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WASH WORKING PAPER NO. 14

RELATIONSHIPS AMONG IMPROVED WATER SUPPLY AND SANITATION, DIARRHEAL MORBIDITY, AND NUTRITIONAL STATUS: REPORT OF A WORKING MEETING

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Edited by:

Raymond B. Isely

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Chapter 1

OVERVIEW/PURPOSE

The Water and Sanitation for Health Project (WASH) has been accumulating information on past and ongoing research and evaluation studies in which improvements in water supply and sanitation are related to nutritional status, to diarrheal morbidity, or to nutritional status through improved diarrheal morbidity. These studies are in various stages of development but, taken together, form a part of a growing body of literature. The purpose of this meeting was to review the evidence afforded by some of these studies, to reflect together on their meaning, and to generate some ideas for future strategies of collaboration among water and sanitation, health, and nutrition programs in action, evaluation, and research. The discussion was aided by having some active researchers present at the meeting, notably:

1. Dr. Branko Cvjetanovic, Professor of Epidemiology at the University of Zagreb, who reported on the Jhansi (India), Teknaf (Bangladesh), St. Lucia, and Dominica studies.

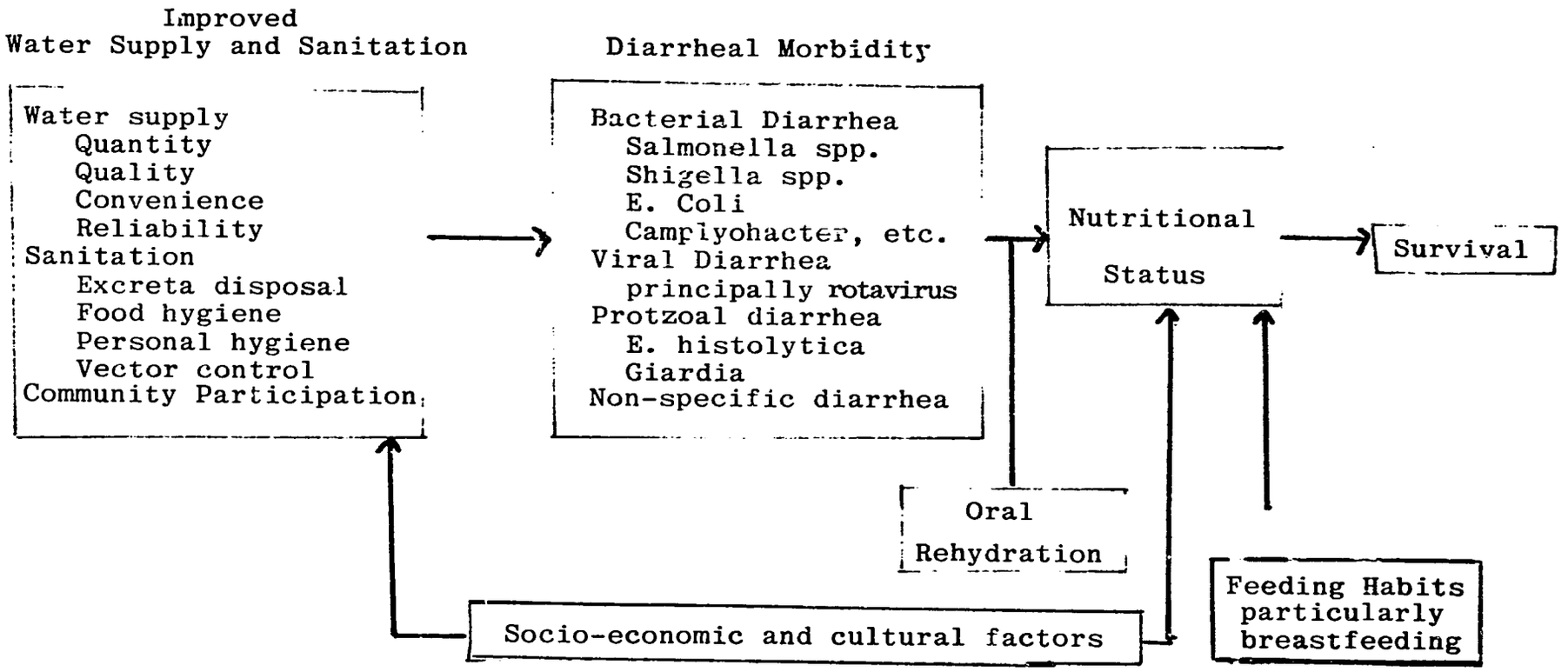
2. Mr. Steven A. Esrey of Cornell University, who is analyzing data on the effect of water supply and sanitation on infant mortality in Malaysia.

3. Mr. James Hebert of Harvard University, who has a data set from India in which differences in water quality are correlated with anthropometric measures.

4. Mr. Paul Howard of the WASH Project, who was part of a WASH team sent to the Dominican Republic to design the evaluation of a rural health project in which water supply and sanitation improvements play a large part. Anthropometry figures strongly in the design as an outcome measure.

The diagram on the following page attempts to illustrate the relationships the group discussed.

The central group of relationships exists among improvements in water supply and sanitation of various types, diarrheal morbidity of various etiologies, and nutritional status. The strength and nature of these relationships are viewed as conditioned or moderated by a multiplicity of socio-economic and cultural factors, especially feeding habits. Oral rehydration therapy may have a positive influence on the nutritional outcomes of diarrhea (Hirschhorn, 1975), but these findings have not been obtained elsewhere (Rowland, 1980). Survival of infants and children is, of course, an ultimate outcome.



