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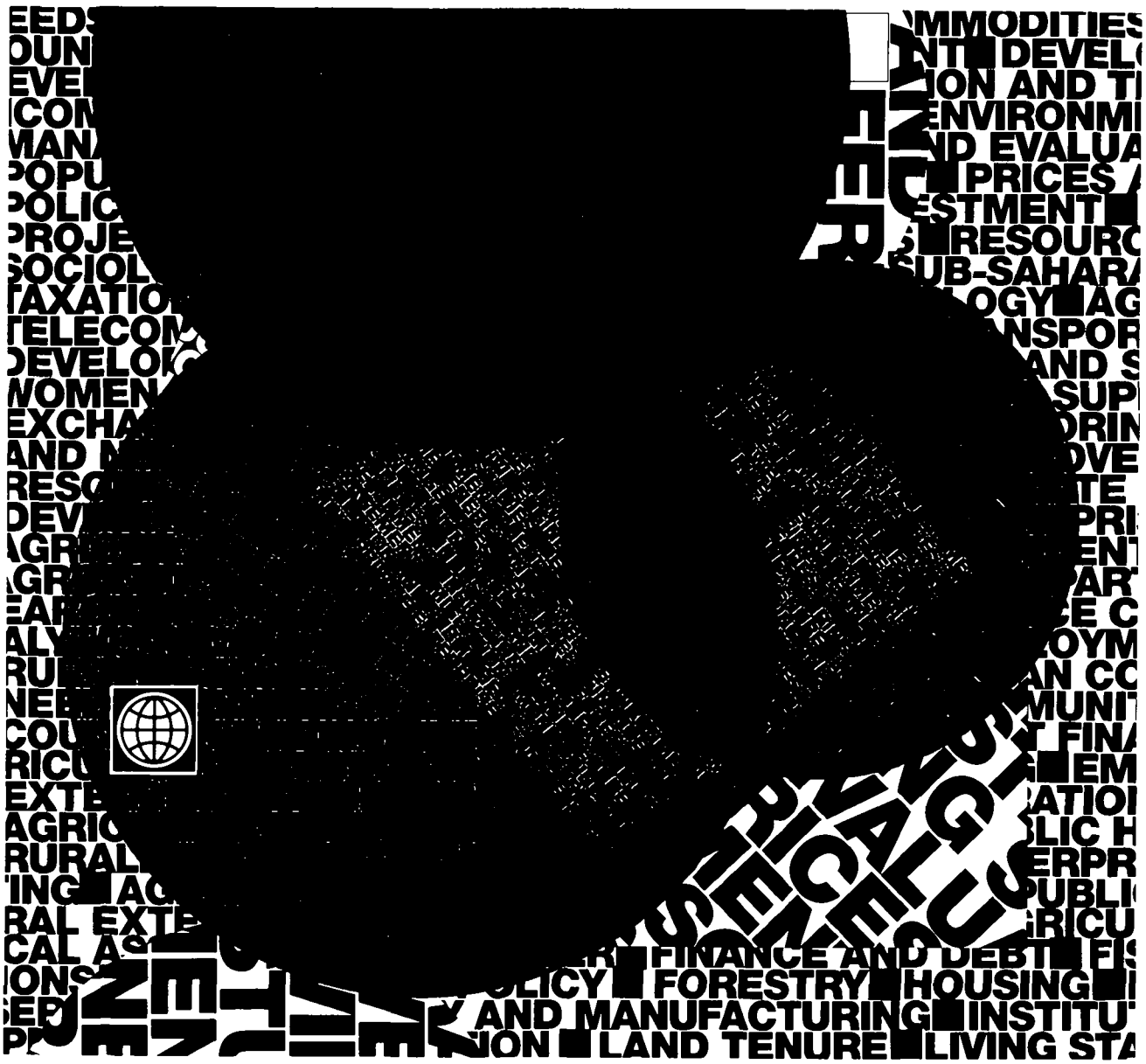
Environmental Health Components for Water Supply, Sanitation, and Urban Projects

James A. Listorti



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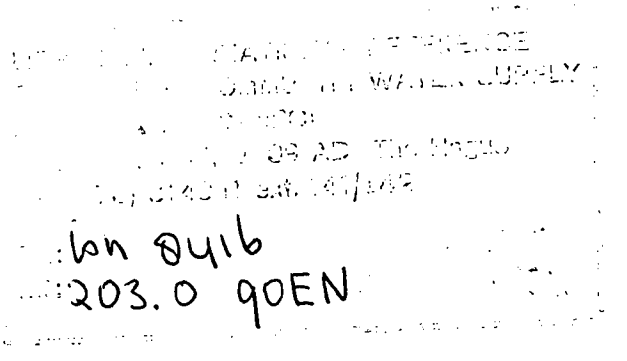

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ABSTRACT

Development projects have time after time and sector after sector shown that intensive capital investments while essential are not sufficient to sustain development and growth of that sector. Projects that respond to specific local conditions but conform to and are strengthened by supportive macro-policies have a better chance to achieve their goals. These concerns together with the need to improve health in the face of the stagnant or shrinking national health budgets have prompted the theme of this Technical Paper: a practical methodology to enhance health at minimum cost by maximizing benefits of on-going urban development, water and sanitation projects.

An environmental health component for such project mirrors in many ways the necessities that have emerged from a reexamination of development strategy: (a) it recognizes that no one sector or project can thrive in isolation and thus builds interlinkages that can foster cooperation among agencies responsible for various sectors, e.g., water, sanitation and health, and among governmental and non-governmental organizations; (b) it proposes relatively simple interventions both as a way to keep costs down and to encourage beneficiaries to accept the program more readily; (c) it helps avoid administrative bottlenecks that can so often delay or derail project implementation and stresses expertise versus expediency, and (d) it advocates the use of local resources by involving beneficiaries, especially women, in campaigns to improve hygiene and dietary habits.

Finally, the Technical Paper has three main objectives: first, to present a pragmatic guide for improving health through discrete local programs which are supplements but not alternatives to national health measures; second, to help detect, through the preparation of the environmental health component, needs for more extensive efforts and accordingly alert the appropriate health authorities; and third, to contribute to a realistic assessment of what what an environmental health component can achieve. The Paper also provides reference material, written for those without training in health, of twenty six of the most serious diseases that pertain to water, sanitation and urban development projects.

The message is one of caution and promise: health benefits often are difficult to detect at first and slow to mature but health can be greatly improved with a modest investment that can reach those most in need, the urban and rural poor.

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EXECUTIVE SUMMARY

This Technical Paper discusses the rationale and methodology for including an environmental health component in water, sanitation and urban development projects. An environmental health component is defined as a set of health-related measures, as broad as health and hygiene education, or as specific as a deworming program.

The rationale is based on the premise that it is possible to improve the quality of life of project beneficiaries with relatively inexpensive components. The methodology focuses on simplified processes to incorporate realistic strategies into projects. Both rationale and methodology give due consideration to the practical managerial constraints of borrowers and lenders. The Technical Paper establishes realistic expectations for environmental health components to improve health.

BACKGROUND TO HEALTH INTERVENTIONS

An appreciation of the complexity of evaluating health improvements will avoid the unrealistic expectations that have arisen in the past. The benefits of an environmental health component are difficult to evaluate or at least cannot be easily measured by standard economic parameters such as rates of return. Changes in overall morbidity and mortality can, of course, be computed statistically. However, benefits do not necessarily show up gradually; often they can only be measured after the last of several variables falls into place and standards of living rise. The delay in producing tangible benefits cannot be regarded as a failure of the environmental health component but only proof of the difficulty of evaluation. Other factors, including reduced exposure, must in the interim be regarded as a bench mark for progress while the other remaining benefits are maturing.

Two points, based on common past misconceptions need to be clarified when discussing past health improvements from development projects such as water supply, sanitation and urban development: no single intervention has been wholly responsible for such health improvements; and interpersonal contacts are an extremely important mechanism transmission of diarrheal diseases, which remains one of the most serious health problems. Heretofore, transmission had been attributed mainly to contaminated water and food. These two points lead to seemingly opposite approaches while trying to reach otherwise complementary objectives: broadening the scope of interventions while at the same time paying closer attention to personal behavior. A potential conflict arises when trying to apply the theoretical objectives to the real world of project interventions with their practical constraints such as inadequate resources. In a phrase: do more with less.

Improved understanding of the health field has led to a reevaluation of how better health has evolved. In Western Europe during the nineteenth and twentieth centuries, major respiratory and diarrheal

diseases often had already begun to decline in advance of medical breakthroughs. Control or virtual eradication of some diseases did coincide statistically with medical discoveries but could not have been affected to the degree that is often accorded them since their application from laboratories into medical practice took place only much later. Reductions in mortality in North America and Europe have not been primarily due to improvements in water supply and sanitation, as commonly postulated. Rather, they occurred as as integral part of overall economic development and improvement of living standards, consisting of better water supply, sanitation, housing, medical services, education and other social programs which occurred contemporaneously though not necessarily in an ordered sequence. This confirms that health improvements depend not on one but on many interrelated factors, covering a broad spectrum of interventions ranging from individual hygiene to sanitary living quarters, from health care delivery to adequate diet.

Recent diagnostic advances point to interpersonal contacts as being at least as, if not more, important, in the transmission of diseases than the more traditional routes such as contaminated water and food. Improved diagnostic techniques now indicate a multiplicity of causes heretofore unsuspected, and consequently a change in emphasis of interventions. These confirm that water quality and quantity are not the single most important elements in direct transmission of gastroenteric infections --- primarily the killer diarrheas. They also imply that since interpersonal contacts and contaminated living environment--dirty floors, play areas, markets--are important mechanisms for disease transmission, a greater effort than in the past will have to be made to improve housing, excreta disposal and personal hygiene. The implication that it is necessary to change behavior, furthermore, points to a greater role for education, especially as it pertains to diseases with multiple routes of transmission, and makes the need for simultaneous interventions more critical. The problem, of course, is compounded when applied to the main audience, the poor and low-income groups. Behavioral change is complicated and takes time --- normally more time than the average life of a project.

These observations are bewildering and encouraging at the same time: bewildering because they imply more work, more time, more complicated projects in an atmosphere of competing needs and shrinking resources for both borrowers and lenders alike; encouraging because they provide an opportunity for innovation and new solutions. Being told that more complicated problems need more money is not a solution. The shortage of resources, in context of a more comprehensive project approach, provide a catalyst and an incentive for greater resolve by borrowers and lenders alike. Accordingly, this Technical Paper focuses on practicality and pragmatism in rationale and methodology for the benefit of borrowers and lenders alike.

RATIONALE FOR AN INTEGRATED APPROACH

The most important justification for an environmental health component is the improved quality of life for its beneficiaries. The component maximizes the benefits of the project in which it is included. As a minimum and with a small financial investment, the education campaigns that are part of the component, for example, alert beneficiaries to the need of personal hygiene and perhaps make them aware that they can have some control over their health. Generally, the component contributes to better use of facilities at little extra cost.

For lending agencies such as the World Bank, the Paper confronts the practical limitation of loans and their ability to address problems within the project cycle. Two interrelated points are noteworthy: the project cycle itself and sound project management. Components need to be manageable and avoid the pitfall of trying to accomplish too many objectives in too short a period within the same project so that it becomes administratively cumbersome. Typical health components rarely comprise more than two percent of a loan, even though their potential benefits extend well beyond their small share of the project. Given demands on time and budget in the remainder of the project worth millions of dollars, the Paper, therefore, stresses simplicity and selectivity to reduce and standardize paperwork in order to ease the administrative burden of project officers. Because of the need for behavioral change beyond the project cycle, many environmental health components run this risk. It is not the intention of this document to actively promote environment health components, but to alert project officers and borrowers of the opportunities to enhance projects at minimal cost.

Borrowers, too, confront similar constraints, especially in interministerial coordination. Because the borrower is usually a municipal agency or a public utility, it most likely does not have in-house expertise in the health or education sector and needs to rely on consultants or its counterpart agency responsible for health and education to integrate the goals of a component within a project in the context of other ministerial, municipal or government programs. Such agencies, however, when not directly associated with the project are often not interested in or capable of providing assistance or long term management of a health component. Urban, water, and sanitation project agencies typically are not competent to undertake health interventions and should not be expected to do so except for information and motivation campaigns which can be handled by a public relations office. Such efforts should, whenever possible, be included in projects as a minimal attempt to enhance the projects impact on the users, especially mothers, infants and children. This realistic assessment of borrowers capabilities, when added to the practical limitations of loans, underscores the need for pragmatic methodologies to address health problems. The lack of expertise for component implementation should be addressed by suitable conditionalities in the project. Consultants and ongoing programs run by NGOs can provide such needed assistance.

The guidelines contained in this Paper are intended to assist client governments in the preparation of environmental health components and thus encourage them as well as lending institutions to consider environmental health components systematically, as part of their respective lending and borrowing operations. Such consideration is important for several reasons. Environmental health components affect large investment projects where successes or failures have considerable impact. If the component is to produce behavioral changes, extended time and efforts are required and early inclusion of the component in the project cycle is therefore important.

An environmental health component reaches and benefits some of the poorest groups. As an illustration, beneficiaries of water installation and sewerage projects can afford paying for such services and do not need much persuasion to appreciate resulting benefits. Beneficiaries of slum-upgrading and low cost water projects are, on the contrary, among the poorest and least informed groups. Educational health campaigns envisioned under the component help the very poor to exploit more fully the benefits of the project and thus upgrade their living conditions.

Among the beneficiaries to be reached, women are crucial because of their domestic and nurturing roles. Women are in fact the intermediaries through whom the improved health of future generations rests. Their active participation in health activities, especially in health information campaigns at the grass root level, strongly influences their success.

METHODOLOGY FOR IDENTIFICATION AND PREPARATION

The Paper presents a simplified methodology to gather health data, evaluate the importance of health problems and, especially, assist in preparing a response feasible within an urban, water or sanitation project. Five tables help prioritize diseases according to the practicality of remedial measures which lead to a short list of potential projects. The process essentially requires extrapolation of information on the ten leading causes of morbidity and mortality, followed by suitable interventions in the water, sanitation, and housing sectors. The steps involved are spelled out in Chapter III of this Paper and samples of tables are given at Appendix A (filled in for reference) and B (blank).

With its stress on realistic achievement, the Paper focuses on feasible aspects, small components, demonstration projects, and follow-up arrangements by a collaborating institution to combat those health problems not easily integrated as a component into projects. In general, the more complicated the administration and the higher the requirement for education and follow-up, the greater should be the emphasis to seek complementary actions outside the project. Depending on the health assessment of the project area, interventions may be short or long term with appropriate follow-up requirements. The nature of the problem, and thus the measures to be undertaken, and the capability of the local government, will

determine whether to prepare an environmental health component or to recommended complementary action outside the project. For example, short-term components may entail building a clinic or carrying out an immunization program; long-term measures may involve solid waste demonstration projects or education and nutrition programs. A sample of such a component to be included in an urban project is presented at the end of Chapter III. During appraisal and implementation, Bank and field staff will ensure that commitments and schedules are finalized and adhered to.

The client government and the Bank will both participate in the preparation of the environmental health component. During preparation of a water, sanitation or urban projects, the need for health-directed measures may become apparent. The entity who will be responsible for overall project management will prepare and submit to the Bank proposal for the component, following some of the guidelines outlined in this Paper. The client government may find it useful to use non-government organizations (NGO), consultants or the national health agency to gather data, design proposals, and write terms of reference. Bank staff will assist in the review and final selection.

The Technical Paper is not intended nor suitable to prepare an environmental health project. If health problems in the project area are of a magnitude which requires major interventions, the project officer should consult with appropriate staff in the health or environment department. The latter should also be kept informed throughout the process of environmental health component identification and design.

IMPLICATIONS FOR PROJECTS

An environmental health component is a practical approach to help combat the major diseases that are affecting health in developing countries. Its attractiveness is twofold: it is particularly effective because it builds on and enhances the health benefits inherent in public sector projects; its benefits far outweigh the modest investment required. Even, without a specific environmental health component, sanitation, drainage, and waste disposal can reduce bacteriological and chemical contamination and eliminate diseases such as filariases and guinea worm. In these cases, health analysis merely serves to identify problems and change the project composition to incorporate standard project activities if they have not already been included into the project. A modest environmental health component, involving, for example, improved sanitation facilities and housing, can reduce intestinal worms and accidents such as burns and drownings. Long-term environmental health components make significant inroads in combating diarrheas through water and sanitation works and personal hygiene. Another example are nutritional supplements and health education, long-term measures that can reduce malnutrition.

From these observations it becomes clear that the success of a health component depends on a realistic assessment of what the component can do. Good results are often tied to the extent and thoroughness of

follow-up programs. For example, schistosomiasis and malaria require long-term efforts in the control of snails and mosquitoes. Such programs require extensive administrative support and educational campaigns well beyond the mandate or capability of water, sanitation and urban project agencies. These long-term health improvements should be addressed through separate health projects, perhaps with technical or financing assistance from international agencies specializing in the health field such as the World Health Organization (WHO) or the United Nations Children Fund (UNICEF). These limitations do not detract from the utility of an environmental health component but suggest that to be truly effective the component must be used judiciously.

LEADING DISEASES

Chapter IV, presents an introductory discussion of some of the major disease groups affecting the developing which will form the basis for the interventions proposed. The Chapter continues with a compendium of the 26 most prevalent diseases related to housing, water supply and sanitation. In each case, diseases are broken into three sections: a description of symptoms and effects, their means of transmission, and suggestions for practical interventions. The presentation stresses preventive rather than curative measures and can be used as a reference tool or educational material for staff preparing or selecting environmental health components. It may be particularly useful to specialists working in health-related activities who lack scientific or medical training.

Enteric water-related diseases, especially diarrheas, are among the most severe health problem in the developing world. They are particularly devastating in children. Their manifestation is often symptomatic of other ailments. Closely related to enteric diseases are respiratory infections, most common among slum or shanty-town dwellers who live in poorly ventilated quarters and suffer from smoke inhalation and overcrowding. Industrial and automobile pollution producing low-quality air also contributes to respiratory infections. Malnutrition greatly exacerbates contraction of the diseases already mentioned. A poor or imbalanced diet weakens the body's immune system so that a person is more susceptible to contract diseases and also less able to fight them. Babies are clearly at risk once they lose the post-natal protection inherited from their mothers. Intestinal parasites are also a leading cause of morbidity and mortality, affecting approximately 3 billion people. They aggravate malnutrition by absorbing many vital nutrients. While rarely fatal, they contribute to an individual's general debilitation. Re-infections are common. Mosquitoes and snails are active vectors for the many serious diseases spread to humans. Their adaptability makes them difficult to exterminate. Mosquitoes, for example, can thrive in very diverse environments, from water holes to discarded car parts.

I. BACKGROUND

This Paper presents practical steps to select and integrate an environmental health component into water supply, sewerage and urban development projects.[1] To fully appreciate how that integration will enhance the overall benefits of such projects, it is useful to re-examine from an historical perspective the interrelationship of improved health, improved water supply and sanitation, and overall higher standards of living.

