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Monitoring the Safety Of Sugar-Salt Solutions Prepared in the Home:

A Sample Protocol

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A. Introduction and Justification

The mortality and morbidity associated with dehydration due to diarrhea can be significantly reduced through the appropriate use of oral rehydration therapy (ORT) at the household level. Many national programs have encouraged mothers to use sugar salt solution (SSS) to prevent and treat mild dehydration in children. This policy is attractive because the solution can be prepared from products usually available in the home, thereby avoiding dependence on a distribution system.

Unfortunately, many studies have shown that significant errors frequently occur in the preparation of sugar salt solution (5,9,12,13,14,16,17,18).[1] Three separate measurements (of sugar,salt and water) are required, creating many opportunities for error. Therefore, programs that promote SSS need a simple methodology for monitoring the safety of solutions prepared in the home.

This document provides a step by step guide for conducting a household survey to determine the safety of SSS prepared by mothers with previous knowledge of the intervention. It is based on interviews with caretakers, on the direct observation of mothers' practices in SSS preparation, and on quantitative measurements of ingredients and containers. The methodology enables managers to decide whether the current communication/education strategy about the preparation of SSS has worked well.

The study outlined below does not address several important issues, such as:

- whether caretakers administer SSS in sufficient quantities or at appropriate times

- how caretakers perceive SSS and whether they are motivated to use it

- the variability in physical characteristic and chemical composition of local salt and sugar

- whether the local recipe is optimal, either in terms of yielding the desired concentration or in terms of being understandable to caretakers.

Given the effort to organize a survey, some programs may choose to add questions and measurements that address some of these

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[1] A selection of available studies is provided in the bibliography with comments regarding the most significant findings of each.

issues. This would be appropriate if the survey team is skilled and experienced in both data collection and analysis.

B. Study Objectives

The main objectives of this research are to measure the ability of representative groups of caretakers to prepare SSS according to a standard local recipe, and to make rough estimates of the proportion and seriousness of mixing errors. Secondary objectives include the collection of information on the availability of sugar and salt in the home, as well as on the relationship between mixing ability and other variables such as source of knowledge, the availability of a written reminder, etc.

C. Background Information

The goal of ORT is to replace the salts (mainly sodium) and water lost during an episode of diarrhea; therefore ORT contains salt mixed in water. The glucose (or other carbohydrate) in ORT helps to carry sodium across the gut wall so that it can be used by the body. Therefore, the ratio of sodium to glucose concentrations is important.

If the fluid contains too much sodium, hypernatremia can result. If the fluid contains too much glucose, the high osmolality of the solution can draw water from the plasma into the intestine. This will cause an increase in the diarrhea which may in turn lead to dehydration and hypernatremia. Annex A provides a brief explanation of osmolality and its importance in home fluids.

The World Health Organization recommends that recipes for sugar-salt solution and other fluids to be prepared in the home for diarrhea be developed so that the sodium concentration ranges from 30-80 millimoles per litre (mmol/l); the concentration of glucose ranges from 30-112 mmol/l; and the ratio of sodium to glucose concentrations is between 1:1 and 1:1.4. It is also recommended that the combined osmolarity of the sodium and glucose be less than that of blood plasma, that is, less than 300 mOSM/kg H_2O.

Summary of Recommended Composition of Home Therapy Fluids[2]

	Recommended range	
Osmolality[3]	<300 mOsm/kg H20	
Sodium concentration	30-80 mmol/l	with a ratio of sodium : glucose between 1:1 and 1:1.4
Glucose concentration	30-112 mmol/l	

It should be noted that the safe ranges for sodium and glucose concentration were developed assuming that SSS alone is administered. The safety of various concentrations when given with food, water or other fluids remains unknown. This may be particularly important in areas where the available water has a high salt content.

D. Methodology

The methodology outlined below is intended as a general guide that may be tailored to local conditions. Comments about possible local variations are offered in footnotes.

The methodology employs trained fieldworkers to conduct household interviews with caretakers[4] of young children using a pretested survey instrument. The fieldworkers determine whether the respondent has heard about sugar-salt solution. Respondents who know or have access to a recipe for SSS are asked to prepare the

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[2]The table was reproduced from reference 20a. To provide an extra margin of safety, the recommended ranges of sodium and glucose concentrations for home therapy fluids (which include SSS) are lower than the concentrations obtained with the WHO formula for packaged oral rehydration salts (ORS).

[3]It should be noted that the total osmolality of the solution is 2 times the sodium concentration plus the glucose concentration. This is because chloride (from sodium chloride) contributes to the osmolality of the solution. Chloride does not play an active role in absorption and therefore is not included in the recommended list of home therapy fluid ingredients.

[4]In this document the words "mother" and "caretaker" are used interchangeably to indicate the individual with primary responsibility for a child's routine care.

solution. The fieldworkers measure and record the volumes of sugar, salt and water used. The safety of the solution is subsequently determined (based on algorithms that are standardized to local ingredients) during the analysis phase.

The 8 steps of the methodology are presented in detail in the following sections. Annex B contains a chart estimating the time requirements and sequence of necessary activities.

Steps in Monitoring
The Safety of Sugar-Salt Solution

1. Planning and organization
2. Standardization of measurements
3. Questionnaire development and pre-testing
4. Selection and training of fieldworkers
5. Sample selection
6. Data collection
7. Data analysis
8. Presentation and subsequent action

STEP 1: PLANNING AND ORGANIZATION

A. Identify the population to be surveyed.

Since the purpose of the survey is to measure knowledge about and ability to prepare SSS, the population surveyed should have had significant exposure to educational messages about SSS. If national rates are desired, the sample should be drawn from the entire population of the country. However, most surveys will focus on one or a few areas. An area may be selected because it is "typical" of the country, because it has been the focus of educational efforts, or because there are high diarrhea morbidity rates among young children.

B. Make logistical arrangements.

Consider the optimal timing of the survey. If there is seasonal variation in the availability of salt and sugar in the home or marketplace, the survey planners should attempt to coordinate the timing of the survey with the situation in the community regarding availability of salt and sugar that they wish to test. It would seem reasonable to time the survey during the diarrhea season because that is when it is most important to know about the availability of salt and sugar.

The necessary government clearance should be obtained in advance. Outline a budget that includes the salary and perdiem of fieldworkers and supervisors, transportation to and from the field site(s), the costs of duplicating the survey instrument, as well as the costs of field supplies.

The availability of personnel to code, enter (if computers will be used) and analyze the data should be established in advance.

In addition to the standard supplies necessary for a survey (pencils, erasers, clipboards, umbrellas in certain climates, etc.) this methodology also requires a balance with an accuracy of at least 0.01 g, at least one ten ml syringe for each fieldworker, a graduated cylinder or other graduated container for measuring water, and standard graph paper. In areas where salt or sugar are scarce, field workers may need to carry a small amount with them.

C. Draft a preliminary survey instrument.

The survey instrument provided in Annex C is an example that can be translated and adopted for local conditions. Questions can be added or deleted according to program needs. The local instrument should be designed so as to simplify data collection and analysis.

D. Establish acceptable error rates.

Criteria for deciding acceptable rates of error and determining which situations warrant remedial action should be defined in advance. Suggested criteria might be 20 percent or more errors that are potentially dangerous (sodium 81-119 and/or glucose:sodium ratio >1.4) or 5 percent or more errors that are very dangerous (sodium 120+ and/or osmolarity 375+).

It is desirable to include key medical and public health figures in the process of discussing acceptable error rates in an effort to increase the acceptance and use of the results of the survey.

