is consumed, and not at the source. The formulation is different from that used by the Pakistan program mentioned earlier as it excludes mentioning the need to treat water "even when it comes from the tap" as the quality of tap water may vary from country to country.

Numerator:
# of survey participants with responses 4 and 5 to question WAQ7

Denominator:
Total # of survey participants

[12] Figueroa, M. E. and L. Kincaid. (2006). Evaluation of Communication Programs: Application of Theory-Driven Models to Water Treatment in Guatemala and Pakistan. Washington, D.C.: University of Handwashing, WSP.

[13] PSI. (2008). Measuring Water Quality and the Impact of Water Treatment Programs. Tracking Results Continuously, p. 11.

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA5: % of respondents who believe others treat drinking water at home

Rationale/Critical Assumptions for Indicator:
A social norm is defined either as the perception that relevant others (e.g., friends, neighbors, relatives) practice household water treatment or that relevant others want respondents to do the same. The first definition is typically referred to as descriptive norms. Rivis and Sheeran (2004)[14] concluded that descriptive norms can be a predictor of behavioral intentions after several other theoretical predictors (for example, attitudes, locus of control) are taken into account. In the specific realm of HWTS, Figueroa and Kincaid (2006)[15] argued that social norms emerged as one of the predictors of water treatment in POU programs in Guatemala and Pakistan. Buszin (2008)[16] has argued about the importance of social norms and beliefs in predicting household water treatment.

Data Source:
Household survey

Data Analysis:
Individuals may react to the item by indicating their level of agreement and a Likert-type scale may be used for this purpose where 1 may mean total disagreement, 2 partial agreement, 3 no opinion, 4 partial agreement, and 5 total agreement. Keeping a continuous variable may permit more sophisticated analysis such as logistic regression as indicated earlier for similar scales.

One item per influential individual may be used (neighbors, relatives). In such cases, it is recommended that a weighted average of the responses be used to get a score for the individual interviewed.

In addition, to calculate the indicator above, a dichotomy will need to be created using the average weighed scores. To create the dichotomy, responses up to 3 may be considered as disagreement and responses above a value of 3 can be considered as agreement with the belief statements.

The continuous variable converted into a dichotomy may be cross-tabulated by variables that measure water sources (e.g., improved vs. unimproved), program exposure (e.g., no exposure, intermediate exposure, high exposure), water treatment at point of use (e.g., treatment practiced vs. not practiced), and appropriate storage of household treated water (e.g., appropriate storage vs. inappropriate storage).

A special statistical analysis procedure, factor analysis, can be conducted with responses to questions WAQ8 to WAQ10. This analytical tool will determine if the variables measured hang

[14] Rivis, Amanda and P. Sheeran. (2004). Descriptive Norms as an Additional Predictor in the Theory of Planned Behavior: a Metanalysis. *Current Psychology*. Vol. 22, No. 3, pp. 218-233.

[15] Figueroa, M. E. and L. Kincaid. (2006). Evaluation of Communication Programs: Application of Theory-Driven Models to Water Treatment in Guatemala and Pakistan. Washington, D.C.: University of Handwashing, WSP.

[16] J. Buszin. (2008). Measuring Water Quality and the Impact of Water Treatment Programs. Washington, D.C.: PSI.

together and form a dimension or a "factor." If such a factor is detected, a second procedure, such as Cronbach's alpha, can be calculated to determine if the items are not redundant. Scores on the integrated scale may then be used in other bivariate or multivariate statistical analyses.

Issues/Limitations:

Social norms are often defined as the perceptions that individuals may have about what others around them are doing. Or better yet, they can be defined as "perceived standards for behavior accepted as usual practice." This concept differs slightly from another construct: that of normative beliefs. The latter are often defined as what a person may believe influential individuals in a given social environment want him/her to do or not do. These concepts may help distinguish between behaviors we want to emulate vs. behavior we do to please others or earn their respect. In essence, normative beliefs are more related to normative expectations.[17] Normative beliefs have been traditionally used to define "subjective norms," and it is subjective norms that may be predictors of behavior, according to social psychology models and theories.

The use of a Likert-type scale may prove difficult among illiterate populations. One way of avoiding difficulties is to break down the questions into two steps. During the first step, respondents are asked if they agree or disagree. During the second step, they are asked to indicate their level of agreement or disagreement, as the case may be. The question that is typically asked is, "Do you agree a little or a lot?" or "Do you disagree a little or a lot?"

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**35%**			
Actual		**45%**	**60%**	**75%**

Statements that may be used to measure the indicator include the following:

Level of agreement with any of the following statements as suggested by Burzsin (2008):

WAQ8. Most of my friends take some action at home to treat their water to make it safer to drink.

Totally disagree……..……... 1
Partially disagree……..…… 2
No opinion…… 3
Partially agree……..……. 4
Totally agree……..…… 5

WAQ9. My neighbors take some action at home to treat their water to make it safer to drink.

Totally disagree……... 1
Partially disagree……. 2
No opinion……...…… 3

[17] Ajzen, I. and M. Fishbein. (1980). Understanding Attitudes and Predicting Social Behavior.

	Partially agree……...…… 4 Totally agree…….…… 5
WAQ10. The majority of people in my village take some action at home to treat their water to make it safer to drink.	Totally disagree……...…… 1 Partially disagree……..…… 2 No opinion…… 3 Partially agree……..…… 4 Totally agree…… 5
Indicator Calculation: Calculate mean score for responses to WAQ8 through WAQ10 and consider only answers where mean score is 4.0 or higher. **Numerator:** Average scores of WAQ8 through WAQ10 higher than 4.0 **Denominator:** Total number of study participants	

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA6: % of respondents that feel confident they can improve the quality of their drinking water

Rationale/Critical Assumptions for Indicator:
Social learning theory suggests that perceptions of self-efficacy may be crucial in the adoption of healthy practices, and water treatment and storage are no exceptions. Self-efficacy is defined as the perception that one has the necessary skills to perform a given practice. Social learning theory suggests that individuals tend to perform practices that they feel they are skillful at and are thus comfortable performing.

The formulation of the question(s) suggested below takes into account that there may be different water treatment options available (e.g., chlorination, filtration, solar disinfection, and boiling) and that consumers choose the method that best suits their preferences and needs.

Data Source:
Household survey

Data Analysis:
To calculate the indicator above, a dichotomy will need to be created. To create the dichotomy, responses up to 3 may be considered as disagreement and responses above a value of 3 can be considered as agreement with the attitude statement.

The continuous variable converted into a dichotomy may be cross-tabulated by variables that measure water sources (e.g., improved vs. unimproved), program exposure (e.g., no exposure, intermediate exposure, high exposure), water treatment at point of use (e.g., treatment practiced vs. not practiced), and appropriate storage of household treated water (e.g., appropriate storage vs. inappropriate storage).

Issues/Limitations:
The use of a Likert-type scale may prove difficult among illiterate populations. One way of avoiding difficulties is to break down the questions into two steps. During the first step, respondents are asked if they agree or disagree. During the second step, they are asked to indicate their level of agreement or disagreement, as the case may be. The question that is typically asked is, “Do you agree a little or a lot?” or “Do you disagree a little or a lot?”

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**35%**			
Actual		**45%**	**55%**	**75%**

Statements that may be used to measure the indicator include the following:	
Level of agreement with the following statement: **WAQ11. I feel confident that I can correctly treat water to make it safer for drinking.**	Totally disagree……...…… 1 Partially disagree……..…… 2 No opinion…… 3 Partially agree……..…….. 4 Totally agree……..…… 5
Indicator Calculation: **Numerator:** # of respondents with scores 4 and 5 to question WAQ11 **Denominator:** Total # of survey participants	

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA7: % of respondents who know at least one location where they can obtain recommended household water treatment product(s)

Rationale/Critical Assumptions for Indicator:
For Chapman (2004)[18] opportunity includes either institutional or contextual factors that may influence an individual's chance to perform a given behavior. Opportunity may be measured objectively (e.g., retailers involved in distributing a given product needed to perform the behavior of interest) and subjectively (e.g., knowledge or perception about where to obtain such a product). One of the elements of opportunity is availability, which is defined as "the presence or absence of a promoted product within a predefined area." As such, availability or perceptions about the availability of a given product increases opportunity and should be included in any measure of behavioral determinants. For the purposes of this manual, subjective measures of product availability are chosen as issues to be incorporated into a household survey. Two aspects of availability are considered: accessibility and frequency. Accessibility means that HWTS products can be found easily, and frequency would mean that these products are accessible when sought. The questions proposed below to address the indicator include these two aspects of availability.

Data Source:
Household survey

Data Analysis:
To calculate the indicator above, a dichotomy will need to be created. To create the dichotomy, responses up to 3 may be considered as disagreement and responses above a value of 3 can be considered as agreement with the attitude statement.

The continuous variable converted into a dichotomy may be cross-tabulated by variables that measure water sources (e.g., improved vs. unimproved), program exposure (e.g., no exposure, intermediate exposure, high exposure), water treatment at point of use (e.g., treatment practiced vs. not practiced), and appropriate storage of household treated water (e.g., appropriate storage vs. inappropriate storage).

Issues/Limitations:
The questions used address availability and constant supply. Answers to these questions need to be reported separately.

In addition**,** questions proposed below require Likert-type scale answers. Among certain populations, the questions may need to be broken down into two steps. The first step would require informants to state their agreement or disagreement with the item, and the second step would require them to indicate the amount of agreement or disagreement: low or high.

Field testing of questions measuring accessibility will be required, even though these are questions commonly used in PSI's TRaC surveys.

[18] Chapman, S. (2004). PSI Behavior Change Framework: Bubbles. Concept Paper. Washington, D.C.: PSI.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**10%**			
Actual		**25%**	**45%**	**65%**

Statements that may be used to measure the indicator include the following:

Level of agreement with the following statements:

WAQ12. Where I live there are vendors that sell water treatment products.

Totally disagree……...…… 1
Partially disagree…….……. 2
No opinion…… 3
Partially agree……..…….. 4
Totally agree…….…… 5

WAQ13. Shops near my house always carry water treatment products.

Totally disagree……..……... 1
Partially disagree…….……. 2
No opinion…… 3
Partially agree……..…….. 4
Totally agree…….…… 5

Indicator Calculation:

Numerator:
# of respondents with weighted mean scores above 4 to questions WAQ12 and WAQ13

Denominator:
Total # of study participants

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA8: % of households practicing correct use of recommended household water treatment technologies

Rationale/Critical Assumptions for Indicator:
Hygiene promotion ultimately seeks to change practices at the household level. Families may opt for one of the effective methods currently promoted to treat their drinking water to improve water quality and reduce diarrheal disease, which include chlorination, filtration, solar disinfection, or boiling. This indicator captures those practices, regardless of which of these treatment methods is used. When possible, the questions used to measure this indicator observe or infer the performance of the practice, relying only exceptionally on self reports.