Relationships among improved water supply and sanitation, diarrheal morbidity, and nutritional status.

In general the strength of the relationship of water supply and sanitation to diarrheal morbidity depends upon the comprehensiveness of the WS&S inputs, but particularly the attention paid to increasing water quantity (Hughes, 1981). In addition certain diarrheas are more responsive to certain types of inputs, as for example the impact of handwashing with soap on Shigella transmission (Kahn, 1980).

Likewise diarrheas of different etiology vary in their impacts upon nutritional status, depending on the amount of nutrient lost in the gut, the amount of pyrexia, the duration of anorexia, and the degree and duration of associated malabsorption (M.U. Khan, 1979).

Chapter 2

SUMMARIES OF PRESENTATIONS

2.1 Steven Esrey

Studies inspecting the association of water supply and sanitation facilities with morbidity and mortality fail to show the expected benefits from these environmental improvements. A study in Guatemala (Scrimshaw, 1968) failed to demonstrate a decline in postneonatal mortality in villages after the introduction of comprehensive medical services which included the promotion of environmental sanitation. The design, however, was inadequate to randomize the effect of two epidemic outbreaks of Shigellosis during the five year study period.

A second study in Costa Rica (Moore, 1965) failed to show any consistant relationship between the type of water supply, sanitation facility, or water quality to diarrheal morbidity in six districts of one canton. Again, a poor design may have led to spurious results. Factors influencing the onset of diarrhea may be unrelated to water and sanitation facilities.

A review of 43 studies conducted in five continents found in general that studies which focused on water availability, and excreta disposal resulted in reduced morbidity, but the reduction was more statistically significant in projects that emphasized increased quantities of water than in those emphasizing improved quality (Hughes, 1980). The studies were of multiple design, and procedures differed. Perhaps more importantly educational background, socio-economic status, breastfeeding practices, nutritional status, and access to medical care were often not considered.

The failure to show the expected results from water supply and sanitation improvements may result from poor implementation of programs, poor measurement, or be due to confounding factors. It is not always easy to measure morbidity and death, and the quantification of water supply and sanitation systems and their use may also be difficult. A confounding factor is one which would foster infant survival independent of water supply or sanitation. The existence of interactional factors may partly explain why expected results are not attained.

2.1.1 Types of interacting variables

Two types of interacting variables need to be addressed. In the first type the independent factor may produce a similar beneficial result in the presence of either safe water and

adequate sanitation or in their absence, but the factor is only found among those without facilities so the interaction cancels out the detrimental effect of poor water and sanitation. For instance, preliminary results of the Rand analysis of the Malaysian Family Life Survey (MFLS) found that breastfeeding was associated with lower infant mortality (Butz, 1981). Since it was found that women who breastfed tended to have unsafe water and inadequate sanitation while those women with safe water and adequate sanitation tended not to breastfeed, the effect of water and sanitation was masked.

In the second type of interaction, one observes a synergism of two independent variables, i.e. breastfeeding and improved sanitation, such that the improvement in infant mortality is greater when both variables occur than would be expected from adding the independent effects of each. The beneficial effect of breastfeeding on infant survival is much greater among families with poor water and sanitation than among families that have good facilities. The Rand analysis found no great benefit due to the main effects of adequate excreta disposal (defined as having toilets), yet when the interaction with breastfeeding was quantified a significant benefit from these sanitary installations resulted among infants who were not breastfed. This is possible because both breastfeeding and good sanitation may prevent oral ingestion of pathogens.

While the Rand analyses of the MFLS automatically identified the gross interaction of the first kind, the second type of interaction must be specifically analyzed for biological and behavioral insights as it was for its interacting effects in reference to breastfeeding.

2.1.2 Objectives

Cornell intends to follow up the insights gained from the Rand analysis of the MFLS by ascertaining the effect of differing levels of water and sanitation facilities when feeding and hygiene habits are also different. A stronger beneficial effect of improved water and sanitation would be expected when people do not have good feeding and hygiene habits compared with people whose habits are good. Based on the results of this investigation a method will be developed for targeting areas where improved water supply and sanitation would reduce infant mortality in Malaysia. This targeting may be useful in other countries as well.

2.1.3 Specific aims

The protective effects which come into play when water supply and sanitation are poor will be ascertained. This procedure is equivalent to searching for factors which make a lack of good water and sanitation detrimental to infant survival.

1. A detailed review of the literature will be provided looking at the association between water supply and sanitation on diarrhea, nutritional status, and mortality.

2. The effect of water supply, sanitation, and their interaction will be examined when feeding habits are poor.

3. The effect of water supply, sanitation, and their interaction will be examined when factors affecting hygiene habits are poor.

4. It will be determine if there is a point when improvements in feeding practices and factors affecting hygiene habits are such that improvements in water supply and sanitation have no benefit.

5. In households with access to only poor water and/or sanitation but with relatively low infant mortality rates, efforts will be made to determine the factors which protect infants.

6. How these protective factors vary over the first year of life will be examined.

7. It will also be determined if any of these factors improve survival rates even more when water supply and sanitation improvements are implemented.

