WATER AND SANITATION FOR HEALTH PROJECT

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WATER AND SANITATION-RELATED HEALTH CONSTRAINTS ON WOMEN'S CONTRIBUTIONS TO THE ECONOMIC DEVELOPMENT OF COMMUNITIES

WASH TECHNICAL REPORT NO. 17

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1. INTRODUCTION

If women are to achieve their potential as contributors to the economic development of their communities, regions, and nations, they must be freed somehow from the burden of disease and disability that impinges on their ability to contribute. An analysis of these health constraints reveals that many are related to their roles as women, not the least of which is the role of water fetching and transporting. Some of the problems associated with obtaining water such as long distances and hilly terrain or water of poor quality result in still other problems of personal hygiene and the spread of diarrheal disease. Improvements in water supply and sanitation not only make personal hygiene more feasible but lighten the burden of women and children, freeing up additional calories and time for other productive tasks, and resulting in higher levels of energy and activity for pregnancy, lactation, and child care. Likewise these improvements may lessen the exposure to infections associated with the locality where water is drawn.

In speculating about how these needed improvements in water supply and sanitation and the associated health benefits could be realized, one is immediately confronted with the issue of women's roles in traditional societies. Water and sanitation-related roles are but a subset of these larger considerations and the health constraints arising from the latter but a function.

The paper thus looks first briefly at women's overall roles, then at their water supply and sanitation roles, then at the health consequences of these roles, and finally at the process of bringing about improvements.

2. ROLES OF WOMEN

Women form a large part of the work force in most countries and constitute a substantial economic resource. The labor contributions of women to the economy of their countries go unreported in many national statistics, whether those contributions are in the form of supports for wage earners and learners in families or as the cultivator of foodstuffs and other agricultural products for home consumption or sale. Despite the participation of women, their status is often disadvantaged. Although status varies from country to country depending on the cultural framework or the level of development, basic similarities do exist.

A fundamental concept in social science is that of sex role: expected attitudes and behaviors connected with sex-determined status positions (Linton, 1936). This differentiation of roles is universal but locally highly variable (Mead, 1949). Females

in all communities have specific but different rights, duties and expected norms of behavior, and populations have beliefs about what women as mothers, wives, and daughters ought to do (Elmendorf, 1982).

2.1 Public and Private Roles

Oppong (1981) has designed a framework in which women have seven discrete roles. A woman as individual, mother, wife, and kinswoman on the one hand and as worker, producer (of income, goods, and services), and community member on the other, moves into and out of the private and public spheres, but finds all these roles, even the latter three, usually concentrated in the private domain. In domestic roles women are more involved than men in the "grubby and dangerous stuff of social existence: giving birth and mourning death, feeding, cooking, disposing of feces and the like" (Rosaldo and Lamphere, 1974).

2.2 Women and Water

In traditional societies, women are the primary drawers, carriers and users of domestic water supply (Obeng, 1980). In most cases in fact, women's emotions, energy, and attention are focused on meeting these and other basic needs. Children share in these responsibilities. Women and children are caught, as it were, in a complex web of responsibilities that saps their physical and emotional energy, with implications for their health and social well-being (Russel, 1979). And water supply is one of the most demanding of these needs. It has been said that "man is a slave to water" because all civilizations depend on it for survival, but it is really women who have literally become slaves to water. It is "on her back or head that water reigns supreme" particularly in the rural areas of the developing countries (UNICEF-UNDP, 1982).

2.3 Why is Water so Important?

First we must remember that water is a nutrient--the most basic of all, without which death results in a few days. Adequate water to support basic biological processes is essential to survival. Without food humans can live for several weeks, but death comes in days without water.

Secondly as a number of researchers have reminded us 'the malnutrition problem' is not due solely to an insufficient food availability. McJunkin (1982) notes that studies indicate that improved water supply is related to measurable improvements in nutritional status, especially growth of children, and suggests that the "water supply-nutrition linkage" needs more attention. The heavy burden of infections and infestations, especially

among children retards growth, physical and mental development, and may, under some circumstances precipitate or exacerbate frank clinical malnutrition (Scrimshaw, 1970; Chen, 1980; McJunkin, 1982).