E. Establish a policy on correcting errors and teaching recipes.

In the course of conducting the survey, the team will undoubtedly identify mothers who either do not know how to prepare sugar-salt solution or who prepare a solution with dangerous or ineffective concentrations of sodium and glucose. The team should have a clear policy on whether the surveyors should teach such mothers the correct recipe. If it is decided that the interviewers should correct the problems they identify, training must include practice with explaining and demonstrating SSS preparation.

STEP 2: STANDARDIZATION OF MEASUREMENTS

Fieldworkers will record the volumes of salt, sugar and water that mothers use in preparing ORT. The survey coordinators will later convert the volume measurements of sugar and salt to weight measurements (in grams) and calculate the concentrations of the solutes in water. The relationship between the volume and the weight of sugar and salt varies from place to place depending on the size of the granules and the amount of moisture in the product. Therefore, local guidelines for converting the volumes (milliliters) of sugar and salt into the weight of the sugar and salt (grams) must be determined.

Similarly, the purity of sugar and salt varies from place to place. A given number of grams of sugar (or salt) that is contaminated with other materials gives a lower concentration of glucose (or sodium) when mixed with water, than the same number of grams of pure sugar (or salt). Therefore, gram to mmol conversion standards should also be checked.

A. Determine the constants to convert from volume to weight.

First collect basic information regarding SSS recipes that are promoted locally and on the variability of local sugar and salt granularity and quality. Determine if sugar cubes are frequently used.

Obtain a properly calibrated balance with an accuracy of at least 0.01 g. Take one of the 10 ml syringes that will be used by fieldworkers during the survey.[5] Remove the plunger and seal off the needle end with adhesive tape. Pour 1 ml. of salt into the syringe, then measure and record the weight of the salt to the nearest 0.1 g. Similarly measure and weigh 3ml, 5ml, 8ml, and 10 ml of salt. Make a table comparing volume in ml. with weight in grams, similar to the one in Example 1. Calculate the conversion constant for salt (k_1) by dividing weight by volume.

(If both refined salt and coarse salt are used locally and give weight conversions that vary by more than 5%, separate conversion factors should be determined for each type of salt.)

Example 1

Table Comparing Volume and Weight of Locally Available Salt

Volume (ml)	Weight (g)	Weight/Volume(k_1)
1.0	1.5	1.5
3.0	4.2	1.4
5.0	7.0	1.4
8.0	11.0	1.4
10.0	13.7	1.4

In Example 1, 1 ml. of local salt weighs about 1.4 grams. Therefore the volume of salt can be converted to grams by multiplying by the constant value of 1.4. The constant value may be different depending on the coarseness and purity of the salt. Therefore, the manual will refer to the constant value for this mathematical conversion as "k_1".

[5]It would be optimal for all fieldworkers to use the same type and brand of 10 ml. syringe. If different types or brands are used, be sure to check that all syringes give equivalent measurements.

Following the same procedure, make a similar chart for sugar and determine the conversion factor ("k_2") for sugar. Where sugar cubes are used, measure the weight of 5 different sugar cubes and take the average value. If more than one size is available, measure the weights of the different sizes and prepare a paper showing the sizes for direct comparison for fieldworkers. The survey instrument can be modified to simplify recording if sugar cubes are commonly used.

B. Check gram to millimole (mmol) conversion standards.

WHO has developed tables for calculating the concentration (mmol/l) of sodium and glucose when various combination of water (in mls) and table salt or sugar (in grams) are mixed. These tables are based on the assumption that one gram of salt contains 17 mmol of sodium and that one gram of cane sugar contains 2.9 mmol of glucose. (The tables are reproduced in Annex E.) The tables will be valid only if the gram to mmol conversions for salt and sugar are the same.

If possible, check the gram to mmol conversion standards developed by WHO using flame photometry analysis. If, for example, local salt is heavier because of impurities, the same amount by weight might give a lower concentration of sodium in solution than the standard chart suggests. Similarly, the humidity can influence the state of hydration (and thus the weight) of salt and sugar. Therefore, it is important that the gram to mmol conversion standards be checked in the same season as the survey. The WHO chart could then be adapted accordingly before being used locally.

STEP THREE: PRE-TESTING AND REVISING THE QUESTIONNAIRE

Note that the questionnaire consists of two parts. The first part is completed for every mother (of children under 5) who is interviewed. This will give you the denominator for determining what percentage of mothers of young children: a) have heard of SSS, b) say they know how to prepare SSS, and c) have sugar and salt available to them.

Test both parts of the questionnaire with the same type of respondents and the same type of fieldworkers that will be used during the survey. Some questions may need to be revised because they are unclear or misinterpreted. Some responses may require more space than allowed on the draft questionnaire. Some responses may be difficult to interpret without additional information and it may be necessary to add more questions.

Code and analyze some of the questionnaires collected during the pretest. Can the questionnaire be rearranged to make coding and analysis easier? Would pre-coding some of the questions speed up the data processing?

Revise and re-test as often as necessary to produce a questionnaire that seems to elicit the necessary information and that works well in the hands of the fieldworkers.

STEP FOUR: SELECTION AND TRAINING OF FIELD WORKERS

The pre-testing experience should give estimates of how long it takes to administer the questionnaire, as well as how many mothers with knowledge about mixing SSS can be identified and interviewed in a day. This information can be used to determine the number of field workers needed. For example, it may take approximately 30 minutes to complete the interview. However, if only 25% of mothers of young children have knowledge about mixing ORT, it may be possible to complete only 5 interviews per fieldworker per day since fieldworkers would have to visit an average of 20 houses in order to find 5 mothers who know how to mix ORT. Assuming the goal is to complete interviews with 100 mothers (see the following section on sample size), the data collection should take 20 (100 divided by 5) person-days. Therefore, the survey can be completed by 4 fieldworkers in 5 days, or 2 field workers in 10 days.[6] One supervisor should be in the field for every 2 to 3 fieldworkers.

Selection criteria for appropriate fieldworkers include fluency in the local language, ability to establish rapport with mothers, ability to read the questionnaire and record answers accurately, and ability to measure volumes using calibrated syringes. A preliminary group of candidates for the fieldworker positions might be used to carry out the first phase of the study (i.e., the collection of information on recipes and ingredients and pre-testing the questionnaire) before narrowing the selection to the final team.

Careful training and supervision of the fieldworkers is important to guarantee the quality of the data collected. Schedule 3 to 5 days for training, depending on the skill and experience of the fieldworkers. Training should include the following topics:

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[6] In estimating the time required for the survey, include an extra few days (or an extra fieldworker) to allow for inclement weather, vehicle malfunction, or dropout among the fieldworkers.

A. Purpose of the survey

Fieldworkers should know why the survey is being done and how the information will be used. Stress the importance of accuracy in measuring the quantities of sugar, salt and water, as errors in data collection can lead to incorrect conclusions and inappropriate programmatic decisions.

B. How to talk to mothers

The fieldworkers can have input into developing a standard way to introduce themselves and the purpose of the study, and to reassure informants that the information provided will be anonymous and confidential.

C. Household selection process

If a random sampling procedure is used, the concept and importance of random selection should be explained during training. The household selection process described in Step 5 should be practiced in the classroom <u>and in the field</u> before beginning the actual survey if cluster sampling is employed.

Both parts of the survey instrument should be explained and practiced. The trainers should emphasize that part 1 is to be completed for all mothers with children under age 5. The second part is to be completed only with those mothers of children under five who say they can prepare SSS[7], as determined by their answers to the questions in part 1.

D. Data collection

Data collection involves both obtaining and recording answers to questions on the survey instrument, and taking and recording accurate measurements of SSS ingredients.