In the specific case of households using chlorination, information about this indicator has to be collected in conjunction with information from indicator WA12.

The water quality test suggested under indicator WA11 is the ultimate measure to determine the correct and effective use of the methods listed above. Cross-tabulations of results from indicators WA8 and WA11 are recommended.

There are other water treatment methods that families may use. These are all grouped under answers to WAQ28 below. Programs are encouraged to develop evidence regarding the effectiveness of alternative water treatment methods that can improve water quality and reduce the prevalence of diarrheal disease.

Descriptions of the different recommended water treatment technologies may be found by consulting the following links:

http://www.hip.watsan.net/page/2848

http://www.pottersforpeace.org/

Data Source:
Household survey

Data Analysis:
Results may be broken down by source of water (improved vs. unimproved using JMP standards) and residence (urban vs. rural). Results obtained regarding inferred water treatment practices should be correlated with results of the water quality test suggested under WA11.

Issues/Limitations:
Families may use more than one method. If so, the calculations would have to take that reality into

account and adjust accordingly. Boiling will remain the more challenging treatment method. Measurements included here reflect CDC (2009) recommendations regarding boiling.[19] Training of enumerators will be particularly important to properly use suggested questions for this indicator.

Chlorine residual testing may be optional and added to those that practice chlorination.

The indicator proposed here focuses on the practice of solar disinfection, not determining whether bottles used for this purpose have been cleaned prior to their use.

Questions below are related to four water treatment options. They may need to be expanded if there is evidence in favor of the impact that other water treatment methods have on diarrheal disease and if hygiene promotion programs expand the treatment methods endorsed.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**54%**			
Actual		**61%**	**67%**	**73%**

Questions that may be used to measure the indicator include the following:

WAQ14. Do you currently treat your drinking water?

Yes……...…… 1
No ……... 2

WAQ15. What treatment method are you using? (*Choose method mentioned* and *read across by rows. If more than one method is mentioned, ask questions associated with each one of them. If methods other than the first four are mentioned, just record what they are. No detailed questions about those additional methods are required.*)

WAQ16. Chlorination	**WAQ17. May I see the packaging of the product used?**	**WAQ18. (*Based on observation),* is the product still valid?**
Not applicable …..…. 0 Chlorine solution (Sur'Eau,WaterGuard, etc.)……..……..…. 1 Aquatabs…….…… 2 PUR…… 3	*Observed* Yes……...…… 1 No ……... 2	Yes……..……. 1 No …….……... 2

[19] CDC. (2009). *Household Water Treatment Options in Developing Countries: Boiling.* Fact Sheet. http://www.hip.watsan.net/page/3216

WAQ19. Filtration Not applicable……. 0 BioSand…..……... 1 Potters for Peace filter (Colloidal silver-enhanced ceramic water purifier ……... 2 Candle filter……... 3 Pureit……. 4	**WAQ20. May I see the filter?** *Observed* Yes……..…… 1 No ……... 2	**WAQ21. *(Based on observation)*** *(For filters others than BioSand*) Is there water in the bottom container? Yes……...…… 1 No ……..……. 2 *(For BioSand filters*) Is there a standing layer of water on top of the filter? Yes…….…….. 1 No ……..…….……. 2
WAQ22. Solar Disinfection Not applicable……. 0 Yes…….……...….. 1 No ……...….... 2	**WAQ23. May I see the bottles exposed to the sun**? *Observed* Yes……...…… 1 No ……... 2	**WAQ24. How long do you expose them before drinking the water?** 6 hours during one day when sunny ……. 1 6 hours per day during two days when cloudy …….. 2 Shorter periods than indicated in responses 1 and 2 …… 3 Other (specify)…...…..…… 4
WAQ25. Boiling Not applicable……. 0 Yes……..…... 1 No ……..... 2	**WAQ26. How long did you let the water boil?** Until it was smoking… 0 Until it came to a rolling boil……..…..... 1 Several minutes……..... 2	**WAQ27. Where did you store the boiled water?** Same container where it was boiled ……. 1 Transferred it to different container than where it was boiled …….. 2

WAQ28. Other methods

Not applicable……0
Let it stand and settle……1
Strained through a cloth……2
Aluminum salt coagulant…..……3
Iron salt coagulant……4
Polymers (natural or synthetic)…….……5
Combined system (e.g., PUR, Aquasure, Pureit, LifeStraw Family, etc.)……6
Chemical removal system (arsenic, fluoride, other)…….....……7
Other (specify)_____……8

Indicator Calculation:

Numerator:
If chlorination is used:
# of households where WAQ14=1 + WAQ16 gt 0 + WAQ17=1 + WAQ19=1 (gt = greater than)

If filtration is used:
# of households where WAQ14=1 + WAQ19 gt 0 + WAQ20=1 + WAQ21=1

If solar disinfection is used:
# of households where WAQ14=1 + WAQ22 gt 0 + WAQ23=1 + WAQ24 lt 3 (lt=less than)

If boiling was used:
# of households where WAQ14=1 + WAQ25=1 + WAQ26 gt 2 + WAQ27 = 1

Denominator:
Total # of households participating in study

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA9: % of households practicing sustained use of recommended household water treatment technologies

Rationale/Critical Assumptions for Indicator:
"Sustained use" is defined here as households practicing recommended household treatment of drinking water during two measures separated in time. This indicator requires a longitudinal study research design and at least two measures using the same study participants. Sample design to track this indicator should take into account possible study attrition as respondents may fall out of the sample.

Projects are encouraged to take at least two measurements of the same population to determine if HWTS is practiced in a sustained fashion.

This indicator does not track "consistent use," which would require a panel study**.** Under such design, a panel of respondents would be selected and followed up over time through different measures separated at set intervals.

Data Source:
Household survey

Data Analysis:
Households must have an identification number that guarantees anonymity but still allows for matching cases over time. Cross-tabulations of indicator WA8 by measurement (Time 1, Time 2, Time 3, etc.) over time will be required.

Issues/Limitations:
Depending on the country, attrition could be high, so over-sampling will be required to have sufficient cases to make appropriate inferences and generalizations.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**40%**			
Actual		**44%**	**56%**	**62%**

Questions that may be used to measure the indicator include the following:
Use the same questions as suggested for indicator WA8, since it is a longitudinal study and what is important is the comparison over time for the same respondents.
Indicator Calculation: **Numerator:** # of households complying with indicator WA8 in each measurement Please note that different calculations are associated with indicator WA8 depending on the type of water treatment technology used. **Denominator:** Total # of households in the measurement

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA10: % of households storing treated water in safe storage containers

Rationale/Critical Assumptions for Indicator:
The CDC (2009)[20] suggests that drinking water storage containers should meet some characteristics to avoid recontamination when the treatment option used by a family does not leave residual protection such as would be the case with chlorination. In such circumstances, treated water should be placed in plastic, ceramic, or metal containers that have the following characteristics that can help prevent recontamination:
A narrow mouth (under 10 cm) [21]
A lid or secured/fitted cover
A tap (spigot)

These characteristics prevent users from placing potentially contaminated items (e.g., hands, cups, ladles) into the stored water. The rationale behind the width of the mouth is that it should be wide enough to permit the container to be cleaned, but narrow enough to prevent objects such as cups to be used to retrieve water inside the container.

Some household water treatment and storage products and methods include safe storage (e.g., hard lid and spigot) that are integral to the design. This would be the case for some ceramic filters and solar disinfection. Others such as BioSand filters and boiling do not include safe storage and would require additional steps to ensure safe storage.

Data Source:
Household survey

Data Analysis:
If data collection occurs in intervention and control zones, analysis may be done to see what differences exist in the two areas. If different measures over time are conducted, the analysis should include comparisons of storage practices across measurement waves.

The calculation suggested above includes criteria that define an ideal practice. Approximations to the ideal practice may be tracked. Programs may separate each one of the criteria defining safe storage (mouth, lid, and spigot), determine if households are meeting any of those, and establish if program participants are moving in the right direction, even if the ideal has not been fully achieved.

Issues/Limitations:
In a country setting where households keep different drinking water storage containers, questions will need to be modified to collect information about all of them, if this is important for the program under implementation.

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[20] CDC. (2009). *Preventing Diarrheal Disease in Developing Countries: Safe Storage of Drinking Water.* Fact Sheet. http://www.hip.watsan.net/page/3219

[21] Based on personal communication with Robert Quick, CDC, March 30, 2009.

Example of Target Setting:				
Results Data	**Baseline Year 1**	**Year 2**	**Year 3**	**Year 4**
Planned	**50%**			
Actual		**65%**	**80%**	**90%**

Questions that may be used to measure the indicator include the following:

WAQ29. Do you store your drinking water?	Yes……..……. 1 No…… 2
WAQ30. May I see the main container(s) where you store it?	Allowed…….....……..... 1 Not allowed……. 2
WAQ31. Is this container used only for storing drinking water?	Yes……...……..... 1 No…….. 2
Based on observations determine if container:	
WAQ32. Has wide or narrow mouth	Wide mouth (>10 cm).... 1 Narrow mouth (< 10 cm) 2 Not observed…… 3
WAQ33. Has spigot	Yes……..... 1 No……. 2
WAQ34. Has lid or fitted cover	Yes……..... 1 No……. 2
WAQ35. Is covered filtration reservoir with tap	Yes……..... 1 No……. 2

Indicator Calculation:

Numerator:
# of respondents with the following response patterns:

WAQ29=1 + WAQ30=1 + WAQ31=1 + WAQ32=2 + WAQ33=1 + WAQ34 = 1
or WAQ29=1 + WAQ30=1 + WAQ35=1

Alternatives for partial compliance would be:
a) WAQ29=1 + WAQ30=1 + WAQ31=1 + WAQ32=2, or
b) WAQ29=1 + WAQ30=1 + WAQ31=1 + WAQ33=1, or
c) WAQ29=1 + WAQ30=1 + WAQ31=1 + WAQ34=1, or
d) WAQ29=1 + WAQ30=1 + WAQ31=1 + WAQ32=2 + WAQ33=1, or
e) WAQ29=1 + WAQ30=1 + WAQ31=1 + WAQ32=2 + WAQ34=1

Denominator:
Total # of households in study

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA11: % of households with negative test for E. coli in drinking water at the point of use

Rationale/Critical Assumptions for Indicator:
The ultimate test to determine the consequences of proper treatment and storage of drinking water is the quality of that water at a storage location prior to human consumption. The international public health community uses the presence of *Escherichia coli* (E. coli) in drinking water to determine bacteriological contamination. E. coli is a Gram-negative bacteria commonly found in the lower intestinal tract of warm blooded animals. The presence of E. coli in drinking water indicates that the water is contaminated with fecal matter. Furthermore, it is generally assumed that if E. coli is present, other bacteria, viruses, and protozoa are potentially present as well, thus making the water unsafe for drinking.