The investigation begun in the MFLS will continue to examine the protective effects at differing levels of water supply and sanitation. These relationships will be determined both in terms of relative risk in order to extrapolate these findings into other situations where disease may be more or less than in Malaysia and in terms of attributable risk which is useful for cost/effectiveness analysis.

2.1.4 Methods

The literature review will be done according to an algorithm developed by Habicht. This will identify, in a systematic fashion, biases which make data uninterpretable or affect inferences, in order to control for these biases the extent possible.

The data set provides retrospective data documenting biological and socio-economic correlates of infant mortality in peninsular Malaysia. In August 1976 the first of three rounds of interviews were begun with the other two rounds spaced four months apart. The sample contained 52 primary sampling units, 49 of which were random. Private households that contained at least one ever-married-woman (EMW) less than 50 years of age were interviewed. In round one 1,262 households were visited and there were 5,573 live singleton births. Of these births 270 died in infancy. The variables to be used in this study were collected in MFLS. These variables should allow us to examine these interactive confounding effects.

The sources of water supply documented in the MFLS are river, canal, well, other public, and piped water inside or outside the household. It was found that infants born to households using piped water compared to infants in houses using other water sources generally enjoyed a significantly lower mortality. Forty-four percent of the sample births occured in households with piped water. The search will begin by dividing the sample between those households with piped water from those with and non-piped water.

Household toilet systems in the MFLS are either flush or nonflush and either exclusive to the household or not. Households without toilets use either pits, bushes, or rivers for excreta disposal. Toilets of any type were determined to be more beneficial than any other type of disposal system. Seventy-nine percent of sample births occurred in households with toilet sanitation. The distinction will be maintained between toilet and non-toilet as the type of household sanitation system.

The information which the MFLS has related to food habits are the length of breastfeeding, full or supplemented, and data on the first food introduced to infants other than breastmilk. The first foods introduced were infant formula, condensed or evaporated milk, fresh milk (primarily cow's or goat's milk), or non-milk foods. We will determine if the time of introduction of each type of food plays a role in mortality risk in the presence or absence of piped water or toilets.

Data which the MFLS has related to hygiene habits are educational level, income, and housing density. For education the number of years of schooling were reported for each ever-married-woman. If they obtained school certificates or diplomas this was also recorded as was the ability to read or write. The Rand analysis determined that a mother's educational level was significant for infants in the latter half of the first year of life. It will be determined if the educational level has an even stronger effect in the absence of piped water or toilets.

The data on income included cash earnings, hours worked, and the husbands extraordinary income. Extraordinary income was determined from property owned, gifts, inheritances, and dowries received. Although the Rand analysis found that the overall effects due to income were not significant in lowering mortality in the first year of life, there might be significant improvements in infant mortality related to income among those households with poor water and sanitation even though there is no income effect among households with good water and sanitation.

Data relating the number of people per room was also documented and was found only to be significantly related to infant mortality in the last three weeks of the first month of life. It might be expected that poor water and sanitation become more pernicious as household density increases, particularly in the latter half of the first year of life.

Statistical multivariate analysis will be used with the appropriate interaction terms to investigate synergistic and antagonistic confounding. These techniques will utilize ordinary least squares regression analysis on appropriately transformed mortality rates which is related to attributable risk, and logic analysis which is related to relative risk. Chi-square techniques will also be utilized when appropriate.

Sophisticated and expensive techniques, such as hazard functions (a multivariate life table analysis technique), will be attempted only when they are likely to deliver parsimonious descriptions of the data which will be easier to understand by the reader.

It was suggested by Hope Sukin that Mr. Esrey get in contact with Ms. Tina Sanghvi in the Office of Nutrition who is in charge of studies of breastfeeding and other aspects of infant feeding.

2.2 James Hebert

This project lasting two years was carried out in a low income urban area of Madras. The hypothesis tested in the first year; i.e. in the "point prevalence" study period, was that children with access to bacteriologically contaminated water would be nutritionally inferior to children who were otherwise similar but had access to water of good quality.

At the outset of the project it was recognized that difficulties which other researchers had encountered in studying the sanitation-nutrition-health complex concerned:

1. The collinearity of the various determinants of health/nutritional status within human populations and

2. The decision not to use precise, accurate measurements of health status which aren't subject to reporting bias.

Because of the prominence of nutrition and sanitation as factors in the manifestation of disease, especially the diseases of childhood, any attempt at assessing relative contributions of the determinants of disease must concern both of these phenomena. While econimic condition is not the ultimate determinant of health status it does, for example, bear on factors, such as parity of women, which in turn may affect intrafamilial allocation of food resources and therefore could have a rather direct effect on the health status of a given child.

Ideally, a well chosen experimental context would minimize the variability in the proxy index, for example economic. Status, while enabling a detailed analysis of the real, underlying determinants of human health. In effect the choice of experimental site could prevent a considerable amount of confounding since confounding is basically a problem of misrepresenting "nature" in the data. By using an experimental situation which more closely approximates the laboratory paradigm it would be more likely to pick out potential confounders before they become confounding. Once a variable is known to both be associated with the risk factor and influence the outcome, it can be controlled. Once controlled it can no longer be confounding. Effect modification, or interaction between determinants would also be more easily described in the situation where there is less variability across the values of the parameters of interest.