HISTORICAL OVERVIEW

The promise of improved health has been commonly used as a partial justification for projects such as drinking water supply, excreta disposal, drainage, housing, and slum upgrading. The rationale for these investments has been based on medical knowledge of disease transmission and the genuinely positive experiences in North America and Europe following massive investments in water supply and sanitation in their cities in the latter part of the nineteenth and the early twentieth century. However, when we simultaneously consider medical progress, cultural influences, popular perceptions, and improved living conditions as contributing elements to better health, the traditional correlation between health and infrastructure investments seems less clear and the need for more systematic integration more pressing.

Until the end of the nineteenth century the miasmic theory of disease, i.e., the notion that diseases were spread by bad odors, dominated medical theory. In fact, the term malaria, a derivative of "bad air" in Italian, stems from the illnesses contracted during the construction of the Suez Canal. This erroneous theory was only dispelled after half-a-century of social reform and path-finding medical research, which radically altered the potential of direct medical intervention. Yet, the advances of bacteriology could not percolate into the practice of the average health practitioner until the twentieth century, by which time death rates had already begun to fall. England offers an excellent example. It was hardly by chance that the death rate in London began to fall decisively in the 1870s shortly after the city opened its new sewerage/drainage system in 1865. There were, however, numerous interrelated factors at play at the

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1 Water supply and sewerage is the Bank's official designation for this sector dealing with drinking water and sanitation services, even though the work encompasses much broader aspects; health considerations fall under the population, health and nutrition sector; water for agricultural uses falls under the agriculture and rural development sector.

same time: the higher wages, the availability of cheaper imported foodstuffs, the amendment of the Poor Laws (1834), the passage of the Public Health Acts (1848 and 1875), plus the spread of literacy.

Comparison of data before and after 1865 shows almost the whole reduction in documented mortality can be attributed to five important disease groups.[2] Only about a third, however, can be directly traced to disease groups linked with water supply and sanitation. Respiratory ailments, common companions of poor housing, accounted statistically for at least as much. Mortality from tuberculosis, for example, declined in a relatively constant fashion from 1850 to 1950, irrespective of the sequence of major medical breakthroughs of the period. Similar trends have been reported for other respiratory diseases. In New York City, for example, between 1900 and 1930, a period noted for its social reforms, the decline in infant mortality from gastrointestinal and respiratory infections was largely unaffected by advances in chemotherapy and new pharmaceutical discoveries. Improved health during most of the nineteenth and early twentieth centuries was a combination of economic development, better housing and nutrition, fortified by improved sanitation and water supply. In other words, water supply, sanitation and housing are thought as indispensable but often insufficient by themselves to produce an overall positive health impact.

INTERRELATED FACTORS OF ENVIRONMENTAL HEALTH COMPONENT

Environmental health components are difficult to evaluate because of the innumerable and interrelated physiological and social factors involved. Physiologically, many factors predispose individuals to contract or withstand disease: general health and nutritional status, stomach acidity, natural or acquired immunity. (Unfortunately, the length and strength of immunity is still a perplexing unknown.) Current research should produce vaccines to protect against many of these childhood diseases, but broad coverage of the order needed is highly improbable in the next decade.

These physiological variables are complicated by equally critical anthropological ones. Societies commonly have proscriptions against "fouling the nest," but the "nest" is not always clearly defined. For example, in low-density or arid areas, the nearest bush may provide nearly as good a means of excreta disposal as the most sophisticated flush toilet. Many societies consider infant feces harmless and are, consequently, hygienically careless with their disposal vis-a-vis interpersonal contact and food preparation. To people brought up with "modern" sanitation facilities, a toilet inside the house is unobjectionable. Yet, it took considerable time for North Americans and Europeans to accept that indoor plumbing was not merely an undesirable permanent consolidation of feces in

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2 Tuberculosis, 45%; typhus, typhoid and "continued fever," 22%; scarlet fever, 19%; cholera, dysentery and diarrhea, 8%; smallpox, 6%. (Listorti, 1977, and McKeown & Record, 1962).

the middle of one's living environment. These social changes implicit in water supply, sanitation and urban development projects will take time.

As mentioned, behavioral change most often does not occur until after the project cycle. Improvements are therefore often not evident in the short-term. Moreover, measurement of health benefits is difficult, even in successful projects. Only one disease (Guinea worm infection) is transmitted exclusively by drinking water. The remaining diseases are spread through a variety of mechanisms with varying responses to improvements in housing, drinking water, excreta disposal and domestic hygiene. Eradication and control calls for a combination of interventions. Projects dealing with these deficiencies separately have, therefore, dealt with only a portion of the variants, making assessments difficult. Recent projects adopting a more comprehensive approach, however, show evidence that refutes the argument that health benefits do not accrue through project interventions. In Malawi, for example, the integration of hygiene education into an ongoing water supply program of 14 years has shown substantial health benefits over the 5 years since its integration.

EVOLVING UNDERSTANDING OF DISEASES

On a more positive note, diagnostic advances of the past decade have enormously improved techniques to identify the etiology of diseases, now possible in over 80% of the cases when diarrhea is a symptom of infection. The implications of these findings indicate that transmission through direct personal contact rather than contaminated water or food is much more important than had been presumed earlier. Improved water, while still important, may not be the most important element in transmission of gastroenteric infections.

This knowledge establishes a link between water, sanitation and poor housing and also implies a change in emphasis in project interventions requiring a minimum set of interventions such as health education, good nutrition, and medical care. Water supply and sanitation still play an important role in reducing diarrhea; likewise shelter is important in reducing respiratory ailments. In the case of water supply, there is no doubt that the superior solution is the provision of individual water connections to houses. Water remains relatively free from contamination right up to the faucet and greater quantities of water are generally available for hygiene. But it is unlikely that house water connections will be universally installed in this century. It follows that to obtain maximum health benefits, projects should include, wherever practicable, subcomponents such as health education and health care.

II. RATIONALE FOR AN INTEGRATED APPROACH TO HEALTH

This Chapter presents the rationale for including environmental health components in water, sanitation and urban development projects and discusses issues that merit special attention when conceptualizing such components. It is intended principally but not exclusively for World Bank staff and their consultants.

LESSONS FROM HEALTH IMPROVEMENTS

Health improvement has provided one rationale for many water supply, sanitation and urban projects. It has been argued, however, that anticipated improvements have not approached those of Europe and North America in the latter part of the nineteenth early in the twentieth century. The challenge lies in interpreting past experience. Two lessons are immediately pertinent. First, environmental health improvements should be undertaken in the context of integrating the multiple causes of disease and death, not merely those interventions feasible in water, sanitation, or urban projects. Second, health improvements arising from such interventions may not have a perceivable impact over the short term on some of the most prevalent diseases, but can certainly make substantial inroads for future success. Hygiene education links the two lessons by relating them to human behavior and point to the need to consider projects in an integrated manner, beyond discrete sector interventions. In project terms, this would require a minimum package of complementary interventions.

IMPLICATIONS FOR PROJECTS

Environmental health components have an important role to play in eradicating the six broad disease categories which account for the majority of death and disease throughout the third world: malaria, schistosomiasis, hookworm, diarrheas, respiratory ailments, and malnutrition.

The positive impact of environmental health components over time will vary according to local circumstances. In all cases, health improvements are seriously compromised by not being able to control exposure outside the confines of the project. Malaria and schistosomiasis control are especially difficult because they entail long-term, complicated control of mosquitoes and snails. Hookworm and especially guinea worm control, by comparison, could quite likely be positive and perceptible in the short term even without major health education efforts. Diarrheas, respiratory ailments and malnutrition, by their nature, involve behavioral change. Whereas short-term improvements are possible, wide-spread sustained improvements will probably occur over the long term but probably not within the project cycle. Nonetheless, in all of the above, education about the means of transmission, plus improvements to living environments can reduce exposure, strengthen current programs and lay the framework to shorten the delay in the overall decline of morbidity and mortality.

HEALTH IMPACT ENHANCEMENT

Urban development, water supply and sewerage projects usually consist of several hardware components, such as housing, water supply, sewerage, drainage, roads, solid waste removal, etc. The principal justification for these projects is generally not the improvement of the health of the beneficiaries per se, although the impact on health is recognized. This impact can be significantly enhanced by changes in project composition or the addition of an appropriate environmental health component to the project. Changes in project composition, for example, the addition of drainage to control filariasis, can improve environmental health conditions. As a complementary input provided separately, a health education component could help ensure that such improved conditions are sustained as health benefits to the project beneficiaries.

Three principal categories of health effects arising from urban and water sector projects are identified below. In each category, projects require proper maintenance of facilities and would benefit from at least a minimal program to disseminate information and enhance beneficiaries' motivation. Such a program should explain the project, its health impact, and the need for proper maintenance. Obviously, beneficiaries will vary according to each project. As a rule of thumb, mothers are likely to be an important target group for most projects.

A positive health impact can be achieved as part of a traditional project:

1. Even without a specific health component, by providing improved facilities only. These projects do not necessarily require behavioral changes of the user. Examples are:

   - Bacteriological or chemical contamination, controlled by change in source or treatment of water in an urban water supply and sanitation and drainage project;
   - Filariasis, eliminated by improved waste disposal and drainage in a solid waste and drainage project;
   - Respiratory diseases, reduced by providing more efficient cooking/heating facilities and ventilation in a slum upgrading project.
   - Guinea worm, eliminated by changing or protecting the source of water in a rural water supply project.
   - Application of the guidelines merely serves to identify health conditions with a view of changing the project composition accordingly to ensure that feasible health considerations are included in the project.

2. By including environmental health components which require only moderate programs and follow-up. Local conditions can often be substantially improved by relatively simple interventions. Moreover, improvements tend to take place in the short term, and continue, assuming proper maintenance of the facilities. Examples are:

   - o intestinal worms, substantially reduced through provision of sanitation facilities combined with limited hygiene training, in urban or rural sanitation project; and
   - o accidents (such as drowning and burns), which can be eliminated by structural modifications to the living environment in a housing project.

3. By including health components which require extensive programs and follow-up, e.g., health education/ personal hygiene training or other complementary inputs. In many cases, a positive impact can actually occur within months, but requires long-term follow-up to be sustained and must allow time for behavioral change. Examples are:

   - o Diarrheas, substantially reduced through the provision of water and sanitation facilities combined with personal hygiene training in an urban development project with water supply, sanitation and slum upgrading; and
   - o Malnutrition, substantially reduced through extensive long term health education, provision of nutritional supplements, improved living conditions and water supply in a sites and services project.

The degree of follow-up will depend on local conditions. The terms moderate and extensive are therefore relative and represent two ends of a spectrum rather than mutually exclusive categories of components. Consequently, project officers should not to attempt to use health components to combat certain diseases. Examples are: schistosomiasis, malaria, and diseases resulting from industrial pollution. Controlling these diseases requires substantial long-term efforts, better tackled on a larger scale, and is typically not suitable for inclusion as environmental health components considered here. Disease prevalence should be noted and possible separate interventions explored, e.g., as a free-standing health project or a government program executed by another agency such as WHO or UNICEF. In such cases, of course, health education is helpful to explain to the beneficiaries how diseases are spread and it would be appropriate to add to an environmental health component which has been justified on other grounds. For their part, projects can contribute to disease control by including appropriate components such as drainage, pollution control, or identification of potential negative impact of project components (e.g., solid waste pollution of underground water, or creation of insect breeding habitats). The distinction between an actual health component and a

component with an environmental health impact is largely semantic. Ultimately, the difference is determined by the administrative feasibility of including such activities within the project. In light of the above, certain projects i.e., rural water supply and sanitation, shelter, and slum upgrading, could without exception include an environmental health component.

JUSTIFICATION

Improved Quality of Life. Environmental health activities offer an opportunity to provide benefits by improving the quality of life of project beneficiaries, in urban, water and sanitation projects. The benefits are complements to the provision or improvement of housing, water supply and sanitation that could otherwise be missed in large projects. Equally important, environmental health components can help forestall deterioration of health and lay a solid foundation for future improvements. In a phrase, environmental health activities can improve the effectiveness of project investments. Water, sanitation and urban projects may only require support in the form of health education to optimize health benefits. As a minimum when neither financial nor institutional means are available to do more, project beneficiaries can be informed and motivated to improve personal hygiene habits through a project agency's public relations effort.

Increased Investment Effectiveness. Projects designed to improve housing, water supply and sanitation services usually represent a significant investment for the community and the user. It therefore makes sense to incur the relatively minor expenses, at least for a public relations effort, to improve those personal habits which deny the user the full benefits of the facilities provided. In addition, the projects can provide the impetus to undertake more substantial measures to improve health if the institutional infrastructure exists. Environmental health components provide a low-cost means to make high-cost investments more effective at reaching their beneficiaries, especially poverty groups and women.

Systematic Consideration. Inclusion of environmental health components in projects is time consuming. Health components typically require a disproportionately large amount of time to prepare and implement relative to their size of the loan amount. This occurs for several reasons. First, health falls into the social sector and entails behavioral change. The required preparatory and follow-up activities frequently outstretch the project cycle. Second, responsibilities for health, shelter, water and sanitation are dispersed among several ministries, frequently weak. Inter-ministerial coordination is difficult. Third, health components normally require local funds, drawing on the beneficiary government's limited resources. Fourth, the community itself may not rank health improvement as a high priority. Often, because of ignorance, people live with malnutrition as fact of life and perceive high mortality as a cruel part of it. The community's perceived need, albeit inaccurate, often exacerbates the situation. Nevertheless, given the major investments that

projects represent, their impact on health should always be considerable and at least minimal health oriented-steps included to ensure the projects potential health impact is reached.

World Bank Publications. This Technical Paper supplements current World Bank publications with technical information needed to help incorporate environmental health considerations into projects. Publications on the water and sewerage sector largely address a technical audience and publications on the urban development sector deal only marginally with health issues, e.g., solid waste management (see Appendix F for list of publications). Those papers which do discuss health issues invariably focus on water- and sanitation-related diseases, primarily the diarrheas. The materials do not treat respiratory infections, malnutrition, poor housing and poor hygiene--equally important contributors to high morbidity and mortality. Health publications currently available on the market do not consider lending procedures in the context of water supply, sanitation and urban development and are thus of limited use in such projects.

EVALUATION

An environmental health component is defined as a support activity which focuses on environmental health aspects of urban and water sector projects, such as health education, deworming and immunization, and health clinics. In many respects, however, the term component is a misnomer; it implies a self-contained adjunct to a project. Health activities involve social change and cannot be so clearly circumscribed. For cost estimates and accounting purposes, however, it may be desirable to label part of a project "environmental health component" to accommodate project administration. Nonetheless, the long-term objective of improving health is implied--indeed, it is part and parcel of a project's conception and development--without overt identification. Similarly, success cannot be defined or measured by standard parameters, e.g., rates of return or construction schedules. In health work, ultimate benefits defy correlation with specific measures because too many interrelated variables interact simultaneously. That is, overall morbidity and mortality may not decline until the last of several conditions fall into place and standards of living rise. Health is a game of chance based on exposure and resistance to infection coming from several sources at once. Reducing exposure does constitute progress, even though individuals may still be sick due to other factors, just as regular, if sporadic, payments on a lien represent progress even though the lien is not removed until the last payment has been made. Lack of immediate visible success has contributed to a misunderstanding of the role and potential of environmental health components: unrealistic expectations, later unfairly judged as failures because of project-related time restrictions and a lack of statistically measurable data. This document, therefore, has made no provision for monitoring and evaluation of environmental health components.

TARGET GROUPS

Poverty Groups. Conventional water supply and sewerage projects [3] generally do not require health-oriented complementary software project inputs. Their beneficiaries are typically of a socio-economic status that allows them to pay for water connections, flush toilets and private health care. Their understanding of the interrelationship among health, water, sanitation, housing and personal hygiene practices does not require further health education. Moreover, the technologies do not require particular care by the user either to protect the purity of water or to ensure the sanitary disposal of waste.

Projects designed to improve the life of urban and rural poor, such as slum upgrading or low-cost water supply and sanitation, by comparison, are based on technologies providing lower, more affordable, service standards in order to reduce investment costs. Project beneficiaries are of low socio-economic status and usually need to better understand the interrelationships among health, water, sanitation, and housing in order to improve their personal hygiene practices and properly maintain the services. Thus, the feasibility of introducing health education and hygiene training (existing or new programs) should be at least considered for all such projects. Depending on the beneficiaries' health status, other actions such as immunization or nutrition improvements, may be desirable.

Women. No matter what combination of services make up a typical project in the two sectors, women figure predominantly as key participants and beneficiaries. Women support families, manage households, fetch water, and care for children when healthy or sick. Their specific needs will therefore require consideration as a high risk group and as a primary audience. Sustained health improvement stemming from water, sewerage or urban development sector projects hinges on education and behavioral change, factors which fundamentally involve women. Indeed, their role in ensuring the success of a project or component should not be underestimated; and their inputs and opinions actively solicited.

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3 Multiple outlet house connections and water-borne sewerage.

III. METHODOLOGY FOR IDENTIFICATION, PREPARATION AND IMPLEMENTATION OF ENVIRONMENTAL HEALTH COMPONENT

This Chapter first describes the main processes involved in the identification, preparation and implementation of an environmental health component and, second, presents in more detail the various steps. Appendix A gives step-by-step guidelines. The processes are the shared responsibility of the client government and the Bank, with the former collecting and analyzing the bulk of the data and the latter providing guidance and review as needed. Competent preparation, appraisal and monitoring of an environmental health component are important for two reasons: to produce the most beneficial component and to begin a more clear assessment of the effects of health measures in water, sanitation and urban projects.

MAIN PROCESSES FOR DESIGN AND IMPLEMENTATION

Determining the current health status of the population living in the project area will form the basis for preparing a suitable environmental health component. Gathering and interpreting information could be performed by the entity responsible for managing the anchor project, i.e., the water, sanitation or urban project. However, borrowers such as municipalities or public utilities typically have no expertise in the health or education sector and no resources to provide assistance on long-term health components. The work will then most likely be performed by consultants engaged by the agency or through some cooperative arrangements between the agency and local non-government organizations (NGOs). This Paper recommends that project organizations, when lacking expertise in the health field, not undertake extensive health-related activities; nor should they be encouraged to do so.

Once the principal sources of morbidity and mortality have been identified and matched to their sources, i.e., water, sanitation or housing, it will be possible to select inputs required to achieve the fullest health impact from the investment. Final selection will be made from a short list of possible environmental health components identified on the basis of their potential impact and feasibility of implementation. Each proposed initiative should be accompanied by terms of reference. Bank staff will assist government by reviewing the proposals.