The WHO standards on E. coli presence in water may be found at the following link: http://www.who.int/water_sanitation_health/dwq/gdwq0506_11.pdf. According to these standards, conformity means "E. coli per 100 milliliters of water less than 1."

Data Source:
Water samples are obtained from drinking water storage containers in the household. In the case of families that practice boiling, the same container used to boil water may be used to store water. In those cases, the water samples should come from such containers. When filters are sampled, water should be collected directly from the tap, not from a separate storage container.

For further information on the Colilert test please consult:
http://www.idexx.com/water/colilert/

Data Analysis:
The Colilert test is a presence/absence test for coliform and E. coli, which means that it comes out either positive or negative.

If tubes are clear, no coliforms are present and the water is safe to drink.

If tubes are yellow, but there is no fluorescence under black or UV light, coliform bacteria other than E. coli are present. These are likely to come from the environment and do not have public health significance.

If the tube is yellow and fluoresces blue when you shine the black or UV light on the tube in a dark location, at least one E. coli is present in the water sample, so the water poses a substantial health risk.

The Colilert test offers the possibility of measuring total coliforms and E. coli. Yet, there are other water quality tests currently available on the market that may also be used to measure water quality. These are:
DelAgua: fecal coliforms or total coliforms and E. coli (depending on the medium used)

Membrane filtration: total or fecal coliforms or E. coli (depending on the medium used)
H_2S: sulfate reducing bacteria

Further information on these tests may be found at the following websites:

DelAgua
http://www.delagua.org/products.html
http://www.delagua.org/instructions.html

Membrane filtration:
http://www.hach.com/fmmimghach?/CODE%3ADOC316.53.0119015729%7C1
http://www.uvm.edu/envnr/sal/ecoli/pages/ecolenum.htm
http://www.epa.gov/nerlcwww/1604sp02.pdf

H_2S
http://www.indiawaterportal.org/data/kits/h2s.html;
http://www.lteksystems.com/bactoh2s/h2sstripkit.htm

Annex 1 offers a list of water quality tests.

Issues/Limitations:
Availability of a residual test may represent a constraint. Instructions should be followed carefully.

It is important that the sample accurately represents the body of water studied. For microbiological testing, including E. coli testing, aseptic techniques must be followed when handling sterile bottles and collecting samples.

Correct sample volume measurement is essential for accurate testing as well. The Colilert test requires a 10 milliliter sample. Before beginning Colilert testing, the enumerators need to use a permanent black marker pen to mark the 10 milliliter place on all Colilert test tube vials that will be used.

When water cannot be directly sampled from a spout or tap, such as when sampling from any open storage container or surface water body (river, lake, channel, dam), one must not submerge the vial into that body of water. Rather, enumerators will need to use a separate, sterile water collection container to collect the sample then transfer it to the Colilert vial. In these instances, enumerators will need to use presterilized wide-mouth borosilicate glass or polyethylene bottles with screwed caps. Whirl-Pak disposable bags may be also used.

Specific instructions for using the Colilert procedure are available from
http://www.idexx.com/water/colilert/index.jsp

Example of Target Setting:				
Results Data	**Baseline Year 1**	**Year 2**	**Year 3**	**Year 4**
Planned	**75%**			
Actual		**80%**	**85%**	**90%**

Questions that may be used to measure the indicator include the following:	
WAQ36. May I take a sample of your drinking water?	Allowed…… 1 Not Allowed …… 2

Indicator Calculation:

Numerator:
# of water samples with negative Colilert E. coli results

Denominator:
Total # of households participating in the study

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator WA12: % of households with positive chlorine residual in drinking water treated with a chlorine product

Rationale/Critical Assumptions for Indicator:

"The presence of chlorine residual in drinking water indicates that: 1) a sufficient amount of chlorine was added to the water initially to inactivate the bacteria and some viruses that cause diarrheal disease; and 2) the water is protected from recontamination during distribution and storage. The presence of free chlorine in drinking water is correlated with the absence of disease-causing micro-organisms, and thus is a measure of the potability of water." [22]

Experts suggest that 24 hours after the addition of chlorine (sodium hypochlorite) solution to drinking water storage containers there should be a minimum of 0.2 mg/L of free chlorine residual present (this ensures microbiologically clean water).

"There are four main methods to test free and total chlorine residual in drinking water in the field in developing countries: 1) pool test kits; 2) color-change test tubes; 3) color-wheel test kits; and 4) digital colorimeters. All four methods depend on a color change to identify the presence of chlorine, and a measurement of the intensity of that color to determine how much chlorine is present.

The selection of which methodology to use to measure free and total chlorine can be complicated and should consider a number of programmatic factors, including: 1) need for accuracy; 2) cost; 3) number of samples to be tested; and 4) how the data will be used."[23]

One of the CDC recommended residual chlorine tests is LaMotte's DPD 1 Rapid Test. For more information on this specific product consult: www.lamotte.com.

Other options include the Hach Free and Residual Chlorine Test. For more information on these tests consult: http://www.hach.com.

For qualitative results, swimming pool test kits using othotolidine media may be used. However, positive qualitative results do not necessarily indicate that water is safe for drinking. But they are an objective measure of water treatment behavior.

For fuller explanations on chlorine residual testing consult: http://www.ehproject.org/PDF/ehkm/cdc-chlorineresidual-updated.pdf.

For the interested reader, Annex 1 offers a list of Standard Methods of Detection and Values for Microbiological Quality of Water.

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[22] CDC. *Chlorine Residual Testing Fact Sheet,* Safe Water Project, http://www.cdc.gov/safewater/publications_pages/chlorineresidual.pdf

[23] Ibid.

Data Source:
Drinking water samples tested with chlorine residual test.

Data Analysis:
Cross-tabulate with results obtained through questions associated with Indicators WA4 and WA5, usually considered as determinants of POU practices. Cross-tabulations may also be done with other variables related to knowledge of POU products and exposure to the promotion of POU technologies that may be added to questionnaires on top of what is suggested in this manual.

Issues and Limitations:
Availability of residual tests may represent a constraint. Instructions should be followed carefully and test tubes should be cleaned properly after each use. The reading of the test results should be incorporated into the data collection tool/spreadsheet as soon as possible.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**50%**			
Actual		**75%**	**100%**	**100%**

Questions that may be used to measure the indicator include the following:

WAQ37. May I take a sample of your drinking water?	Allowed…….……	1
	Not Allowed …….…….……	2

Indicator Calculation:

Numerator:
# of households with positive results of chlorine residual test

Denominator:
Total # of households reporting the use of chlorination to treat drinking water

HAND WASHING WITH SOAP AT CRITICAL MOMENTS

Four indicators are proposed for **hand washing with soap at critical moments**. The first indicator proposed is based on the assumption that knowledge of the critical moments for hand washing with soap to prevent diarrheal disease is an internal determinant of the practice. The five critical moments include: 1) after defecation, 2) after cleaning a child, 3) before preparing food, 4) before feeding a child, and 5) before eating. The remaining three indicators are considered to be proxy measures for hand washing practices.

Researchers and practitioners believe that there is no one valid and reliable measurement of hand washing practices. More promising measures such as Smart Soap—a bar of bathroom soap charged with an electronic device that can detect soap use developed by Unilever and tested in 2007 in a study in Bangladesh—have proven unsuitable for either larger studies or monitoring and evaluation activities of intervention programs with limited financial resources. In addition, this device presents specific challenges because the increased use of soap that may be detected by Smart Soap cannot be associated with: 1) any family member in the household or with 2) any specific time other than after defecation in sites where anal cleansing is done using water carried in a container to the toilet.

Proxies proposed in this document are considered both reliable and valid based on the assumption that the presence of the supplies (soap and water) is a necessary condition for the practice of hand washing to occur. It is recognized that households may use cleansing agents other than soap to wash their hands. However, hand washing programs generally promote the use of soap because of extensive evidence that soap use is associated with health impact. This is not necessarily true in the case of other cleansing agents such as ash or sand. Nevertheless, these are common hand cleansing agents used in Ethiopia and Madagascar, respectively. These cleansing agents are included in the responses in order to be sensitive to local conditions.

CONTENT AREA: HAND WASHING WITH SOAP AT CRITICAL MOMENTS

Indicator HW1: % of respondents who know all critical moments for hand washing

Rationale/Critical Assumptions for Indicator:
Motivators for hand washing may include: Critical hand washing moments for child caretakers to prevent diarrheal disease: 1) after defecation, 2) after cleaning a child, 3) before preparing food, 4) before feeding a child, and 5) before eating.

Data Source:
Survey data

Data Analysis:
Tracking increases in knowledge is possible. Appropriate occasions may be given a score of 1 for correctness, and number of correct times may be calculated to see if there is progression toward the ideal of knowledge of the critical moments.

Issues/Limitations:
This is an indicator to track hand washing interventions accepted by the M&E Working Group of the PPPHW Initiative.

The knowledge of all five critical moments is more appropriate for child survival programs promoting hand washing with soap at critical junctures for diarrheal disease prevention. Some programs may opt to be less demanding and accept simply the measurement of movement in the right direction or positive answers for knowledge of at least two or three critical junctures.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**50%**			
Actual		**65%**	**80%**	**95%**

Statements that may be used to measure the indicator include the following:

HWQ1. Please mention all of the occasions when is it important to wash your hands.
(*Do not read the answers. When zero, one, or more answers are given by the respondent, ask two more times if there is anything else. Record responses. Circle all that apply. If the respondent indicates that she does not know, do not probe for additional responses. After recording all responses, probe twice asking for any other occasions*.)

Before eating……..	1
After eating…….	2
Before praying…….	3
Before breastfeeding or feeding a child…..	4
Before cooking or preparing food…..……	5
After defecation/urination……..	6
After cleaning a child that has defecated/changing a child's nappy……	7
When my hands are dirty……	8
After cleaning the toilet or potty…….……	9
Other (please list) _____	10
Does not know……	11

Indicator Calculation:

Numerator:
Number of respondents who report that they should wash hands before eating or feeding a child, before cooking or preparing food, and after defecation or cleaning a child that has defecated (Any combination: ∑(HWQ1 = 1 or 4 + 5 + 6 or 7)

Denominator:
Total # of study participants

CONTENT AREA: HAND WASHING WITH SOAP AT CRITICAL MOMENTS

Indicator HW2: % of households with soap and water at a hand washing station commonly used by family members

Rationale/Critical Assumptions for Indicator:
Biran et al. (2008)[24] conducted a study to test the validity of different hand washing indicators. Twenty-seven measures were compared to what is believed to be the gold standard for hand washing measurement: structured observations. Using the 27 measures, the study attempted to predict whether individuals were washers or non-washers as defined via structured observation. The results indicated an ability to predict the non-washers but were inconclusive about predicting the washers. The indicator associated with prediction of non-washers was the lack of soap in different locations in the household, including the yard. If there is no soap, there is no hand washing with soap. This is self evident, but it may demonstrate the importance of recalling that if there is no soap at a hand washing station, no hand washing with soap will ever occur. Consequently, checking to see if soap is present at hand washing stations is a simple and important indicator. Water is obviously needed to wash hands. The quality of water is not important and may not be detected through a survey.