2.4 Women's Roles and Water

The roles women play in relation to domestic water and household sanitation draw on all seven of Oppong's role classifications (ibid.). In fact four functions of women world-wide demonstrate that any planned change in water availability or excreta disposal should be based on information about their present knowledge, attitudes, practices, perceptions and beliefs regarding water preferences, hygienic practices, and defecation behavior.

These four functions are:

- Women as acceptors of new technologies
- Women as users of existing or improved facilities
- Women as managers of water supply and sanitation programs
- Women as agents of behavioral change in the use of facilities.

2.4.1 Women as Acceptors of Improved Water and Sanitation Technologies

It is primarily women that use any water system whether new or traditional. Their domestic managerial role means that in food preparation, washing, and bathing, women are the primary users and the mediators between the water source and household demand. The choice of water for drinking, cooking, laundry, bathing, and other household functions is a result of women's careful decisions, based on what they have learned from their mothers and grandmothers, and on their observations of the costs and benefits, both social and economic, of any change of system, and are often based on sensory or macroscopic perceptions--color, taste or smell--rather than microscopic qualities of technical purity.

2.4.2 Women as Users of Improved Water and Sanitation Technologies

A central question confronting each new water and sanitation project at the threshold of its execution is whether or not those for whom they are intended will use the new facilities once installed. Even the most sophisticated sanitation technology will not bring health improvements unless it is properly used and combined with good personal hygiene habits (Feachem et

al, 1978). Women as the primary users of water the world over and as frequently the first to use sanitary installations often are not singled out for the intensive user education so necessary for project success.

2.4.3 Women as Managers of Water and Sanitation Facilities

Women are usually the managers of household water supplies. Whether it is recognized or not, they also have a strong potential role as managers of community water supplies. Women are bound more tightly to the household than their male counterparts, who must often leave the home or community in search of work. Women who are usually responsible for obtaining water and seeing that it is available for daily use, also select water sources, and in some instances play key roles in seeing that funds and/or labor are available to maintain them.

2.4.4 Women as Agents of Behavioral Change in Water and Sanitation

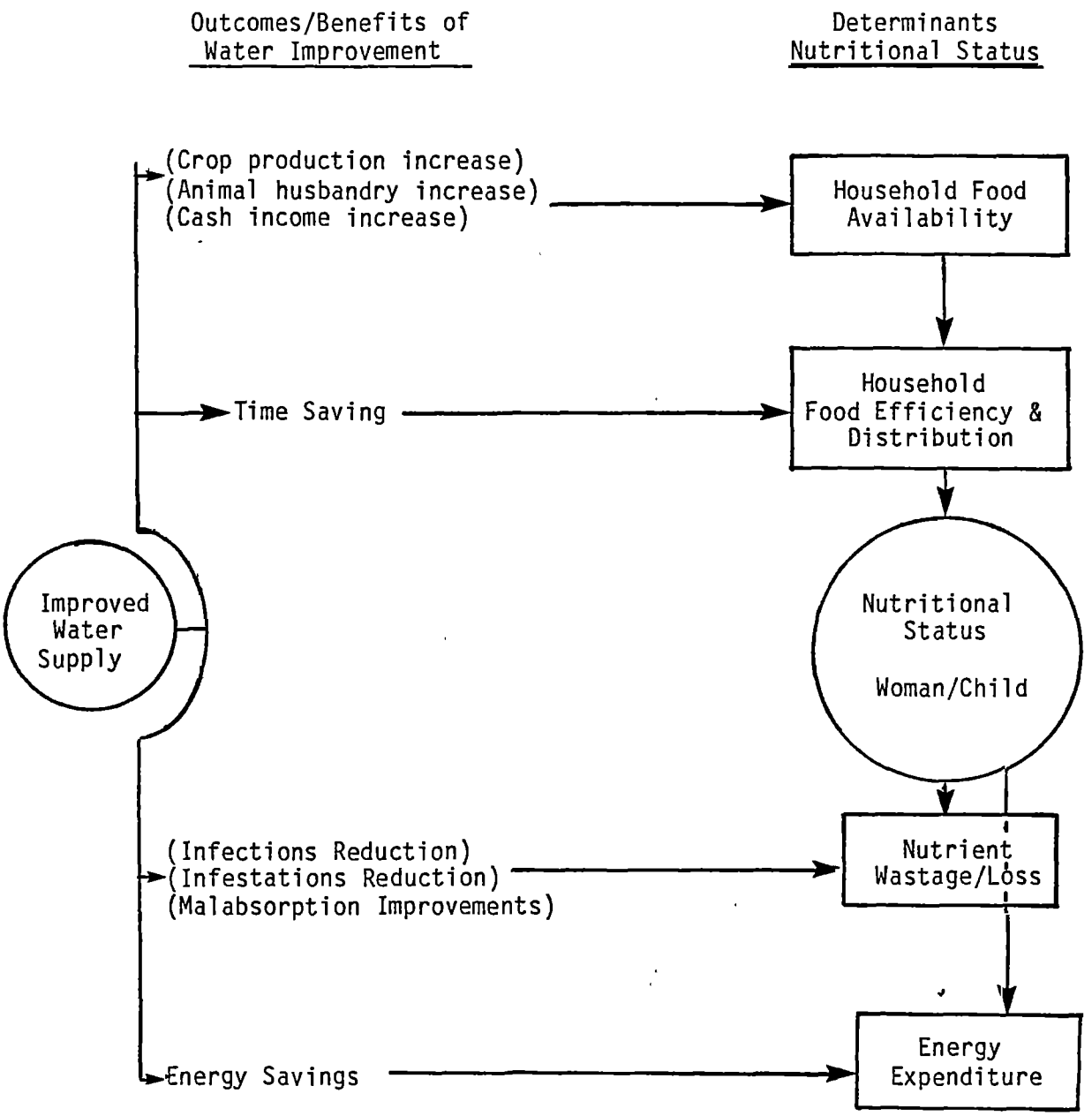
In the process of behavioral change the importance of women, both those within and outside the community, becomes even clearer when we consider that changing traditional behavior depends on an understanding of the reasons why change is beneficial. Furthermore women in their roles as mothers and homemakers must receive such information in terms which are closely related to their current beliefs and customs and the availability of water.