Interviewing techniques can be first demonstrated and practiced (using role play) in the classroom. It is essential that the training experience also include field

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[7]"Reported knowledge" about SSS can be defined locally. In this manual mothers are identified as "knowing" how to prepare SSS if they can either recite a recipe from memory, or have and are able to follow a written guide for mixing SSS. In some cultures, especially where there are extended families and a great deal of community interaction, it may be easy for a mother to ask a more experienced or educated person how to prepare SSS. In this circumstance, the survey planners may consider a mother who can ask another person how to prepare SSS as "knowing" how to prepare SSS.

practice under supervision. Emphasis should be placed on phrasing the questions consistently (as on the questionnaire) and on not suggesting answers to the informant.

Practice measurement procedures in the classroom using known volumes of sugar, salt and water. (The measurement procedure is explained in detail in Step 6) A target level of concordance of ratings (agreement between the volumes measured by the field worker and known volumes of sugar and salt) should be set at the start of training. For example, the survey planners may decide that a field worker is well trained when 8 out of 10 of his or her practice measurements are within 10% of the true volume and none of the 10 measurements is an error of more than 20%.

When the trainees are comfortable with the procedures in the classroom, conduct supervised practice of interviewing techniques and measurement procedures in the field.

STEP FIVE: SAMPLE SELECTION

The selection of a study population was discussed in Step 1. The next task involves choosing a sample of the study population so that survey results obtained from the sample can be used to generalize about the population. The goal is to ensure that results are as representative as possible of the true situation in the whole population.

This document describes cluster sampling in detail. Cluster sampling has been used in many types of household surveys including EPI coverage surveys and diarrhea morbidity, mortality and treatment practices surveys. It offers practical advantages in developing countries and many program managers are already familiar with it. The survey coordinators may choose whatever sampling method they prefer. If less rigorous sampling methods (such as convenience sampling) are used, the limitations in generalizing to a larger population should be acknowledged.

A. Determine the number of mothers of children under 5 to be screened[8].

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[8]This manual defines "mothers of children under 5" as the sampling unit. Therefore, the survey determines what proportion of mothers of children under five know how to prepare ORT. Another option is to define households with children under five as the sampling unit and to ask "In what proportion of households with children under five is there an individual who knows how to prepare ORT?". In this case, the initial question might be "Does

For the purpose of estimating error rates, it is recommended that at least 100 mothers (of children under five) who say they know how to prepare SSS be interviewed in each area or region that is being surveyed.[9] The number of mothers of children under five who must be questioned (part 1 of the questionnaire) in order to find 100 mothers who say they know how to prepare SSS will vary from population to population. For example, if pre-testing suggests that 25% of mothers of children under 5 in the population can either recite or have a written reminder of the SSS recipe, then on the average, 400 must be questioned to find 100 who can demonstrate preparation of the solution.

Required number of mothers with children <5	=	100	÷	Proportion of mothers knowing recipe

To be sure you find at least 100 mothers who can prepare the solution, plan to screen an extra 10%. In the example given, you would therefore plan to survey a total of 400 + 10% of 400, or 440 mothers with children under five.

B. Determine the cluster number and select communities where the clusters will be located

It is recommended that the required number of mothers with children under five, be selected from 10 different clusters[10] located in each of 10 communities. Therefore, the recommended cluster number is 10. The next step involves selecting the communities where the clusters will be located. This can be done so that larger communities are more likely to be selected than smaller communities, thereby

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anyone in the house know how to prepare SSS?" rather than "Do you know how to prepare SSS?" This option may be appropriate in cultures where many nuclear families live in one household and childcare is shared.

[9]If error rates in preparing SSS are less than 25%, then limits of precision cannot be calculated for a sample size of 100. If more precision is needed (for example, in comparing rates between regions or in pre- and post-intervention studies), then larger sample sizes will be required.

[10]In this document, a cluster is defined as a randomly selected population group likely to include a specified number of mothers with children under 5.

giving a sample that is representative of the overall population. Detailed instructions for and examples of this process are included in Annex D, Section 1.

C. Determine the required cluster size.

The required cluster size is the number of households that must be visited in each cluster in order to find the required number of mothers with children <5 years old[11]. This depends on the total number of clusters and on the average proportion of households containing mothers of children <5 years. The required cluster size can be calculated as follows:

1. Determine the required number of mothers with children under five (mothers of < 5) per cluster

$$\text{Required number of mothers of} < 5 \text{ per cluster} = \frac{\text{Required number of mothers of} < 5}{\text{Number of clusters}}$$

2. Determine the required cluster size

$$\text{Required cluster size (total number of households)} = \text{Required number of mothers of} < 5 \text{ per cluster} \div \text{Proportion of household with mothers of} <5$$

To continue the previous example, assume that the objective is to interview a total of 440 mothers of children <5 in 10 clusters. The required number of mothers with children < 5 per cluster would be 440 ÷ 10 = 44.

Now assume that approximately 75% of households contain mothers with children <5. The required cluster size (total number of households that must be surveyed per cluster) would be 44 ÷ .75 = 58.7, or about 60.

[11]Readers may be familiar with "cluster size" defined as the population that must be surveyed in order to find the required number of sampling units. However, for the purpose of this survey, it is easier to define cluster size according to the total number of households.

D. Select households to be surveyed.

In most cases, the number of households in the randomly selected communities will not be the same as the required cluster size. The actual number of households may be greater than or smaller than the required cluster size, or the number of households in the community may be unknown. Therefore, supervisors and fieldworkers need to have a method of randomly selecting the households to be surveyed under a variety of circumstances. A detailed methodology is presented in Section 2 of Annex D.

STEP SIX: DATA COLLECTION

After the households to be surveyed have been identified, the actual data collection process can begin. Data collection can be divided into 3 steps:

* Identifying caretakers of children under 5 and interviewing them regarding their knowledge about SSS;
* Obtaining additional information from caretakers of children under 5 who say that they know how to mix SSS;
* Observing caretakers who say that they know how to mix SSS as they actually prepare the solution.

A. Identify and interview caretakers of children under 5

When fieldworkers locate a household with children under 5 years of age, they record the cluster number and the household number (for example, it may be the 4th household with children under 5 located in cluster number 9) on Part 1 of the questionnaire. They then identify the primary caretaker of the young child(ren) and proceed to obtain the information asked in questions 1 through 10. If the household contains more than one mother of children under 5, all eligible mothers should be interviewed individually. Survey coordinators should develop a policy regarding returning to households in which eligible mothers are not at home.

B. Obtain additional information from eligible caretakers who say that they know how to mix SSS

If the caretaker reports that she knows a recipe for SSS or has a written guide that she can follow to prepare it, the fieldworker proceeds with Part 2 of the questionnaire, completing questions 11 through 17.

C. Observe the same caretakers as they actually prepare SSS.

When the fieldworker finishes asking the questions about preparing SSS, the fieldworker then observes as the mother prepares the solution. The fieldworker provides salt and sugar if these are not available in the home.[12] The fieldworker asks the caretaker to put the amount of salt she intends to mix in the solution onto a piece of paper. The measuring utensil (finger pinch, spoon, bottle cap, etc.) and the number of utensils-ful used are recorded on the survey form.

The fieldworker then asks the caretaker to put the amount of sugar she intends to mix in the solution onto another piece of paper. The measuring utensil and the number of utensils-ful of sugar are recorded on the survey form.

Similarly, the fieldworker asks the caretaker to pour out the amount of water she intends to use to prepare the solution. The utensil and numbers of utensils-ful are recorded.

The fieldworker then folds the paper with the salt and uses it as a funnel to pour the salt into a dry, 10 ml syringe. The volume of salt is read with the syringe at eye level and carefully recorded on the survey form. The salt is then returned to the respondent, and the syringe wiped with a dry cloth to remove any remaining salt.

The same measuring process is repeated with the sugar. Finally, the volume of water used to prepare the solution is measured in a graduated measuring cup or cylinder.