In view of administrative practicalities, environmental health components can be defined as having short- or long-term impact. A short-term impact is possible within the project cycle but might probably require follow-up. Typical components in these categories could be: health facilities construction (clinics, health posts), deworming, immunization, household, community safety, emergency/stop-gap measures, health and hygiene education. A demonstration or pilot project, if coupled with long-term follow-up outside the project cycle, qualify as long-term impact

components. Typical components in this category might be: health facilities administration (clinics, outreach programs), hygiene education, nutrition, health promoters, sanitation inspectors, or demonstration projects in sanitation, water supply, or solid waste. The distinguishing feature in each case revolves around the suitability of the project entity to administer, operate and maintain the component. Usually, projects provide mainly the physical infrastructure. The thrust of the component should aim to formulate an appropriate collaboration with an agency outside the project. In general, the more complicated the administration and the higher the requirement for follow-up, the greater should be the effort to set up free-standing programs. A sample of an environmental health component based on a peri-urban area outside a South Asian city follows at the end of this Chapter.

Design and implementation of the environmental health component will begin with the identification of the agency to undertake the work and the inclusion of the inputs in the proposed project. Prior to project appraisal, agreement about the execution of the component(s) should be reached between the project entity and the agency responsible for the implementation of the component.

During appraisal both Bank staff and officials from the project implementing agency should be satisfied that commitments to be undertaken and schedules to be met are realistic and practicable. This is especially crucial because health activities are not monitored unless the anchor project specifically requires monitoring, evaluation, and data analysis. Since these are separate activities difficult to measure within the project cycle and, in any event, usually beyond the ability of the project agency to undertake, they are beyond the scope of this Paper and are not discussed.

USE OF TABLES

As mentioned above, the analysis of environmental health component identification and preparation revolves around the top ten sources of morbidity and mortality of the project area. Out of the top ten sources those related to housing, water and sanitation are then fed into a set of five tables formatted to include 26 of the most prevalent diseases also related to housing, water and sanitation. This formatting will allow comparison among projects and provide, as best as possible, standardization of terminology. The apparent complexity of the tables is misleading. Their main function is to stimulate discussion and help with the analysis, given that most borrowers may not have already compiled the necessary information. In essence, the information constitutes a combination of a health needs assessment and component impact assessment. Information can be ascertained by interviewing doctors, nurses, paramedics or NGO staff or from Ministry of Health officials. Normally, surveying is not required.

The complete set of tables to be filled out is repeated in three sections of this Paper. They are filled out as a sample environmental

health component described later in this Chapter (Tables III-1 to III-5). Next, they appear in Appendix A (Tables A-1 to A-5) worked out as a reference with typical values. This version also contains a definition of terms used in the Tables. Finally, they are included as blank worksheets in Appendix B (Tables B-1 to B-5).

Preparing an environmental health component entails six operations briefly described below.

Gathering Basic Health Data. The first step focuses on gathering basic information necessary to identify problems and define a suitable response. Essentially, this entails filling in two tables, which request the top ten causes of mortality and morbidity of the target population.

Relating Basic Data to Urban/ Water/ Sanitation Sectors. The second step produces a more clear definition of needs by relating the top ten causes of mortality and morbidity to deficiencies in housing, water and sanitation. Table A-2, Health Needs Assessment, provides a list of the most common diseases related to the urban, water, and sanitation sectors and requires an evaluation of frequency and severity of diseases.

Determining Source of Problem and Type of Project Intervention. The third step takes the analyses a step further by comparing the main sources of the problems with the focal points of preventive interventions, such as water quality, waste disposal, and education. Table A-3, Summary of Problems and Preventive Interventions, is designed to compare problems with possible project interventions.

Determining Complexity of Interventions. The next and perhaps most important step calls for analyses of the complexity of possible interventions to determine whether they are appropriate within the project. Table A-4, Summary Complexity of Interventions, gives a range of possibilities, e.g., time span, labor and material requirements, follow-up, etc., to help define the suitability of components.

Listing Possible Components. With an understanding of problems, potential interventions and their complexity, it should be possible to derive a short-list of components. The more complicated the intervention, the more likely it should be viewed independent of the proposed project. In these cases, a component would consist of a demonstration project or an effort to secure appropriate collaboration in tandem with the project. Table 5, Environmental Health Assessment Component, lists seven such possibilities (Annex A-5).

Preparing Proposal for Component (Terms of Reference). The short-list of possible components can then be worked into a specific proposal, indicating if it is to be entirely within the project or outside it. Sample Terms of Reference have been prepared and are given at Appendix C. The terms of reference call to attention costs, design, staffing, institutional aspects, implementation schedules, reporting procedures, etc.

A SAMPLE OF ENVIRONMENTAL HEALTH COMPONENT

The health situation described below is drawn from actual experience in a peri-urban area outside a South Asian city of one million inhabitants. The figures given in the tables are estimates and will vary according to local situations. The information would have been provided under the supervision of a local health professional with field and administrative experience. The tables are subjective and intended primarily to stimulate analysis of environmental health problems and assess the administrative complexity of their solutions. The tables are not intended to provide satistically significant information. In fact, they are based mostly on the educated guess of those familiar with the target population, rather than on recorded data.

The project could either be urban development or water/ sanitation, with slum upgrading. According to Tables III-1 and III-2, the following diseases should be considered for the proposed component:

- diarrheas
- hookworm
- malaria
- respiratory diseases
- typhoid
- tetanus (of newborns)
- tuberculosis
- malnutrition
- accidents (burns/poisoning/drowning)
- snake bites

Filling in Tables III-3 through III-5 would provide a list of essential and desirable elements to a component. Essential elements would consist of health education to help reduce diarrheas, hookworm, respiratory diseases, typhoid, accidents and malnutrition, and to a lesser extent, snake bites. The component could also help reduce drowning accidents (children and adolescents) in the nearby river by constructing bridges, fences and "beach" area for swimming. The component could also reduce household accidents by including a "model cooking area" as a demonstration project, showing a safe stove and proper storage of hazardous items. Household accidents consist largely of burns from cooking fires, drowning of infants who fall into various types of water-storage containers, and poisoning of children with rat poison and insecticides. A safe stove would have the additional benefit of reducing smoke which is a respiratory irritant. Improved cooking and storage facilities might also help reduce typhoid by inculcating better hygiene practices in food preparation. Improved storage facilities can also help reduce snake bites (snakes live in surrounding fields but feed on rodents around the homes, where most bites occur). Women, especially mothers, would be a crucial element in determining the component's success.

Desirable elements to complement the component, but executed by an agency outside the project, would include TB outreach program and malaria

control. Depending on the local administrative capacity, a nutrition program could be undertaken by the MoH or a local NGO. Moreover, it would also be desirable to provide information to residents, perhaps through the cooperation of the local agricultural extension service, to advise how to control rodents and avoid attracting snakes. The project would have to include funds to reimburse transportation costs of the agricultural extension agents.

The project entity should, therefore, undertake a minimum set of interventions that could have a major impact on hookworm, accidents, respiratory ailments and possibly, typhoid and malnutrition. Health benefits should occur even without complementary interventions, and the limited hygiene education could be done by the project entity without outside assistance. The project entity should seriously consider a set of recommended options that would complement the above but require outside management. These would include TB, malnutrition and snake bites. Finally, the project entity should avoid direct project involvement with malaria control, a measure too complex to be included in such a component. The project entity should, however, alert the appropriate ministry to ensure they are aware of the project activities, its health needs assessment and only then determine how to combat malaria. In this case, a component might provide assistance in setting up an appropriate malaria control program by an outside agency.

From values compiled in the tables, the following elements would be recommended for the health component: health education, with special emphasis on mothers; a demonstration stove (cooking area) and storage facilities; and construction of a protected swimming area. The project entity should also include the following as complements to the project to be managed by an outside agency: nutrition program; TB outreach program; and rodent/snake control.

Table III-1a

ESTIMATE OF TOP 10 CAUSES OF MORTALITY IN PROJECT AREA*

Sample from a peri-urban area near a city of 1 million in Southern Asia

Disease/Condition	Comments	Trends Over Past 5 Years
1. Gastroenteritis	Infants and children highest risk, especially of village people looking for work	Stable
2. Respiratory	Infants and children highest risk, especially of village people looking for work, congested living conditions	Stable
3. Meningitis	Infants & children highest risk, especially of village people looking for work, congested living condition	Stable
4. Neonatal Tetanus	Infants, many mothers do not come to clinic; mothers and traditional midwives have poor hygiene	Decreasing because of DPT programs
5. Puerperal Sepsis	Many mothers and traditional midwives have poor hygiene	Stable
6. Typhoid	All ages	Stable
7. Home Accidents	Fire accidents from cooking and poisoning of children (rat poison and insecticides); drowning (infants and children fall into water storage containers)	Stable
8. TB	Infants	Decreasing because of BCG program
9. Snake Bites	Generally around houses, snakes feeding on rodents that are near houses	Stable
10. Drowning	Children and adolescents swimming in nearby river	Stable

* For explanation, see Appendix A, Table A-1a

Table III-1b

ESTIMATE OF TOP 10 CAUSES OF MORBIDITY IN PROJECT AREA*

Sample from a peri-urban area near a city of 1 million in Southern Asia

Disease/Condition	Comments	Trends Over Past 5 Years
1. Malaria	Children and mothers	Increasing
2. TB	All population; infants most serious	Stable
3. Malnutrition	Mainly children-especially of villagers looking for work	Decreasing
4. Anemia	Children and pregnant mothers	Stable
5. Home Accidents	Burns in mothers and children from cooking fires, poison in children (rat poison and insecticides)	Stable
6. Whooping Cough	Infants and children	Decreasing because of DPT program
7. Diphtheria	Infants and children	Decreasing because of DPT program
8. Tetanus	Infants from poor hygiene by mothers and traditional midwives	Decreasing because of DPT program
9. VD/STDs, especially Gonorrhea	Adolescents	Stable
10. Ankylostomiasis	Children and adolescents	Stable

* For explanation, see Appendix A, Table A-1b

Table III-2

ENVIRONMENTAL HEALTH NEEDS ASSESSMENT OF PROJECT AREA

Sample from a peri-urban area near a city of 1 million in Southern Asia

Disease/Condition	Common and Serious	Common But Not Serious	Serious But Not Common	Explain Seriousness or Other Appropriate Information
Chaga's Disease				
Cholera				
Dengue				
Diarrheas:				
a) Undifferentiated	x	x		- prevalent throughout community, high cause
b) Specific				of both serious and not serious illness
Dysentery:				
a) Amebiasis				
b) Shigellosis				
Filariasis				
Food Poisoning				
Giardiasis				
Guinea Worm				
Hepatitis				
Intestinal Worms:				
a) Ascariasis				
b) Hookworm		x		- major cause of anemia
Malaria	x	x		- prevalent throughout community, but esp. high as cause of death in children
Onchocerciasis				
Respiratory Diseases:	x	x		- same as for diarrheas
a) Mild Short-Term				
b) Influenza				
c) Pneumonias				
Salmonelloses:				
a) Salmonellosis				
b) Typhoid	x			- very common, still has high mortality
Schistosomiasis				
Sleeping Sickness, Afr.				
Tetanus	x			- mostly of newborns because of poor hygiene
Trachoma				
Tuberculosis	x	x		- high because of overcrowding
Others:				
Accidents		x	x	- infant drowning more common than adolsec.
Malnutrition	x	x		- animal protein very expensive

Table III-3

SUMMARY -- PROBLEMS AND PREVENTIVE INTERVENTIONS*

	Main Source of Problem						Focal Point of Intervention					
Disease/Condition	Water Quality	Water Quantity	Excreta Disposal	Waste Disposal	Housing	Education	Water Supply	Excreta Disposal	Waste Disposal	Housing	Health Care	Education
Chaga's Disease												
Cholera												
Dengue												
Diarrheas:												
a) Undifferentiated	2	3	2	1	1	3	2	2	1	1	2	3
b) Specific												
Dysentery:												
a) Amebiasis												
b) Shigellosis												
Filariasis												
Food Poisoning												
Giardiasis												
Guinea Worm												
Hepatatis												
Intestinal Worms:												
a) Ascariasis												
b) Hookworm	0	1	3	2	2	3	1	2	3	1	0	3
Malaria	0	1	0	1	1	2	1	0	1	2	3	2

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

*For explanation of terms, see Appendix A, Table A-3.

Table III-3 contd.

SUMMARY -- PROBLEMS AND PREVENTIVE INTERVENTIONS*

Disease/Condition	Main Source of Problem						Focal Point of Intervention					
	Water Quality	Water Quantity	Excreta Disposal	Waste Disposal	Housing	Education	Water Supply	Excreta Disposal	Waste Disposal	Housing	Health Care	Education
Onchocerciasis												
Respiratory Diseases: a) Mild Short-Term b) Influenza c) Pneumonias	0	0	0	0	3	2	0	0	0	3	1	2
Salmonelloses: a) Salmonellosis b) Typhoid	2	1	1	0	0	3	1	1	0	0	0	2
Schistosomiasis												
Sleeping Sickness, Afr.												
Tetanus	0	0	1	1	0	3	1	1	1	0	0	2
Trachoma												
Tuberculosis	0	0	0	0	3	2	0	0	0	3	2	2
Other:												
Accidents	0	1	0	0	3	2	1	0	0	3	1	3
Malnutrition	3	1	1	1	1	3	1	1	1	2	3	3
Snake Bites	0	0	0	0	2	3	0	0	0	2	1	3

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

*For explanation of terms, see Appendix A, Table A-3.

Table III-4

SUMMARY -- COMPLEXITY OF INTERVENTIONS*

Disease/Condition	Area of Focus			Time Span				Integration Hard=3 Easy=1	Critical Mass High=3 Low =1	Labor Skilled=3 Unskilled=1	Material Outside Local	Perceived Priority	
	User	Environment	Health System	Long Short	Recurrent	Initiate	Impact					Need	Program
Chaga's Disease													
Cholera													
Dengue													
Diarrheas:													
a) Undifferentiated	3	2	1	3	2	1	1	1	1	2	1	2	3
b) Specific													
Dysentery:													
a) Amebiasis													
b) Shigellosis													
Filariasis													
Food Poisoning													
Giardiasis													
Guinea Worm													
Hepatitis													
Intestinal Worms:													
a) Ascariasis													
b) Hookworm	2	3	1	2	3	2	2	2	1	2	1	3	3
Malaria	1	3	2	3	3	3	3	3	3	3	3	3	3

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

*For explanation of terms, see Appendix A, Table A-4.

Table III-4 contd.

SUMMARY -- COMPLEXITY OF INTERVENTIONS *

Disease/Condition	Area of Focus: User	Area of Focus: Environment	Area of Focus: Health System	Time Span: Long Short	Time Span: Recurrent	Time Span: Initiate	Time Span: Impact	Integration: Hard=3 Easy=1	Critical Mass: High=3 Low=1	Inputs: Labor Skilled=3 Unskilled=1	Inputs: Material Outside Local	Perceived Priority: Need	Perceived Priority: Program
Onchocerciasis													
Respiratory Diseases: a) Mild Short-Term b) Influenza c) Pneumonias	2	1	1	1	1	1	2	1	1	2	2	2	2
Salmonelloses: a) Salmonellosis b) Typhoid	2	0	1	3	2	1	3	2	1	2	2	3	2
Schistosomiasis													
Sleeping Sickness, Afr.													
Trachoma													
Tuberculosis	2	2	3	2	3	2	2	2	2	3	3	3	2
Other:													
Accidents	3	2	1	1	0	1	1	1	1	2	0	2	1
Malnutrition	3	2	2	1	2	1	1	2	2	3	1	2	2
Snake Bites	3	3	1	1	1	1	1	1	1	2	0	2	2

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

*For explanation of terms, see Appendix A, Table A-4.

Table III-5

ENVIRONMENTAL HEALTH COMPONENT IMPACT ASSESSMENT *

Sample from a peri-urban area near a city of 1 million in Southern Asia

Disease/Condition (Use appropriate diseases from Tables 2)	Short-term Impact		Long-term Impact		Recommendations		
	Component with no follow-up	Demo. proj. alone	Component with follow-up	Demo. proj. plus follow-up	Component	Demo. Proj.	Outside Project
Diarrheas	health ed.				x		
Hookworm	health ed.				x		
Malaria							x
Respiratory Diseases	health ed.	demo. "stove"/ storage area			x	x	
Typhoid	health ed.	(demo. "stove"?)					
Tuberculosis							x
Malnutrition	health ed.	(demo. "stove"?)					x
Accidents	constr. "beach"	(demo. "stove"?)			x	x	
Snake Bites							x

A fuller explanation of the project components would be included elsewhere as part of the health component proposal.

*For explanation of terms, see Appendix A, Table A-5.

IV. LEADING DISEASES

This Chapter presents general observations on the most prevalent groups of diseases affecting health in the developing world and their vectors such as mosquitoes. A description of the principal twenty-six diseases giving a basic account of their development, symptoms, mode of transmission and interventions follows.

Basic knowledge about groups of diseases and individual diseases is essential in the preparation of an environmental health component when relating health considerations to sectoral interventions. The information contained in the Chapter aims to supplement and complement knowledge of Bank and field staff and consultants whose areas of specialty in urban or water sectors may not include a medical background.

The Chapter aims to put individual diseases in context. That is, individuals may be simultaneously afflicted with several diseases of different origin that are not always apparent. Consequently, the positive impact of a preventive intervention such as improved water, sanitation or housing may be effective, but not apparent since other interventions are also required. A persistent link among the interventions discussed is the need for improved hygiene practices, better drainage and sanitation and reduced malnutrition both in term of higher food intake and a better balanced diet--thus the importance of a multi-dimensional stance to attack health problems.

OBSERVATIONS ON SOME MAJOR DISEASE GROUPS AND VECTORS

Enteric Diseases. Enteric diseases, primarily diarrheas ,are diseases of the intestines and constitute one of the world's most severe health problems, perhaps the single most important cause of morbidity and mortality. As a group, most are preventable by simple, cheap means to keep drinking water free of contamination, provide sufficient amounts of water and education to enable people to maintain good personal hygiene. Despite their prime importance, a great deal of information is still speculation. Diarrheas can be caused by a vast range of conditions and are symptoms of numerous diseases. In most cases, however, the important biological distinctions, i.e., whether viral, bacterial or protozoal, are unnecessary since the majority of environmental health components would address the same set of factors: improved housing, environmental sanitation and hygiene coupled with a basic understanding of the vital importance of their interrelationship.

For the layman, intestinal disorders can be unnecessarily complicated. Under normal conditions, the intestines expel only about 1-2% of their intake. Diarrheas radically upset the process, expelling fluids

that should remain within the body. This excessive expulsion of fluids drastically alters the body's fluid/nutrient/electrolyte balance to the point of causing death.4 Diarrheas are particularly devastating for children. Children are more susceptible and more fragile to the shock of fluid loss. Since body organs develop at different rates, the effects of dehydration and shock are more pronounced due to the relative size of their intestines compared to total body weight. Some 10-20 million children die yearly as a result of diarrheal diseases. Unfortunately, the attention given to the infant mortality caused by diarrheas has tended to overshadow maternal mortality from childbirth as well as other enteric infections. Equally salient is the high morbidity to the general population from intestinal parasites, caused primarily by deficiencies in excreta disposal and lack of personal hygiene. These parasites currently infect some 3 billion people in developing countries and cause about 160,000 deaths per year. Even though their mortality rate -- under 1% of the infection rate -- is much less dramatic than infant mortality, the incalculable loss in human productivity is certainly significant.