Although in most communities men exercise positions of authority in the public domain, women often have a great deal of power in decision-making, particularly decisions that impinge on the domestic domain (Chinas, 1973; Elmendorf and Isely, 1983; Rosaldo and Lamphere, 1974; Oppong, 1981). In fact, within their confined roles women, individually or in groups, develop strategies to reach valued goals. In order to exercise this decision-making power effectively and make considered choices about changes in traditional activities, knowledge about alternatives must be available.

3. WATER AND NUTRITIONAL STATUS

A conceptual framework developed by Lincoln Chen (1980) (Figure 1) demonstrates the multiple routes through which water supply and sanitation improvements can influence the health of women and children. In the first place the amount of energy available to any individual is basically determined by the balance of energy intake and energy output or loss. Household food availability, including water and mothers' milk, reflects the ability of the family economically and physically to provide adequate quantity and quality of food for individual members.

Figure 1



Taken from Chen, L. (1980)

Household food efficiency and distribution depend primarily on the ability of the household managers, usually women, to optimize available inter- and intra-family food distribution and determine how much food each individual receives. Food including water is required for basic metabolic functions. Other energy expenditures are for work, leisure and other personal activities. Additional energy is lost because of nutrient wastage due to infections and infestations. Unnecessary wastage of nutrients is caused by the malabsorption of ingested nutrients and catabolic losses through fever and tissue destruction. As shown in Figure 1, the first two mechanisms--domestic food availability and household food efficiency and distribution--are seen primarily as regulators of the inflow of nutrients. Therefore interventions that increase either of these could be expected to result in improved nutritional status and increased energy. On the other hand, actions that reduce the energy expenditure for performing the same task, such as water carrying, or limit the energy losses through infections or infestations would be expected to diminish nutritional status and available energy.

The magnitude of the nutritional effects will vary widely depending on many variables including the sociocultural characteristics of the community, geographic and climatic conditions, systems of water improvements, and parallel programs in sanitation and health education. Of significance are the mediating roles of savings in women's time and energy and increases in food production occasioned by these improvements. Although diminution in infectious disease, especially diarrhea, plays a significant role in mediating improved growth and survival of children, these intermediate changes in women's roles are gaining increased support in the literature (Isely, 1981; Vis et al, 1981; Elmendorf and Isely, 1981, 1982).

