The Impact of Water and Sanitation on Malnutrition and Under 5 Mortality Rates

The Need for an Integrated Approach

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This paper is a by-product of a mission to Namibia in April 1993. Although written three years ago, the issues dealt with are still relevant for the current UNICEF strategies for child survival protection and development.

Impact of WATSAN[1] on Malnutrition and Early Child Death:

The Need for an Integrated Approach

The objective of this article is to review the conceptual basis and the programmatic implications of an integrated approach involving community based universal access to safe water, hygenic practices and sanitation.

For this purpose, the conceptual framework presented in Figures 1 and 2 will be used. In these Figures, household access to water and sanitation pertains to the cluster of underlying determinants related to services. Learning hygenic practices is included in the interface between care and access to services.

Diarrhoea as a Cause of Child Death

One and a half million children under 5 years of age die each year in Africa due to diarrhoeal disease. This is more than one third of children under 5 years of age who die in the continent every year. About two thirds of those who die of diarrhoea are also malnourished.

Diarrhoea as Cause of Malnutrition

Duration of diarrhoea could statistically explain up to 18 per cent of the gap in incremental growth in length in children 3–36 months of age (Martorell, 1975). Much of the nutritional impact of diarrhoea is mediated through:

1. decreased dietary intake in mothers and children. In children, the presence of diarrhoea is associated with a decrement of 15–20 per cent of the dietary intake from foods other than breastmilk (Brown, 1990 and Martorell, 1990). In pregnant mothers, diarrhoea accounts for a decrease of 400 kcal/day, or 25 per cent of usual dietary intake (Lechtig 1972);
2. increased fecal loss because of malabsorption; and
3. increased catabolism because of increased rate of basal metabolism.

The contribution of mechanisms 2 and 3 above, may be equivalent to further decrease of 10 per cent of dietary intake. This means that in children the presence of diarrhoea is associated with a decrease of up to 30 per cent of dietary intake. In pregnant mothers this effect could be equivalent to a decrease of up to 35 per cent of their current dietary intake.

Both inadequate dietary intake and high prevalence of diarrhoea interact synergistically to produce higher prevalence of malnutrition (Lutter, 1990) par-

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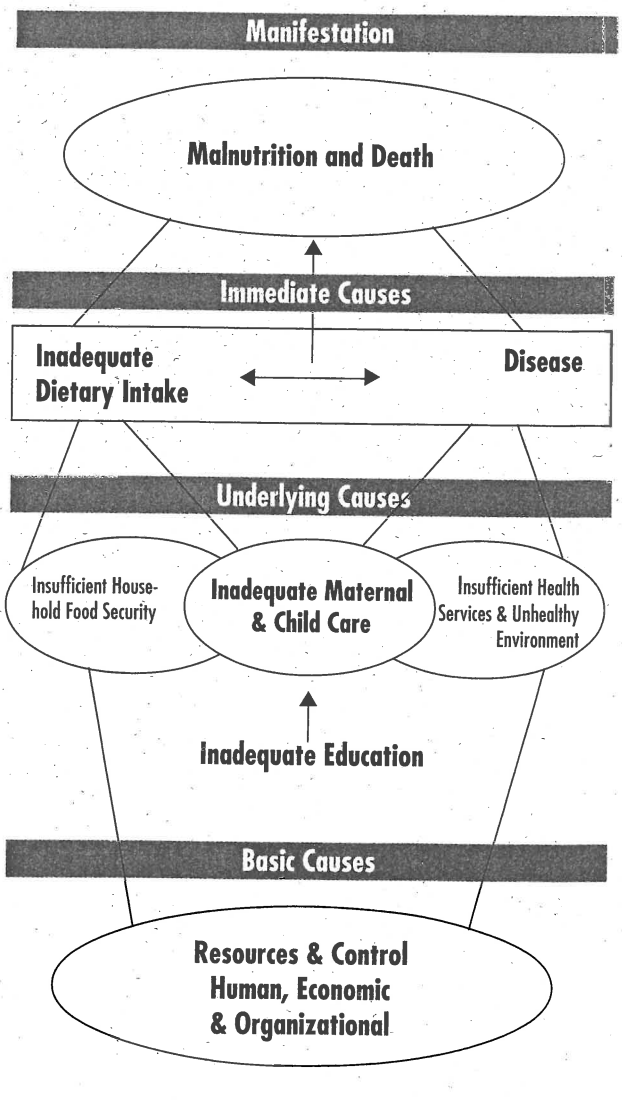
Figure 1: Conceptual Framework on Causes of Child Death and Malnutrition



1. WATSAN: Universal access to safe water, improved hygiene practices and environmental sanitation

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ticularly in low income populations where these two factors are highly prevalent.