Because of the fact that differences in water quantity and quality are rarely isolated factors it was deemed obligatory that the problems of multiple interactions be minimized by the prudent choice of the study area. India was chosen because it is markedly different from the rest of the developing world. The caste system has rather rigidly defined patterns of employment, social interaction, and food and water use. The south, where Madras is located, is the most traditional regarding caste area of India.

The communities within Madras were selected on the basis of their homogeneity for socioeconomic factors. It was ascertained that over 95% of the persons in the communities are from a particular jati (subcaste). Most of the heads of households are engaged in the jati's traditional occupation, fishing.

Households were chosen as the unit of measurement in order to eliminate the possibility of self-selection bias. This decision was made in the same spirit as that concerning the selection of India in general and the communities in particular; i.e. to minimize the problems with estimating effect modification and to avoid the problem of confounding.

Since all households in two of the three communities were living in tenement blocks, the block numbers were selected randomly and all households with children under six years of age were included in the study. All of the households in the third community who had children under six were included in the study. Sixty-six independent variables, including those related to water supply, were measured (see table).

Water samples were taken at the tap. Slides of the taps revealed that taps are generally recessed in concrete access pits of varying depths. It appears that bacteriologically purer water was found nearer the central water main and the further the piped water had to travel through the communities the more contaminated it would become. This allegedly happens due to gross on-site contamination with fecal material in combination with the low-pressure characteristics of this water system.

Analysis of data from the point prevalence or first year study has been completed. Because it was suspected that inter-community differences could confound the analysis of the data it was decided to partition the data into three parts according to community. Using four anthropometric indices, percent standards weight-for-age, height-for-age, arm-circumference-for-age and weight-for-height, for each of the communities produced a 12-cell grid. Cell values of proportion severely malnourished were compared for the "good" and "poor" water quality groups. Multivariate analysis was used to isolate variables having strong relationships, either single or interactive, to the anthropometric outcomes. There were two comparisons significant at the 0.05 level and one significant at the 0.10 level, about three times the number one would expect by chance alone.

It was decided to continue the study for an additional year beyond the original point prevalence period. This decision was made for the following reasons:

1. The success with which the communities met the original criterion of matching, by jati, for multiple determinants of health/nutritional status;

2. The encouraging results that anthropometric measurements evinced, with regard to accuracy and precision, in verification analyses;

3. The fact that seasonal differences in water quality and quantity across the population could shed light on differential effects of sanitary factors on growth performance;

4. The extra time provided additional opportunities to collaborate with Indian colleagues on projects of mutual interest such as a parasite study.

VARIABLE LIST

MADRAS STUDY (J. HEBERT)

Variable	Enumeration
1. Family Income	Q-25-8
2. Family Size	Q-25
3. Birth Order of Members	Q-25-4
4. Popualtion Density a)household	Q-21 or var45/var2
b)community	var46/var47
5. Family Structure	Q 25-2, 34
6. Other (than water supply) environmental improvements	MMWSSB & ES
7. Sex	Q 25-3
8. Food Availability	Q 28
9. Food Storage	Q 7
10. Type of Priciple Food	Q 28-1
11. History of Breast Feeding	Q 25-4
12. Breast Feeding of Cases	Q 27a,c
13. Incidence of Diarrheal Disease	Q 25-9 NRWTD
14. Incidence of Other Acute Disease	Q 25-9 NRWTD
15. Incidence of Chronic Disease	Q 25-9 NRWTD
16. Public Works Program	Q 16
17. Sewage Disposal System	Q 9,16
18. Water Supply System	ES, SCBS & MMWSSB
19. Water Quality at Point of Service	LD
20. Water Quality at Point of Use	LD
21. Water Storage Facility Type	Q 4,26f
22. Water Storage Facility Volume	Q 26b
23. Separate Water Supplies for Cooking, Drinking, Washing	Q 6
24. Village Size	ES & SCBS
25. Village Age and Sex Structure	Q 25 & SCBS
26. Home Sanitation	Q 13,20
27. Eating, Cooking Utensils	Q 8
28. Fuel for Cooking	Q 12

29.	Education	Q 25-5
30.	Precipitation	
31.	Duration at Present Residence	Q 22
32.	Occupation	Q 25-6
33.	Duration of Water Supply	Q 26d
34.	Health Care	NRWT-CD
35.	Distance from Water Source to Point of Use	Q5, 26c
36.	Type of Housing	Q 1,2,3
37.	In House Power (electricity)	Q 6
38.	Disposal of Human Wastes	MMWSSB, ES & Q 9
39.	Transportation	Q 10
40.	Cooking Facilities	Q 11
41.	Dishwashing	Q 14
42.	Clotheswashing	Q 17
43	Bathing	Q 15
44.	Sleeping Arrangements	Q 19
45.	Size of Dwelling	Q 21
46.	Size of Community (area)	SCBS,ES
47.	Size of Community (population)	SCBS
48.	Withholding of Food to Child	Q 27
49.	Domestic Animals, Type	Q 24-1
50.	Domestic Animals, Number	Q 24-2
51.	Domestic Animals, Where Kept	Q 24-3
52.	Relation of Case to Head of Household	Q 27-7
53.	Upper Arm Circumference of Cases	Q 27a
54.	Weight of Case	Q 27b
55.	Height of Case	Q 27c
56.	Ages	Q 25-2
57.	Caste, Subcaste	Q 23
58.	Washability of Wall, Floor Surfaces	Q 1,2
59.	Protection from Rain, Flooding	Q 3
60.	Complaints of Food Shortages	Q 28-2
61.	Amount of Food in Storage	Q 28-3
62.	Money Spent on Food	Q 28-4
63.	Boil, Filter Water	Q 26e
64.	Case Presently Under Medication	Q 27-6