Respiratory Diseases. Respiratory diseases are the unfortunate complement of water-related enteric diseases. Pneumonias, influenzas and the common cold fall into the category. Respiratory diseases have not been studied in the context of project interventions to the same extent as enteric diseases. The emphasis given to enteric diseases, therefore, reflects available literature, not an implication of relative importance. Essentially, there have been no equivalent quantum leaps in technology such as piped water supplies and sewerage to provide a benchmark for comparative analysis. There are, however, numerous links between respiratory and enteric diseases when one considers overall health improvement historically.

Respiratory infections are transmitted by airborne particles, droplets or physical contact, an extremely difficult feature to confront in typical project and component interventions. Again, hygiene education emerges as vital. An often overlooked aspect of transmission of respiratory diseases is as important as the diseases they cause. Airborne irritants predispose the body to respiratory disease. Influenza or pneumonia, for example, are often secondary infections that develop as a result of such irritations. This simplified distinction may help understand the consequences of high density living in slums and squatter settlements and poor quality housing in general. Smoke from cooking and heating with wood, charcoal, and kerosene irritates the mucuous membranes of the respiratory tract. Overcrowding increases the risk of exposure to droplet-spread infections. Poor circulation and lack of sunshine exacerbate the effects of both by inhibiting dispersion or natural sterilization by sunlight. Overcrowding, per se, is not the problem --

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4 In the average adult, approximately 8 liters of water pass through the intestines daily. Only about 2-3 liters come from food and drinking, the remainder being drawn from body fluids (e.g. mouth, stomach pancreas, liver and small intestines). Of this quantity, only about 0.1 liter is actually expelled as water via the large intestine; the rest is absorbed or excreted in urine.

high density cities much as Hong Kong and New York have very high health standards -- but a combination of factors which negatively reinforce each other.

Some respiratory infections are also associated with water supply and sanitation. Asbestos, a known carcinogen, is one such example. The question often arises about the risk to drinking water from the use of asbestos cement pipes. No clear health hazard has been established linking asbestos to drinking water, even though it may appear in small amounts. It does pose an occupational hazard in pipe installation, but wet-cutting can reduce the risk. Aerosol sprays from flush toilets and spray irrigation can also cause some enteric infections, e.g. polio and hepatitis, by spreading viruses contained in feces. This accounts for an insignificant amount except as an occupational hazard. In addition, air pollution from automobile exhaust and industrial waste, also can cause lung cancer and other respiratory diseases. Unfortunately these are difficult to trace systematically, since, cancers often do not develop until twenty years after exposure.

Malnutrition. Malnutrition, of course, complicates the problems of diarrheas and respiratory infections. Malnutrition also contributes to predisposing the body to infection by reducing natural resistance and can aggravate the consequences of any infection. Unfortunately, malnutrition, like so many of the diseases cited later, can go unnoticed unless it is severe. A specific example is the common deficiency of vitamin A. Vitamin A helps keep the mucuosal lining of the nose and mouth healthy to function as the body's first lines defense in resisting respiratory infections.

The distinction between imbalance and inadequacy is important to understand since malnutrition is frequently equated with food shortage, i.e. starvation or famine. While an unfortunate fact of life, extreme food shortages occur only in pockets and represents only the tip of the iceberg of general malnutrition. The most widespread problem comprises a combination of deficiencies of certain food groups, coupled with long-term or intermittent shortage of food. In a phrase, hunger rather than famine. An imbalance or an inadequacy of nutrients can contribute as much to malnutrition as starvation. In its severe stages, malnutrition is irreversible and can cause permanent brain damage and stunted physical growth. Two of the most common forms of malnutrition with serious consequences entail protein-carbohydrate and vitamin A deficiencies. The problem is compounded in the case of proteins since the body is incapable of manufacturing a certain category of proteins, "essential" amino acids from food not already containing them. Unfortunately, protein sources, i.e., meat, fish, egg, dairy products, certain vegetables and legumes, tend to be expensive.

After three months, children begin to loose the natural protection they inherited from their mothers. At the same time, they begin to be exposed progressively to more and more potential sources of infection from their living environment. Clearly, the highest risk confronts children up to five years, and pregnant or lactating mothers. Poverty enters the picture because the most nutritious foods, especially proteins, tend to be

expensive. Education enters the picture because the poor do not understand enough about nutrition to be able to combine inexpensive foodstuffs to be nutritious.

Intestinal Parasites. Viewed from another perspective, malnutrition has vast socioeconomic repercussions of national consequence. The health of a malnourished child is more severly compromised by infections with intestinal parasites, mostly worms. The most prevalent worm, ascaris, diverts nutrients to itself. An average load of 20-40 worms can consume the equivalent of 3.0 grams of rice per day per person. Current estimates indicate about 1 billion people world-wide are infected, which theoretically could account for some 3 million kilos of rice daily. The table below summarizes the six most prevalent intestinal parasites.5

Table IV-1

MAJOR INTESTINAL PARASITES

Worms	Infection Rate Year	Mortality Rate Year
Roundworms (e.g. Ascaris)	1,000,000,000	20,000
Hookworms (e.g. Ancylostoma/Necator)	900,000,000	60,000
Tapeworms (e.g. Taenia)	50,000,000	50,000
Whipworms (e.g. Trichuris)	500,000,000	? (low)
Other Parasites		
Amoebas (e.g. Entamoeba histolytica)	500,000,000	75,000
Giardia	200,000,000	? (low)

Most serious are the intestinal worms which account for over three-fourths of the infection and death rates. The parasites interfere with digestion, absorb needed nutrients, cause anemia and diarrhea. Each of these factors, in turn, can evolve into serious problems, such as malnutrition, vitamin deficiency and dehydration -- all more severe in children. Even though many curative medicines exist and are effectively administered, prevalence of these infections remains high because of the frequency of reinfection. This is in part due to a relative neglect in research and control since World War II when compared with other health matters such as primary health care, immunizations, oral rehydration therapy, and malnutrition which have, since that time, increased in importance of public health programs. Whatever the reasons, intestinal parasites remain an important health problem and contributing factor to malnutrition even though the death rate -- under 1% of the infection rate in the six examples cited -- is much less dramatic than the diarrheas of infant mortality.

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5 Source: World Health Organization. World Health, March 1984, p. 16; and Global Estimates for Health Situation Assesment and Projections, April, 1990.

Mosquitoes. Three mosquito genuses account for the majority of serious diseases spread to humans: Anopheles, Aedes and Culex. Each has vastly different breeding habits that have a bearing on project interventions (see Table IV-2, below). Anopheles favor reasonably pure, gently moving water. Aedes breed in small temporary amounts of clean water, e.g., water storage containers or puddles. Culex are much less choosy and breed in wells, standing water and other unsavory places such as pit latrines and cesspools. The implications of these breeding habits are obvious for water, sanitation or urban sector project and components. Drainage and solid waste disposal emerge as important as the provision of uncontaminated water itself. Despite specific breeding preferences, mosquito adaptability is indeed impressive. They can breed in fresh, salt or brackish waters and virtually anywhere where water collects: in tree holes, fallen leaves, coconut shells, cut bamboo, gourds, cans/tins, plastic residue, drying river beds, plant axils or leaves of pineapple, banana, coco yam, paw paw -- even hoof prints and discarded car parts! They thrive on living, organic matter, but can eat almost anything small enough to ingest. Their potential flight range extends as far as 200 miles (300 km.), but usually remains within two miles, and averages about 3/4 miles. In most cases, comprehensive environmental sanitation measures up to one mile are effective. This means, as a rule of thumb, that the inhabited area, plus a mile area around it, would require consideration as containing potential mosquito breeding grounds.

Table IV-2

CHARACTERISTICS OF MOSQUITOES

Mosquito Genus	Breeding Environment	Flight Range	Disease Vector for
Aedes	Clean fresh or salt water, e.g., water pots, cisterns, temporary pools, small containers, periodic flooding	up to 50 - 100 miles	Filariasis, yellow fever, dengue
Anopheles	Fairly clean brackish and fresh water, e.g., irrigation water, ponds, marshes	up to 3 miles	Malaria, filariasis
Culex	Polluted fresh or salt water, preferably permanent and heavily contaminated with organic matter, e.g., pit latrines, clogged storm drains, open sewers	up to 10 miles	Filariasis

Mosquitoes are attracted by bright light, dark clothing, carbon dioxide, warmth and moisture. Most frequently they bite at dusk, though precise habits depend on the species. Drawn by these factors, some species frequent houses for feeding and resting, while others only for feeding. Residual spraying is an effective means of control to reduce exposure, but must be repeated (e.g., every 4 months) and comprehensive to be effective in the long term. In most species, the female is the blood sucker, a biological necessity to produce eggs. The average female lives only about one month. Mosquito breeding takes from 3-7 days from hatching to adulthood, shorter at high temperatures (e.g., 30° C) and longer at lower temperatures (e.g., 16°).

INDIVIDUAL DISEASES

The following reference section lists twenty-six of the most prevalent diseases in developing countries gathered under a rather imprecise rubric of "living conditions." Reflecting the practical limitations of an environmental health component, the analysis stresses preventive rather than curative interventions which would also be a concern of health project. The presentations also reduce the importance of certain physiological and epidemiological distinctions of individual diseases as too refined for most component work. Indeed, these distinctions would be very important and absolutely essential to pin-point weak spots in cycles of transmission in research or health projects. To be practicable, however, component work tends to be much broader. Each disease description presented below is broken into three parts: description, transmission, and intervention.

Caveat: These are generalizations and may not be accurate for local conditions. For example, malaria and filariasis are spread by different species of mosquitoes that exhibit vastly different breeding and feeding habits. Still other diseases, such as measles or sexually transmitted diseases, have not been included. In theory, or under controlled laboratory conditions, they could respond to improvements in housing, water supply and sanitation coupled with health education. In practice, however, health components as treated in this document would realistically have little effect. Furthermore, the interventions described for each disease generally exclude curative health care interventions. Rehydration, for example, which includes Oral Rehydration Therapy (ORT), is discussed only if they serve as a means to interrupt transmission as a preventive measure for curtailing the spread of cholera, for example. In an analysis of a health project, rather than health component, this would assume a much more important role. Finally, due to recent advances, much of the information on diarrheal diseases in general is rapidly changing.

The Technical Paper is based on an integrated approach to health. That is, it looks at health as simultaneously related to the water, urban and infrastructure sectors as well as the need to

accommodate behavioral change of the beneficiaries. This integrated approach, unfortunately, complicates project administration and the nature of the health related interventions but is necessary to assure the maximum impact from health components. The point to note is that communicable diseases are spread by multiple interrelated factors due, in part, to deficiencies in water supply, sanitation, housing and education. All of these are aggravated by malnutrition and low levels of personal hygiene. Consequently, it may be necessary to consider in an environmental health component the integration of multiple factors as a minimum package of complimentary interventions. With this in mind, this Technical Paper is based on the premise that the simpler the component, the easier it will be to include, implement, and supervise it.

Name: **CHAGA'S DISEASE**

Other names: Trypanasomiasis, American

See also: Sleeping Sickness, African

Description: Chaga's disease is an acute infection which generally occurs in children, but can also be a chronic condition manifested later in life. Approximately 75% of cases are under 21 years old. The acute stages consist of variable fever, malaise, infection of the lymph glands and enlargement of the liver and spleen; inflammation of the site of initial infection (chagoma) may last up to eight weeks. Symptoms can develop into life-threatening complications involving the heart and inflammation of the brain. Chronic symptoms cause dilation of the heart, enlargement of the esophagus and colon. Chaga's disease is confined to the Western Hemisphere, especially in rural Mexico, Central and South America. About 15-18 million people are infected in Latin America. Of these, about 10% will probably develop into chronic, severe Chaga's disease. In some areas, chronic Chaga's disease accounts for 10% of adult mortality. In endemic areas, around 15% of the population may be infected. It tends, however, to be most common in rural areas, poverty groups, in families living in thatched/adobe huts, which provide an excellent habitat for the cone-nose bug which spreads the disease.

Transmission: The disease is spread by a blood-sucking cone-nose bug and has numerous reservoirs: infected humans, domestic and wild animals (dog, cat, pig, guinea pig, bat, house rat, wood rat, fox, opposum, armadillo). The bugs defecate when feeding; their feces transmit the disease by contaminating the eye, mucuous membranes, abrasions and wounds, including the bite-wound itself, the most common point of entry. Cone-nose bugs tend to bite at night. The disease develops within two weeks after the bite. The bugs become infective within a month after biting an infectious host and remain so for life, about two years. All ages are susceptible but the young are more severely affected.

Intervention: Elimination of insects from dwellings through insecticides or physical repair (they like to hide in small crevices),

use of bed nets, education concerning cycle of transmission are all recommended interventions. The cost of physical repair to poor housing, however, makes this potential solution difficult. No drugs yet are of proven value as a curative or preventive.

Name: **CHOLERA**

Description: Cholera is a serious acute diarrheal disease characterized by sudden onset, profuse watery stools (rice-water stools), followed by cramps and vomiting. These symptoms occur as a result of a poison produced by the cholera bacteria, or vibrio, in the intestines. Its most serious effects are rapid dehydration and shock. These, in turn, cause chemical imbalance in body fluids and eventually circulatory collapse. There are two types of the disease, classical and El Tor, the former being generally more serious. Fatality in untreated cases is severe - as high as 60% depending on its type - and can occur within hours of onset. With proper treatment, fatality can be reduced to less than 1%. Most infections, however, are symptomless or cause only short bouts of diarrhea. Cholera affects all age groups. In the malnourished, however, who are more susceptible to the disease in lower doses, even short bouts of diarrhea can have far-reaching consequences. Hence cholera is serious primarily as an epidemic, predominantly of lower socioeconomic groups where malnutrition is prevalent. There have been seven pandemics of cholera, i.e., global spread over an extended period (+ 15 years). For most of this century, cholera has been confined largely to Asia, but is now endemic throughout most of Asia, the Middle East and Africa. Since the 1960's, it has spread throughout Asia and extended into Eastern Europe, North Africa and Africa, and the South Pacific. Current foci are Africa (13 countries) and Asia (11 countries). Cholera is so well known and feared because of its dramatic, short-term, devastating consequences. Having originated in Bengal, cholera transmission has been understood for well over a century. The threat of cholera has probably done more to improve environmental conditions in 19th century Europe than any other form of persuasion or logic.

Transmission: Humans are the main carriers. Certain types of seafood and domestic animals are also known to harbor the disease, although their role in actual transmission is unclear. For every actual attack, there may be 50-100 symptomless carriers who can carry the disease for up to two months. Ingestion of water contaminated with feces or vomitus of infected individuals is generally considered the main route of transmission. Contamination of clothing, hands, food and bed linens by carriers or patients is also important. Transmission is also possible by eating raw or undercooked sea food, and to a lesser extent, food contaminated by flies. Because all of these have been implicated in varying degrees, it is difficult to single out a dominant mode of transmission. Vibrios multiply rapidly in foods like milk or boiled rice, especially if salt fish or meat is added. The vibrios are highly sensitive to desiccation, but can survive in absorbent materials, such as cotton, in bed linens, clothing, and bandages saturated with sweat.

The vibrios are also highly sensitive to gastric acid. Consequently, high doses must be ingested to cause infection in healthy individuals. Direct person-to-person contact is thus considered unlikely. Where cholera is endemic, it appears to occur with regular seasonal variations. Inconsistencies in various parts of the world, however, preclude precise correlation of spread of infection with climatic conditions. Infection usually occurs about 2 days after exposure and its communicability is presumed to last for a few days after recovery in most cases, and up to two months for asymptomatic carriers. The cholera vibrios can live in water for up to approximately 2 weeks; prefer brackish water and can survive for approximately 2 months in sea water. Higher temperatures reduce its endurance, lower temperatures extend it. Susceptibility of the population is variable and poorly understood, though it is considered to be a function of an individual's gastric juices and acquired immunity, hence its greater severity among children, especially the malnourished. In epidemics, infection rates, however, rarely exceed 1 to 2 percent of those exposed.

Intervention: Sanitary disposal of feces, improved housing, proper hygiene, handwashing, protection (chlorination in large doses) and purification of water supplies, boiling/pasteurizing milk and dairy products are all important general interventions. Tracking and, if necessary, quarantine of known cases is required but not always possible. Moreover, many governments tend to withhold figures on incidence of cholera. Effective control is still a matter of conjecture. The many inconsistencies in transmission make it difficult to cite various specific universally applicable steps. Cholera control due to environmental, water and sanitation improvements is inconclusive at best. Some apparently effective interventions may be due to a natural cyclical fluctuation of epidemics. Immunizations are possible, but they are short-lived (up to 6 months) and only partially effective (about 50%). Rehydration of victims, isolation, hospitalization, and medication are necessary curative interventions, and also function as means to interrupt the cycle of transmission.

Name: **DENGUE FEVER**

Other names: dengue hemorraghic fever, arthropod-borne viral fever, break-bone fever.

Description: Dengue is an acute fever of sudden onset and usually lasts about five days. Its symptoms include intense headache, muscle pains and rash. A more serious form of the disease, dengue hemorraghic fever, also exists. Its symptoms include vomiting, hemorrhaging, and shock where fatality in untreated cases can reach 50%, or be brought down to 5% or less with proper hospital care. Recovery may entail prolonged fatigue and depression. Dengue has been spreading steadily on five continents; it is endemic throughout tropical Asia, Northern Australia and West Africa, and also occurs in the Caribbean, South and Central America. The more serious hemorraghic version is limited mostly to Southeast Asia. Approximately 30-60 million dengue infections occur each year.

Transmission: Humans and certain mosquitos are the reservoirs (in jungle/forest areas, monkeys are also a reservoir). Dengue is transmitted by the bite of an infectious mosquito (genus Aedes). The disease usually develops three to fifteen days after the bite. Dengue is not transmitted person-to-person. Human blood is infective for about a week; the mosquito remains so for life. The general population is susceptible, however depending on type of disease, children or adults can be more seriously affected, especially for dengue hemorrhagic fever in children. Dengue hemorrhagic fever appears to be spread in the rainy season.

Intervention: The major intervention entails the elimination of the Aedes habitat which live in a variety of small pools ranging from tree holes to water storage pots (see note on mosquitoes). Education of the population about the mosquito habitat is indispensable. Protective screening and insecticides are also recommended but not always practicable or affordable.