Simply stated, a malnourished body weakened by diarrhoea is prone to infectious diseases, becomes more malnourished and is then more susceptible to further disease. If WATSAN prevents diarrhoeal disease, the downward spiral of malnutrition and disease leading to death, can be partially prevented.

Food Equivalent of Increased Physical Activity

In rural Africa, women, the fetchers of water, often travel 3 km or more to the nearest water point. Assuming two journeys of 6km round trip per day, (12 km/day) and an average walking speed of roughly 4km per hour on uneven surfaces, about 3 hours per day will be spent in fetching water. An additional one hour must be allowed for queuing, waiting and resting.

For the average rural African woman, roughly an extra 178 calories per hour will be expended while walking to the water point and 210 calories per hour while returning with a full water pot. The energy expended in fetching a total of 20 litres (2 journeys) of water per day will be 582 calories per day. This is 36 per cent of the usual dietary intake of these women (about 1600 cal/day). This is also the equivalent of 166 grams of grain.

In rural Africa, as in many rural areas of developing countries, most women of reproductive age are pregnant, lactating or both. The above energy expenditure is enough to improve fetal growth and produce a significant decrease in the prevalence of low birth weight babies if the woman is pregnant (Lechtig et al., 1975). It is also enough to notably improve breast milk output if the mother is lactating (Lechtig et al., 1979).

Women's Time

Assuming an average 16-hour working day for the average rural African woman and access to safe water within a one hour round trip, the four hours spent in fetching water can be reduced to one. The three hours saved represent 20 per cent of her available time. This means:

1. increased time to look for better opportunities for income generating activities, resulting in improved access to food at household level and
2. for the nursing mother, more time at home to breastfeed and to care for her child during the critical 0–24 months period.

Furthermore, girls are often used to help the mother collect water. The time required for this purpose may contribute to a significant disincentive to sending girls to school — hence higher rate of female illiteracy, which is another important factor in children and women's care as well as for child malnutrition and death in Africa.

Linkages between WATSAN, malnutrition and child deaths

National data from 84 countries were used to estimate this relationship. The analysis involved a model with malnutrition as the dependent variable indicators of household access to food, access to health services and safe water and sanitation and proxies of child care as independent variables. Possible intervening variables were statistically controlled.

In the first step, indicators of each of the three underlying causes were selected in terms of their association with the prevalence of underweights. The second step was to identify the indicators of each cluster that presented the highest association with malnutrition. These were then introduced in a step-wise analysis. Two variables came out as the best predictors of nutritional status:

1. The proportion of income allocated for food. This is an indicator of degree of financial access to food.
2. The percentage of households with access to safe water (see Figures 4 and 5).

Interestingly, the strong association

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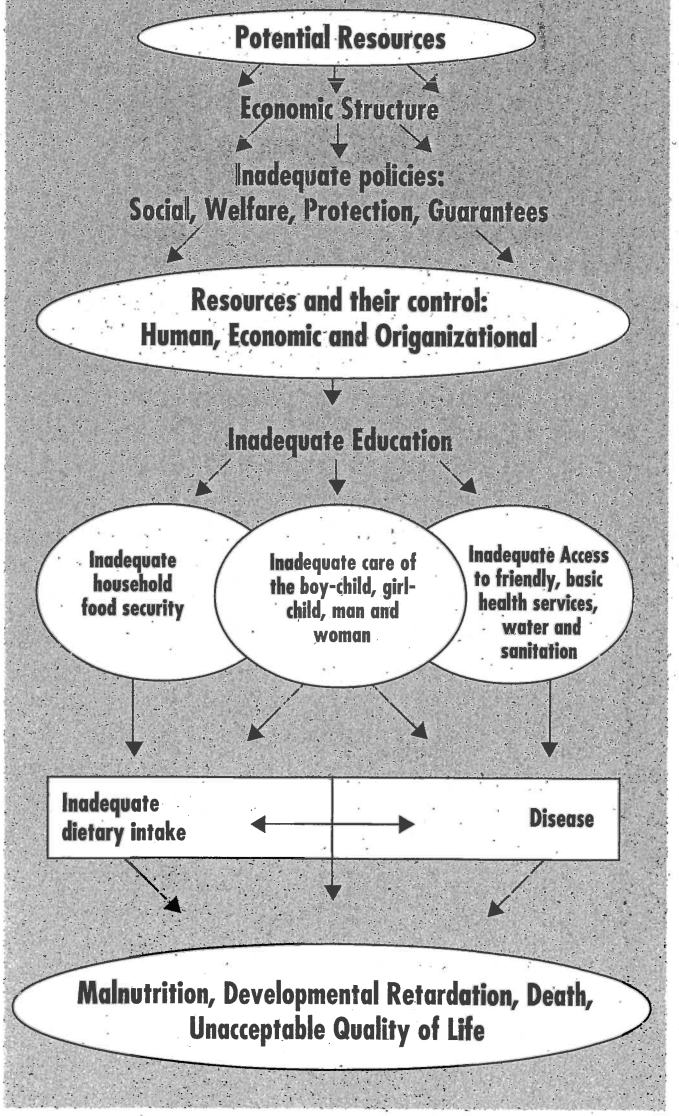
Figure 2: Conceptual Framework Applied to WATSAN, Malnutrition and Child Death