Data Source:
Household surveys

Data Analysis:
May cross-tabulate with study groups (experimental vs. control) and with exposure variables to hand washing interventions.

Issues/Limitations:
This is a proxy indicator to track hand washing interventions accepted by the M&E Working Group of the PPPHW Initiative.

In some contexts, soap may be an expensive commodity and families may opt to protect soap from theft or misuse and keep it in a safe place. In such instances, families may carry the soap to the hand washing station when they want to wash their hands with soap. However, it is assumed that the visible presence of soap at a hand washing station acts as a cue and thus as a reminder that it needs to be used at critical junctures. When conducting the analysis, program managers and evaluators may decide to cross the information about the presence of water at hand washing stations with the presence of soap anywhere in the house to see if, for households where there was no observable soap at a hand washing station, there was soap available elsewhere. In such instances 1) the presence of water plus soap at the most commonly used hand washing station and 2) the presence of water at the same location plus the presence of soap elsewhere in the house may be reported separately.

[24] Biran, A., T. Rabie, W. Schmidt, S. Juvekar, S. Hirve, V. Curtis. (2008). Comparing the performance of indicators of hand-washing practices in rural Indian households. *Tropical Medicine and International Health*. Vol. 13, No. 2, pp. 278-285.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**25%**			
Actual		**35%**	**45%**	**55%**

Questions that may be used to measure the indicator include the following:

HWQ2. Can you show me where members of your household <u>most often</u> wash your hands?

(*Ask to see and observe. Record only <u>one</u> hand washing place. This is the hand washing place that is used most often by the respondent or household.*)

Inside/within 10 paces of the toilet facility.. 1
Inside/within 10 paces of the kitchen/cooking place……..... 2
Elsewhere in home or yard……..... 3
Outside yard……..... 4
No specific place…..... 5
No permission to see……..... 6

HWQ3. OBSERVE: Is water present at the specific place for hand washing?

(*If there is a tap or pump present at the specific place for hand washing, open the tap or operate the pump to see if water is coming out. If there is a bucket, basin, or other type of water container, examine it to see whether water is present in the container. Record observation.*

Water is not available……..... 1
Water is available……..... 2

HWQ4. OBSERVE: Is soap or detergent present at the specific place for hand washing?
(*Record observation. Circle <u>all</u> that apply.*)

None……..... 1
Bar soap……..... 2
Detergent (powder/liquid/paste)……..... 3
Liquid soap (including shampoo)……..... 4

HWQ5. OBSERVE: Is locally used cleansing agent present at the specific place for hand washing?
(*Record observation. Circle <u>all</u> that apply.*)

None……..... 1
Ash……..... 2
Mud/sand……..… 3
Other (specify)……..... 4

Indicator Calculation:

Numerator:
# of households <u>with</u> water and soap at the specific place for hand washing (HWQ3=2 + HWQ4 not equal to 1 + HWQ5 = 2, 3, or 4) if HWQ2 not equal to 5 **or** 6

Denominator:
# of households where observation of hand washing station was permitted

CONTENT AREA: HAND WASHING WITH SOAP AT CRITICAL MOMENTS

Indicator HW3: % of households with soap and water at a hand washing station inside or within 10 paces of latrines

Rationale/Critical Assumptions for Indicator:
It is assumed that proximity of a hand washing station to a latrine, provided that it has the necessary supplies, will facilitate hand washing practices after defecation. There are specific sanitation programs that assume that the installation of hand washing stations must be promoted alongside the installation of latrines. The 10 paces of distance indicated may be measured around the latrine.

Data Source:
Household surveys

Data Analysis:
Raw frequencies and percentages are a minimal requirement. They may be crossed with other variables such as the presence of additional hand washing stations with needed supplies elsewhere in the household. In some country programs, latrine promotion suggests that latrine construction be accompanied by the installation of a hand washing station next to the latrine. Comparisons across country programs may also be performed to determine if there are differences between countries where such promotion exists and where it does not.

Issues/Limitations:
Although a hand washing issue, it is dependent on the observation of latrines.

This is a proxy indicator to track hand washing interventions accepted by the M&E Working Group of the PPPHW Initiative.

The questions for this indicator should be associated with those pertaining to sanitation and should be inserted in a logical way to follow a sequence. The observation of the latrine should include the observation of hand washing supplies and devices at that facility.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**10%**			
Actual			**25%**	**30%**

Questions that may be used to measure the indicator include the following:

HWQ6. Where is your toilet facility?	Inside/attached to dwelling…… 1 Elsewhere on premises……..… 2 Outside premises……..… 3

	Public……..…… 4
HWQ7. May I see the facility? **(***NOTE: Same as SANQ15. If HW questions proposed here are used in conjunction with questions for sanitation, avoid repetition.)*	Not allowed……..….. 1 Allowed to see it……..…… 2
HWQ8. OBSERVE: Is there a hand washing station inside the latrine or within 10 paces of the latrine?	No……..……...… 1 Yes……..…..…… 2
HWQ9. OBSERVE: Is there water at this hand washing device?	No……..……..…. 1 Yes……..…. 2 *(If "No" is recorded, skip to HWQ11)*
HWQ10. OBSERVE: What device is used for water at this HW station?	Tap…… 1 Tippy tap…….. 2 Bucket…….. 3 Wash basin…… 4 Other (specify) ……..…… 5
HWQ11. OBSERVE: Is there a cleansing agent at this hand washing station inside/near the latrine? (*Record all present.)*	None…… 1 Soap……..…… 2 Detergent……..…… 3 Ash……...…… 4 Mud/sand…… 5 Other (specify) …… 6
Indicator Calculation: **Numerator:** # of households <u>with</u> water and soap at the specific place for hand washing (HWQ7 =2 + HWQ8 = 2 + HWQ9 =2 + HWQ11 = not equal to 1) **Denominator:** # of households where observation of latrines was permitted	

CONTENT AREA: HAND WASHING WITH SOAP AT CRITICAL MOMENTS

Indicator HW4: % of households with soap or locally available cleansing agent for hand washing anywhere in the household

Rationale/Critical Assumptions for Indicator:
Cleansing agents that may be used for hand washing may be available in the house, but not necessarily placed at the hand washing stations in the house, including those commonly used by household members or any that would be placed at specific locations such as inside or nearby latrines. This indicator tries to differentiate households that in fact have such cleansing agents in the household and would need some motivation to place them where needed to facilitate hand washing at critical moments. It is assumed that it would be easier to get members of these households to wash hands with soap at critical moments than to get households that had no cleansing agent available to do so, as a HIP-implemented study in Madagascar in 2007[25] demonstrated.

This indicator can also help establish the frequency of households relying on cleansing agents other than soap that can serve the same purpose as soap, even if not placed at the right location for hand washing purposes.

Data Source:
Household surveys

Data Analysis:
Cross with information obtained from indicators HW2 and HW3.

Issues/Limitations:
Presence of cleansing materials other than soap may exist in households that also have and use soap. Households where both types of cleansing materials exist may be in transition from traditional to modern hygiene practices. The focus of the questions associated with this indicator is on cleansing materials for washing hands, even if ash or sand may be used for other cleaning purposes.

Because this indicator may be optional, it is included as exploratory as it may be important for programs to get a sense of how frequently households use cleaning agents other than soap.

[25] Hernandez, O. (2008). Baseline Report for Madagascar: 2007 Measurement. USAID Hygiene Improvement Project. http://www.hip.watsan.net/page/3189

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**70%**			
Actual		**75%**	**85%**	**90%**

Questions that may be used to measure the indicator include the following:

HWQ12. Do you have any soap in your household for washing hands?	No……... 1 Yes……. 2
HWQ13. Can you please show it to me? (*Record observation and circle <u>all</u> that apply*.)	Not able to show…….. 1 Bar soap…… 2 Detergent (powder/liquid/paste)…… 3 Liquid soap…….. 4
HWQ14. Do you have any ash or sand or mud in your household for washing hands?	No……... 1 Yes……. 2
HWQ15. Can you please show it to me?	Not able to show…….. 1 Ash……. 2 Mud/sand…….. 3

Indicator Calculation:

Numerator:
# of households where HWQ12 =2 + HWQ13 not equal to 1 or HWQ14 =2 and HWQ15 not equal to 1

Denominator:
Total # of households in the study

ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

For **sanitation,** nine indicators are proposed. This manual suggests separating availability to improved facilities from verification of actual use of those facilities. In some countries, households benefited from subsidized latrine programs. The latrines may exist but are not necessarily used.

The indicators suggested below for access and use are separate, and the questions associated with each one of these indicators are different. This manual uses the JMP proposed definitions of improved sanitation. The types of facilities that are considered improved are listed later on in this document, along with the indicator description.

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN1: % of households with access to an improved sanitation facility (urban and rural)

Rationale/Critical Assumptions for Indicator:
This indicator requires the use of questions that determine first if there is a sanitary facility in the household, and second if that sanitary facility meets the improved sanitation standards defined by the JMP tracking MDGs in the water and sanitation sector.

According to the JMP, improved sanitation is defined as:

- Flush or pour/flush facilities connected to a:
  - piped sewer system
  - septic system
  - pit latrine
- Pit latrines with a slab
- Composting toilets
- Ventilated improved pit latrines

Unimproved sanitation includes:

- Flush or pour/flush toilets without a sewer connection
- Pit latrines without slab/open pit
- Bucket latrines
- Hanging toilets/latrines
- No facilities, open defecation

Data Source:
Household survey

Data Analysis:
Break down data by residence (urban vs. rural). This breakdown will require surveys to clearly indicate whether the interview is being conducted in an urban or a rural area. A definition of the meaning of these terms has to be added to the interview guidelines as there is no universal definition that may be applied.

Use coverage information obtained through SANQ1 to explore if all family members are using existing facilities by crossing that data with information obtained through SANQ2. In some contexts, children do not use toilet facilities even if they have been toilet trained and are capable of using existing sanitary facilities. By the same token, women may not defecate in the same sanitary facilities used by men.