Name: **DIARRHEA**

a. **UNDIFFERENTIATED**
b. **SPECIFIC**

Diarrheas comprise some of the socially most important diseases in the world today. The level of understanding their spread and potential control has changed dramatically in the past decade and is in a state of flux. Prior to the 1970's, diarrheas were assumed due to three major bacterial pathogens: shigella, salmonella and cholera. It is now clear that other bacteria, viz., E. coli and campylobacter, plus severe viruses, especially rotavirus, play an important role in diarrheal diseases. This distinction has helped markedly to understand their transmission and eventual control. Viruses tend to be very fragile outside their human host and die rapidly under adverse conditions of temperature and moisture. This has lead to the assumption that the majority of transmission occurs through interpersonal contact rather than in water or food. By comparison, bacteria can exist for long periods outside their human host and are more tolerant to adverse conditions of temperature and moisture. This leads to the assumption that bacterial infections as a broad class are probably spread more in food and water, than by interpersonal contact. Whereas prior strategies have emphasized water and sanitation -- in a phrase, engineering interventions -- this revised emphasis clearly points to the pivotal role of education as well. In this vein, personal hygiene emerges at least as important.

Diarrheas can be a mild to severe infection due to over 30 common communicable diseases (e.g. cholera, shigellosis, salmonellosis, amebiasis, giardiasis, gastroenteritis, viruses, protozoans or helminths). They can occur as a side-reaction to another disease or its treatment. Or they may also erupt for a variety of conditions such as

stress, changing environmental conditions, irregular diet or nutritional imbalances. Usual symptoms are loose stools (more than 5 episodes in 24 hours), nausea, often accompanied by vomiting and fever.

Name: **DIARRHEA: a. UNDIFFERENTIATED, WEANLING/CHILDHOOD, TRAVELER'S**

Other names: acute diarrhea, diarrhea of early childhood, weanling diarrhea, traveler's diarrhea, turista, Montezuma's revenge, Delhi belly...

See also: cholera, dysentery (amebic and shigellosis), giardiasis, food poisoning, specific diarrhea, salmonellosis.

This section discusses childhood and travellers diarrheas, the two major types of non-identifiable or undifferentiated diarrheas. They are most often classified as "undifferentiated" since diarrhea may result from several different pathogens, and laboratory identification is difficult or facilities unavailable. The others with a specific etiology are described elsewhere.

Weanling/childhood diarrhea

Description: This is a common infection that recurs for up to three months in bouts of four to five days. It can affect children before and after weaning, but is most common after, when the child loses the nutritional value of breast milk and some of the immunities acquired from its mother. At the same time that the child is being exposed to more and more sources of infection from its external environment. Only imagination limits what infants and children can put in their mouths, all of which is exacerbated by an unsanitary living environment and poor hygiene. Protein calorie malnutrition is commonly associated with these acute diarrheal episodes. (A typical example would be about 115 attacks per year per 100 children under five months receiving breast milk, but 275 attacks for the same 100 children after breast feeding.) Mortality can exceed 50 per 1,000 per year in preschool children or be as high as 40 per 100 in premature or low-birth-weight children. Highest incidence tends to be in hot dry periods, and associated with lack of water. Prime consideration is rapid dehydration, an important cause of death. Weanling diarrhea occurs at ages approximately 4 to 30 months depending on period of weaning and nutritional status of the mother and the child. In developing countries, diarrhea of newborns and children claims some 10-20 million lives yearly.

Transmission: Transmission in most cases occurs as a result of ingestion of pathogens in or on food, toys, pets, clothing and unclean hands of mothers and other children. The transmission cycle is perpetuated in a vicious cycle in cultures where children's feces are considered harmless. Unknowingly, mothers jeopardize their child's health by lax hygiene habits that actually increase exposure. Indeed,

even in nurseries, transmission appears primarily due to intrapersonal contact, mostly on the hands of those nursing the infants.

Intervention: Education about personal hygiene, especially the benefits of breast feeding and hand washing are key interventions. Except in nurseries, it is not clear, however, from contradictory findings how effective personal hygiene measures actually are. That is, certain viruses (e.g., rotavirus) have been transmitted in developed countries, although without producing disease, despite high levels of hygiene, sanitation, water supply and education. The crucial variable may likely be nutritional levels.

Traveler's diarrhea

Description: Common in tropical areas in newly arrived or departing travelers, migrants or refugees, this undifferentiated diarrhea can be triggered by a radical change in environment and food. Normally, the bouts last one to three days and are accompanied by nausea, vomiting and sometimes fever. A substantial portion, if not the single most important cause, of traveler's diarrhea is thought to be due to a bacterium, E. coli. Because high doses are necessary to cause infection, transmission is assumed to be via food or water in which bacteria have had time to multiply to an infective dose.

Transmission: The majority of traveler's diarrhea is assumed to be transmitted in food and water rather than interpersonal contact. Some diarrhea can be attributed to a radical and abrupt change in intake of food and water rather than to a pathogen *per se*.

Intervention: Precaution should be taken to maintain proper personal hygiene, and wash personal items, e.g. eating utensils, and the less obvious ones such as soiled clothing and bed linen, since certain bacteria can in fact live in these under ambient conditions of temperature and moisture.6

DIARRHEA: b. SPECIFIC - Campylobacter, E. Coli, Rotavirus, Norwalk-virus

Other names: Epidemic diarrhea and vomiting, epidemic collapse, epidemic nausea and vomiting, winter vomiting disease, severe gastroenteritis of infants and children, sporadic gastroenteritis.

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6 There is no convincing evidence that any of the prescription and over the counter medications used are especially effective in treating or preventing the symptoms. Medications which inhibit intestinal intestinal motility, for example, are of questionable use for either treatment or preventive since they inhibit intestinal activity. Sometimes expulsion of intestinal contents provides the best medicine by voiding the body of the infectious agent. The most important consideration in these cases is the liberal ingestion of safe and nutritious fluids to rehydrate the body and reestablish the various chemicals which have been voided through excessive loss of fluids.

Description: Gastroenteritis or diarrhea is an infection of the intestines causing nausea, vomiting, diarrhea, fever, abdominal pain. It can be severe in children and require hospitalization. When not specifically identified, it can also be classified as an "undifferentiated diarrhea". Usually, it lasts about 1-5 days, depending on the type. The occurrence of gastroenteritis or diarrhea is worldwide, most frequent in the winter months in temperate climates, year-round in the tropics. This feature suggests a higher level of interpersonal contact, including the possibility of air-borne transmission. There are four major types of pathogens currently deemed responsible for the major portion of these illnesses: rotavirus and Norwalk-type (both viruses) and campylobacter and E. coli (both bacteria). Normally the viral types are referred to as gastroenteritis and the bacterial types as diarrhea. For component interventions, this distinction is not significant since the general response would treat them the same. There are, however, different aspects of each. Three of the four account for high percentages of infant and childhood mortality (E. coli, rotavirus and campylobacter). Rotavirus, for example, which may account for up to 10% of childhood diarrhea, is most common in children 3 months - 6 years old, i.e., after weaning and until they have been able to acquire immunity from exposure. By comparison, since E. coli requires a large dose to cause infection, transmission in food and water increases in importance relative to intrapersonal contact. In dealing with infants, children, however, it is difficult to determine when they swallow an "infective dose", given the broad range of exposure. The high presence of antibodies in the blood (which show that an individual has been exposed to the disease) throughout the industrialized countries indicates that these diseases are being transmitted -- although with much lower rates of morbidity and mortality -- in spite of the high levels of education, hygiene, and water/sewerage services. Individual resistance due to higher standards of living and better nutrition may be a key factor. Unfortunately, the remainder of unknowns is still overwhelming.

Transmission: Humans are the major reservoir. The actual mechanism of transmission is still unknown because there are so many complicating factors and multiple routes of transmission. They are all clearly transmitted by the fecal-oral route, with food and water both implicated. In the case of children, the variety of means of transmission is infinite. Diarrheas usually occur within 1-5 days after exposure depending on type. Individuals can spread the infection to others for duration of infection, which can last up to several weeks, depending on type. The entire population is susceptible, though it is more severe in children. Some acquired immunity is apparent, but its duration depends on the virus or bacteria and often is unknown, reinfection is possible.

Intervention: Because of the number of complicating factors in transmission, recommendation of specific interventions is difficult. Proper hygiene, food handling, sanitary disposal of waste remain, of course, of paramount importance. In one case, campylobacter, which

accounts for 5-15% of diarrheas, transmission is also possible through animals: pets (dogs and birds), poultry, pigs, sheep, and cows. Unfortunately, their actual role is still unknown. This feature clearly defines a potential strategy: additional care is food preparation, avoidance of unpasteurized milk, and special care aimed at children to avoid pets and domestic animals -- hardly a practicable measure. As with all diarrheas, rehydration is important.

Name: **DYSENTERY: a. AMEBIC DYSENTERY**

Other names: Amebiasis.

See also: Bacillary dysentery.

Description: Amebiasis is an infection, primarily of the large intestine, with the parasite Entamoeba hystolitica. Most cases are symptomless or cause only mild abdominal discomfort. When a serious infection does develop, it causes fulminating [rapid onset and termination] dysentery, i.e., fevers, chills and blood or mucoid diarrhea in its severe forms. (Blood and mucuous in the stools are characteristic of dysentery but not diarrhea.) Long term infection can cause ulcers or abscesses or lead to secondary infections. The precise factors causing the more serious forms are still unknown. Amebas can absorb nutrients and blood, but feed mostly on bacteria in the intestines and, in most cases, appear not to be a primary contributor to malnutrition. Death from amebic dysentery is rare. Amebic dysentery ranks as a moderate problem socially because most regular infections are asymptomatic, endemic areas tend to be localized and epidemics tend to be short-lived. In the already malnourished, however, its social importance increases.

Transmission: Amebiasis occurs worldwide, with a prevalence estimated at 10 percent of the population. In areas with poor sanitation, prevalence is of the order of 30 percent, and can go as high as 80 percent. Asymptomatic humans are the main carriers. The parasite exists in 2 forms which can transmit the infection, a cyst, which is reasonably hardy, and a trophozoite, which is extremely fragile and extremely susceptible to gastric acid. It is the latter which is common during an acute attack or epidemic and hence, not extremely infectious because of its fragility. Transmission usually occurs by ingestion of cysts expelled in feces. Cysts cling to the surface of raw vegetables or fruit which have been contaminated by flies, by soiled hands of food handlers, or which have been washed or freshened by sprinkling contaminated water. Transmission is also possible through drinking water or improperly prepared local "brews." Cats and dogs have been implicated experimentally as carriers to other mammals. (Amebiasis can also be transmitted sexually where intimate contact would involve ingestion of fecal residue.) The trophozoites normally die within hours at ambient temperatures, as opposed to the cysts which can live several days, longer at lower temperatures. Cysts are most susceptible to desiccation but can remain alive on vegetables for 1-3 days, in fecal

matter under fingernails for 45 minutes, or on the hands for 10 minutes. In epidemics, infection is more commonly spread through contaminated drinking water. Infection occurs commonly two to four weeks after exposure, though it varies from a few days to several months or even years. An infected person can be communicable for years if untreated, which in mild or unsymptomatic cases can last for years. The general population is at risk, though all who are infected do not develop symptoms. Race, sex and age may affect susceptibility; immunity to reinfection has not been proven, but seems important.

Intervention: Sanitary disposal of feces, protection of water supplies from contamination, screening of food handlers, and hygiene education, especially of mothers, are the main recommended interventions. Unfortunately, extensive case studies do not show a consistent pattern which clearly implicates any single or collective means of transmission. Hence, preventive interventions such as sanitation are most likely to have a sustainable effect only over the long term. For drinking water, sand filtration removes nearly all cysts, while filtration with diatomaceous earth removes all. Standard chlorination does not destroy cysts, but iodine tablets are effective for small quantities of water. Because of the small size and low density of cysts, primary treatment is not especially effective. Secondary treatment and tertiary treatment can both achieve 100% reduction of cysts depending on the methods. Disinfectant dips for fruit and vegetables are not proven, though it is certainly recommended that vegetables be prepared using iodine solutions, strong vinegars or boiling. Infected individuals can be treated with amebicidal drugs.

Name: **DYSENTERY: b. SHIGELLOSIS**

Other names: Bacillary dysentery; can also sometimes be considered as food poisoning, gastroenteritis or undifferentiated diarrhea

Description: Shigellosis is an acute disease primarily of the large intestine, characterized by diarrhea, fever, vomiting, cramps, strained unrination/defecation and blood, mucuous and pus in the stools. (Blood and mucuous are characteristic of dysentery but not diarrhea.) The average case lasts about 4 days. Symptoms usually develop within two days of exposure. The severity of infection depends on dose, age and nutritional state of the infected individual. Mortality rate for a certain type can be 25% if untreated and can exceed 20% even in hospitalized patients. Shigellosis occurs worldwide. Its prevalence and fatality are greatest among children 1-4, with 60% occuring in children under 10. (Children under six months appear to have immunity from their mothers). It is a common and serious illness where nutrition and sanitation are poor and is more readily transmissible from an infected individual than many other diarrheal diseases. This means in effect, that shigellosis can be readily spread by interpersonal contact and flies. The potentially high mortality rate of certain strains and ease of transmission make it an important health problem.

Transmission: Humans are the reservoir. Transmission occurs by direct or indirect transfer of feces from an infected individual or carrier to another. An extremely low dose may suffice to cause infection. (Under laboratory conditions, only 10-100 bacteria were able to cause an infection in 10-40% of adult volunteers.) The prime method of transmission seems to be from unwashed hands or fingernails after defecation. Most transmission occurs within the household, except for occupational hazards. A large variety of transmission routes are possible besides direct physical transfer among individuals, e.g., clothes, toilet seats, glasses. Low temperature and lighting, plus high humidity extend the bacteria's survival. For example, 3 hours on hands, 17 hours on toilet seats, and 1 week in cotton have been recorded. Shigella multiply in contaminated food not served immediately. Water, milk and fly-borne outbreaks are also possible. The bacteria can survive for up to 3 months under optimum conditions in foods such as flour, eggs, milk and some molluscs and up to 2 weeks in acidic foods such as citrus juices. Individuals remain infectious as long as Shigella is present in feces, usually under one week and not more than four weeks. Because of its requirement for low temperature and light, plus high humidity, transmission on crops is not a major route. Survival on crops is rare beyond one week and probably very low beyond 2 days in hot arid climates. The bacteria can, however, be spread by aerosol droplets in flush toilets and spray irrigation systems. Groups working with wastewater are therefore at risk in irrigation or treatment. The general population is susceptible, but the disease is more severe in children than adults and in the aged or those suffering from malnutrition. Some resistance is apparent from the particular strain causing the infection.

Intervention: Most studies show that shigellosis reduction correlates most highly to water availability. Personal hygiene, especially of hands and fingernails; sanitary disposal of feces, fly control; education; proper cooking and storage of prepared foods are the major preventive interventions. Emphasis on home, schools or workplaces will vary accordingly. Standard chlorination is effective in reducing shigella in drinking water. As in the case of diarrheas, rehydration is important for those with the disease. Antibiotics appear to shorten the illness, but resistance to them is common.

Name: **FILARIASIS**

Other names: Wuchereriasis, Bancroftian filariasis, Elephantiasis, Malayan filariasis, Brugiasis, Timorean filariasis, lymphatic filariasis.

See also: Introductory note on mosquitoes.

Description: Filariasis is general term referring to an infection with filarial worms, spread by insect vectors. River blindness (onchocerciasis) and Guinea worm infection (dracunculisais) are examples, and treated separately. This section referes to lymphatic filariasis, the most widespread.

Filariasis is an infection with a small worm which causes inflammation and blockage of the lymphatic system (a part of the circulatory system). Reaction to this blockage, in turn, can cause headaches, nausea, fever, and painful swelling of the lower extremities, genitalia and breasts, often with thickened and rough skin. Though it can result in serious complications to the circulatory system, the disease is more disfiguring than life-threatening except in serious cases. Disfigurement and deformity, which may take up to 20 years to manifest themselves, may have a greater social consequence as a handicap than its actual health effects. Filariasis is endemic across the equatorial belt in most warm regions where mosquitoes can exist (Genus: Aedes, Culex, Anopheles, and Mansonia). Currently there are over 250 million cases in 76 countries worldwide, over half in Southeast Asia, especially India. In the Western Hemisphere, filariasis occurs in the West Indies, Venezuela, Panama, part of the Guyanas and Brazil. Approximately 900 million people live in areas where filariasis is endemic. Because filariasis is spread by mosquitos, it can be either urban or rural. The predominant form of the disease, however, occurs in urban areas. It has been suggested that the disease is on the increase because water resources development projects have expanded year-round mosquito habitats in rural areas. Similarly, a proportionate lack of development projects to keep pace with urban growth and population migration have potentially expanded its urban habitat. Waste water contaminated with organic matter, storm drains functioning as open sewers, and pit latrines are of particular importance. Stagnant and improperly maintained water sources also play a role. These provide breeding sites for the Culex mosquito which accounts for most of the disease distribution. In Africa, however, Anopheles, which breeds in clean water, accounts for most cases. The disease has been know since ancient times, and the intermediate mosquito identified in 1878. This has given rise to speculation that the the disease originated in India and was conveyed to Africa by Indian migrants to eastern Africa. In the South Pacific, the disease is spread by a species of Aedes which is rural.

Transmission: The disease is spread by mosquitoes when they pass on the blood of an infected individual. Humans are the major reservoir (though, in some species, mammals can provide and intermediate host). The mosquito biting habits have a bearing on local transmission and intervention. 7 Culex, the major source of filariasis, bites at night. (It is interesting to note that a heavily infected human can kill the mosquito!) Development of the disease in humans takes three months

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7 An infected individual can only spread the disease at certain stages, i.e., when the parasite worms are actually active in the blood for the mosquito to suck out. It now appears that the parasitic activity may be a result of oxygen release in the blood due to physical activity. Better understanding of this factor may provide an additional means to break the cycle of transmission.

or more after the bite. Humans can infect mosquitoes, and continue the chain of infection, as long as they are infective, up to five years or more. 8 All humans are at risk, though the disease is rare among children because it may take up to 20 years for the disease to cause blockage in the lymph system. There is considerable variation in severity according to various geographical differences. Repeated infection can occur.