65. Change in Water Use Patterns	Q 29
66. Intestinal Parasites	LD

Enumeration Code:

Q	Questionnaire- followed by number of question
var	variable obtained from the other sources
MMWSSB	Madras Water Supply and Sewage Board
ES	Environemtal Survey
NRWT(D)	New Residents Welfare Trust (Data)
SCBS	Slum Clearance Board Survey
LD	Laboratory Determination
CD	Clinic Data

Data from the longitudinal study await analyses. Analyses will include various regression techniques which should throw considerable light on effect modification (interaction) in the anticipated absence of confounding.

2.3 Dr. Cvjetanovic

Reporting on the study carried out in St. Lucia, Dr. Cvjetanovic informed the group that Dr. Fitzroy Henry had compared progressive anthropometric measures among populations with differing levels of water supply and sanitation services. One community received only community standpipes (Cul-de-Sac), another household taps only (Desruisseau), and a third household taps plus water seal latrines (Ti-Rocher).

Before sanitary installations, the growth curves of infants and children in all three areas had been similar. After the installations, infants and children in Desruisseau and Ti Rocher had improved growth rates (see attached figures 1-3) whereas Cul-de-Sac rates remained the same.

This was a relatively small study but well done by a man who is a really competent epidemiologist and who would like to look more deeply into the nutritional component to tease out the relationships among feeding habits, water and latrines, and growth rates. Dr. Henry knew all the children personally in this study and was therefore able to add qualitative descriptive data to the numbers.

On the study in Uttar Pradesh Dr. Cvjetanovic was not able to report very much. He will be there in January for a progress review. At that time the project will have continued for two years. The present protocol is a modification of one distributed to participants in this meeting, but the basic design wherein four groups of villages with different types of water supply and sanitation combinations are compared, remains. Anthropometry is an important outcome variable.

In Bangladesh, a similar study is being carried out at Teknaf, but the cells are much smaller and the number of variables limited. Basically three cells with handpumps, handpumps and water-seal latrines, and no intervention are being compared. Anthropometry figures heavily in the comparisons. In Dr. Cvjetanovic's view the problem with this study is the possibility of multiple Hawthorne effects in an oft-studied area.

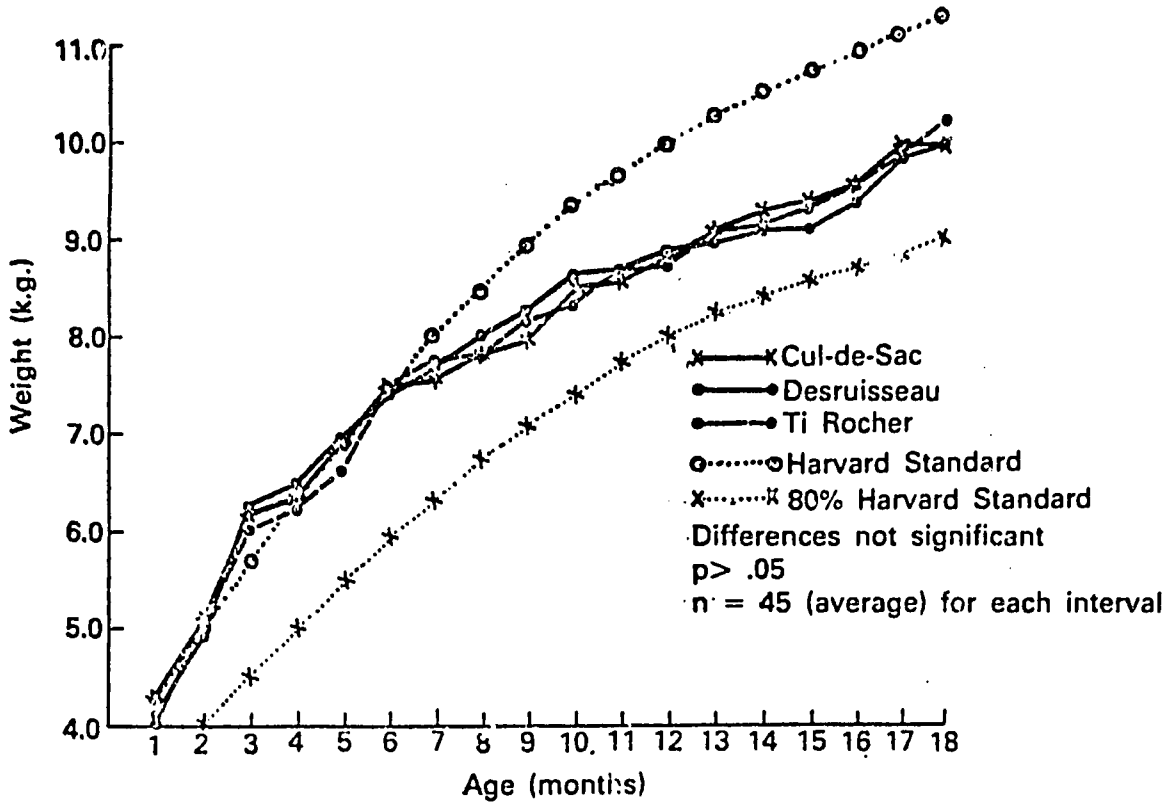


Fig. 1 Infant growth in the study areas before sanitary installations - 1974 and 1975 surveys.