Cross-tabulate SANQ1 and SANQ6a to understand the relationship between the type of facility families use and their level of satisfaction with that facility. This cross-tabulation will generate information to gauge the possible motivation families have to get on to the sanitation ladder if they

practice open defecation, or if the family is interested in moving up the ladder through the use of an improved sanitation facility.

Issues/Limitations:

The classification of improved vs. unimproved sanitation may go through modifications in the near future. These modifications may partially result from issues raised by Shäfer, Werchota, and Dälle (2007), cited earlier, who argue that JMP sanitation monitoring does not take into account system performance or the quality of sanitation coverage. They have argued that counting sanitary facilities without taking into account "the treatment of effluents to prevent pollution and public health risks downstream has generated misleading results."

If the Joint Monitoring Programme changes the definition of improved sanitation facilities to include certain types of shared facilities, the calculation of the indicator proposed here would have to be modified accordingly.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**17%**			
Actual		**25%**	**35%**	**45%**

Questions that may be used to measure the indicator include the following:

SANQ1. What kind of toilet facility do members of your household usually use?	No facility/bush/field ..... 0 (*If answer is "No facility," skip the remaining household sanitation questions.*) Flush or pour/flush toilet flushed to: Piped sewer system ..... 1 Septic tank ..... 2 Pit latrines ..... 3 Somewhere else ..... 4 Ventilated improved pit latrine ..... 5 Pit latrine with slab ..... 6 Pit latrine with no slab/open pit ..... 7 Composting toilet ..... 8 Bucket toilet ..... 9 Hanging toilet/latrine ..... 10 Other (specify) _____ 11
SANQ2. Which members of your immediate family use this toilet? (*Record all answers without probing.*)	Male adults ..... 1 Female adults ..... 2 Male children ..... 3 Female children 4

SANQ3. Do you share this facility with other households?	No. Facility only used by my household ..... 1 *(If answer is "No," skip remaining questions on sharing toilets)* Yes 2
SANQ4. How many households do you share this facility with? (*Write the number of households*.)	
SANQ5. Are these households where only relatives of yours live?	No ..... 1 Yes 2
SANQ6. Is this toilet used by people that you do not know?	No ..... 1 Yes 2
SANQ6a. How satisfied are you with the place where your family defecates?	Very unsatisfied ..... 1 Somewhat unsatisfied ..... 2 *(If answer is 3-5, skip SANQ6b)* No opinion ..... 3 Somewhat satisfied ..... 4 Very satisfied 5
SANQ6b. Do you intend to install/change a sanitation facility in the next 6 months?	No ..... 1 Yes 2

Indicator Calculation:

Numerator:
# of households where SANQ1 = 1 through 3, 5, 6, or 8 + SANQ2=1 + SANQ3=0

Denominator:
Total # of households in study

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN2: % of households with reliable access to sanitary facilities

Rationale/Critical Assumptions for Indicator:
Access to sanitary facilities may be more reliable if the facilities are located on the visited household's own land, do not require a fee for their use, and are available permanently. In crowded peri-urban areas, households may confront difficulties accessing sanitary facilities when needed if they depend on pay toilets not available throughout the day (making them look for alternative defecation points when the facilities are closed); when the wait lines are too long; or when they do not have resources to pay for fees.

Data Source:
Household surveys

Data Analysis:
Cross-tabulation by area of residence of informant and type of family (e.g., nuclear or extended).

Cross-tabulations between the characteristics of toilet sharing and reliable access to the toilet may lead to a better understanding of whether households are letting extended family members and neighbors use the sanitary facilities they own at no cost.

Issues/Limitations:
Sharing toilets may be a way of increasing sanitation coverage. A study in rural Madagascar indicated that extended families that live together have sometimes opted to share one facility among all family members. Three generations may live next to each other in different adjacent living quarters. These families may have less difficulty gaining access to the shared facility. In their case, toilet sharing may need to be treated differently and must be correctly identified so they are considered as a separate category in the analysis. Response 2 to question SANQ7a will help make this distinction. Cross-tabulation of data from indicators SAN1 and SAN2 is recommended. The cross-tabulation will help determine if households with access to improved sanitation also have reliable access to these facilities.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**12%**			
Actual		**25%**	**35%**	**45%**

Questions that may be used to measure the indicator include the following:

SANQ7. Where is the toilet facility most frequently used by members of your household?	In own dwelling/attached to own dwelling.... 1 In own courtyard..... 2

	Inside neighbor's dwelling ..... 3 Inside neighbor's courtyard ..... 4 In common area of building for public toilets ..... 5 In common yard/premises ..... 6 Pay toilet outside in different building structure ..... 7 Other 8
SANQ7a. Is this facility used exclusively by your relatives?	No ..... 1 Yes 2
SANQ8. Is this a facility that is open to the general public?	No ..... 1 Yes ..... 2 *(If answer is "No," skip to question SANQ10)*
SANQ9. Do you have to pay to use this facility?	No ..... 1 Yes 2
SANQ10.How often do you pay?	Every time facility is used ..... 1 Weekly/monthly fee ..... 2 Other arrangement (specify)_____ 3
SANQ11. Can you use this facility at all hours of the day and night?	No ..... 1 Yes 2

Indicator Calculation:

Numerator:
# of households where SANQ7 = 1 or 2 + SANQ8 = 1 + SANQ9 = 1 + SANQ11 = 2

Denominator:
Total # of households in study

CONTENT AREA: ACCESS TO WATER SUPPLY AND USE OF HOUSEHOLD WATER TREATMENT TECHNOLOGIES AND SAFE STORAGE

Indicator SAN3: % of households spending less than 10 minutes to travel to public or shared facilities

Rationale/Critical Assumptions for Indicator:
Distance to shared sanitary facilities will influence their use. The longer the distance the less likely that the facilities would be used frequently and at all times during the day by all family members. Distance may be a hindrance to open defecation free sites. This indicator proposes that distance be measured in terms of the time it takes to travel from the household to the shared facility. It is based on the assumption that if a facility is beyond a 10 minute travel time, it may be used only sporadically**.**

Data Source:
Household survey

Data Analysis:
Analysis may be done by geographic area (urban and rural) or by administrative unit of interest (region, district, and municipality).

Cross-tabulate SANQ12 with SANQ6, SANQ9 and SANQ10 to determine if payment for facilities, distance to facilities and satisfaction with facilities are related. These variables may also be crossed with SANQ6b. This analysis may help establish barriers to use or motivation to install a household facility and the relationship between potential barriers leading to dissatisfaction with facility and the intention to modify that situation in the near future.

Issues/Limitations:
The sense of time may vary from culture to culture and the concept of minutes may not be commonly used among informants. However, time has been used internationally to measure access to improved water sources after formative research was conducted to establish its usefulness and identify the threshold that would be needed. The expectation in this case is that the findings from that research will also be applicable in the context of sanitary facilities.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**45%**			
Actual		**50%**	**55%**	**65%**

Questions that may be used to measure the indicator include the following:

SANQ12. How much time does it take on average to get to the sanitary facility you share?	10 minutes or less……..…….	1
	Over 10 minutes……..……	2
	Does not know……..……	3

Indicator Calculation:

Numerator:
# of households providing answer 1 to Question SANQ12

Denominator:
# of households with answer 2 to Question SANQ3

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN4: % of children <36 (or 60) months whose feces were disposed of safely

Rationale/Critical Assumptions for Indicator:
Information in this section was adapted from the Tier I indicators developed for the West Africa Water Initiative (WAWI).[26]

With exposure to feces being a primary source of diarrheal disease, it is essential for hygiene improvement that households safely dispose of both adult and child fecal matter. Exposure to children's feces, especially feces from children under age three, is a critical factor, because young children are more likely to contaminate the household environment since they are less likely to use a toilet facility.

The **safe disposal of feces** refers to the proportion of children less than three years of age whose caretaker safely disposed of their stools after their last defecation. In some societies children's feces are regarded as relatively inoffensive and children are allowed to defecate anywhere in or near the house. A proportion of these children will excrete substantial quantities of pathogens in their feces. In these households it is highly likely that feces from children may play a significant role in transmitting diseases to other children and adults.[27]

The safe or sanitary disposal of feces indicates that feces are disposed of in a way that reduces the risk of contaminating the household environment significantly. Safe disposal means either defecating or disposing of feces in a latrine or toilet. These are considered the only safe means of disposal. Young children may defecate on the ground or use a "potty," but caretakers should then dispose of the feces in a toilet facility. In cases where washable diapers are used, the feces can be disposed of in a toilet facility and the diaper then washed. Soiled diapers may be washed at wells, creating the potential for the contamination of well water. If the wastewater from washing diapers ends up in a toilet facility, the disposal is safe overall. In the case of disposable diapers, safe disposal would entail placing them in covered garbage containers and a solid waste collection system that keeps disposable diapers out of the household and community environment, but whether these are truly safe means should be determined on a case-by-case basis. Throwing away disposable diapers in toilet facilities is not recommended because diapers clog flush-type facilities and cannot be fully decomposed in pit latrines.

A sanitary latrine or toilet that allows the safe disposal of feces includes only the following types:

- Flush toilet with connection to an onsite septic system
- Flush toilet with connection to a public sewer
- Pour-flush latrine with a connection to an onsite disposal system

[26] Environmental Health Project. (2004). Detailed Description of WAWI Tier I Core Indicators.

[27] Feachem, R.G., D.J. Bradley, H. Garelick, D.D. Mara. (1983). Sanitation and Disease. Health Aspects of Excreta and Wastewater Management. John Wiley and Sons, p. 46.

- Simple pit latrine
- Ventilated improved pit latrine

The safe disposal of feces requires a private latrine (one facility per family) or a well-maintained shared facility (private or publicly owned). Shared facilities that are not cleaned regularly may discourage use because of unhygienic conditions. Whatever the type of latrine, to be considered accessible the latrine must have an appropriate superstructure, at minimum, and an enclosure that provides privacy to users. Latrines without a minimal superstructure discourage use in many societies, but standards may vary and response categories to observations may need to be adapted accordingly. Bucket latrines and similar types that require the manual removal of feces are not considered sanitary because they risk contaminating the immediate environment.

Data Source:
Household survey

Data Analysis:
Cross with area of residence (urban vs. rural) and ownership of latrine.

Issues/Limitations:
This indicator suggests recording how caretakers disposed of child feces the last time the child defecated to reduce recall bias.