Intervention: Control of mosquito breeding grounds is of paramount importance. Culex mosquitoes, the principal vector, prefers water contaminated with sewage or other organic matter for breeding. This implicates poor sanitation, especially pit latrines as a source of spread near living environments. VIP latrines are effective for control of breeding in latrines. However, in urban areas filariasis is primarily associated with sewage and sullage in drains and ditches. Where waste stabilization ponds are used for wastewater treatment, overhanging vegetation has been associated with Culex breeding. By and large, mosquito control should focus on: 1) elimination of mosquito breeding sites through land fill or application of oil or insecticides and ii) alteration of physical environment. Obviously, local factors will determine the efficacy of any measures. High water tables, seasonally or throughout the year, and increased water use compromise many sanitation methods. Detergents in wastewater emulsify oil and limit its efficiency (oils inhibit respiration of mosquito larvae). Natural predators, e.g., guppies, are only possible in canals large enough to provide adequate oxygen. Some mosquitoes readily build up resistance to insecticides. Nonetheless, numerous possibilities exist which are universal: keeping drains as clear as possible to reduce stagnation; fitting and retrofitting of septic tanks, latrines, and vent pipes with mosquito netting (more mosquitoes escape through vents than holes in squat plate or toilet seat); covering or repairing soakage pits, septic tanks, and latrines; fitting or retrofitting water seals; avoidance, where possible, of open drains for sewage and sullage; use of insect traps. Use of insecticides, however, is compromised by their high cost. Because of the short breeding cycle, i.e., approximately 2 weeks, all methods require recurrent attention. This factor, in turn, requires community involvement and education. Protective netting and spraying against mosquitoes in houses are effective only for "domesticated" mosquitoes, but not for sylvan types. Medication and, in extreme cases, surgery are the major curative interventions; no vaccine exists at the moment.

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8 The worms undergo development in the mosquito in about 2 weeks, then and are passed on to reinfect another human. When they are deposited on the skin during a bite, the worms later penetrate the skin, probably at the punctured skin area. The mosquito, which takes about 2 weeks to hatch, becomes infective 10 days after the blood meal and remains infective until larvae are discharged from its system.

Name: **FOOD POISONING**

Other names: Foodborne intoxication, foodborne disease, botulism.

Description: Food poisoning is a general term referring to illnesses, usually vomiting, caused by contaminated food or water. It is often, but not necessarily, accompanied by diarrhea, cramps, or fever. Food poisoning can be considered more an intoxication than an infection. Intoxicants or poisons can be chemical, bacterial or a variety of naturally occurring organic substances present in such foods as mushrooms or shellfish. Vomiting and diarrheas from gastroenteric infections, e.g. salmonellosis or typhoid, can also be classed as food poisoning, whenever their identification is not possible. A characteristic feature of food poisoning is its rapid onset. Food poisoning occurs worldwide, and is relatively frequent. Indeed, WHO even considers illness due to contaminated food as perhaps the most widespread health problem in the wontemporary world. Food poisoning commonly refers to a bacterial, rather than viral infection, a distinction not of major consequence to this Technical Paper since both types of infections respond in more or less the same way to project interventions, but with bacterial infections being somewhat more responsive to improved water quality.

Transmission: The most common mode of transmission is through food, especially meats and food prepared with milk products, which have been under-cooked or kept unrefrigerated, allowing time for the pathogen to reproduce in the food to a toxic dose. (In the case of botulism, food insufficiently cooked prior to canning.) Of particular risk are large quantities prepared for groups where portions of the food cool or are reheated unevenly. Most cases produce symptoms within 1-14 hours depending on the type of food and the toxin. Food poisoning is not directly communicable among humans.

Intervention: Proper food handling, and storage is essential, though this is not always a feasible recommendation. Cooking to 60°C or 140°F for at least 15 minutes is the recommended procedure to ensure chemical break-down of the toxins, and storage of food (covered) under 4°C or 40°F. In the case of cooked foods, cooling time of 2 or more hours is sufficient time for food to become contaminated. Curative interventions include rehydration and patience since the best method is often for the body to purge itself of the toxicants.

Name: **GIARDIASIS**

Other names: Giardia enteritis, Lambliasis, Giardia duodenalis.

Description: Giardiasis is a infection of the small intestine. Sometimes only mildly symptomatic, the disease can cause diarrhea, bloating, malodorous stools, inflammation of the bile duct, malabsorption of nutrients, fatigue, weight loss and malaise. The disease usually lasts less than three months and is rarely fatal. Giardia has been known as an intestinal parasite since 1859 and not

considered especially important, probably because of the high levels of symptomatic cases and the earlier assumption that it was not pathogenic. It is now apparent that giardiasis can have negative nutritional consequences. Giardiasis is more likely to be severe in prolonged cases and in individuals with protein-calorie malnutrition, low gastric acidity and immunodeficiency, all of which predispose individuals to contract the disease. In severe cases, the disease can persist for years. Giardiasis can be one of the causes of travelers diarrhea, and is now one of the most commonly found intestinal parasites through out the world today, with about 200 million people infected worldwide. Giardiasis occurs worldwide; children are more frequently infected than adults (perhaps three times more). A prevalence rate of 50% among children is not uncommon. Current prevalence is estimated at about 2-7% of the world's population. Giardiasis is more prevalent in areas of poor sanitation and poor hygiene, and among malnourished children. A direct correlation between poor sanitation and economic development is not clear, since outbreaks regularly occur in economically developed countries with high standards of living, and in children in developing countries who are not disadvantaged.

Transmission: Humans are the main carriers, but it can also be spread by animals. Beaver and deer are known vectors; rats possible. Flies are probable in areas of high prevalence. The disease is spread primarily through fecal contamination of water, and also by fecal-oral transmission in food and interpersonal contact. Epidemics tend to be water-borne. Contaminated hands are probably the main sources of transmission in outbreaks where water supply is protected. Development of the disease varies, but usually develops within 3 weeks of exposure. A high rate of asymptomatic carriers contributes markedly to its continuation. Up to 900 million cysts can be shed by an infected individual though it is not clear that all are infective; 25-100 cysts are sufficient to cause an infection. An infected individual remains communicable for the duration of infection, usually under three months. The high level of infection in children implies some acquired immunity, but its duration is unknown and reinfection is common.

Intervention: Sanitary disposal of feces to protect water supplies is the main preventive intervention, since the disease is primarily waterborne. Protection of water supplies from animal feces is clearly more difficult. Sand filtration is effective in eliminating cysts when done under high standards of operation. Chlorination is probably not effective at currently practiced standards. Because of the anomalies in transmission, hygiene education may be the most important intervention (as with amebiasis). Cysts are killed by desiccation and freezing, but resistant to wide ranges of pH and ambient temperatures. Secondary sewerage is effective in reducing 50-90% of the cysts, waste stabilization ponds 100%. Since normal night soil and sludge treatment process do not produce a hostile environment for cysts, their reduction and elimination is a function of time and temperature. There is evidence of protective immunity after repeated exposures. Medication is available for infected individuals. (See also "amebiasis". By comparison, amebiasis has been the object of more study and the information is applicable to giardia).

Name: **GUINEA WORM DISEASE**

Other names: Dracontiasis, Dracunculiasis

Description: Dracontiasis is an infection of the tissues with a large roundworm. Its most frequent characteristics are blisters or skin ulcers that last up to several months and are caused by toxins released by the worms. The blisters normally occur on the lower extremity, especially the foot, and elsewhere on the body. The thread-like worms measure 30-120 cm. (1-4 ft.) Symptoms include burning, itching of skin, nausea, fever, vomiting, diarrhea. As such, dracontiasis is not a killing disease but an extremely debilitating one. The main repercussions occur as the consequences of infestation by the worm, secondary infections, and the presence of an open sore. These include abscesses, arthritis, and tetanus. Some worms remain in the body and are calcified. These repercussions determine its social importance, a devastating consequence to agricultural productivity, since the disease causes debility during planting and harvest seasons. In endemic areas, it is not uncommon to find 50% of an entire village afflicted. About 30% of cases result in incapacitation, about 0.5% with permanent disability and 0.1% mortality. Disability ranges from 5-10 weeks in untreated cases. In western Nigeria, for example, the average disability lasted for 100 days. In essence, the disease means a significant wage loss those whose livelihood depends on seasonal labor. Prolonged periods of school absenteeism is more difficult to measure but certainly important. Over 50 million people worldwide are estimated to have the disease which occurs in Asia (India), Africa (primarily western, central and north), Middle East, West Indies and northeastern South America. Dracontiasis has been known since biblical times, i.e. the "fiery serpent." Guinea worm infection is also significant in that it is the first human disease discovered to have an arthropod as an intermediate host (1869), a "first" which has unfortunately not made it any easier to eliminate the disease.

Transmission: The disease is spread by infected humans, and is the only disease spread exclusively in drinking water. Larvae are discharged by the worm periodically over 2-4 months when the infected individual immerses the blister in water, e.g. swimming, fetching water, doing laundry. These larvae, which can survive in water for up to a week, are swallowed by a small crustacean (Cyclops) about the size of a flea and then develop in about two weeks. Humans who swallow the crustacean can acquire the infection when the worms are released in the stomach and then migrate to muscle tissue.9 Individuals with high stomach acidity are less prone to multiple infections. This feature tends to increase susceptibility for those actively engaged in farming. That is, they tend to drink more to replenish water lost in sweat and, being away from their houses, probably eat less frequently. These, in turn, dilute or lower stomach acidity. The species of cyclops which spreads the disease

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9 After discharging her eggs, the female is expelled and the open sore can heal. Females live about 12-18 months; it takes about 1 year to produce eggs.

favors stagnant water, i.e., unprotected wells, ponds and inlet pools, rather than flowing rivers or streams. Transmission is seasonal, depending on geography and rainfall. In dryer regions, peaks occur where rainy a season produces seasonal ponds that can support the cyclops. Transmission in wetter regions, by comparison, is reduced where the rain overflows ponds or causes turbidity unsuitable for the cyclops. There is no known acquired immunity.

Intervention: Protection of water source from contamination by infected individuals is a straightforward and effective measure. Simple architectural improvement of water sources, such as sealing wells with covers or adding a stepping platform, can prevent immersion of infected parts, usually lower leg. Boiling or filtering water eliminates the crustacean. Holding tanks are not effective since it is possible for larvae to be released from a dead cyclops. Treatment of water with chlorine or copper sulfate is also effective. High risk groups are those engaged in farming, a sweat-enducing activity, when they drink directly from ponds or unfiltered, unboiled water. Education about life cycle of the disease is also vital, but it is not always possible to change behavior where water sources are not protected from contamination at their access points. The most common form of treatment is to remove the worm physically by wrapping at around a twig, little by little, until the worm is fully removed. Chemical control of the cyclops is possible, but of limited utility due to the cost and practical difficulties of application in rural areas. Several medications exist hat can control the worm once in the body, but these are expensive for mass treatment and have toxic side effects. There are also traditional herbal remedies, but their potential use is often compromised by people that think the disease is not preventable, especially since the disease is not manifest for a year after drinking water that is only potentially contaminated for part of the year.

Name: **HEPATITIS**

Other names: Type A hepatitis, Viral hepatitis, Epidemic hepatitis, Epidemic jaundice, Infectious hepatitis, Catarrhal jaundice.

Description: Hepatitis is actually a general term referring to an infection of the liver. There are three main types of hepatitis: type A, type B (or serum), and type C (formerly called non-A,non-B). This description pertains only to Type A. The remaining two types, while serious health problems, do not fall in the purview of this work since their transmission revolves around contamination of blood (e.g, in transfusions, dirty needles), and to a certain extent, sexual intimacy.

Hepatitis is a serious infection of the liver with an abrupt onset of fever, malaise, loss of appetite, nausea, abdominal discomfort, followed in a few days by jaundice (yellowing of skin and whites of the eyes). It can be a mild illness of one to two weeks or last several months. A long convalescence is generally necessary, but completely

effective. The severity of the disease seems to increase with age. Many children are only mildly symptomatic and escape diagnosis. Most cases are diagnosed in older children and adults. Mortality is usually less than 1%. Even in countries with high standards of living, exposure to hepatitis is widespread but underreported because infections are mild and go undetected. Outbreaks are common in institutions, lower socio-economic groups; epidemics are common in school-age children and young adults, and situations of congested housing with poor hygiene. The disease tends to be more prevalent in rural rather than urban areas. Hepatitis is endemic worldwide, with a tendency to cyclic recurrences. In temperate countries, incidence is higher in autumn and winter except in cases of epidemics. Known since the fifth century B.C., the virus was only identified in feces in 1973.

Transmission: Humans are the main carriers. The disease is transmitted in feces, urine, and probably also discharges from throat and nose. Intrapersonal contact is the main route of transmission, presumably of the fecal-oral route. Outbreaks are most frequently related to contaminated water supplies, but can also be due to food, including milk, raw or undercooked molluscs (e.g. clams and oysters), which retain and accumulate the viruses. Transmission via molluscs appears to be dose related since it is not clear that cooking kills all the virus. Spread through this route, therefore, would appear to reflect general levels of contamination of the salt water habitat. Depending on dose, the disease develops normally about 30 days after exposure and is most highly communicable while still developing within the infected individual, i.e. usually about two weeks after exposure. Susceptibility increases with age probably because the effects of immunity lessen with age as the body becomes more generally susceptible to disease. Infants and preschool children are infected, but frequently do not exhibit symptoms. Hepatitis imparts an immunity but its strength and longevity are not certain.

Intervention: Proper sanitation of human waste, personal hygiene, and thorough cooking of shellfish are the main interventions. Precise interventions concerning water and wastewater treatment still remain speculative because of past difficulties in isolating the virus from actual field outbreaks. The hepatitis virus appears resistant to normal chlorination, but water meeting conventional bacteriological standards does not appear to cause the disease. Immunization is also available but usually lasts under two months. No specific medication for hepatitis exists. A vaccine is under experimentation.

Name: **INTESTINAL WORMS: a. ASCARIASIS**

Description: Ascariasis is a worm (nematode or roundworm) infection of the small intestine which causes digestive and nutritional disturbances, rashes, restlessness and insomnia. Symptoms in 85% of the cases are mild or absent. During its development, the worm larvae migrate through the circulatory system. This can lead to numerous other secondary infections such as pneumonia. In children with heavy loads, ascariasis

can cause other serious complications, e.g., severe malnutrition or intestinal blockage.10 Prevalence is worldwide, but mostly in tropical countries where it can reach 50% of the population. Young children are more frequently and more heavily infected. Prevalences from 60 - 90% of children and 10-50% of the aged are not uncommon. In Africa, it was estimated that about one-third of the population is infected. Up to 1 billion people are estimated to be infected worldwide, resulting in some 20,000 deaths annually. It has been suggested that mortality due to ascariasis as a contributing factor is much higher than estimated but generally underreported or attributed to another disease listed as immediate cause of death. Unfortunately, its widespread mild occurrence has led many people to assume it is harmless, a part of life. Ascariasis tends to be spread in the immediate vicinity of households. Where night soil or sewage effluent is used as fertilizer, ascariasis can be spread through raw or undercooked vegetables. This distribution pattern, therefore, may be due to cultural and occupational factors where the very young and very old tend to spend more time near the house, a feature which tends to compound the problem in a vicious cycle. Because it is so widespread and difficult to eliminate, due to the persistence of ascaris eggs, it is a serious health problem. However, in view of its proportionate low mortality rate (less than 0.02%) and symptomless infection, it is not considered a priority when compared with other diseases seen to be more serious.

Transmission: Humans are the reservoir, but pigs, chickens, cats and dogs can act as vectors by eating human feces and passing on the eggs, which aggravates transmission in work and living environments. Ascariasis is spread by ingestion of eggs from soil contaminated with human feces. Salads and raw vegetables are the most frequent vehicles, especially when manured with human feces. Dirty hands and children's play things that have fallen on the ground also tend to be the major vehicles of transmission. By and large, the bulk of transmission in highly endemic areas appear to focus on household activity, exacerbated by small children's defecation indiscriminately around the living areas. Soil on feet, shoes and sandals can also transport eggs long distances; transmission in dust is also possible. Indeed, transmission on bank notes has even been implicated. After eggs are swallowed, they eventually develop passing through the circulatory system and settle in the intestines as mature worms, a process which takes about 2 months. About two to several weeks after being shed, eggs develop into an infective stage in soil under ambient conditions (loose, moderately damp soil with ample oxygen and temperature over 15°C) but eggs can tolerate adverse conditions. Eggs die within 1 hour at temperatures over 50°, and within 15 hours of exposure to direct sunlight. Humans remain infective as long as live female worms inhabit the intestines. A female

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10 Estimates of nutritional consequences vary. Twenty adult worms, a normal mild infection, consume about 3g. carbohydrate and 1g. protein daily, hence the consequences of infection depend on the load. Similarly, this could consume 10% of a child's protein and cause deficiencies in vitamins A and C. In addition to this consumption, worms also can inhibit nutrient absorption.

can produce 200,000 eggs daily, or 26 million eggs over her life time, about 6-18 months average. About 60% of these can become infective. Average worm life span extends 6 to 18 months. Eggs in the soil can remain viable for several months; up to 10 years has been reported. The general population is at risk, though some individuals seem to develop some immunity with age.

Intervention: Since water is not significant in transmission, proper disposal of feces, prevention of contamination in areas adjacent to living quarters, especially play areas are some of the primary preventive measures. Because children appear to be the main reservoirs of infection, education about hygiene and food handling, focusing on them, is indispensable, including the design of toilets. Given that eggs do not become infective for about two weeks, regular environmental clean-up of household areas is not unrealistic. A variety of sanitation measures are possible and effective, but depend on three overriding complementary variables: time, temperature and moisture. Mass deworming with drugs is of questionable value except in severe cases because of high probability of reinfection unless effective sanitary measures and hygiene education are also taken. To be effective, deworming campaigns should be repeated at intervals of less than 2 months as long as individuals are shedding eggs. Otherwise, reinfection to pre-treatment levels are likely to return within 6-12 months. Effective sanitation measures, however, will only work if accompanied by proper education.

Name: **INTESTINAL WORMS: b. HOOKWORM DISEASE**

Other names: Ancylostomiasis, Necatoriasis, Uncinariasis, Ankylostomiasis

Description: Ancylostomiasis is a chronic and debilitating infection of the small intestine with hookworm (a nematode, Necator sp. or ancylostoma sp.) causing anemia of varying severity depending on the worm load. The anemia is caused by the blood-sucking worm which attaches itself to the intestinal wall. (It's "head" end is curved like a hook, hence the name.) It can be symptomless in light loads, or conversely, in heavy loads, lead to mental retardation and stunted physical development in children, especially if they are malnourished. Symptoms include abdominal pain, indigestion, diarrhea, constipation and a desire to eat soil (geophagy). Pregnant and lactating women are especially vulnerable. It has been estimated that one liter of blood is lost for every hundred persons infected. The consequences of anemia can include lower productivity, poor memory, heart disease and variety of adverse effects to the reproductive system, e.g., infant and maternal mortality, miscarriages, still births, abortions, and delayed puberty. Some 900 million individuals are estimated as having the infection, which causes about 60,000 deaths per year. In tropical Africa, hookworm-related anemia is one of the host common causes of hospitalization. The disease is widely endemic in hot, humid tropical and sub-tropical countries with poor sanitation where eggs or larvae can survive. Prevalences of 50% are common. Distribution is relatively

even among all ages, except that the very young and aged appear low. Socially it is not always considered high priority in public health campaigns because it often goes underdetected and has a relatively low mortality rate when compared with the infection rate. Yet it rates as one of the three most important parasitic diseases afflicting humankind together with malaria and schistosomiasis and hookworm. (Bear in mind that diarrheas are not considered "parasitic" diseases.) It has been suggested that the mortality is in fact much higher than estimated, but generally underreported or attributed to another disease listed as the immediate cause of death.