Improvement of water supplies could theoretically affect nutrition and/or energy availability through all four mechanisms. Increased household food can become available through home gardens, animal husbandry, and in cash income. With more accessible water sources, women can use their time saved for more efficient household management or storage, processing, distribution of food and more attention to child feeding. Energy expended by women and children in water drawing and carrying could be reduced by more accessible water sources, leaving added calories for growth, fetal development and lactation respectively. and last but not least the reduction of chronic and acute infections and infestations could reduce the wastage of nutrients with resulting lowered energy availability.

These nutritional effects of intestinal infections and long arduous searches for water and conversely the possibility of their mitigation through improvements in water supply and sanitation may be the key to the entire group of health constraints we are about to discuss. As we shall see, for pregnant and lactating women nutritional effects are primary.

4. HEALTH CONSTRAINTS

Given the importance of water supply and sanitation activities in the overall situation of rural women in developing countries, it is useful to analyze the health constraints impinging on their roles from the point of view of the influence of water supply and sanitation. Just as improved water supply can be shown to have a direct positive impact on nutritional status--so lack of improved water increases the health hazards to which women are exposed in their expected roles.

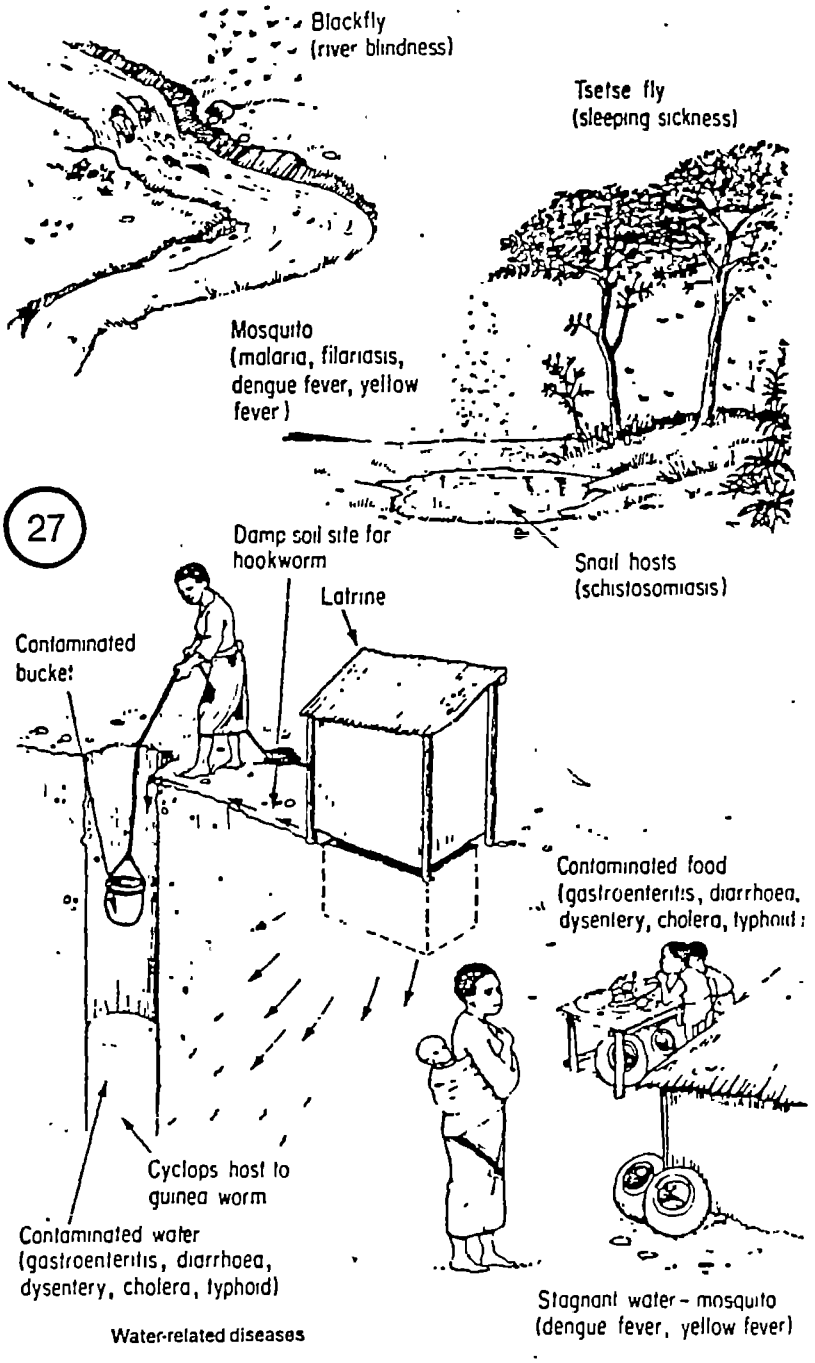
Women encounter unique health conditions in pregnancy, in lactation, and in certain selected diseases. We shall examine a few of the tasks primarily carried out by women and girls, shown graphically in Figure 2 (O'Kelly).