D. (Optional) Determine the price and availability of sugar and salt in local shops or markets.

Before leaving the study community, the fieldworkers can collect additional information about the availability of sugar and salt by visiting and conducting informal conversations with local shopkeepers and merchants. In addition to asking whether sugar and salt are available at the time of the interview, the fieldworkers should inquire about the current price, and about whether price and availability varies from day to day or from season to season.

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[12]Where salt or sugar are valuable or scarce commodities, the fieldworker should be prepared to replace the volume of the caretaker's ingredient that was used to prepare the SSS.

STEP SEVEN: DATA ANALYSIS

A. Summarize general findings

First count the number of copies of Part 1 of the survey that have been completed. This will give the number of mothers with children under five who were interviewed (N).

Using that number (N) as the denominator calculate:

- The proportion of mothers (of children under 5) who have heard of a special solution for children with diarrhea. This is the number of positive responses to question 3 divided by N.

- The proportion of mothers (of children under 5) who had salt in the home at the time of the survey. This is the number of positive responses to question 6 divided by N.

- The proportion of mothers (of children under 5) who had sugar in the home at the time of the survey. This is the number of positive responses to question 8 divided by N.[13]

- The proportion of mothers (of children under 5) who report that they knew a recipe for SSS (positive responses to question 10a divided by N) and the proportion who report they can prepare SSS, but only by referring to a written guide (positive responses to question 10b divided by N)

B. Perform the conversions and calculations

Take all the copies of Part 2 of the survey that have been completed, and the table for calculating concentrations of sodium (Annex E)[14] All conversions can be recorded directly on the survey form as demonstrated below:

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[13]If more than 10% of mothers do not have sugar or salt in the home, it might be useful to also calculate the percentage who have easy access to sugar or salt (see questions 7 and 9).

[14]If flame photometry analysis indicates gram to mmol conversion standards that are different than those in Annex E, it will be necessary to revise the tables to reflect local standards.

	INGREDIENT		
	SALT	SUGAR	WATER
Measuring Utensil	2-finger pinch	4-finger fist	metal cup
Number of Utensil-fuls	1	1	2
Total Volume (milliliters)	1 ml	15 ml	(e) 480 ml
Conversion factor	1.4	1.1	**************************
Total grams	(a) 1.4	(c) 16.5	**************************
Concentration (Mmol/l)	(b) 51	(d) 87	**************************
Sodium : Glucose ratio	1 : (d)/(b) = 1 : 87/51 = 1 : 1.7		
Total Osmolality (mOsm/kg H_2O)	[2 X (b)] + (d) = 189 MOsm/kg H2O [2 X 51] + 87 = 189		

The top part of the chart (within the single lines) was completed by the field workers. Begin the calculations for salt by multiplying the total volume (1 ml) by the conversion factor (in this case it was 1.4) and write the result in box (a). Next, take the table for calculating concentration of sodium and locate the value of sodium in grams that is closest to 1.4. This is 1.5. Now locate the value of water in mls that is closest to the value in box (e). This is 500 ml. The intersection of the row corresponding to 1.5 grams and the column corresponding to 500 ml. is 51. This is the concentration of salt in mmol/l. Write the result in box (b).

Now follow the same procedure using the total volume of sugar the conversion factor for sugar, the total volume of water, and the table for calculating concentration of glucose to complete boxes (c) and (d).

Complete the table by using the formulae provided to calculate the sodium to glucose ratio and the total osmolality.

When processing the survey forms, calculate the sodium concentration for all completed records and then go back and calculate the glucose concentrations. This will avoid working with two tables for calculating concentrations at the same time. In this way the risk of mistakenly using the glucose standards to calculate sodium concentration will be eliminated.

C. Summarize the results of the mixing trials

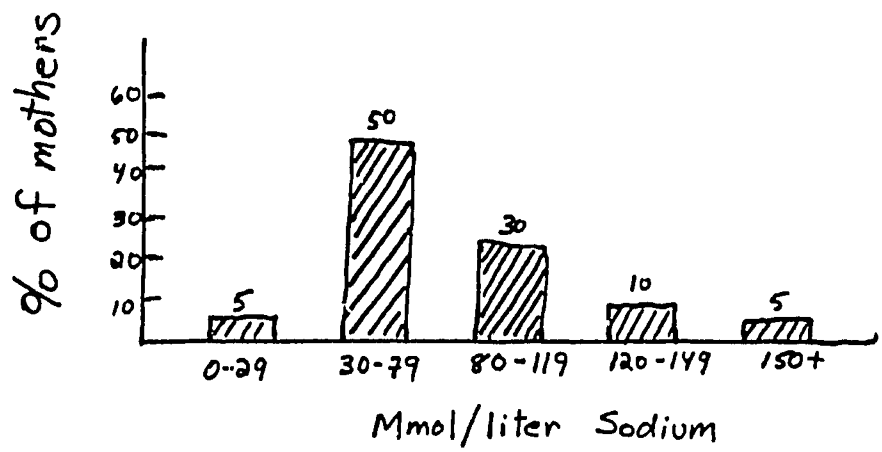
First count the number of copies of Part 2 of the survey that were completed. This will give the number of mothers (of children under 5) who say that they know how to mix SSS (N2).

Using that number (N2) as the denominator calculate:

- The proportion of mothers preparing a solution with an ineffective sodium concentration (b < 30 mmol/l), the proportion of mothers preparing a solution within the recommended range of sodium concentration (b = 30 - 80 mmol/l), and the proportion of mothers preparing a solution of high sodium content (b > 80 mmol/l). It might also be informative to calculate the proportion of mothers preparing a solution with a high sodium concentration (b> 120 mmol/l) and with a very dangerous sodium concentration (b > 150 mmol/l). The results can be presented graphically as shown below.

Example 2

Sodium Concentrations of SSS Solutions
Prepared by (N2) Caretakers



- The proportion of mothers preparing a solution with an ineffective glucose concentration (d < 30 mmol/l), the proportion preparing a solution with a glucose concentration within the recommended range (d = 30-112 mmol/l), and the proportion preparing a solution with an unacceptably high glucose concentration (d > 112 mmol.l). A graph similar to the one prepared for sodium can be used to demonstrate the findings.

- The proportions of mothers preparing solutions with sodium to glucose ratios below, within, and above the recommended range.

- The proportion of mothers preparing solutions with total osmolalities less than 300 mOsm/kg H_2O, and the proportion of mothers preparing solutions greater than or equal to 300 mOsm/kg H_2O

D. Analyze the determinants of preparing an acceptable solution.

Additional analyses can be done, especially if computers are available to facilitate the tabulation of data. Use a statistical package or a database programme that can recode variables and can perform simple cross tabulation.

Cross tabulate mixing ability with relevant variables such as age of the caretakers, the types of utensils used, the source of information about SSS, length of time since training, reported prior use of SSS, and the availability of a written reminder. If written reminders are available in some communities and not in others, a comparison of the mothers in the different communities may be helpful to assess the value of providing written reminders.

STEP 8: PRESENTATION AND SUBSEQUENT ACTION

Sharing of the information collected is essential so that the findings of the study can be used in determining policies and guiding future strategies of the country's or region's diarrheal diseases control program. Present and discuss the results and implications of the study at meetings and workshops at the regional and national levels. Prepare and distribute a written report of the findings and the workshop to all individuals concerned with the development and implementation of ORT policy.