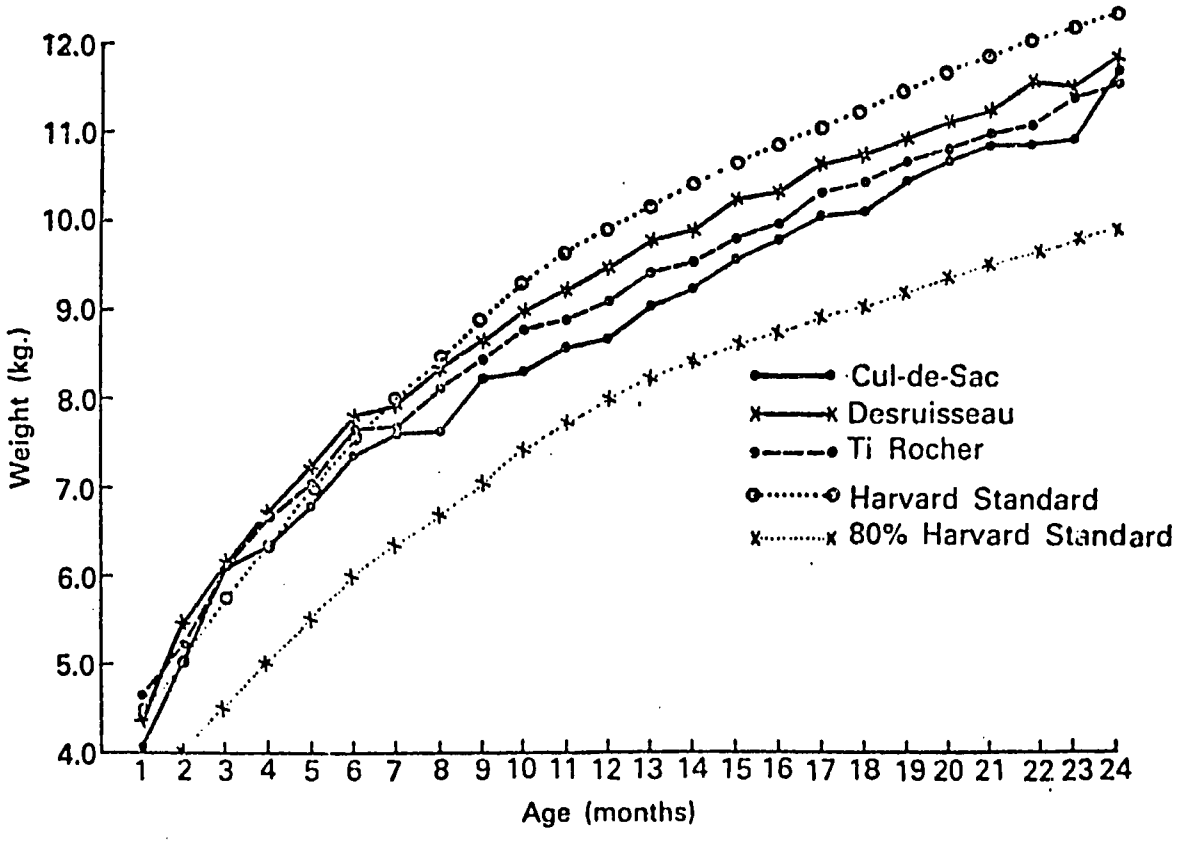


Fig. 2 Comparison of growth (weight) in the three areas

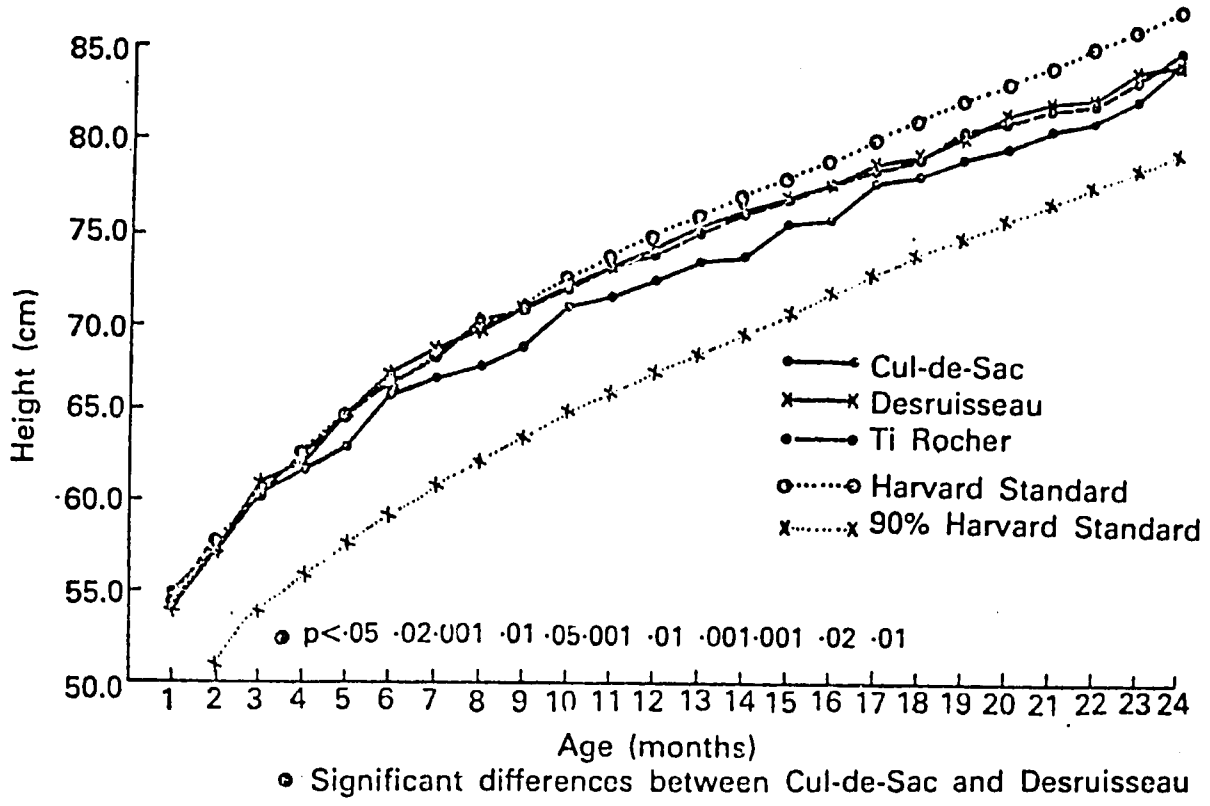


Fig. 3 Comparison of growth (height) in the three areas

2.4 Paul Howard and Robert Struba

Two specific, concrete measurements will be made to establish the date set to be used in the evaluation of the outcome of the Health Sector Loan II project in rural communities of the Dominican Republic. The project includes installation of water supply (public handpumps and public fountains) and sanitation (latrines) and implementation of a health education program. The two measurements are mortality and anthropometry in infants and pre-school children.

Although the rationale for using childhood anthropometry as an Health Status Indicator was discussed in the evaluation study design report (Howard, Struba, 1981), it is useful to summarize the main reasons for selection of this approach. Anthropometry was recommended for practical and methodological reasons. Practically speaking, anthropometry is relatively easy for village level promotors to perform and record. A number of these health workers have already been taught how to take anthropometric measurements on children. Therefore, as long as the interval between measurements is not too short (2-4 months), reasonable compliance can be expected on the part of the promotors. It must be emphasized, however, that as with all health status indicators, previous performance by the promotors does not obviate the need for project monitoring (validity checks) to insure compliance and validity.

There are also methodological reasons for choosing anthropometry. Anthropometric measurements are typically quite valid, as they are objectively determined by using simple instruments (scales, charts, tapes). Statistically speaking, they are useful since they are continuous variables and are collected over time to show increments of change; both of these characteristics are desirable. Finally, some evidence exists to show the potential usefulness of anthropometry as an indicator of chronic wasting and therefore of diarrheal morbidity (Struba, 1981). The authors recognize (and state in their report) that this relationship is not necessarily a direct one. Indeed, intervening and/or interacting variables (such as food consumption practices, personal hygiene, and socio-economic status) could alter this association. The authors have attempted to reduce such effects in the design aspect of the study (control groups, randomization of "treatments"). The authors also mention the