The classification of water-related diseases provided by Bradley (1972) helps to define further the possible health constraints on women's roles (see Figure 3). Health constraints may be derived from any of four categories of disease: among the waterborne diseases both cholera and typhoid fever are important causes of morbidity and loss of time from household and agricultural activities in certain regions of the world. Water-washed diseases are those related to lack of personal hygiene when water is scarce. Women play a key role in the transmission of these infections (Smith, 1980) and by the same token are at increased risk of disease themselves because of the great numbers of pathogens to which they are exposed (Capparelli and Mata, 1975).

Children are not only the chief sufferers from sanitation/water-related diseases, but they are also the main source of infection. Since many of these diseases affect children primarily, a large proportion of these children are excreting substantial quantities of pathogens. The importance of understanding attitudes toward children's excreta cannot be overemphasized. The widespread perception that they are "harmless" or the failure to perceive their infectious potential (Feachem et al, 1978; Elmendorf, 1980; Isely, 1981), can contribute to a continuous chain of infection and re-infection, wherein feces may be thrown on a nearby garbage heap or diapers washed with dishes in an urban home with a newly installed standpipe. And it is the women who care for the infants who become carriers of infection and whose time, emotions, and energy are expended in caring for ill and dying children.

Water-based diseases are those encountered in direct contact with contaminated water (schistosomiasis) or when swallowing water containing the intermediate hosts of parasites, as in guinea worm infection.

Figure 2



Source: O'Kelly, Elizabeth. Water and Sanitation for All. London Associated Country Women of the World, 1982.

Figure 3

Mechanisms of Water-Related Disease Transmission and Contol Strategies

Mechanisms	Illustrative Diseases	Control Strategies - Involve Women
I. Water-borne	cholera typhoid hepatitis	Improve water quality Prevent casual use of other unimproved sources
II. Water-washed	shigellosis scabies ascariasis	Improve water quantity Improve water accessibility Improve personal hygiene Provide Information and Instruction
III. Water-based	schistosomiasis guinea worm	Decrease need for water contact Control population of acquatic host Improve quality Protect access to water source
IV. Water-related	malaria onchoceriasis sleeping sickness	Improve surface water management Destroy breeding sites Decrease need to visit breeding sites Improve water storage

Adapted from Bradley (1974) and Feacham (1975).

Source: Chen, L. "Evaluating the Health Benefits of Improved Water Supply through Assessment of Nutritional Status in Developing Countries", Unpublished paper. Harvard School of Public Health, 1980.

Lastly, a fourth group of health risks to women are disease, such as malaria, trypanosomiasis, and the filariases which are transmitted by other types of intermediate hosts that must spend a part of their life cycle in or near water.

These conceptual frameworks of Chen and Bradley provide us with a helpful introduction to the health constraints impinging on women. As we have seen water supply and sanitation are central to questions of personal time and energy, food supply and transmission of infection. These considerations are particularly relevant for women in three aspects of their existence:

- in pregnancy
- in lactation
- in their multiple occupations.

4.1 Pregnancy

Maternal and fetal well-being during pregnancy are dependent upon an adequate intake of calories, at least 200 more than the normal non-pregnant intake. This amount is needed to assure fetal growth and placental function. In addition mother and fetus alike need protection from noxious influences in the environment: malaria, certain viral infections, venereal diseases, and tuberculosis.