Several types of programmatic action might be appropriate as a result of the study. Decisions should depend on the rates, nature, and distribution of mixing errors. Program managers may choose among the following:

* Continue the existing policies and programs
* Revise the communication/education strategy
* Revise the SSS recipe (e.g., quantities, utensils)
* Reorient the national ORT strategy to de-emphasize SSS in favor of other home fluids or ORS packets
* Obtain additional information

If the study planners choose to limit the survey to an assessment of mixing errors (and do not include questions about the variability of local sugar and salt, attitudes toward and impressions about SSS, etc.) they may be able to determine whether action is needed, but not necessarily what action. In this case, some additional information may be needed to decide on a course of action. If this is the case, the specific research needs should be identified and plans for that research initiated right away.

ANNOTATED BIBLIOGRAPHY

1.Abed, F.H. Household teaching of ORT in rural Bangladesh. Assignment Children 61/62:249-265, 1983.

Tested sodium in field lab using chloride titration.

2.Baume, Carol. Preliminary results from the resurvey in Honduras. Paper prepared for HEALTHCOM, February 1988.

Found 83-91 percent knew how to mix an ORS packet.

3.Chowdhury, A.M.R., Vaughan, J.P., Abed, F.H. Mothers learn how to save the lives of children. World Heath Forum 9: 239-244, 1988.

Evaluation of BRAC project in Bangladesh found 26 percent of lobon-gur (SSS) solutions had sodium > 120 mmol. Resurvey after retraining found only 2.5 percent > 110 mmol.

4.Conteh, S., McRobbie, I., Tomkins, A. A comparison of bottle tops, teaspoons and WHO glucose-electrolyte packets for home made oral rehydration solutions in The Gambia. Transactions of the Royal Society of Tropical Medicine an Hygiene 76: 783-785, 1982.

Analyzed solutions made by different methods 1 day after training. Defining 80-120 mmol as safe range for sodium, they found 88 percent of ORS, 50 percent of teaspoons in safe range. All solutions with bottle caps were <80 mmol.

5.Cutting, W.A.M., Harpin, V.A., Lock, B.A. et al. Can village mothers prepare oral rehydration solution? Tropical Doctor 9: 195-199, 1979.

Measured pinch size in India and Trinidad and found wide variations. Also wide variations in salt quality in India. Of sample measured in lab, 29 percent > 120 mmol of sodium/L.

6.de Zoysa, I., Carson, D., Feachem, R. et al. Home-based oral rehydration therapy in rural Zimbabwe. Transactions of the Royal Society of Tropical Medicine and Hygiene 78: 102-105, 1984.

Defining safe range for sodium as 30-100 mmol, they found 12 percent could prepare a safe SSS at first survey. When tested again 11-26 days after training 74 percent could make solution in safe range.

7.de Zoysa, I., Kirkwood, B., Feachem, R. et al. Preparation of sugar-salt solutions. Transactions of the Royal Society of Tropical Medicine and Hygiene 78: 260-262, 1984.

Study in Zimbabwe compared level teaspoons, heaped teaspoons, and special double-ended spoon for SSS. Heaped teaspoon was most reliable; double-ended spoon gave high sodium concentrations.

8.Ellerbrock, T.V. Oral replacement therapy in rural Bangladesh with home ingredients. Tropical Doctor 11: 179-183, 1981.

Pinch and scoop method for lobon-gur (with target sodium level of 50 mmol) yielded 87 percent of samples in 30-100 range for sodium.

9.El-Mougi, M., Santosham, M., Hirschhorn, N. et al. Accuracy of mixing oral rehydration solution at home by Egyptian mothers. Journal of Diarrhoeal Disease Research 2: 159-161, 1984.

Compared mothers mixing ORS packets with and without special cups. Found mothers using special cups had significantly lower sodium levels. Without cup nearly half had sodium > 120 mmol.

10.Khin-Maung-u, Tin-Aye, Myo-Khin et at. Composition and contamination of oral rehydration solutions prepared with well water by village mothers in Burma. Transactions of the Royal Society of Tropical Medicine and Hygiene 80: 329-332, 1986.

Found mothers mixing ORS using condensed milk tins made solutions with safe concentrations of sodium and glucose.

11.Levine, M.M., Clements, M.L., Black, R. et al. A practical, reliable method for preparing simple sugar/salt oral rehydration solution. Journal of Tropical Medicine and Hygiene 84: 73-76, 1981.

In Honduras study using teaspoons to measure sugar and salt, they found 16 of 20 women could make safe SSS with sodium of 60-95 mmol. Only 1 was >120 mmol.

12.Ministry of Health et al. Report of an evaluation of CDD and EPI. Unpublished paper, Lesotho, 1986.

Samples of SSS were analyzed by weight of ingredients. Found 25 percent had sodium >100 mEq and 16 percent >150 mEq.

13.Ntilivamunda, A., Deming, M., Neill, M. Enquetes nationales sur le traitement de la fievre et de la diarrhee chez les enfants de moins de 5 ans a domicile et dans les formations sanitaires. Novembre, 1985; Rapport final. unpublished paper, CCCD/Rwanda.

Survey found 54 different recipes for SSS. When analyzed, 75 percent were >90 mmol sodium and 55 percent > 150.

14.Nwoye, L.O., Uwagboe, P.E., Madubuko, G.U. Evaluation of home-made salt-sugar oral rehydration solution in a rural Nigerian population. Journal of Tropical Medicine and Hygiene 91: 23-27, 1988.

Using spoon of salt and cubes of sugar, mothers brought home-made solutions to health center for analysis. Found 60 percent had 60-80 mmol of sodium, 10 percent had more than 120 mmol.

15.Poudayl, L., Thapa, R. Home-made oral rehydration solutions: feasibility study in Nepal. WHO Chronicle 34: 496, 1980.

Compared SSS made with Morley spoon, local spoon and pinch-and-scoop. Found 25 percent of pinch and scoop had > 90 mmol sodium while 89 percent of Morley spoon had < 50 mmol. After retaining, no errors were found with pinch and scoop samples.

16.Rahman, A.S.M.M., Molla, A.M., Bari, A. et al. Mothers can prepare and use rice-salt oral rehydration solution in rural Bangladesh. The Lancet 2: 539-540, 1985.

Of 150 samples of rice-salt solution analyzed within a few months of training, 57 percent had sodium 71-110 mmol while 28 percent were >120 mmol.

17.Sachar, R.K., Javal, G.S., Cowan, B. et al. Home-based education of mothers in treatment of diarrhoea with oral rehydration solution. Journal of Diarrhoeal Disease Research 3: 29-31, 1985.

Six months after learning SSS recipe only 30 percent could prepare it.

18.Shaw, E., Darracq, R., Kogbo, W. et al. Evaluation de l'utilisation a domicile des solutions familiales de rehydratation orale dans les diarrhees aigues benignes. Unpublished paper, CCCD, n.d.

Study in Ivory Coast compared guava tea, rice water and SSS. Analyzed samples made by mothers a few days after training. Found 62 percent had sodium in 40-100 meq/l range, 17 percent >120 meq. Among SSS samples, 14 percent >120 meq.

19.UNICEF. The case for consensus: Some aspects of oral rehydration in rural Baluchistan, Pakistan. UNICEF, Pakistan, 1986.

Using pinch and scoop method, they found 80 percent of samples had sodium in 58-100 mmol range. Wide variety of spoon sizes seen in home visits.

20.World Health Organization. Oral rehydration therapy for treatment of diarrhoea in the home. Diarrhoeal Diseases control Program, WHO/CDD/SER/86.9, 1986.

Review of history of SSS and problems of mixing it accurately. Includes table with various recipes and their mmol values.

20a.World Health Organization. A decision process for establishing policy on fluids for home therapy of diarrhoea. Diarrhoeal Diseases Control Program, WHO/CDD/SER/87.10.

21.Wornham, W.L. Development and field testing of a method for assessing the effectiveness of diarrhoea case management by mothers. Unpublished paper prepared for Nepal CDD Programme, 1986.