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with malnutrition, observed with the indicator percentage of rural population below absolute poverty level, disappeared once the proportion of income spent on food was introduced. This suggests that association with poverty was mediated by the level of resources allocated to food.

It should be acknowledged, however, that in this model the cluster of child care had very gross indirect indicators such as education and total fertility rate. There is a great need for better indicators of these causes such as time of the mother allocated to care of her children and herself. Availability of this information will permit better analyses and better decisions.

The above review clearly supports the linkages proposed in the conceptual framework presented in Figure 2. The mechanisms are not only those related to higher prevalence of diarrhoea, but also those related to increased physical activity of women, and decreased time for the care of their children and for themselves.

The inference is that WATSAN will significantly contribute to:

1) better weight gain during pregnancy and lower prevalence of LBW babies;
2) better nutrition of lactating women, and increased breastmilk output;
3) lower prevalence of malnutrition and lower under-five mortality rates in children.

Need for an Integrated Approach

The above inferences mean that community-based interventions that include universal access to safe water and sanitation, coupled with improved hygenic practices, will make a significant decrease in the prevalence of malnutrition and the under-five mortality rates.

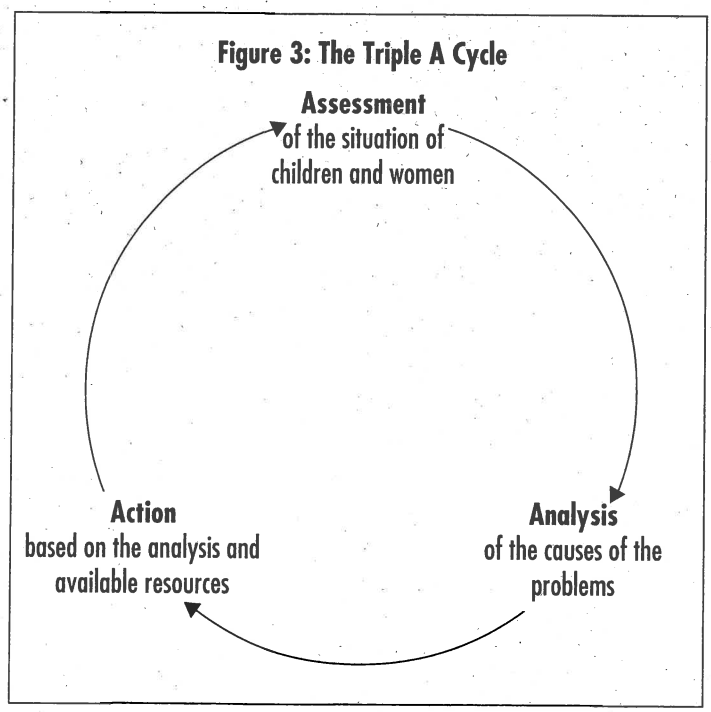
These interventions will be particularly effective in populations where the coverage of WATSAN is low, household access to food is inadequate and malnutrition and under-five mortality rates are high.

These interventions would provide a key complement to enhance the benefits brought by activities aimed to improve household access to food and dietary intake.