The distance traversed by a pregnant woman in the search for water has an obvious influence on her caloric expenditure and therefore her caloric reserve for fetal growth. In mountainous terrain this expenditure may be as much as 27 percent of intake (White et al, 1972) and on the average, about 9 percent. Isely (1981) has calculated the caloric reserve remaining after all household and agricultural expenditures are accounted for: about 42 percent remain for the pregnant woman at the level of 9 percent for water carrying; at a 27 percent level, only 24 percent remains. Studies in Zaire and Gambia have demonstrated the negative influence of distance to fields (and by implication to water source) on maternal nutritional status, duration of breastfeeding, output of breastmilk, and infant mortality from gastrointestinal disease.

Vis et al (1981) demonstrated that rural women in the Kivu province of Zaire gain an average of only 2-3 kg. in pregnancy, about one-sixth of the weight gain of European women. This disparity is thought to be directly related not only to deficient food supply but also to the excess energy expended in agriculture because of the type of terrain worked. When one extrapolates to women who must expend up to 27 percent of their daily calories and up to six to eight hours of their day in the search for water, similar effects on weight gain in pregnancy are not hard to imagine.

The influence of malaria on pregnancy is well-documented (Bruce-Chwatt, 1958). Small blood clots in the placenta filled with malaria parasites may compromise the circulation to an extent sufficient to deprive the fetus of oxygen and calories, and thus limit growth or even cause death. How the environment favors malarial infection is treated below.

4.2 Breastfeeding

The caloric demands of breastfeeding (1,000 additional calories a day) are even greater than those of pregnancy. Isely (1981) calculated a woman's reserve to be only 17 percent of daily intake at a level of 9 percent expenditure for water carrying. When that level becomes 27 percent a woman could conceivably go into negative caloric balance.

The data of Vis et al (1981) on Kivu women are again demonstrative. Measuring quantities of milk produced, they calculated variations among the seasons. In June and July just after the second bean crop, mean milk production is at its peak (611 g/24h), whereas it is at its lowest point between February and June after the first bean harvest (390 g/24h). These variations are thought due to differences in food supply but also, and more importantly, to the increased caloric demand of cultivation and harvesting. Again by extrapolation long distances to traverse in fetching water coinciding with scarce food supply could also bring about the same reductions in milk production.

In an area of the Kivu with a terrain particularly difficult to cultivate women are obliged to leave their breastfed infants with their grandmothers or sisters in order to cultivate distant fields. As a result they can feed their infants at the breast only two or three times a day. During the day many of the infants are given various carbohydrate feedings, often heavily contaminated. Among these infants infections occur earlier in life and more severely, resulting in a higher mortality. Of course with the infrequent breast feedings, there is another cause for reduced milk production and an even more precarious situation for the infant.

Thompson and Rahman (1967) in the Gambia also observed the adverse consequences of long distances to fields on the growth and mortality of infants of weaning age.

For the breastfeeding woman, therefore, the health constraints related to women's roles are chiefly nutritional, and these vary with seasons, with terrain, and with the distances to fields and water supplies.

4.3 Occupational-Related Health Constraints

Examination of the health risks arising from the multiple occupations of women in the developing world reveals many that are related to water and/or sanitation, particularly in rural areas. If she goes to the river to wash clothes she may be bitten by Anopheles mosquitoes, Similium blackflies or Glossina flies and acquire respectively malaria, onchocerciasis, or trypanosomiasis. If she bathes or washes in a pond or canal she can be infected with schistosomiasis. In drinking water from ponds while cultivating the fields she may acquire dracunculiasis or guinea worm infection.

These diseases fall mainly in the categories of water-based or water-related insect vectors. Even the hour of water collection, dusk and dawn, before and after the draining heat of the sun often increases exposure to vectors such as mosquitoes. Water-borne diseases such as cholera or typhoid fever are prevalent among women in some areas especially where water is drawn from rivers and ponds. Water-washed diseases result from scarce water for personal hygiene. Women who care for young children have been shown to have increased numbers of pathogens on their hands, making them at risk for disease transmission to both themselves and their families (Capparelli and Mata, 1975). Dysentery, gastroenteritis, roundworm infections, and hepatitis are among the most frequent. Lack of water for cleansing wounds also favors the occurrence of tetanus consequent to injuries that happen both in the home and in the fields.

Whether through excess energy and time expenditures in water seeking or through infections acquired in water contact, water consumption, and through lack of water for personal hygiene, multiple health constraints on the ability of women to contribute to the economic and social well-being of their families and communities arise. Water supply and sanitation are thus at the center of the health question for women in development and must be at the center of the development decisions affecting them.