Tested survey method based on taking samples of salt and sugar to local jewelers' scales. Found moisture content caused too much variability; recommends just observing number and type of measuring units.

ANNEX A

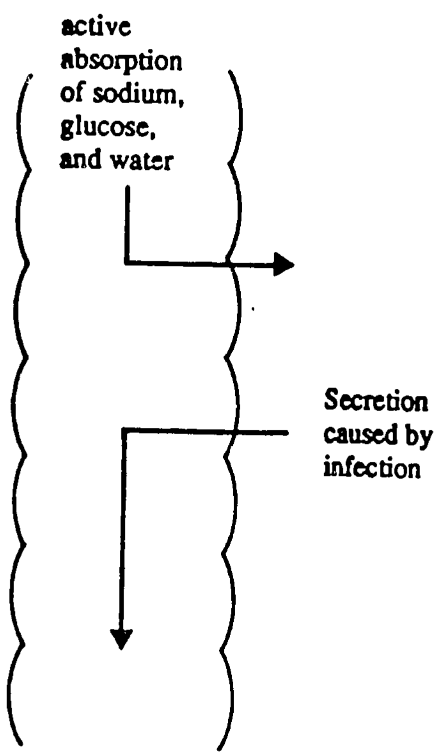
THE NEED FOR APPROPRIATE OSMOLALITY IN A HOME FLUID

Osmolality is a measure of osmotic pressure, which is the pressure exerted by a substance dissolved in water, when it is separated from another fluid by a membrane such as the intestinal wall. Osmolality is expressed in milliosmols per kilogram of water, abbreviated as mOsm/kg H_2O.

When two solutions are separated by a membrane such as the intestinal wall, water tends to move across the membrane towards the solution of higher osmolality. (You can think of the water as trying to achieve a balance of osmolality.) For this reason, a home therapy fluid should not have a higher osmolality than that of blood plasma. If water from blood plasma crosses the intestinal wall towards the fluid in the intestinal lumen, that water will be lost as diarrhoea. This is called "osmotic diarrhoea". It is as though the fluid in the intestine is "stealing" water from the blood, actually worsening dehydration. When water is lost in osmotic diarrhoea, the sodium concentration in the body becomes higher as well. This can cause hypernatraemia, another serious problem.

The diagrams below may help to explain the need for appropriate osmolality in a home fluid. (The wavy lines represent the intestinal wall.)

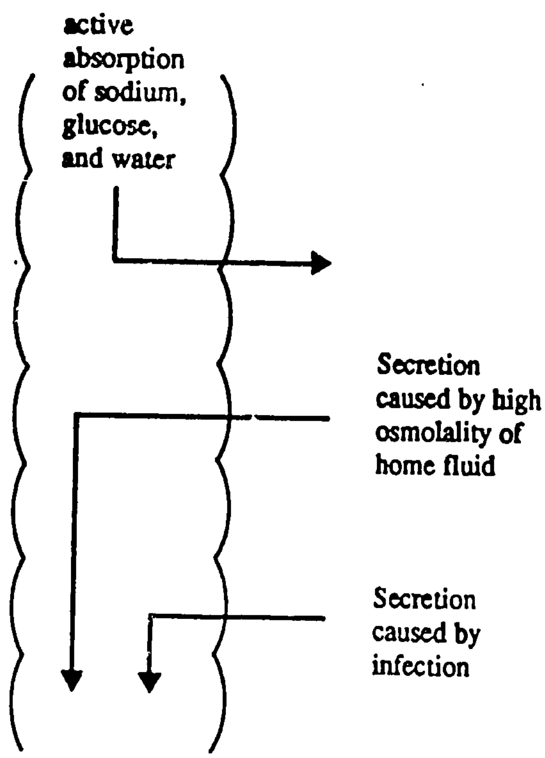
Correctly composed home fluid



Diarrhoea, with maintenance of hydration

Secretion caused by infection is balanced by absorption of home fluid.

Home fluid with osmolality higher than blood plasma



Increased diarrhoea and worsening dehydration

Water from plasma is "stolen" by home fluid of high osmolality and increases diarrhoea.

ANNEX B

TIME CHART FOR CONDUCTING A SURVEY TO MONITOR THE SAFETY OF SUGAR-SALT SOLUTION PREPARED IN THE HOME[1]

ACTIVITY	WEEKS								
	1	2	3	4	5	6	7	8	9+
Planning and organization	***	***							
Standardization of measurements		***							
Questionnaire development and pre-testing		***	***						
Selection and training of field workers			***	***					
Data collection					***	***			
Data analysis						***	***	***	
Reports, Presentation and Subsequent Action								***	***

[1]These times may be less if the team is experienced. The time needed will also depend on the number of field workers used and the amount of time required to recruit field workers.

ANNEX C

SAMPLE QUESTIONNAIRE FOR MONITORING SSS PREPARED IN THE HOME[1]

Part 1 (To be completed by interviewing the primary caretaker in all households where there are children under 5)

1. Cluster number ____ Household number _____

2. Age of caretaker 15-24 ___ 25-34 ___ 35-44 ___ >=45 ___

3. Has the caretaker ever heard of any special solution that can be prepared at home for children with diarrhea?
   yes ___ no ___ don't know ___

[If no, continue to question 6]

4. If yes, what is in the solution? ____________________
   ____ (If not SSS, ask if she knows SSS. Go to question 6 if she does not)

5. Where did the caretaker hear about the solution?
   ____

6. Does the caretaker have any salt at home now?
   yes ___ no ___

7. If no, is salt:
   a. available from a neighbor? yes ___ no ___ don't know ___
   b. available in the market? yes ___ no ___ don't know ___
   c. can she afford to buy it? yes ___ no ___ don't know ___

8. Does the caretaker have any sugar at home now?
   yes ___ no ___

____

[1]This sample questionnaire is written for surveys that seek to determine how many caretakers know how to prepare SSS from their own recall or by using a written guide. If the survey planers decide they are interested in knowing if anyone in the household can prepare SSS (see footnotes 7 and 8 of the main text) or if caretakers have access to the recipe from a neighbor, the questions will have to be changed to reflect this.

9. If no, is sugar:
   a. available from a neighbor? yes ___ no ___ don't know ___
   b. available in the market? yes ___ no ___ don't know ___
   c. can she afford to but it? yes ___ no ___ don't know ___

10. If you wanted to prepare the solution for your child now, would you know how to do it?
   a. Yes, knows the recipe ___
   b. No, does not know the recipe ___

11. (If "NO" to the previous question, ask:) If you wanted to prepare the solution for your child now, do you have a printed guide to prepare it, or is there someone you could ask?
   a. Yes, has a printed guide ___
   b. Yes, could ask someone else how ___
   [If "b" is checked, ask who and if that person is available now]
   ____
   c. No, does not have access to the recipe ___
   d. Other____

[If the caretaker does not have access to the recipe, or must ask someone else for it, go to the next household. If the caretaker either knows a recipe or has a written guide that she can use to prepare it, continue to Part B.]

Part 2 (To be completed with every caretaker who can either recite a recipe for SSS or who has a written guide that she can use to prepare it)

11. Ask the caretaker to tell you the recipe she uses:
____
____
____

12. Does the caretaker have a written reminder of the recipe?
yes ___ no ___

13. If yes, record the type ______________________________

14. Where did she learn how to prepare SSS? ______________
____

15. Did she have a chance to practice it when she learned it?
yes ___ no ___

16. How long ago did she learn how to mix it?
<1 month ago ___ 1 - 6 months ago ___
7-12 months ago ___ >1 year ago ___

17. Has she ever made SSS at home before?
yes ___ no ___

18. If yes, when was the last time she prepared it?
<1 month ago ___ 1 - 6 months ago ___
7-12 months ago ___ >1 year ago ___

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Part 2 (continued)

Ask the caretaker to prepare sugar salt solution for you, letting you measure the amount of salt, sugar and water she uses before mixing them together. Record the results below. Do <u>not</u> write within the double lines.