This indicator suggests an age group of less than three years old, which is frequently the target group for child health interventions and their relevant survey instruments. However, the age range can be adapted to meet local needs without impairing comparability as long as the child's age is measured to allow an analysis for different age groups. Children rather than caretakers are used as a unit of measurement because it is assumed that safe disposal is assessed for more than one child in the age range targeted. This can be converted into caretakers who practice the safe disposal of their children's feces. If only one child per caretaker is assessed, the results for children or caretakers as the unit of analysis will be the same.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**50%**			
Actual		**65%**	**75%**	**95%**

Questions that may be used to measure the indicator include the following:

SANQ13. The last time *(name of child)* passed stool, where did he/she defecate?	Used potty ..... 1 Used washable diaper ..... 2 Used disposable diapers..... 3 Went in his/her clothes 4

	Went in house/yard ..... 5 Went outside the premises ..... 6 Used own sanitation facility ..... 7 Used public latrine ..... 8 *(If answer is 7-8, skip SANQ14 and SANQ14a* Other (specify) ..... 9 Don't know 10
SANQ14. The last time *(name of child)* passed stool, where were his/her feces disposed?	Dropped into toilet facility ..... 1 Buried ..... 2 Solid waste/trash ..... 3 In yard ..... 4 Outside premises ..... 5 Public latrine ..... 6 Into sink or tub ..... 7 Thrown into waterway ..... 8 At the well ..... 9 Thrown elsewhere (specify) ..... 10 *(If answer is response 1-10, skip SANQ14a)* Washed or rinsed away(specify) ..... 11 Not applicable 12
SANQ14a. *If the answer to SANQ14 is "washed or rinsed away," probe where the wastewater was disposed.*	Dropped into toilet facility ..... 1 Solid waste/trash ..... 2 In yard ..... 3 Outside premises ..... 4 Public latrine ..... 5 Into sink or tub ..... 6 Thrown into waterway ..... 7 At the well ..... 8 Thrown elsewhere (specify) 9
Indicator Calculation: **Numerator:** SANQ13=6 or 7 and SANQ14 =12 or SAQ13= 1 through 5 and SANQ14= 1, 2, or 6 **Denominator:** Total number of households with children under 36 (or 60) months of age	

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN5: % of households using the available (improved) sanitation facility

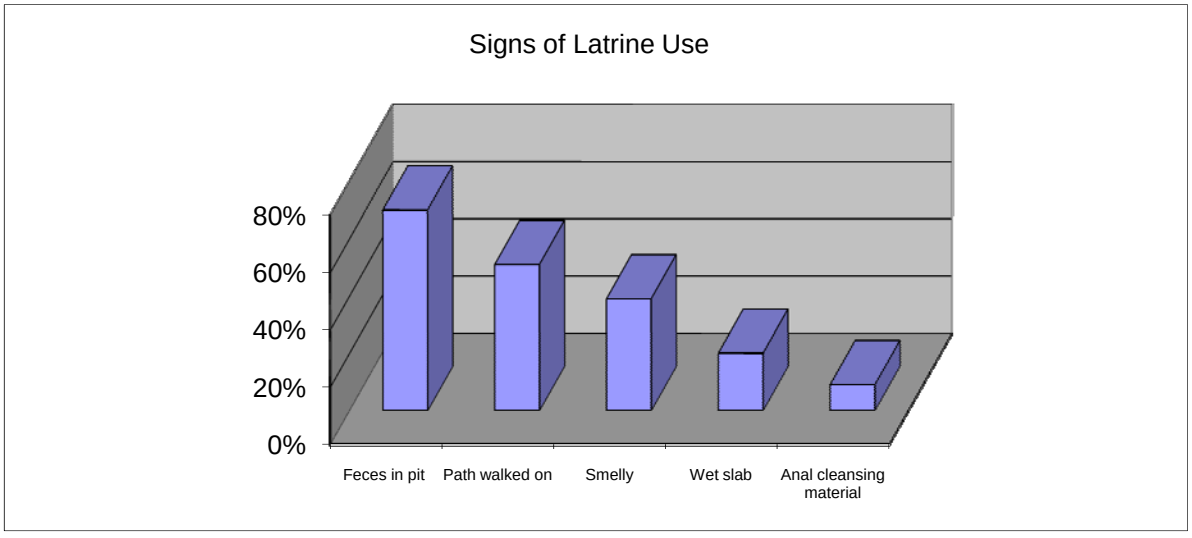
Rationale/Critical Assumptions for Indicator:
Different indications pertaining to the actual use of the latrine may be used to determine if in fact an existing latrine is used (for example, if the path to a latrine is walked on or if the pit is not empty). In addition, the presence of a protected latrine entry (door, curtain, L-shaped, or blind corner) and latrine cleanliness are used to calculate the indicator. Protected entries and cleanliness of latrines will encourage use and are considered as proxies of use.

Data Source:
Household surveys

Data Analysis:
"Yes" responses for questions associated with this indicator are desirable as they indicate use of sanitary facilities.

Data analysts should present the results of the different use indicators separately, then accrue them, and create a dichotomy that would have two categories: not used vs. used.

A chart showing the distribution of latrine use signs in decreasing order detected through a survey in Ethiopia is presented below.



Issues/Limitations:
Results from observations may be analyzed collectively to make a determination about latrine use. As observed in the chart above, the frequency of each of the signs may vary**.**

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**45%**			
Actual		**55%**	**65%**	**75%**

Questions that may be used to measure the indicator include the following:

SANQ15. May I see the sanitary facility you use please?	Not allowed……... 1 Allowed…..…… 2
SANQ16. OBSERVE: Does it have a protected entry? (*It has a curtain or door or entrance is L-shaped.*)	No…….. 1 Yes……. 2
SANQ17. OBSERVE: Is it being used? (*Observe systematically each of the different items below and report your observations separately for each item.*)	
SANQ17a. Path to latrine has been walked on	No…….. 1 Yes……. 2
SANQ17b. Visibly used anal cleansing material	No…….. 1 Yes……. 2
SANQ17c. Detected feces in pit using flashlight	No…… 1 Yes…….. 2
SANQ17d. Slab is wet	No…… 1 Yes…….. 2
SANQ17e. Smelly	No…… 1 Yes……... 2

Indicator Calculation:

1) First step:

SANQ15=2 + SANQ16=2 + SANQ17a=2 +SANQ17b=2 + SANQ17c + SANQ17d + SANQ17e

2) Second step:

   Dichotomize such that if any sign is present, put household in category 1, otherwise in category 0

3) Calculate final percentage:

   Numerator:
   # of households in category 1 in previous dichotomy

   Denominator:
   # of households in study with sanitary facilities

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN6: % of households with sanitary facilities that practice adequate cleanliness to encourage use

Rationale/Critical Assumptions for Indicator:
The use of sanitary facilities by household members depends on their being relatively safe and hygienic. Upkeep of sanitation facilities contributes to safety, hygiene, and health status,[28] thus helping families to continue using existing household sanitation facilities over the long run, which in turn helps ensure that donor and government sanitation investments are sustained.

Upkeep involves three components:

- Facility cleaning
- Overall facility maintenance
- Future contingencies for sustaining the service

Separate indicators are offered for these different components of facility upkeep.

Indicator SAN6 focuses on facility cleaning. Cleaning is more easily accessed through observation, although it can be confounded by low use or the number of users relative to the ability of the caretaker to keep it clean. Criteria to determine cleanliness are broken down by the type of latrine available in households: dry latrine or water seal latrines. For dry pit latrines, enumerators will consider two elements: the condition of the latrine floor and the use of a lid for the squat hole. For water seal latrines, the focus will be on the toilet bowl, the toilet floor, and the presence of a receptacle for cleansing materials.

Three levels of cleanliness may be established using the criteria listed below:

- No cleanliness/operation
- Limited cleanliness/operation
- Adequate cleanliness/operation

The approach adopted here is partially based on approaches used elsewhere, examples include research conducted by Grimason et al. (2000),[29] O'Laughlin et al. (2006),[30] and Diallo et al. (2007).[31]

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[28] Aborico, M., N. Shamlaye, C. Shamlaye, and L. Savioli. (1966). Control of intestinal parasitic infections in Seychelles: a comprehensive and sustainable approach. *Bulletin of the World Health Organization*. Vol. 4, No. 6, pp. 577-586.
[29] Grimason, A. M., K. Davison, K. C. Tembo, G. C. Jabu, M. H. Jackson. (2000). Problems associated with the use of pit latrines in Blantyre, Republic of Malawi. *The Journal of the Royal Society for the Promotion of Health*. September, Vol. 120, No. 3, pp. 175-182.
[30] O'Loughlin, R., G. Fentie, B. Flannery, and P. M. Emerson. (2006). Follow-up of a low cost latrine promotion programme in one district in Amhara, Ethiopia: characteristics of early adopters and non adopters. *Tropical Medicine and International Health*. September, Vol. 2, No. 9, pp.1406-1415.
[31] Diallo, M. O., D. R. Hopkins, M. S. Kane, S. Nyandou, A. Amadou, B. Kadri, A. Amza, P. M. Emerson, and J. Z. Zingeser. Household latrine use, maintenance and acceptability in rural Zinder, Niger. (2007). *International Journal of Environmental Health Research*. December, 17 (6), pp. 443-452.

Data Source:
Household survey

Data Analysis:
Break down data by residence (urban vs. rural). This breakdown will require surveys to clearly indicate whether the interview is being conducted in an urban or a rural area. Definitions for the meaning of the terms "urban" and "rural" have to be added to the interview guidelines as there is no universal definition that may be applied.

Cross-tabulate with level of satisfaction with current household's place of defecation identified through Question SANQ6a under Indicator SAN1 as maintenance may be connected with how satisfied a family is with their sanitary facilities. The more highly satisfied families are likely to worry more about the facility upkeep.

Cross level of satisfaction with sanitary situation and ownership of latrine to determine whose responsibility it is to clean it.

Issues/Limitations:
There is a degree of subjectivity in the criteria proposed, which may be resolved through experience in using the indicator in different contexts. For example, the terms "abundant" and "limited" are used to determine the condition of the floor of the latrine. The meaning of abundant vs. limited is connected to fecal volume. Yet, what volume of feces needs to be present to be categorized as either abundant or limited will depend on cultural tolerance. Abundant refers to accumulation of fecal matter that may imply more than one person depositing feces on the floor. Limited could be defined as smears of fecal matter on the floor. The field application of this indicator will provide guidance on valid definitions of these adjectives.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**50%**			
Actual		**65%**	**75%**	**85%**

Questions that may be used to measure the indicator include the following:

SANQ18. (Cleaning and operation—*for dry latrines only.* ***Observe conditions, first circling characteristics and subsequently reporting corresponding points in score column of table provided below. Add points to arrive at total score.*)**

Latrine Component	No Cleaning/ Operation (Score of 0)	Limited Cleaning/Operation (Score of 1)	Adequate Cleaning/Operation (Score of 2)	Scores
Floor (concrete, soil, plastic, tile, wood, etc.)	Abundant fecal matter/used anal cleansing	Limited amount of fecal matter or used anal cleansing material on floor. Smeared feces	No fecal matter or used anal cleansing material on floor.	

	material on floor to the extent that entering facility without stepping on feces is difficult. Dried fecal matter is present.	may be present.		
Hole Cover/Lid *(if clearly part of original facility)*	No hole cover present.	Hole cover defective, broken, or not used.	Hole cover placed over hole and tight fitting.	
Anal Cleansing Material	Soiled anal cleansing material accumulated on floor of latrine.	Some soiled anal cleansing material on latrine floor.	No soiled anal cleansing material visible.	