Transmission: Humans are the main reservoir, though dogs and cats can spread certain varieties in South East Asia. Eggs in the feces of an infected individual are deposited in the ground and hatch into larvae where soil density, moisture and temperature are favorable (loam or sandy soil, about 20° to 30°C). The larvae, which become infective about a week after hatching, live in the soil or attach themselves to grass where they can survive for up to 15 weeks. Transmission tends not to be in the immediate vicinity of homes because soil is packed too tightly. High transmission probably occurs at regular defecation sites where the larvae density is high, soil is moist, not water logged and there is prolonged, stationary contact of feet with the soil. (Sunlight and urine, however, are lethal to the larvae.) The larvae penetrate the skin, usually through the feet or legs (sometimes hands and buttocks), producing dermatitis, "dew itch" or "ground itch". Certain types can also be ingested, though this is less common. The larvae pass through the body to the small intestine. They attach themselves to the intestinal wall, develop to maturity and begin to produce eggs to complete the cycle, which usually takes between 1 and 2 months. Depending on species, hookworms produce from 9 - 30,000 eggs per day. Symptoms develop after a few weeks, but can take up to several months depending on the worm load and nutritional status of the infected person. In the absence of treatment, infected individuals are potential spreaders for up to 7 or 15 years depending on species, though most worms die within 3 years. Hookworm infection, and therefore transmission, varies seasonally but the particulars are not clear. Generally, anyone can contract the disease, though some immunity is thought to develop with infection.

Intervention: Proper disposal of feces (night soil and sewage effluents are particularly hazardous when used as fertilizer) is of paramount importance, together with proper education. This would include identification of high risk defecation sites such as cool, shady areas with moist soil. Encouragement to wear shoes or sandals is extremely important, though not always feasible for economic and cultural reasons. Deworming, however, is of questionable value, except in cases of heavy loads, due to the likelihood of reinfection unless the entire population is treated and effective hygiene education measures are also taken. Improved excreta facilities alone have not proved especially effective in areas of high prevalence. Because hookworms continue to produce eggs, on average, for 3 years in an individual, programs to eradicate the disease are predictably slow. A variety of sanitation measures are possible, but depend on three complementary variables: time, temperature, and moisture.

Name: **MALARIA**

Other names: Paludism, Roman fever, Chagres fever, marsh fever, tropical fever, ague.

See also introductory note on mosquitoes.

Description: The term malaria is derived from the Italian for "bad air" (mal aria). In general, malaria is characterized mostly by general malaise, shaking chills, rapidly rising fever, usually with headache, nausea and profuse sweating. The symptoms, which are produced by the activity of the malarial parasite in the blood, repeat themselves from one to three days depending on type of malaria. (It is this variation which is responsible for their names, tertian and quartian which follow the Roman system of dating.) This initial attack sequence varies from a week to a month if untreated. Relapses are frequent with recurrence of symptoms lasting at irregular intervals from 2-5 years (though up to 50 years is possible). As a rule, malaria infections do not extend beyond 1-1/2 years. There are actually four types of human malaria which is essentially a parasitic invasion of the blood. The most serious type (falciparum or malignant tertian) causes periodic bouts of fever, chills, and sweating which can lead eventually to anemia, jaundice, blood coagulation, shock, kidney failure, acute inflammation of the brain (encephalitis), delerium and coma. Prompt treatment is essential as irreversible complications can occur. Case fatality rate in children and non-immune adults exceeds 10%.11 This more serious type of malaria accounts for approximately 50% of all malaria worldwide and is the type more widespread in tropical Africa. In the milder forms of malaria (vivax or benign tertain, quartan and ovale), the symptoms are similar, but are not life-threatening, except in infants or those suffering from other diseases. Of these three milder types of malaria, one type (vivax) is found mostly in Asia and accounts for about 40% of global malaria, but has a low prevalence in Africa.

Malaria has been mostly eradicated in temperate climates and occurs primarily in the tropics and sub-tropics (i.e., 60°N to 40°S latitude) wherever anopheles mosquitoes breed and is usually absent in dry regions or altitudes above 1500 meters. Malaria tends, however, to be more of a rural disease with consequences adversely effecting agricultural development. Malaria remains one of the worlds most severe health problems, and one of the most difficult to combat. Approximately 2.1 billion people currently live in areas where malaria is endemic. Estimates of its prevalence vary enormously. 12 It is estimated that

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11 Blackwater fever, i.e., urine "blackened" by blood, is a condition associated with this type of malaria among non-immune individuals who have undergone repeated malarial attacks without adequate medication (e.g., quinine) to suppress the disease. Mortality in these cases is 20-50%.

12 Its most obvious symptom, fever/chills, is symptomatic of numerous illnesses and thus can be incorrectly over-diagnosed. It can also be under reported. (Proper diagnosis requires blood tests.)

150 million new cases and 1.5 million deaths occur annually. Some 250-350 million people, most of them in Africa, live in areas without any meaningful public health control programs. For Africa, malaria accounts for about 10% of hospital attendance and for 1 million deaths of children and infants annually. Some 40 countries have been certified by WHO as having eradicated malaria. Similarly, incidence was reduced from 300 million cases to its current level of about 150 million cases. There are still 103 countries which have not achieved eradication. Malaria is staging a resurgence over the past decade in southern Asia, Latin America and Turkey. Unfortunately, mosquitoes have become increasingly resistant to insecticides and the parasite in the blood resistant to drugs.

Transmission: Humans are the main reservoir. Malaria is transmitted predominately through the bite of an infected (female) anopheles mosquito. (It can also be transmitted in transfusion of blood from an infected human or the use of contaminated needles.) Anopheles mosquitoes tend to bite from dusk through dawn; many species favor indoor feeding and areas around human habitation. There is a complicated life cycle. When the mosquito bites a human with active malaria, she ingests parasites which undergo transformation. This development is temperature dependent (i.e., 70-80^{o}F or 21-27^{o}C and does not occur under 60^{o}F or 16^{o}C). These parasites are eventually passed on to a human in whom they undergo development and actually cause the disease. On average, it takes humans 2-8 weeks to develop malaria, (though some strains take up to ten months). By comparison it takes the mosquito about eight to 35 days to become infective after the blood meal from an infected human. The human can be infective as long as the parasite is in the blood, which can occur irregularly for up to three years. Once infected, a mosquito remains so for the duration of her life, which lasts from a few days to about a month. The general population is susceptible to malaria but the degree is lessened by previous infection. Tolerance is evident in adults in some areas where malaria is highly endemic and where there has been frequent exposure of over years. High risk groups are children 6 months to 5 years and pregnant mothers.

Intervention: Mosquito eradication and control, treatment of infective cases to reduce spread, house spraying with repellents, bed nets, protective clothing, proper control of blood for donations and transfusion, protective medications are the full range of possible interventions, each with varying complexity and possibility of success. Since the young anopheles must pass their early development stages in water, drainage of all possible breeding grounds is important - though certainly not always possible. Unfortunately, the same climatic factors that encourage people to wear protective clothing, viz, cold weather, naturally reduce mosquito reproduction. Limited immunity occurs from exposure to the disease. Antimalarial medications are available but their efficacy has been compromised in recent years by resistance of the parasites.

Name: **ONCHOCERCIASIS**

Other names: River blindness, Onchocercosis

Description: River blindness is a chronic, but non-fatal disease caused by infestation with a roundworm (nematode). The disease is characterized by small lumps (nodules) in the skin, seen mostly in areas where bones are near the surface of the skin. The female worm within an infected individual discharges small thread-like worms (microfilariae) which cause skin itching and dermatitis, rash, pigmentation change, swelling (edema, because of abnormal accumulation of fluids) and wasting (atrophy) of the skin. Progression of its various stages have given the disease local names (e.g., skin of an orange, lizard, or crocodile). The loss of skin elasticity, the last stage, is responsible for hanging groin and hernia that frequently accompany the disease. In endemic areas, populations sometimes associate the intense itching and change in skin as part of the aging process. Worms reaching the eyes can produce blindness. Severity of individual infection depends on progressive build-up of microfilariae which can take up to 30 years to cause blindness.

While not a life-threatening disease, it has enormous socioeconomic consequences. The dermatitis, for example, causes premature aging in appearance and intense itching which can inhibit sleep and reduce overall work productivity -- sometimes of whole communities. In endemic areas, e.g., parts of Africa, as many as 50% of a local population have the disease, 30% have impaired sight, and 10% or more have gone blind. The overall effects have caused entire communities to move away from fertile river valleys to less productive land. This of itself can produce adverse effects on the agricultural economy and environment, overpopulation and overcropping. Water resource development projects can have positive effects by reducing the fly breeding areas of vegetation and rocks near fast moving water. (They need high amounts of oxygen.) The spillways and drainage canals, by contrast, can extend the habitat. Because severity of infection depends on build-up of the microfilariae over years, the pattern of community-wide blindness leading to abandonment of the village may take up to 60 years. River blindness occurs primarily in Africa south of the Sahara (in a belt of 26 countries from Senegal to Ethiopia and from Angola to Malawi) and irregularly in the Latin America (Guatemala, southern Mexico, Venezuela, and parts of Colombia, Ecuador and Brazil) and the Middle East (Yemen). Currently, some 40 million people are infected, three fourths of them in tropical Africa, and 85-90 million people worldwide are at risk.

Transmission: Humans are the only known reservoir. Transmission occurs through the bite of an infected female blackfly (genus Simulium). When the fly ingests blood of an infected individual, it becomes infective within 14 days. The flies breed on vegetation and rocks in fast running water which provides sufficient oxygen for the fly eggs to develop. Disease distribution tends to be highest within 2-3 miles/5 km of the water habit. (Average flight range, however, is 40 km, maximum 150 km.)

The flies normally bite during the day outdoors and do not like bright sun. An infected individual can be communicable up to 15 years if untreated. The population at large is at risk, and reinfections can occur since no immunity has been demonstrated.

Intervention: Vector control, protective clothing, and repellents are all possible control measures - and all of varying feasibility for rural populations. For example, according to geographic distribution, certain flies bite above the waist, others below the waist. While a valid observation, it is of dubious practicality. Current practical measures include larvicides in infected streams and medications of infected individuals. Of the variety of interventions, alteration of the fly breeding grounds has proved the most effective. Its major draw backs are the length of time necessary for implementation and follow-up, i.e., 15-20 years, the expense, and the complexity of achieving broad environmental coverage without adverse effects to the environment. DDT for example, has been used effectively in Africa.13 However, efficiency depends on repeated spraying, even of remote areas, for 15 years to avoid reinvasion over the life span of adult worms. An extensive program of onchocerciasis research and control in the Volta River Basin of West Africa was launched in 1974 and is providing much useful information.

Name: **RESPIRATORY DISEASES**

a. **SHORT-TERM MILD**
b. **INFLUENZA**
c. **PNEUMONIAS**

Respiratory diseases are a broad category of diseases of the respiratory tract, i.e. nose, ears, throat, and lungs. From the perspective of project interventions, it is difficult to consolidate them and retain accuracy because their distinguishing features--- e.g. whether they are viral or bacterial --- have only a minor bearing on the type of project intervention. By and large, these interventions focus on reducing overcrowding, which tends to promote the spread of the diseases through a combination of interpersonal contact and poor hygiene. Similarly project interventions should aim at reducing irritants such as air pollution, smoke from cooking, heating, etc., which predispose individuals to infection by virtue of the irritation. As a group, pneumonias and influenza exact a high toll of morbidity and mortality. Such respiratory infections account for approximately one-fourth to one-third of childhood mortality. Illnesses such as the common cold and bronchitis have important socioeconomic repercussions due to absenteeism and reduced productivity.

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13 DDT is criticized for its adverse environmental effects when used for agriculture. The same proscriptions do not necessarily apply to public health purposes, since the risk to humans is not the same as it is to flora and fauna. (See "The Selection and Use of Pesticides in Bank Financed Public Health Projects", Policy, Planning and Research Working Paper, No. 11, 1988.)

Name: **RESPIRATORY DISEASES: a. SHORT-TERM MILD**

Other names: laryngitis, bronchitis, earache, common cold.

Description: Acute respiratory illnesses are broad categories of diseases characterized by a variety of reactions such as chills, headache, bodyache, malaise, loss of appetite, localized inflammations of the respiratory tract. (The absence of fever, however, for the common cold distinguishes it from the other upper respiratory tract infections e.g., laryngitis, bronchitis, tonsilitis, earache.) The symptoms usually subside within a week, unless complicated by another infection. Generally these infections are non-fatal, but constitute a major reason for reduced efficiency and absenteeism from work and school. Irritations of the respiratory tract predispose individuals to other more serious complications such as pneumonia. Respiratory infections and their complications are most serious to children under five who normally have the highest incidence. This set of infections occurs worldwide. In temperate zones, incidences tends to be highest in winter months, in tropical areas, in wet and colder weather.

Transmission: Humans are the main carriers. Respiratory diseases are spread directly presumably by interpersonal contact, droplet spread, and indirectly by contact with soiled articles and eating utensils of an infected individual. Recently, the role of hands appears more important in transmission than was considered earlier. The period of development of symptoms and communicability varies by disease and individual, but is usually under one week. The general population is susceptible. Illness is more frequent and more severe in infants and children. Reinfection is possible, but usually milder if enduced by the same strain of pathogen.

Intervention: Immunization is possible for certain illnesses, but not those that enduce the common cold. Major interventions include reducing crowded living conditions (especially irritants such as smoke), education on personal hygiene (especially concerning sneezing/coughing and disposal/cleaning of soiled articles). By and large curative medications have only limited value.

Name: **RESPIRATORY DISEASES: b. INFLUENZA**

Other names: Flu.

Description: Influenza is a short term infection of the respiratory tract characterized by abrupt onset of fever, chills, headache, muscle ache and cough, often accompanied by common head cold and sore throat. Normally, it lasts two to seven days. Influenza is an important public health problem because of the rapidity of its spread, high attack rate, and seriousness of frequent complications, especially pneumonia, and severity to the malnourished, elderly and the chronically ill. (The name comes from Italian for influence and is traced to the Medieval Latin belief that epidemics were influenced by the stars.) Distribution of influenza is worldwide and seems to follow a 10 to 11 year serious

pandemic (i.e. worldwide epidemic) cycle (1889, 1918, 1947, 1957, 1968). Influenzal infections also occur in swine, horses, and other animals, but transmission from these animals to humans has not been demonstrated. In temperate climates, epidemics tend to occur in winter months; in the tropics no seasonal pattern seems evident. Several distinct strains of the virus exist which evolve into different "substrains" at irregular intervals. This development of new strains at irregular intervals is responsible for the pandemics.

Transmission: Humans are the source of human infections, though some animals are suspected of providing strains of virus that recombine with human strains. Influenza is spread by a direct contact, droplet infection (i.e. airborne through coughing or sneezing) and by indirect contact with freshly soiled articles. The influenza virus can persist for several hours in dried mucous which increases the potential for spread, especially in children and groups with poor personal hygiene. Most frequent outbreaks occur in crowded living conditions. Infection develops usually within 24 to 72 hours of exposure. Communicability of individuals is probably limited to three days after symptoms begin. The general population is susceptible. Infection produces immunity only to a particular strain.

Intervention: Personal hygiene (especially handwashing, encouragement of individuals to cover their mouths when they cough or sneeze) and immunizations are the major preventive interventions. The latter, however, is not a practicable intervention for wide spread use in developing countries.

Name: **RESPIRATORY DISEASE: c. PNEUMONIAS**

Other names: pneumonoccal pneumonia, bacterial pneumonia, myocomplasmal pneumonia, pneumonocystis pneumonia, infant pneumonia, viral pneumonia.

Description: Pneumonias are a category of diseases which affect the lungs, inhibit breathing and thereby can negatively affect oxygen exchange and blood purification. In most cases, pneumonia is actually a secondary infection which results from preceding infections to the upper respiratory tract (e.g., flu, whooping cough or measles) that "spread" to become pneumonia. The pneumonias are therefore especially important in malnourished children, the aged, the chronically ill, and others who have been weakened by another disease which leaves them susceptible to a lung infection. Pneumonia is characterized by fever, pain in the chest, difficult breathing and increase in white blood cells, and a sputum-producing cough; vomiting and convulsions are also possible at onset of disease. Pneumonia is an important cause of death, especially in the aged and infants, with a fatality rate formerly of 20 to 40 percent for hospitalized patients. This fatality has been greatly reduced for certain types by antibiotics, and is now down to about 5%-10%, but early diagnosis and treatment is still important for effective cure. Pneumonia was formerly very common, most frequently in industrial cities

and poorer economic groups. It occurs in all climates and seasons, with highest incidence in winter and spring months of temperate zones. Incidence also commonly increases with epidemics of respiratory infections, especially influenza. Humans are the carriers of infective bacteria that cause one of the more common types of pneumonia commonly found in the mouth, nose and throat of healthy persons.

Transmission: Pneumonias are spread directly by droplets through sneezing and coughing, and by oral contact or indirectly by contact with articles freshly soiled with respiratory discharges. Depending on its type, pneumonia can develop up to a month after exposure. Individuals can remain highly communicable probably under 2 weeks, depending on the type of pneumonia. Resistance to pneumonia is generally high, but lowered by exposure to wet, cold environments, by physical fatigue, by alcoholism, by chronic lung disease, or by a preceding respiratory infection. Immunity is imparted for the specific strain for a few months to years.

Intervention: Reduce crowded living conditions and potential irritations to the respiratory tract, e.g. smoke or dust, through proper ventilation of house or workplaces are the major recommended interventions.

Name: **SALMONELLOSES: a. SALMONELLOSIS**

Other names: can sometimes be considered as food poisoning, undifferentiated gastrointestinal infection, gastroenteritis or enteric fevers.

Description: Salmonellosis is an acute gastrointestinal infection characterized by sudden onset of abdominal pain, diarrhea, nausea and sometimes vomiting, usually with fever. It is often accompanied by a loss of appetite which can last for a few days. Dehydration is an important concern, especially in infants, who, together with children, have the highest infection rate. Salmonellosis occurs worldwide; epidemics are frequent. In many developing countries, however, compared with other diarrheas, salmonellosis represents only a small portion of the other more important diarrheas of infancy and childhood. Mortality is generally low. Salmonellosis is one of the few diarrheal diseases where humans and animals can infect each other and one of the few fecal-oral type disease spread predominately by animals rather than humans. Because of this feature, typhoid and paratyphoid, also types of salmonellosis, are considered separately. Salmonella occurs worldwide, though it tends to be reported more frequently in North America and Europe, where it is classified as a food-borne disease.