	INGREDIENT		
	SALT	SUGAR	WATER
Measuring Utensil			
Number of Utensil-fuls			
Total Volume (milliliters)			
Conversion factor	k_1	k_2[2]	************* *************
Total grams	(a)	(c)	************* *************
Concentration (Mmol/l)	(b)	(d)	************* *************
Sodium : Glucose ratio	1 : (d)/(b) = 1 : _____		
Total Osmolality (mOsm/kg H_2O)	[2 X (b)] + (d) = _____		

[2]When preparing a survey insturment, the actual values of the conversion factors determined in Step 2 Section A of the methodology should be substituted for k1 and k2.

ANNEX D: CLUSTER SAMPLING METHOD[1]

This annex describes a sampling method that is useful for conducting surveys in developing countries. The procedure is divided into three sections:

1. SELECT COMMUNITIES WHERE CLUSTERS WILL BE LOCATED.
2. SELECT HOUSEHOLDS TO BE INCLUDED IN CLUSTERS.
3. RANDOM SELECTION.

1. SELECT COMMUNITIES WHERE CLUSTERS WILL BE LOCATED

This survey method uses a <u>cluster sampling</u> technique. A <u>cluster</u> is a randomly selected population group (or group of households) of a size likely to include a specified number of mothers with children under age 5.

As described in this manual, cluster sampling is a 2-stage process involving:

- first, selecting communities in which clusters will be located (as described in this section), and

- second, within these communities, identifying groups of households where interviews will be conducted. (as described in Section 2). The "cluster" is the population living in these households.

It is best to survey at least 10 clusters from the total area. If it is logistically possible to survey more than 10 clusters, this will generally result in greater precision.

To the extent possible, communities where clusters will be located should be selected according to a principle called "probability proportionate to size." This means that communities with populations of equal size should have an equal chance of being selected to contain a cluster; communities with larger populations should have a proportionately greater chance of having a cluster than smaller communities.

Ideally, to adhere to this principle, you should list <u>all</u> the communities in the area to be surveyed, along with their population sizes. Then, without regard to the locations of the communities, you should select certain ones to contain clusters, as described in steps 9 - 15 of the following process.

---

[1]Adapted from Household Survey Manual, WHO, CDD/SER/86.2

However, in surveys of large areas (e.g. whole countries or large regions[2]), it will usually be impossible to list all the communities and their populations. Because of resource constraints, it may also be impractical to choose communities without regard to their locations; a programme may need to confine travel to a number of districts to save travel time, per diem, petrol, etc. It will therefore be necessary to select districts first, according to steps 1 - 8 of the following process. An example of each step in the process is provided on the following page.

---

[2] In this manual "regions" are the largest administrative/geographic units below the national level, followed by "districts," then "communities." These levels may be called by other names in different countries.

SAMPLING PROCESS (SELECTION OF COMMUNITIES WHERE CLUSTERS WILL BE LOCATED)

1. Decide on the number of districts which can practically be visited. In general, the more districts that can be visited, the more reliable your results will be.

2. List all the districts and their populations for the area to be surveyed.[3]

3. If all the districts are approximately the same size, assign each one a number and select at random the districts to be visited.[4] Then go to step 9 on page 6 of Annex D.

   If the districts differ in size, calculate their cumulative populations by adding each population to the sum of the ones before it. (See example.) then do steps 4 - 8 below.

4. Determine the sampling interval.

$$\frac{\text{Cumulative total population}}{\text{Number of districts to be visited}} = \text{Sampling interval}$$

5. Select a random number which is less than or equal to the sampling interval.

6. To identify the first district to be visited, locate the first district on the list in which the cumulative population equals or exceeds the random number selected in step 5.

7. Identify the second district to be visited as follows:

   Random number + Sampling interval = Location of second district

---

[3] If it is not possible to list all the district populations, or it will be impractical to visit widely distant districts, you can first use the process described in steps 1-8 to select a number of regions. You would then limit your list of districts to those in the selected regions.

[4] Section 3 of Annex D describes how to select numbers randomly.

8. Identify each subsequent district to be visited as follows:

Number which identified the location of the previous district	+	Sampling interval	=	Next district location

EXAMPLE OF SAMPLING PROCESS

STEP 1: The survey coordinator in the country of Tarim decided the programme could afford travel to 6 of the 20 districts.

STEP 2		STEP 3	STEP 6-8
Districts	Population	Cumulative Population	Selection List
Medias	146 000	146 000	143 492 = District 1
Macro	190 000	336 000	
Wallo	164 000	500 000	
Supra	120 000	620 000	
Natur	92 000	712 000	625 159 = District 2
Tonkina	160 000	872 000	
Callif	180 000	1 052 000	
Reno	176 000	1 228 000	1 106 826 = District 3
Prato	150 000	1 378 000	
Teana	80 000	1 458 000	
Raqusa	160 000	1 618 000	1 588 493 = District 4
Jumbo	194 000	1 812 000	
Juba	180 000	1 992 000	
Guyas	190 000	2 182 000	2 070 160 = District 5
Grande	158 000	2 340 000	
Viga	162 000	2 502 000	
Norte	103 000	2 605 000	2 551 827 = District 6
Estra	115 000	2 720 000	
Alta	76 000	2 796 000	
Vista	94 000	2 890 000	

STEP 4: Sampling interval $= \frac{2\ 890\ 000}{6} = 481\ 667$

STEP 5: Random number selected between 1 and 481 667 is 143 492.

PROCESS

9. Prepare a list of all communities and their populations in the districts selected. The list should include communities which are not on official lists (new settlements, refugee camps, etc.) as well as villages and towns.

10. Calculate and list the cumulative population with the addition of each community.

11. Determine the sampling interval.

$$\frac{\text{Cumulative total population}}{\text{Number of clusters*}} = \text{Sampling interval}$$

12. Select a random number which is equal to or less than the sampling interval.

13. To identify the community in which Cluster Number 1 is located, find the first community on the list in which the cumulative population equals or exceeds the random number selected in step 12.

14. Identify the community in which the second cluster is located a follows:

Random Number	+	Sampling interval	=	Location of second cluster

15. Identify each subsequent community to be visited as follows. Stop when you have identified the number of clusters you plan to survey.

Number which identified the location of the previous cluster	+	Sampling interval	=	Next cluster location

---

*10 or more clusters will be necessary

EXAMPLE

STEP 9		STEP 10	STEP 13 - 15
Communities	Population	Cumulative Population	Selection List
Marta	8 000	8 000	
Larame	6 500	14 500	9 465 = Community1*
Fulcra	5 000	19 500	
Patcee	2 000	21 000	
Mari	500	22 000	
Suze	7 000	29 000	
Kinko	11 000	40 000	38 365 = Community 2*
Flori	3 000	43 000	
Talca	9 500	52 500	
Tejo	6 000	58 500	
Madmike	3 500	62 000	
Bakan	2 000	64 000	
Hogano	33 500	97 500	67 265 = Community 3 96 165 = Community 4
(continue this way)	718 500	816 000	125 065 = Community 28
Adana	500	816 500	
Tara	19 000	835 500	818 665 = Community 29
Petro	7 000	842 500	
Newton	8 000	850 500	847 565 = Community 30
Otullok	5 500	856 000	
Nawatu	11 000	867 000	

STEP 11: Sampling interval $= \frac{867\ 000}{30} = 28\ 900$

STEP 12: Random number selected between 1 and 28 900 is 9 465.

* Thus cluster 1 falls in the community of Larame, cluster 2 in Kinko, etc.