In areas hit by famine, the under-five mortality rate is usually increased by outbreaks of diarrhoea of increased severity and duration because of malnutrition. Therefore in these areas, similar types of WATSAN interventions should be introduced to minimize the occurrence of diarrhoea and thereby obtain optimal biological utilization of food aid.

At this point it should be remembered that the conceptual framework presented in Figure 1 indicates that the three underlying causes: food, health and care are necessary conditions for good nutrition, adequate development and high survival rates.

Figure 3: The Triple A Cycle



Cost of a WATSAN Project with Impact on Child Nutrition and Mortality

Options costing less than $30.00 per capita are considered to be low cost. Two preferred technologies with which UNICEF has extensive experience are gravity feed schemes and small diameter drilled wells with VLOM handpumps. Costs per capita for these technologies differ from country to country and from programme to programme, and depend to a great extent on the availability of local human resources and equipment. However, it is generally agreed that a per capita cost of less than $10.00 is achievable with the above two options.

India, rich in resources, with good logistical control over its programmes and a strong industrial base, calculated $0.56 per person per year for 20 litres of potable water per person per day for 250 users for each handpump installed (State of the World's Children 1984). In Bangladesh, the estimate was $2.00 per capita per year. The Ethiopia cost value of $1.70 per capita per year was based on the cost of 21 wells drilled in 1990 in the Gambella Region. Similar estimates have been produced in Uganda. In all cases, these costs represent capital investment (start up costs) and do not include maintenance and other recurrent costs. They include neither the cost of sanitation nor that of learning hygienic practices.

The total estimated resources required to ensure universal access to water, sanitation and adequate hygienic practices by the year 2000, are $30 billion annually. The anticipated available resources are roughly $10 billion per year.

Cost-Effectiveness Estimates

Based on data from India and assuming the installation of four handpumps utilized by an average village population of 1,000 in which 20 per cent are chil-

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dren under five years of age, a capital investment of $560 per annum would be needed to reduce diarrhoeal disease and decrease malnutrition and death in 200 children through WATSAN. The estimated cost per child would be about $2.80 per year. The estimated cost per case of malnutrition avoided is $19.00 and the cost per child death avoided is $93.33.

In Ethiopia, the capital cost estimates are three times higher: $8.50 per child; $56.70 per avoided case of malnutrition and $283.30 per child death avoided, respectively. Both estimates are in the lower range of similar costs of interventions based on food supplementation (i.e. $5.00 – 500.00 per case of malnutrition avoided. Ref: Nutrition Sectoral Paper for the ICAAC). No clear estimates are available yet for comparing costs of avoided child death.

Pragmatic Implications

The strategy from the start should involve the people who suffer the problem as main actors in deciding and implementing the solutions to alleviate or solve their own problems. For this purpose, use the Triple A approach (see Figure 3). Involve the people in:

- the assessment of their problem (is there problems?) make the problems visible.
- the analysis of the main determinants that produce the problems. Develop a common understanding of the nature of the problems. Use of the conceptual framework presented in Figures 1 and 2 will help this process.
- deciding a simple plan of action.
- prioritizing actions that should be implemented.
- implementing the agreed actions.
- re-assessing and re-analysing actions.

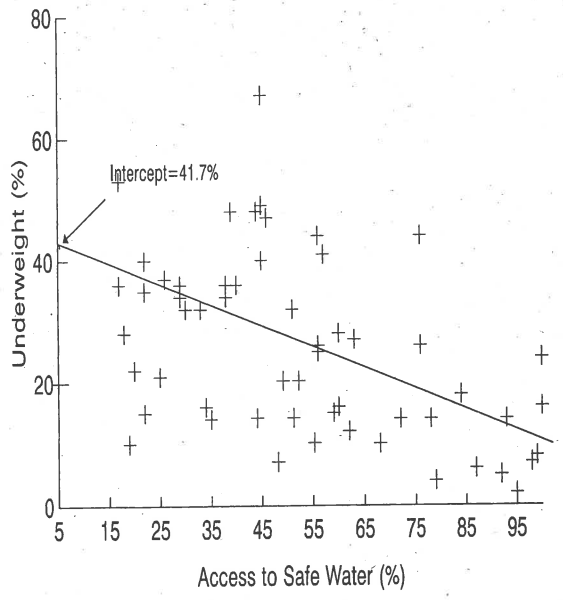
In this way existing positive Triple A cycles will be enforced and new ones will be created.