5. CONCLUSIONS

Improvements in water supply and sanitation are presented not as a luxury (for the poor and for women) but as a major precondition for economic development.

Improved water has potential:

- as a basic food
- as an inhibitor of infections and infestations which increase caloric expenditures

- as a link to improved nutrition through avoiding malabsorption and decreasing caloric losses

- as a means to conserve the energy levels of women and children so as to allow their full participation in development by eliminating the hours of heavy drudgery spent in water collection

- as a component of village level projects, such as raising home gardens and small stock to increase food consumption and/or household income.

Women should be thought of not as passive recipients of improved water supplies but as active participants in the use and management of household water, food, personal and family hygiene practices, and training for technical tasks.

Women's traditional roles as the primary water-drawers, haulers, carriers, and users should not limit their active participation in changing and improving water supplies and systems, both at the household and community levels.

New programs introducing improvements and modernization of water supply facilities should not, by sex stereotyping, overlook women as the obvious candidates for training in the maintenance and operation of such facilities.

If "development" projects were designed by and for women to utilize the time and energy released and the improved nutritional status resulting from improvements in water supply and sanitation, several things could happen:

- Support for the improved systems would be greatly increased among the individual women and the community at large.

- Resistance from husbands or mothers-in-law would decrease. Many men welcome extra family income from a wife. In some village communities "leaders" argued that women didn't have anything else to do with their time, making more convenient water unnecessary.

- Decisions concerning acceptance and use of the new technologies will be made by women and their families on the basis of what seems intuitively logical to them with regard to benefits and costs.

- Changes in behavioral patterns related to the improvements in water supply and sanitation to be effective must be made by the primary users--the women. Social costs such as offense to custom, kin, or friend will be considered

along with economic costs. Convenience, privacy, or prestige may in fact be considered more beneficial than the health improvements which often are ambiguous or not understood.

- Increased nutritional well-being with resulting higher levels of energy related to improved environmental sanitation and household hygiene can be channeled creatively and productively into personal growth and community development.

- Standard of living may be raised by economic benefits which simultaneously maximize health benefits.

- Better management of daily tasks can be made possible since improved water supply and sanitation should result in easier tasks and in healthier more energetic children and mothers. Although many women are proud of their traditional roles as mothers and homemakers, they would like to be better managers and have more time and energy.

- Participation by women and the community in development programs will be increased. In fact, development project planning which does not involve women and local groups in dialogue and problem solving is lacking in essential data needed for implementation.

5.1 Redefinition of Roles and Tasks

Even though understanding the many traditional roles of women as primary users of water is important, the more important problem now is how to use this potential so that women can be responsible for the overall operation and maintenance of the new systems in their communities and in their homes. All too often there is a tendency to underestimate the extent to which women's roles can be increased and changed to bring greater benefits to women and entire communities. Sex-stereotyping often restricts women's full participation. What can be done through education, consciousness-raising and training, so that the traditional roles of women are incorporated into new systems in new ways? Obviously there are no simple answers.

Traditional roles will vary and appropriate new systems will be necessarily widely divergent. We cannot discuss roles, potential and needs of women outside the cultural and social milieu in which they exist, nor the modernization process, but the many hours formerly spent carrying water from source to home can now be devoted to income raising from small industries and handicrafts or to training for new work, perhaps for roles specially related to the improvements in the water systems as pump "doctors", barefoot engineers, mechanics, plumbers, and technicians of all kinds.

REFERENCES

Bradley, D., "A Classification of Infective Diseases Related to Water," Drawers of Water, Chicago, University of Chicago Press, p.163, 1972.

Bruce-Chwatt, L.J., "Malaria and Blackwater Fever", in Trowell, H.C. and B.B. Jelliffe (eds.), Diseases of Children in the Subtropics and Tropics, London, Edward Arnold, 1958.

Capparelli, E. and J. Mata, "Microflora of Maize Prepared for Tortillias", Applied Microbiology, 29:802, 1975.

Cardenas, Margarita, "Community Participation and Sanitation Education in Water Supply and Sanitation Programmes in Paraguay," Assignment Children, 49/50, 1979.

Chen, L., "Evaluating the Health Benefits of Improved Water Supply through Assessment of Nutritional Status in Developing Countries," Unpublished paper, Harvard School of Public Health, 1980.