2. SELECT HOUSEHOLDS TO BE INCLUDED IN CLUSTERS

In most situations it will be necessary to select the households to be included in clusters upon arrival at a community. This section of the annex explains how to do this.

In order to select households to be included in clusters it is necessary to know:
- the approximate number of households in the community,
- the required number of mothers of children under age 5 per cluster, and
- the required cluster size (households) in order to include that many mothers.

The survey coordinator should give the field supervisors a list of population sizes for the communities to be visited. If available, the coordinator should also provide maps of the communities and relevant demographic data (e.g., data on the number of households in different subsections of the community).

The required number of mothers of children under 5 will be the same throughout the survey, as will the required cluster size. The latter is the number of <u>households</u> that need to be included in order to reach the required number of mothers of children under age 5.

Compare the required cluster size to the number of households in the community. Then use the process on the next page to choose which households to interview.

PROCESS FOR SELECTING HOUSEHOLDS TO BE INCLUDED IN CLUSTERS

If:	And:	Then plan to:
The # of households in the community is about equal to the required cluster size	------------------->	Survey all households in the community
The number of households in the community is larger than the required cluster size	There is data on the number of households in subsections of the community <u>or</u> There is a map of the community	-Divide the community into subsections that you estimate to have slightly more than the required cluster size (households). -Number each subsection and select one randomly.* -Survey all households in that section -If you do not find enough mothers, go to the next adjacent sub-section and survey as many households as needed, beginning with the closest.
	There are no data nor maps	See method described on the next page.
The community size is smaller than the required cluster size	------------------->	-Survey all households in the community. -Go to the geographically nearest community. -Survey as many households as needed to get the required number of mothers, beginning with the household closest to the first community.

* Random selection methods are described on page 12.

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EXAMPLE OF HOW TO PROCEED IF THERE ARE NO MAPS NOR POPULATION DATA

ON SUBSECTIONS OF THE COMMUNITY

1. Randomly select a starting point (i.e., the first household to be interviewed):

   - Go to some central location such as a market or church and select a direction at random (for example, by drawing from numbers representing north, south, east, and west or by spinning a bottle on the ground).

   - Moving in a straight line in this direction, count all houses until the edge of the community is reached. (If possible, number each house with chalk as you go.)

   - Select one of these numbered houses at random as the starting point for the cluster.

2. Proceed with the survey to the closest household, then the next closest, etc., being sure to stay within the boundaries of the community.

3. When there is uncertainty about the next closest household, use a random selection process to decide which household to interview.

Note: Whatever selection process is being used, if you are interviewing with another team member, you will need to divide the community in some way so that you will not interview the same households. For example, each person could work on one side of the main road.

Example of Household Selection Process

Suppose that the required number of mothers of children under age 5 per cluster in your survey is 44, and about 75% of the households contain a mother of a child under 5. Since 44/0.75 = 58.7 the required cluster size for the survey is about 60 households.

One of your assigned communities has a population of 2340, living in 290 households. You have a rough map but no data on how many people live where. As instructed on the table on page 9 of Annex D, you divide the map into 3 subsections which you hope will each have at least 60 households.

You assign each of these three areas a number 1, 2 or 3 and write the numbers on bits of paper. Someone draws the number 3, so interviews will be conducted in area 3.

You assign 2 surveyors to work in area 3. You note that the area has a road which divides it. You instruct one team member to take one side of the road and another team member to take the other side. Each one is to interview all households on this side of area 3 until he has found 22 mothers or has reached the edge of the area, which you define as clearly as possible using the map. The surveyor who finishes first is to find the other and help him complete the cluster.

If the surveyors cannot find 44 mothers in area 3, they should go to the next adjacent area, select the closest house to the last household interviewed in area 3 as a starting point, and continue interviewing the next closest households until they have found enough mothers.

3. RANDOM SELECTION

To make a random selection (of a direction, a number, a household, etc.), you must select in such a way that all of the possible choices have an equal chance of being selected. Two methods of random selection are described below.

Drawing Bits of Paper from a Container To Select A Random Number

1. Write the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 on separate bits of paper, and put them in any container such as a hat, bag or pot.

2. Decide how many digits you need to select. Usually this will be the number of digits in the higher number of the range from which you are selecting. For example, if you must select a number from 1 to 25 000, you will need to select 5 digits. Since the initial digits may be 0's, these 5 digits may yield a number of 5, 4, 3, 2, or 1 digits.

   Note: If you must select a number between 1 and 10 000, you would select only 4 digits, since there are no numbers under 10 000 with 5 digits. Similarly, if you need to select a number between 1 and 100, you should select 2 digits, etc.

3. Without looking in the container, reach in and remove one bit of paper. This will be the first digit in the random number, unless it is too large. For example, if you are selecting a number between 1 and 2450, the digits 0, 1, or 2 would be suitable. Digits 3 and higher would be too high.

4. If the digit drawn is suitable, put the bit of paper back, and continue drawing the remaining digits in the same manner.

   If the digit drawn is too high, keep it and continue drawing from the container until you draw a suitable digit. then put all the bits of paper back in the container and draw the next digit for the random number.

   Continue until you have constructed a number with the required number of digits.

Spinning a Bottle to Select a Direction

Select a level, smooth spot and spin a bottle. When it stops spinning, the direction in which the mouth of the bottle is pointing is the selected direction.

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ANNEX E

TABLES FOR CALCULATING CONCENTRATIONS OF SODIUM AND GLUCOSE

SODIUM CONCENTRATION (MMOL/L)

Salt (sodium chloride) (grams)	Water (mls)													
	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
0.5	43	29	21	17	14	12	11	10	9	8	7	7	6	6
1.0	86	57	43	34	29	24	21	19	17	16	14	13	12	11
1.5	128	86	64	51	43	37	32	29	26	23	21	20	18	17
2.0	171	114	86	68	57	49	43	38	34	31	29	26	24	23
2.5	214	143	107	86	71	61	54	48	43	39	36	33	31	29
3.0	257	171	128	103	86	73	64	57	51	47	43	40	37	34
3.5	300	200	150	120	100	86	75	67	60	54	50	46	43	40
4.0	342	228	171	137	114	98	86	76	68	62	57	53	49	46
4.5	385	257	193	154	128	110	96	86	77	70	64	59	55	51
5.0	428	285	214	171	143	122	107	95	86	78	71	66	61	57
5.5	471	314	235	188	157	135	118	105	94	86	78	72	67	63
6.0	514	342	257	205	171	147	128	114	103	93	86	79	73	68
6.5	557	371	278	223	186	159	139	124	111	101	93	86	80	74
7.0	599	400	300	240	200	171	150	133	120	109	100	92	86	80

Too dilute

Recommended concentrations

Too concentrated - potentially dangerous

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GLUCOSE CONCENTRATION (MMOL/L)

Cane sugar (grams)	Water (ml) 200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
5	73	48	36	29	24	21	18	16	15	13	12	11	10	10
10	145	97	73	58	48	41	36	32	29	26	24	22	21	19
15	218	145	110	87	73	61	55	48	44	39	36	33	31	29
20	290	193	145	116	97	83	73	64	58	53	48	45	41	39
25	363	242	181	145	122	104	90	81	73	66	60	56	52	48
30	435	290	218	174	145	124	109	97	87	79	73	67	61	58
35	508	338	254	203	169	145	127	113	102	92	85	78	73	68
40	580	387	290	232	193	165	145	129	116	106	97	89	83	77
45	653	435	328	261	218	186	163	145	131	119	109	100	93	87
50	725	483	363	290	241	206	181	161	145	132	121	112	104	97

- Too dilute
- Recommended concentrations
- Too concentrated - potentially dangerous

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