SANQ19. (Cleaning and operation—*for water seal toilets only*. *Observe conditions, first circling characteristics and subsequently reporting corresponding points in score column of table provided below. Add points to arrive at total score.*)

Toilet Component	**No Cleaning/ Operation (Score of 0)**	**Limited Cleaning/ Operation (Score of 1)**	**Adequate Cleaning and Operation (Score of 2)**	**Scores**
Bowl	Water seal not maintained in bowl and bowl very dirty with solid or smeared feces.	Water seal is present but bowl contains fecal material, anal cleansing material, other materials.	Water seal maintained in bowl and bowl is free of other contents—fecal matter, smeared feces, used anal cleansing material.	
	Water for flushing not present or easily accessible.	Water for flushing not present but accessible nearby—e.g., within 20 meters of toilet.	Water for flushing present in the bathroom—piped or in bucket/reservoir.	
Floor	Abundant dried and/or fresh fecal matter, urine, and/or used anal cleansing material scattered on	Some fecal matter or smeared feces, urine, and/or anal cleansing material scattered on floor.	Very little or no fecal matter, smeared feces, urine, or anal cleansing material on floor.	

	floor.			
Receptacle for Anal Cleansing Material	No receptacle for anal cleansing material present.	Receptacle for anal cleansing materials present but unused.	Receptacle for anal cleansing materials present and used.	

Indicator Calculation:

Regardless of the type of technology, score distribution to be used:

0-1: No cleanliness
2-4: Limited cleanliness
5-6: Adequate cleanliness

Numerator:
Households with scores 5 and 6 combined

Denominator:
Total number of households with sanitary facilities

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN7: % of households with sanitary facilities that practice adequate maintenance to keep them operational

Rationale/Critical Assumptions for Indicator:
The use of sanitary facilities by household members depends on their being relatively safe and hygienic. Maintenance of sanitation facilities contributes to safety, hygiene, and health status,[32] thus helping families continue to use existing household sanitation facilities over the long run, which in turn helps ensure that donor and government sanitation investments are sustained.

Maintenance involves three components:

- Facility cleaning
- Overall facility maintenance
- Future contingencies for sustaining the service

Separate indicators are offered for these different components of facility maintenance.

Indicator SAN7 focuses on facility maintenance and the upkeep of the latrine's structural elements, which will help ensure structural safety of the facility. For dry pit latrines the proposed criteria address the following structural elements: roof, walls, door, and slab. For water seal toilets the focus is on roof, walls, door, and disposal system. The criteria offered below will be used depending on whether the facility design includes each one of these elements.

The indicator for maintenance is confounded by the myriad of sanitation technical options/designs, each with its own maintenance needs; the age of facilities and who uses them (large families, small families, neighbors); the composition of the household (woman-headed, HIV/AIDS, etc.); the climate; socio-cultural norms; and the quality of materials and construction of the facility. This indicator does not explore reasons for inadequate maintenance or the reasons behind a deteriorated facility. The only conclusion that can be drawn from observations regarding the status of maintenance is that the latrine appears unusable or unsafe because it has not been repaired or maintained.

This indicator contains questions that will permit observation of the conditions of sanitation facilities during a household visit but also explore maintenance issues faced in the three months prior to the visit.

The approach adopted here is partially based on approaches used elsewhere and reported in connection to SAN6.

[32] Aborico. Control of intestinal parasitic infections. pp. 577-586.

Data Source:
Household survey

Data Analysis:
Break down data by residence (urban vs. rural). This breakdown will require surveys to clearly indicate whether the interview is being conducted in an urban or a rural area. Definitions of the meaning of the terms "urban" and "rural" have to be added to the interview guidelines as there is no universal definition that may be applied.

Cross level of satisfaction with sanitary situation and ownership of latrine to determine whose responsibility it is to clean it, and age of the facility.

Do a frequency analysis of responses to SANQ22 through SANQ25 and cross-tabulate these questions to determine the relationship between duration of the breakdown and reasons of the breakdown. Explore if the family stopped using the facility based on the type of repair that was needed and establish how long the facility was not in use due to maintenance problems.

In addition, cross-tabulate with scores related to observed maintenance conditions to establish if there is a relationship between observed and reported need for sanitation facility repair.

Issues/Limitations:
The condition of a latrine may depend on original specifications and original quality of the construction. Adjustments to the calculations will be in order if elements considered are not part of the original design and construction.

Informants may not be familiar with the causes of the breakdown. The breakdown recall period is limited to three months. Many breakdowns may have occurred in the recall period. If so, informants may have difficulty recalling the reason(s) for different breakdowns.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**45%**			
Actual		**55%**	**65%**	**75%**

Questions that may be used to measure the indicator include the following:

SANQ20. (Maintenance—*for dry latrines only*.) *Observe conditions, first circling characteristics and subsequently reporting corresponding points in score column of table provided below. Add points to arrive at total score.*

Latrine Component	No Maintenance (Score of 0)	Limited Maintenance (Score of 1)	Adequate Maintenance (Score of 2)	Scores
Roof *(if part of original design)*	No roof, or roof in complete	Roof present, but leaky.	Roof present and provides	

	disrepair with large gaps that expose user to elements.		shade and at least some protection against rain.	
Walls *(if part of original design)*	User visible from outside through walls because walls are heavily deteriorated.	Cosmetic issues in need of repair, even though user is not visible from the outside.	Walls in sufficient repair to provide privacy.	
Door *(if part of original design)*	Door absent.	If door is part of design, door does not close properly.	Door is present and can be closed.	
Slab	Slab is significantly eroded, deteriorated to the point of being a safety concern.	Hole significantly eroded or other small gaps or cracks in slab. Not yet a safety hazard.	Slab more or less intact. No danger of children or adults slipping on uneven eroded surfaces, or of a foot or leg entering the pit through enlarged hole or other gaps in the slab.	
Total				

SANQ21. (Maintenance—*for water seal toilets only*.) *Observe conditions, first circling characteristics and subsequently reporting corresponding points in score column of table provided below. Add points to arrive at total score.*

Toilet Component	**No Maintenance (Score of 0)**	**Limited Maintenance (Score of 1)**	**Adequate Maintenance (Score of 2)**	**Scores**
Roof *(if part of original design)*	No roof, or roof in complete disrepair with large gaps that expose user to elements.	Roof present, but leaky.	Roof present and provides shade and at least some protection against rain.	
Walls *(if part of original design)*	User visible from outside through walls because	Cosmetic issues in need of repair, even	Walls in sufficient repair to	

	walls are heavily deteriorated.	though user is not visible from the outside.	provide privacy.	
Door *(if part of original design)*	Door absent.	If door is part of design, does not close properly.	Door is present and can be closed.	
Disposal System	Broken/collapsed or large holes in the slab over disposal pit or tank or in conveyance tube that present safety risk to users, and/or allow escape of wastewater onto ground.	Cracks or holes in the slab over disposal pit or tank or in conveyance tube that allow escape of wastewater onto ground.	Pits, tanks, and tubes in good condition—no leaks or exposed holes eliminating possible contact between humans and wastewater**.**	
Total				

SANQ22. In the past three months, did your latrine/toilet break down?	No……..0 Yes……1	⟶ *If "No, Skip to next indicator*
SANQ23. During that period, how many times did it break down?		Not applicable..... 1 Only once ..... 2 More than once..... 3
SANQ24. *(The last time it broke down*), how many days was the latrine/broken down until it was repaired?		Not applicable..... 0 Less than one week..... 1 More than one week 2
SANQ25. Did your family continue to use that facility during the breakdown period?		Yes..... 1 No 2
SANQ26. Why did it break down? (*Indicate all that apply.*)		Roof problems ..... 1 Slab problems ..... 2 Pit overflow ..... 3 No water in tank ..... 4 Flushing mechanism broke down ..... 5 Bowl overflow/clogged ..... 6 Pipe breakdown ..... 7 Others (specify)_____8 Does not know..... 9

Indicator Calculation:

Regardless of the type of technology, score distribution to be used:

0–1: No maintenance
2–4: Limited maintenance
5–6: Adequate maintenance

Numerator:

Households with scores 5 and 6 combined (assuming that all the aspects considered are part of the original design)

Denominator:

Total number of households with sanitary facilities

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN8: # of communities achieving open defecation free status

Rationale/Critical Assumptions for Indicator:
Some WASH practitioners have argued that the expected drops in diarrheal disease associated with sanitation happen more effectively when the vast majority of households in a community have access to a sanitary facility. Knowledge Links (2005) makes reference to a study indicating that a drop from 38% to 26% in diarrheal prevalence occurred with a change in sanitation coverage from 29% to 95%. However, a larger drop from 26% to 7% was detected when sanitation coverage increased to 100%.[33] Kar and Chambers (2008)[34] have argued that 100% sanitation coverage may be possible through community-led total sanitation (CLTS). CLTS is an innovative methodology for mobilizing communities to completely eliminate open defecation (OD). Communities are facilitated to conduct their own appraisal and analysis of OD and take their own action to become ODF (open defecation free). Rewards may be provided to communities achieving 100% ODF status. The success of CLTS is tracked by counting the number of villages that achieve ODF status. Open defecation free in this context refers to households in a village having access to a sanitary facility.

Community level indicators are included in this manual given the importance of community based interventions in the sanitation field such as CLTS. Open defecation free status is the outcome that may be obtained after a successful CLTS program has been implemented in a given community.

Data Source:
Program records, visits to communities where CLTS activities are implemented

Data Analysis:
This indicator requires a simple count and an accrual of communities meeting the certification criteria in a target area.

Regional differences and program implementer differences may be considered for interventions that are implemented in different regions and through different operational partners/NGOs.

Issues/Limitations:
Program managers may be interested in using a CLTS approach to increase sanitation coverage. A more recent review of the experience has indicated that health outcomes will depend on toilet cleanliness and maintenance and other hygiene practices including hand washing with soap at critical moments and appropriate treatment and storage of drinking water at the point of use. That review also suggests that: leaders may have coerced households to engage in CLTS by imposing fines on non-compliers; no provisions are made for households facing financial or physical difficulties (e.g., elderly, handicapped); subsidies are being shifted from hardware to promotion,

[33] Knowledge Links. (2005). *Formative Research for Sanitation IEC Manual*.