Chinas, B. The Isthmus Zapotec, Women's Roles in Cultural Context, Holt Rinehart and Winston, New York, 1973.

Elmendorf, Mary, "Women, Water and Waste: Beyond Access", Presented at the EPOC Forum of the Mid-Decade Conference of Women, Copenhagen, Arlington, Virginia: Water and Sanitation for Health Project, 1980.

_____, Women and the Decade, WASH Technical Report #6, Arlington, Virginia: Water and Sanitation for Health Project, 1981.

_____, "Women: the Underused Human Resource." Educacion Medica y Salud, Volume 16, No. 4, Washington, Pan American Health Organization/World Health Organization, 1982.

Elmendorf, Mary and Patricia K. Buckles, Sociocultural Aspects of Water Supply and Excreta Disposal, Appropriate Technology for Water Supply and Sanitation, Volume 5, Washington, D.C., The World Bank, December 1980.

Elmendorf, M. and R.B. Isely, "The Role of Women as Participants and Beneficiaries in Water Supply and Sanitation Programmes", Arlington, VA, Water and Sanitation for Health Project, Technical Report No. 11, 1981.

_____, "The role of Women in Water Supply and Sanitation Programmes", World Health Forum (in press), 1982.

Elmendorf, M. and R.B. Isely, "Public and Private Roles of Women in Water Supply and Sanitation Programs", to be published in Human Organization, Fall 1983.

Feachem, Richard G., "Environmental and Behavioral Approaches to Diarrheal Disease Control", Acute Enteric Infections in Children: New Prospects for Treatment and Prevention, The Netherlands, Elseview/North-Holland Biomedical Press, 1981.

Feachem, R.G. et al, Water Health and Development: An Interdiciplinary Evaluation, Tri-Med Books, London, 1978.

Isely, R.B., "The Relationship of Accessible Safe Water and Adequate Sanitation to Maternal and Child Health - Looking Forward to the Drinking Water and Sanitation Decade", Water Supply and Management, 5(6) 417-424, 1981.

Linton, R., The Study of Man, Appleton-Centiry Co., New York, 1936.

McJunkin, F. Eugene, Water and Human Health, Prepared by National Demonstration Water Project for U.S. AID Washington, July 1982.

Mead, M., Male and Female, A Study of the Sexes in a Changing World, Dell, New York, 1949.

O'Kelly, Elizabeth, Water and Sanitation for All, London, Associated Country Women of the World, 1982.

Obeng, Letitia, E., Women-the Water Carriers and Water Related Diseases, Exerpts from statement prepared for Mid-Decade Conference of Women, Copenhagen, UNEP, Nairobi, 1980.

Oppong, Christine, "Population and Labour Policies Programme - Working Paper No. 911 A Synopsis of Seven Roles and Methodological Approach", I.L.O. World Employment Program Research, September, 1980.

_____, A Synopsis of Seven roles of Women: An Outline of a Conceptual and Methodological Approach, Population and Labour Policies Program, Working Paper No. 94, World Employment Program, International Labor Organization, Geneva, 1981.

Rosaldo, M. and L. Lamphere, Women, Culture and Society, Stanford University Press, Palo Alto, CA, 1974.

Russel, A. "Report on the Situation of Women in the Target Villages of the UNICEF Domestic Water Supply Project in Bahr el Ghazal Province, Sudan" (mimeo), New York, UNICEF, 1979.

Scrimshaw, N.S. "Synergism of Malnutrition and Infection: Evidence from Field Studies in Guatemala", Journal of American Medical Association, 212:1685-1692, 1970.

Smith, W. "Media and Health Practices: Results of Honduras Investigation", Report No. 14, Washington, Academy for Educational Development, 1980.

Thompson, B. and A.K. Rahman, "Infant Feeding and Child Care in a West African Village", Journal of Tropical Pediatrics, September 124-138, 1967.

UNICEF/UNDP, "Women as Innovators in Water Supply and Sanitation", (mimeo), New York, 1982.

Vis, J.L., P. Hennart, and M. Rushababisha, "L'allaitement en Zone Rurale Pauvre", Carnets de l'Enfance 55/56:172-189, 1981.

White, G.F., D.J. Bradley, and A.V. White, Drawers of Water: Domestic Water Use in East Africa, Chicago: University Chicago Press, 1972.