importance of control for such variables in the analysis stage of the study, if such additional data are forthcoming. Since the 1981 census data have already been collected in the Dominican Republic (it might be noted, by the health promotors), socioeconomic status indicators (at least for villages as units) could be constructed and used in the analysis of data on health status indicator.

The use of anthropometry as an indicator of diarrheal morbidity and consequent wastage therefore represents a classical trade-off between validity and practicality. It can be argued that only (validly gathered) direct measures of diarrheal morbidity are useful in such evaluation/research projects. The authors agree with this thinking, but maintain that the usefulness of any health status indicator is not absolute, but depends on the context of the study in question. For the Health Sector Loan II health impact evaluation study design, a number of factors could compromise the utility of direct measurements of diarrheal morbidity or of intermediate variables (such as personal hygiene or food consumption). These factors include high cost, overburdening of the promotors, and possible validity problems (e.g., if diarrheal morbidity is recorded subjectively and in a controlled non-clinical setting).

One further related point concerning the interpretation of these results is in order. As stated in the original project evaluation report, the authors do not recommend the isolated interpretation of any differences in levels of health status indicator. Interpretations should be made after considering the results of the project as a whole, with special emphasis on trends in the data, even in the (occasional) absence of statistical significance for differences in any given health status indicator. Such a viewpoint should guard against overzealous (or overcautious) interpretation of the possible effect of the interventions on various health status indicators used in the project.

Chapter 3

DISCUSSION

The discussion focused on six major issues. The discussion falling under each one is summarized below:

3.1 Accounting for cultural variations

Dr. Cvjetanovic emphasized the importance of knowing the living styles of populations studied. It is not enough to have quantitative data on the numbers of persons/households with certain characteristics. These skeletal estimates of variables must be fleshed out with qualitative descriptions of the lifestyles and day to day habits of the people studied. In this way statistical estimates can be at least partially validated.