Planning Aspects

There is a need for Coordination of WATSAN projects with other nutrition and survival impact projects. The following suggestions could be useful in facilitating the integration of these activities:

- Use high prevalence of malnutrition and high U5MR as criteria to prioritize the geographic areas where WATSAN projects will be developed.
- Prioritize the same geographic areas, selected above for other projects with impact on nutrition and survival i.e. breastfeeding, community-based nutrition rehabilitation, household food security projects, control of Vitamin A deficiency (VAD) and Iron Deficiency Anemia (IDA).
- Integrate activities aimed to improve access to safe water with those aimed to improve environmental sanitation (i.e. latrines) and particularly with learning and internalization of hygienic practices.
- It is essential for any WATSAN intervention intended to contribute to a nutrition impact to be community driven, so that sustainability is ensured and continued effectiveness is obtained.

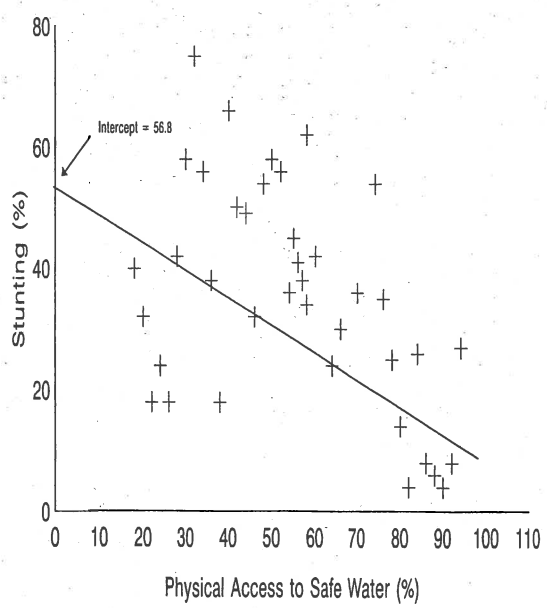
Figure 4: Underweight by Physical Access to Safe Water



r= -.49861; R2= .24861; Slope= -.30588 (SD= .06923)

Source: Lechtig et al. 1993

Figure 5: Stunting by Physical Access to Safe Water



r= -.5398; R2= .29142; Slope= -.38026 (SD= .0847)

Source: Lechtig et al. 1993

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- In all cases ensure coordination, convergence and directionality of activities. A useful tool for this purpose is the regular use of the conceptual framework at all steps of planning and implementation.

Conclusions

1. Community-based interventions aimed at universal access to safe water, sanitation and hygienic practices will reduce the incidence, duration and severity of diarrhoea, enable women to participate more extensively in activities that would increase their household access to food; decrease their energy expenditure in fetching water; improve the dietary intake and nutrient utilization of all family members; and increase their presence in the home to care for the children and for themselves.
2. As a consequence, the nutritional status of the family as a whole would improve and the under-five mortality rate would decrease at an affordable cost. And the human right of universal access to safe water and adequate sanitation will be attained.
3. In terms of practical implications for planning, it is suggested that the assessment, analysis, action approach and the conceptual framework for the analysis of the causes of malnutrition and death should be used as the key strategies to guide the incorporation of these interventions in Country Support Programmes. First priority should be allocated to the regions with the lowest coverage of access to safe water, i.e. Africa. As a first step it could be implemented in Area-Based Programmes aiming to gradual expansion at national level.

Community-based interventions aimed at universal access to safe water, sanitation and hygienic practices will reduce the incidence, duration and severity of diarrhoea, enable women to participate more extensively in activities that would increase their household access to food

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UNICEF recipient of award for World Water Day

UNICEF was honoured by the United Nations Centre for Human Settlement (Habitat) with the *"World Day for Water Scroll of Honor"* on 22 March 1996 in Beijing. The plaque presented to UNICEF reads as followed: *" In recognition of 50 years of leadership toward the achievement of universal access to safe drinking water and sanitation"*. This is the second time since being awarded the *"Crystal Drop"* in 1984 that UNICEF's contribution in the sector has been so publicly highlighted. However, UNICEF recognize that such achievement would not have been possible without the close cooperation and coordination with other partners: Governments, Donors countries (Bilaterals donors), International Agencies, notably WHO, UNDP, UNDDSMS, the World Bank and NGO's.