[34] Kar, Kamal and Robert Chambers. (2008). *Handbook on Community Led Total Sanitation*. Plan International/UK and Institute of Development Studies.

instead of being eradicated; and the lowest cost toilets may have lower durability and be harder to clean with resulting gender implications.[35]

The CLTS approach is generally applicable in rural areas; applications in peri-urban areas may prove to be more challenging, even though Goswami and Baksh (2008) have discussed the success of an urban CLTS activity in Kalyani Municipality, India, [36] and DFID has discussed it in a newsletter.[37] Burton (2007)[38] evaluated the CLTS program implemented by WaterAid in Nigeria and concluded that CLTS worked better in communities with fewer than 3,000 people and was less effective in "more urbanized communities partly due to the limited sense of community and the large number of tenant occupied houses."

Given the rewards that are offered for achieving open defecation free status, communities may find it easier to achieve ODF status than to maintain it over time. Indicator SAN9in this document is included to address that concern.

CLTS is not the only community based sanitation intervention available to increase sanitation coverage. More recently, other models are being tried out. One that is beginning to gain recognition is school based total sanitation. Future iterations of this manual may need to be modified to include indicators associated with such newer approaches.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**30**			
Actual		**50**	**80**	**130**

Indicator Calculation:

Kar and Chambers (2008)[39] suggest a qualitative approach to determining open defecation free status. This may include: visiting former open defecation sites at dawn and dusk, determining whether open/hanging latrines are in use as well as paths to installed latrines, and observing existing community sanctions for infringements to open defecation free rules, etc.

To facilitate inspection and safeguard against fraud when rewards to communities are available, verification of ODF may require involving a committee of inspectors made up of government officials, NGO staff, community residents, and residents from neighboring towns that have

[35] Sijbesma, C. (2008). *Sanitation and Hygiene in South Asia: Progress and Challenges. In Use by All: A Collection of Case Studies from Sanitation and Hygiene Promotion Practitioners in South Asia*. The Netherlands: IRC.

[36] Goswami, S. and K. Bakshi. (2008). Urban Community Led Total Sanitation. Case Study: Kalyani Municipality, Kolkata, India. PowerPoint Presentation.

[37] DFID. (2009). Case Study: The First Open Defecation-Free Municipality in India http://www.dfid.gov.uk/Media-Room/Case-Studies/2009/The-first-open-defecation-free-municipality-in-India

[38] Burton, Salma. (2007). An Evaluation of the WaterAid's CLTS Programme in Nigeria. WaterAid.

[39] Ibid.

achieved ODF status. Kar and Chambers (2008) even suggest withholding certification of ODF status for a six-month period to ensure that sanitation coverage has been sustained.

Qualitative methods, such as those mentioned above, may also be combined with quantitative measures. The quantitative measures are possible when households obtain loans to install sanitation infrastructure, and the number of households receiving such loans may be counted.

CONTENT AREA: ACCESS TO AND USE OF SANITARY FACILITIES FOR THE DISPOSAL OF HUMAN EXCRETA

Indicator SAN9: % of communities that are maintaining their open defecation free status

Rationale/Critical Assumptions for Indicator:
Maintaining open defecation free status over time may constitute a challenge as the population in a given community increases, new settlers arrive, sanitation facilities deteriorate, and social pressure to conform to the open defecation free status changes, etc. The sustainability of open defecation free status is an issue that sanitation programs need to address. This indicator is included as a reminder of the importance of maintaining sanitation coverage over time.

Data Source:
Program records

Data Analysis:
If different implementers are participating in promoting sanitation using a CLTS approach, it may be important to compare the extent to which they are able to sustain open defecation free status in communities in their jurisdiction.

Issues/Limitations:
The same methodology used to grant the initial open defecation free certification must be used in subsequent measures.

Example of Target Setting:

Results Data	Baseline Year 1	Year 2	Year 3	Year 4
Planned	**80%**			
Actual		**85%**	**90%**	**95%**

Indicator Calculation:

Numerator:
# of communities that maintain open defecation free status at each measurement

Denominator:
Total # of communities classified as open defecation free during the first program measurement

ANNEX 1: Water Quality Tests

Standard Methods of Detection and Values for Microbiological Quality

Parameters	Methods of Determination	Value[40]	Units of Measurements	Point of Compliance
Total Coliforms	Multiple Tube Fermentation Technique	< 1.1	Most Probable Number (MPN)/ 100 ml	• Service reservoirs • Water treatment works • Consumer's tap • Refilling stations • Water haulers • Water vending machines
	Chromogenic Substrate Test (Presence-Absence)*	Absent < 1.1	MPN/10 ml	
	Membrane Filter Technique	< 1	Total Coliform Colonies/100ml	
	Compliance to total coliform			
	a. For water systems analyzing at least 40 samples per month, no more than 5% of the monthly sample may be positive for total coliform; b. For water systems analyzing fewer than 40 samples per month, no more than one (1) sample per month may be positive for total coliform.			• Consumer's taps
	At least 95% of standard samples taken in each year from each reservoir are total coliform negative.			• Service reservoirs
	No standard sample taken each month should exceed maximum allowable value specified above.			• Water treatment works • Refilling stations • Water haulers • Water vending machines
Fecal Coliform	Multiple Tube Fermentation Technique	< 1.1	MPN/100 ml	• Service reservoirs • Water treatment works • Consumer's taps • Refilling stations • Point sources (level I) • Water haulers • Water vending machines
	Membrane Filter Technique	< 1	Fecal Coliform Colonies/100 ml	
	Chromogenic Substrate test (Presence-Absence)	< 1.1	MPN/100 ml	
Heterotrophic Plate Count	• Pour Plate • Spread Plate • Membrane Filter Technique	<500	Colony Forming Unit/ml	• Service reservoirs • Water treatment works • Consumer's taps nearest the meter • Refilling stations • Water vending machines

[40] Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998.

ANNEX 2: Selected References for Sampling Procedures, Training of Field Staff, and Budgeting

Bell, Judith. (2005). *Doing your research project. A guide for first time researchers in education, health and social sciences.* McGraw Hill International.

Hoshaw-Woodard, Stacy. (2001). *Description and comparison of the methods of cluster sampling and lot quality assurance sampling to assess immunization coverage.* Geneva: World Health Organization, Department of Vaccines and Biologicals.

Valadez, Joseph J. (1991). *Assessing Child Survival Programs in Developing Countries. Testing Lot Quality Assurance Sampling.* Harvard University Press.

World Bank. (2002*). Child Needs Assessment Training Manual.* The Task Force for Child Survival and Development and Early Child Development Team. Available at: http://siteresources.worldbank.org/INTECD/Resources/CNAToolkitTrainingManual.pdf.

ANNEX 3: Brief Description of Commonly Used Sampling Approaches

Cluster sampling. This is a sampling technique used when "natural" groupings are evident in the statistical population and the groupings are called "clusters." The technique requires a sample of clusters to be selected. Required information is collected from the elements within each selected group. This may be done for every element in these groups, or a subsample of elements may be selected within each of these groups. The technique works best when most of the variation in the population is within the groups, not between them. Elements within a cluster should ideally be as heterogeneous as possible, but there should be homogeneity between cluster mean. Each cluster should be a small scale representation of the total population. The clusters should be mutually exclusive and collectively exhaustive. A random sampling technique is used on any relevant clusters to select which clusters to include in the study. In single-stage cluster sampling, all the elements from each of the selected clusters are used. In two-stage cluster sampling, a random sampling technique is applied to the elements from each of the selected clusters.

The World Health Organization developed a 30 by 7 cluster sampling approach to conduct immunization coverage surveys and that technique has been used to study other health issues. As described by Hoshaw-Woodard (2001):

> 30 of these clusters are sampled with probability proportionate to the size (PPS) of the population in the cluster. Sampling with probability proportionate to size allows the larger clusters to have a greater chance of being selected. The clusters are sampled with replacement, such that each cluster can be included in the sample more than once. In the second stage of sampling, seven subjects are selected within each cluster. Although the sampling unit is the individual subject, the sampling is conducted on the household level. The subjects are chosen by selecting a household and every eligible subject in the household is included in the sample.
>
> With traditional PPS cluster sampling, each of the seven subjects would be randomly selected. With the 30 by 7 method, however, only the first household is randomly selected (by a variety of different methods), and all eligible subjects in that household are sampled. After the first household is visited, the surveyor moves to the "next" household, which is defined as the one whose front door is closest to the one just visited.

Lot quality assurance sampling (LQAS). This is a stratification sampling approach based on binary decision-making that originated in the manufacturing industry for quality control purposes to determine if a particular lot of goods meets desired specifications. Instead of checking each item in the lot to determine which items do not meet standards, a sample of the items is chosen and the person in charge of quality control defines the level of risk taken for not inspecting every single item in the lot. Based on this approach, a given lot of goods is then accepted or rejected. The only decision that can be made with this type of sampling is "acceptable" or "not acceptable." No measure of different levels of unacceptability is possible. The sample size is the number of units selected from

each lot. "The decision value is the number of 'defective' items that need to be found before the lot is deemed unacceptable" (Hoshaw-Woodard 2001).[41]

Information from lots can be combined to obtain the overall proportion of defects. This requires that the population be divided into a complete set of non-overlapping lots. Samples are selected from each lot, and the proportion of defective items is calculated. An overall proportion of defects in the population of items is estimated by taking the weighted average of defects from each lot. A confidence interval is calculated in addition. Hoshaw-Woodard (2001) has argued that LQAS is an example of stratified sampling because the overall proportion of defects is determined by combining the information from each lot, and the lots play the role of the strata.

Because the decision-making is binary, a small sample size per lot or per strata can be used. Typically, the sample size per lot varies between 19 and 21 cases.

Different sub-samples are required depending on the topic that needs to be investigated. The monitoring of exclusive breastfeeding practices, for example, would need to be conducted in a sample of households with children less than six months of age as the practice of exclusive breastfeeding is suggested for children from zero to five months. Tracking reproductive health indicators would require obtaining reproductive health information from a set of informants 14 to 49 years of age. By the same token, if the hygiene practices promoted are targeting households with children from newborn to 59 months of age, the LQAS approach requires that a sub-sample of households for each one of these cohorts be drawn. If the focus is on households with the highest diarrhea prevalence in children under five, which in the case of Madagascar is the seven to 23 month cohort, a specific sample for that cohort is required.

[41] Hoshaw-Woodard, Stacy. (2001). *Description and comparison of the methods of cluster sampling and lot quality assurance sampling to assess immunization coverage.* Geneva: World Health Organization, Department of Vaccines and Biologicals.

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