Dr. Henry's study in St. Lucia illustrates this particular strength. He knew each child and each household environment. In Mr. Hebert's study the identification of subcaste proved to be extremely important since, through knowing subcaste, one could predict certain behavior conditioned by thousands of years of tradition.

In addition, food storage and preparation habits may strongly determine diarrheal transmission.

3.2 Accounting for food habits, including breastfeeding

Mr. Hebert would like to have measured food intake and food habits if it had been possible but assumed they remained unchanged. It was in general agreed that unless one can be sure there have not been changes in feeding habits, particularly breastfeeding during the period of a study, then anthropometric measures may be open to question. One is left however with the extreme difficulty of collecting diatery data. Food frequency questionnaires offer some potential, but remain open to question as to their precision. In the St. Lucia study in fact, where it is known that breastfeeding generally stops after the third month, some question can be raised as to whether the differences in growth rates would have been observed had breastfeeding continued through the 24-36 month period. As it is, however, water supply makes a difference.

3.3 Other interactions

Stress was laid upon the existence of statistical interactions among variables at almost every point. Mr. Esrey's study in fact has been conceived on the basis of an observed interaction between breastfeeding and household sanitary facilities. In this particular data set, households characterized by both breastfeeding and indoor sanitation had an infant mortality rate significantly lower than those with only one characteristic.

Maternal education is a frequently important interacting variable. In Mr. Hebert's data, however, maternal defecation habits as a supposed proxy for "maternal caring" appeared stronger.

3.4 Data collection

Discussion focused on who should collect anthropometric and other data. In the Dominican Republic data are being collected by promotors already trained for such functions as a part of their health promotional activities. The question was raised as to how much data collection effort can be expected of primary health personnel. In many instances there is stiff resistance to introducing this function into their repertoire. Mr. Howard assured the group that these promotors at least, who had been selected by their communities, had accepted without question their data collection duties. So well do they perform these functions in fact, that they have been selected as agents of the national census.

In the Teknaf study in Bangladesh, female workers have been used to collect data on diarrheal morbidity from mothers. Using pictorial representations of different types of stools, these workers try to obtain information on the diarrheal patterns of infants and children. This method may lead to a breakthrough in diarrheal surveys. In addition it provides a means of educating mothers as to the meaning of certain stool patterns.

3.5 Survival

Lastly, the participants discussed the implications for survival of improved growth secondary to improved water supply and sanitation. The only studies relating anthropometry to mortality have been carried out in the Northern part of South Asia, one of them in Bangladesh during the war of 1973. In such circumstances firm conclusions are difficult to draw. The point to make perhaps is that studies such as those currently underway in St. Lucia, Uttar Pradesh, Bangladesh, and even the Dominican Republic, need to be

extended in order to assess the differential survival rates of children reaping nutritional status benefits from improved water supply and sanitation and those who do not. The St. Lucia growth curves show a convergence of the groups beyond 24-36 months. The casual observer is prone to say that it probably did not make any difference to improve water supply and sanitation after all, since the growth even of those not benefiting from improvements caught up with the others after two years of age. A more profound consideration of the situation would probably reveal, however, that only the survivors caught up, whereas those who did not survive did not show up in the curves at all.

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

This meeting literally only scratched the surface of the information available, but provided nonetheless a helpful introduction to the study of these relationships. Time did not even permit a consideration of the implications of what is known for related planning, action and evaluation as well as research. Clearly, however, communication channels were opened among health, water and sanitation, and nutrition personnel that should be expanded to collaboration in planning and evaluating projects. As a beginning, nutrition consultants should be asked to assist in the evaluation of water and sanitation programs and vice versa.

As initial concrete undertakings the following are recommended:

1. Distribution of this report to a wide audience.

2. Development and distribution of a periodic (quarterly?) newsletter to update information on the projects discussed in the meeting and any new projects of this nature that come to the attention of participants (see suggested cover page attached as Appendix B).

3. Future meetings - for example a workshop on evaluation design using anthropometry to measure benefits of water supply and sanitation improvements.

APPENDIX A

PARTICIPANTS

Name	Title
Raymond B. Isely, Coordinator	Associate Director, Water and Sanitation for Health Project.
Abby Bloom	Bureau for Program and Policy Coordination - Agency for International Development.
Branko Cvjetanovic	Professor of Epidemiology, Institute of Immunology, University of Zagreb.
Steven Esrey	Doctoral Student, Department of Nutrition, Cornell University.
Craig Hafner	Senior Project Officer, Water and Sanitation for Health Project.
James Hebert	Doctoral Student, Department of Nutrition, Harvard University.
Paul Howard	Project Officer, Water and Sanitation for Health Project.
Howard Keller	Bureau for Asia - Agency for International Development.
Kristin Loken	Bureau for Latin American and the Caribbean - Agency for International Development.
Charles Mantione	Bureau for Latin American and the Caribbean - Agency for International Development.

F.Eugene McJunkin	Bureau for Science and Technology - Office of Health - Agency for International Development.
Fred J. Rosensweig	Senior Training Officer, Water and Sanitation for Health Project.
Barbara Spaid	Bureau for Program and Policy Coordination - Agency for International Development.
Hope Sukin	Bureau for Science and Technology - Office of Nutrition - Agency for International Development.
Charles Teller	Office of International Health Department of Health and Human Services.
Dennis B. Warner	Director, Water and Sanitation for Health Project.

APPENDIX B

Draft Cover

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APPENDIX C

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