Transmission: Primarily domestic animals and to a lesser extent, wild animals (poultry, swine, cattle, sheep, horses, rodents, e.g., rats, mice, and pets e.g., turtles, dogs, cats, baby animals) are the main reservoirs of the disease. Humans also transmit the disease as well as fleas, ticks, lice, flies. In other words, animals and insects that

share the habitat of humans. To offset this long array of reservoirs, typically, large doses are required to cause an infection. Transmission occurs by ingestion of food contaminated with feces of infected animals or persons. Most frequently, contamination occurs at its source, less frequently by contaminated food handlers and finally interpersonal contact. It can also be spread in milk, raw eggs (especially cracked) and egg products (including frozen and dried), meat and meat products (e.g., preserved meats and sausages), poultry, in some pharmaceuticals of animal origin, and by animal feeds and fertilizers prepared from contaminated meat scraps, fish meal and bones. Individuals or animals can spread the disease throughout the course of infection, which varies from days to weeks. Humans can spread the disease for 2 months, but seldom over a year. Salmonellosis develops usually within 36 hours of the exposure. The entire population is susceptible. Severity of infection depends on type of organism and dose. Ultimately, the level of production and consumption of meat and dairy products is a determining factor in its spread to the general population. Water-borne epidemics are, of course, also possible though not the major source of transmission.

Intervention: Major preventive measures are thorough cooking of foodstuffs derived from animal sources, especially poultry and egg dishes (avoid use of cracked eggs). Food handlers tend to be a high risk both for acquiring and spreading the disease, and should be a focal point of any education program, as well as of the producers of meat and dairy products for public consumption. Careful cooking hygiene and proper storage to prevent contamination of food are the essentials of hygiene education, which should also include the possible dangers of pet animals such as chickens, ducks and turtles. This latter, however, is of dubious practicality. No curative measures exist except for rehydration. The existence of such a large animal reservoir, however, makes any intervention strategies extremely complicated. Standard treatment of raw sewage and effluents are practical to inactivate salmonella to acceptable levels. Outbreaks have been tracked, however, to the presence of salmonella on crops, consequently, use of furrow, subsurface or drip irrigation are preferable to flooding or spraying types. Discontinuance, if possible, of contaminated water, 10 days to 2 weeks prior to harvesting is an added precaution, since salmonella on crops will be substantially reduced by heat, sunlight and low humidity.

Name: **SALMONELLOSES: b: TYPHOID and PARATYPHOID**

Other names: enteric fever, typhus abdominalis, typhoid fever, paratyphoid fever.

Typhoid and paratyphoid are salmonella type infections, but are treated separately for two main reasons. First, they are not spread to humans in animal feces. Second, they are characterized by fever, rather than diarrhea. Unless indicated, this section focuses on typhoid since it is more serious.

Identification: Typhoid is a salmonella type infection of the intestines characterized by continued fever, headache, malaise, loss of appetite, slow pulse rate, spleen enlargement, and rash. Since the infection spreads beyond the intestines, it causes fever which is usually the distinguishing feature of salmonellosis from other gastrointestinal infections. Constipation is more common than diarrhea (though diarrhea is a symptom of paratyphoid). Typhoid had a fatality rate of 10%, but this has been reduced by antibiotics to under 1%. The spread of typhoid in contaminated water was recognized as early as 1838. Since that time, typhoid has become a benchmark for the spread of water-borne diseases. In both the US and Europe, improved water supplies has been recognized as the single most important factor in reduction of the disease - up to 80% within five years of water treatment/filtration. Typhoid occurs worldwide but its incidence has been greatly reduced--virtually eliminated in the industrialized countries--because of improved water, sanitary facilities, reduction in the number if carriers and the availability of antibiotics. Unfortunately, this is not the case in developing countries. Furthermore, strains of salmonella resistant to antibiotics have been reported in Asia, Latin America and the Middle East. Currently, typhoid accounts for one million infections and 25,000 deaths annually. In general, the salmonelloses are not a major cause of infant and child diarrhea morbidity and mortality.

Transmission: Humans are the main reservoirs. Asymptomatic carriers play an important role in its spread. Transmission occurs through ingestion of food or water contaminated by feces and, to a lesser extent, urine. Normally, relatively high doses are needed to cause infection. Improperly cooked starchy foods and pastries which allow typhoid to multiply to an infective dose are the most common vehicles. Raw fruits and vegetables, whole milk and milk products are also frequent vehicles. Transmission can also occur in shellfish from contaminated waters, or food stored in, cooled in, or "freshened" with contaminated water. Contamination is most commonly spread by hands of carriers, though flies can also be involved. Depending on size of dose, typhoid develops within three weeks of exposure. (Most other salmonelloses occur within 36 hours.) Individuals remain communicable as long as three months; under 5% become permanent carriers, mostly through their feces. The disease is spread by a large proportion of asymptomatic carriers. Curiously, these individuals frequently acquire illness in middle age, females more than males. The general population is susceptible, but is increased in individuals with low gastric acid levels. Resistance to small doses follows recovery, or after immunizations; in endemic areas, attack rates usually decline with age. As with other salmonelloses, typhoid tends to peak in the warmer months, whether dry or wet.

Intervention: Protection and chlorination of water supplies, proper disposal of excreta are the main preventive intervention. Control of flies through insecticides; elimination of breeding and feeding grounds through proper garbage collections and control are also recommended, but less important because these are not main routes of transmission . Proper kitchen hygiene, cooking and storage, especially of milk and

dairy products are the care of proper education, especially of food handlers. Identification and treatment of carriers, as well as immunization are also recommended. Unfortunately, the latter is not always practicable, and the majority of carriers, being asymptomatic, are unknown. Typhoid and polio are the only diseases spread by human excreta for which immunizations are possible. It requires, however, periodic boosters every three years.

Name: **SCHISTOSOMIASIS**

Other names: Bilharziasis, Bilharzia, snail fever, Schistosomiasis haematobium, S. interculatam, S. japonicum, S. mansoni, S. mekongi.

Description: Schistosomiasis is an infection with a parasitic worm (trematode or blood fluke) which lives in the veins around the bladder, intestines and liver of the infected individual. The worms deposit large numbers of eggs most commonly in the intestines or urinary tract. The presence of the worms and their eggs and the migration of both are responsible for the symptoms which, depending on the type of the disease, affect either the liver and intestines or the urinary tract. These in turn, can cause complications e.g., obstruction of the intestines, tissue scarring, ulcers, bleeding, organ enlargement, and possibly bladder cancer. Blood in the urine is characteristic of the urinary type and is responsible for its scientific name. Minor symptoms, such as cough and fever, occur as the worm matures. Major symptoms occur in response to long-term egg-laying over 2-5 years. (Similar but relatively mild infections occur in many part of the world, typified by "Swimmers Itch", "Clam Diggers Itch" and skin rash, but the invading organism are limited to skin infections.) Schistosomiasis occurs in over 76 countries of the Middle East Africa, Asia, some parts of Latin American and the Caribbean. The type which effects the urinary tract (S. haematobium) is restricted primarily to the African continent and the Middle East and tends to be somewhat less severe.

Currently, from 200-300 million people are infected, nearly four-fifths in Africa. Approximately 600-700 million are at risk worldwide. In endemic areas as much as 80% of the population can be infected, most commonly those 5-20 years old. Because of the snail intermediate vector, schistosomiasis tends to be primarily a rural disease. However, it can exist in ponds and streams of periurban and urban areas and be carried by people who acquire the disease in rural areas. Schistosomiasis has existed since pharonic times and was clinically identified by Dr. Theodore Bilharz in 1851 in Cairo during construction of the Suez Canal. It is ironic that this development project played a role in its identification since it is now seen also as a development disease. The spread of schistosomiasis has increased because of the extension of the snail habitat in water resource development projects: dams, reservoirs, irrigation schemes, hydroelectric power, fisheries, etc. Schistosomiasis is often considered as an occupational disease of fishermen and farmers.

However, women and children doing domestic chores are at equal, if not greater, risk in their regular contact with water. Even though mortality is low, schistosomiasis is a major health problem because of its widespread prevalence and difficulty in eradicating the snail vector.

Transmission: Humans are the principal reservoir for the types that are common in Africa and the Americas. With the Asian version, dogs, cats, pigs, cattle, water buffalo, horses, rodents, and wild rats also act as animal hosts. In all cases, transmission depends on a snail as an intermediate host. These snails generally live near slow moving water. Transmission is seasonal inasmuch as rainfall affects the snail habitat and therefore possibility of exposure. Some snails, however, can withstand dry periods by burrowing into mud. There is a complicated life cycle. Eggs of the mature worm, schistosome, are passed in the urine or feces, depending on the type of schistosomiasis. The eggs hatch in fresh water as "miracidia" and enter the snail where they develop, usually after several weeks, and are passed on as free swimming "cercariae." The cercariae then penetrate the skin (within minutes) or, sometimes, are ingested when humans come into contact with infested waters. The worms reach maturity in the human usually about within six weeks after infection. The worms then begin to produce eggs, some of which are expelled and must reach water to hatch into "miracidia", which in turn penetrate fresh water snails to continue the cycle. Both the miracidia and cercariae must find a host within 6 and 48 hours respectively or die. Some infective snails, however, can survive extended dry periods by "encysting" or burrowing into mud. The disease, because of the necessary snail intermediate, is not directly communicable among humans. Humans remain infective as long as eggs are discharged in the urine or feces of an infected individual, usually one to two years, but this can last up to 5 years for the type expelled in urine and 30 years for the type excreted in feces. The snail can remain infective for several weeks. The general population is at risk an resistance from a prior infection has not been conclusively proven.

Intervention: Overall aim of intervention is to break the cycle of transmission at any of several possible stages: eggs reaching water, and humans being exposed to water, eliminating snails or their habitat. A convenient, close water supply away from snail habits is one of the most effective means. Proper disposal of urine and feces is an essential element of any intervention. This is an especially difficult task where animals are a reservoir which occurs only in the type common in Asia. Equally important are improved irrigation, drainage and agricultural practices which reduce exposure to contaminated waters or eliminate habitat of snails (i.e., slow moving water). Provision of drinking, bathing and water for household use free from water infested with the cercariae is also possible. Retaining pools or storage tanks which hold water for 48 hours are effective as a partial intervention. Coagulation and sedimentation are not effective to eliminate the cercariae. Filtration and chlorination, if properly implemented, can be effective. Biological control of snails through natural predators is also possible, but requires extensive preliminary study and monitoring.

Drugs have been available for about 60 years but generally have had undesirable side effects, though new drugs suitable for widescale use show promise.

Since prior infection does not necessarily impart immunity, reinfection is a direct function of exposure. Even though schistosomiasis is a sanitation deficiency disease, sanitation measures alone have not been effective in curtailing transmission. Because of the large number of eggs produce -- hundreds to thousands per day, depending on species -- effective treatment and control require coverage of an entire community. Moreover, urination behavior especially among 5-20 year olds is very difficult to modify. This is complicated by some types which expel maximum egg output in the afternoon when people are most likely to be in contact with water. In general, reduction of snail populations appears to have been the most effective single intervention, coupled with chemotherapy of infected individuals, water supply, sanitation, and hygiene education.

Name: **SLEEPING SICKNESS, AFRICAN**

Other names: Trypanasomiasis, African.

See also: Chaga's Disease.

Description: African sleeping sickness is a disease transmitted by the tse-tse fly. There are two main types of the disease, one causing anemia, the other potentially far more serious. Depending on the fly species, symptoms are characterized by fever, intense headache, insomnia, lymph node enlargement, anemia, localized swelling, rash; eventually followed at later stages of the disease by body wasting (atrophy), sleepiness (in the West African strain, hence the name) and some disorders of the central nervous system which can lead to lethargy and mental retardation. It is frequently fatal, can last for several years or cause death within a few months. In addition, the fly-bite leaves a sore for up to two weeks which can lead to secondary infections. In endemic areas, as much as 40% of the population can be infected. Its occurrence is limited in tropical Africa between 15° N and 25° S of the equator, according to the distribution of the tse-tse fly.

The disease occurs primarily in rural areas. Specific distribution depends on the fly species and their preferred habitat: riverine areas and savanna. In west and central Africa, this tends to be near streams; in eastern Africa, savanna. Males from 20-40 show the highest incidence and are at highest risk as an occupational hazard of farming because the riverine species bites in the day. The disease, however, can infect the general population, but women and children who fetch water are at the next greatest risk. In general, the riverine type tends to favor west and central Africa, be spread only through a human-fly-human cycle and is less severe and fatal than the eastern African type. By contrast, with the eastern African type, the flies

prefer savanna; cattle and wild animals are important reservoirs. Fly populations tend to decrease in dry seasons, but people tend to gravitate closer to streams and water sources also in dry seasons, bringing them into closer contact with the flies. Normally, the disease is not present on flat plains or closely cultivated areas, probably because of disruption of the fly habitat. That is, the flies deposit their larvae in soil underneath shrubs, and adults use shrubs as resting points. In general, incidence of human trypanasomiasis appears to have decreased. This may be a result of a shift of population from rural to urban areas and increase agriculture which destroys the fly larvae. Although some 50 million people in 36 countries over 10 million square km. are still at risk, the disease is not considered a major public health problem in Africa, except in pockets. For example, 20,000 new cases are reported annually, admittedly an underestimation. By contrast, it is considered a major hurdle to the development of a livestock industry caused by a different species of tse-tse fly which share the same habitats. Apart from its economic effects on agricultural development, it effects human health by hampering the production of animal protein, milk and dairy products, which otherwise may have to be imported.

Transmission: Humans, wild game, domestic animals are the reservoirs. (The importance of animal reservoirs, however, depends on the fly species.) The disease is transmitted in a cycle through the bite of an infective tse-tse fly which is itself infected when it bites an infected human or animal. The flies hunt by sight and are attracted by dark moving objects. High risk groups are those working with livestock and those fetching water. Once infected, a process which takes about 3 weeks, the fly remains so for the duration of its life, about three months. In an endemic area, the percentage of infected flies is generally under 5%. Transmission can also occur as a direct mechanical transfer of blood by any insect, e.g. horse fly, from one infected person directly to another. Depending on the species, the disease develops in humans within two to three weeks, but may take several months or even years. Individuals and animals with the disease are communicable normally for the duration of the infection as long as the parasite is present in the blood which varies greatly. The general population is susceptible. Seasonal migration of animals in search of water and vegetation (transhumance) contributes to the spread.

Intervention: Destruction of tse-tse fly habitat is the major intervention, i.e. brush clearing along streams near villages, application of insecticides. Where possible relocation of population to areas not infested with the flies is a potential intervention, albeit not always practicable. For the riverine species, the aim is to create an area of access to water or passage around water free of flies, e.g., a stretch of land about 800 yards long and 50-150 yards wide. The savanna species are more difficult to eradicate. In addition, education about transmission and recommended precaution against fly bites would also be included.

Name: **TETANUS**

Other names: Lockjaw, infant tetanus, tetanus neonatorum.

Description: Tetanus is infection of the musculature, actually the response to toxic substances produced by the tetanus bacillus. The disease is characterized by painful muscular contractions primarily of the neck muscles (hence the term lockjaw) and secondarily of the trunk. In absence of immunization or treatment, the fatality can range from 30-90%. Because the tetanus bacillus can only produce its toxin in the absence of oxygen, it is an important source of infection from puncture wounds or superficial wounds where there is an accumulation of dead tissue. Tetanus occurs worldwide, most commonly in agricultural regions where contact with animal excreta is frequent. In developing countries, infant tetanus commonly results from the application of a poultice to the umbilical cord, which is used to close the wound.

Transmission: The tetanus bacillus can live in soil, intestinal canals of animals, especially horses, and also humans. It usually enters the body through a puncture wound contaminated with soil, street dust or animal feces; also through burns or scratches, or the umbilical cord of infants. Tetanus has little to do with water quality, since, even if ingested, the toxin produced is not absorbed by the bowel. The disease usually develops within 14 days of exposure. Tetanus cannot be transmitted directly from human to human. Tetanus spores, however, are resistant to drying and high temperatures, even boiling for short periods, which means that in principle, soil or street dirt can possibly be dangerous for extended periods. The general population is susceptible. Immunization lasting ten years is available, but recovery from tetanus only imparts short-term immunity.

Intervention: Apart from immunization, the greatest interventions fall in the realm of education about treatment of small wounds, burns, puncture wounds and hygiene. Special education about the need for thorough cleansing of all wounds since tetanus develops where oxygen is absent (i.e under anaerobic conditions) should be directed to all high risk groups: midwives and those involved with birth about proper procedures for severing and healing umbilical cord cord; farmers, workers in abattoirs, etc. who would have a frequency of small wounds and exposure to animal feces. Provision of adequate water is important as a first aid means in cleaning wounds.

Name: **TRACHOMA**

Description: Trachoma is one of the leading cause of preventable blindness in the world today. Some 400-500 million people are estimated currently to have trachoma, which includes 6-9 million having lost their sight and 8 million at risk of doing so. Trachoma is an eye infection causing inflammation of the cornea and conjunctiva, i.e. the delicate membrane which lines the inner surface of the eyelids and covers the whites of the eyes. (The name trachoma comes from the Greek for "rough

eye".) If untreated, it can last for years and eventually lead to deformity of the eyelids, impair vision and eventually cause blindness. Trachoma exists worldwide generally associated with poor hygiene, crowded living conditions, especially in dry, dusty regions. In endemic areas, up to 3% population may eventually become blind as a result. The infection tends to increase with seasonal decrease in water supply.

Transmission: Humans are the reservoir of the disease. Trachoma is spread by direct contact with ocular discharges and possibly with mucous secretions from the nose of infected persons. Indirect transmission also occurs by contact with articles soiled by the above especially use of same towels, wash basins, and washing water. Flies may contribute to the spread. Communicability is relatively low but endures as long as the infection is active and repeated infections appear an important factor in its transmission. The general population is susceptible, though children more frequently get infected than adults. The severity is related to environmental conditions such as lack of water and exposure to dry winds; dust and sand seem to act as irritants and contribute to the severity of diseases.

Intervention: Personal hygiene, increased supply of water, and hygiene education are the prime interventions. The availability of water plays a crucial role in short term perceptible decreases in trachoma.

Name: **TUBERCULOSIS**

Other names: TB, Koch's disease, Pthisis

Description: Tuberculosis is a chronic infection with most serious repercussions in the lungs, characterized by cough, fatigue, fever, weight loss, hoarseness, chest pain and coughing up blood. Symptoms often do not become apparent until TB has already reached a severe stage. (Other forms of tuberculosis can involve meningitis, blood formation, bones, joints, eyes, lymph nodes, kidneys, intestines, larynx, skin or abdominal membranes, but these forms are much less common.) TB is actually a quite common infection, but most healthy people overcome it without ill effects through natural resistance. TB occurs worldwide, though it seems to be on a downward trend in the industrialized countries because of active campaigns to screen and treat it. Incidence is usually higher in cities than rural areas. Severity of infection and subsequent mortality is higher among the poor, and in males more than females, and increases with age. European TB began to decline before the discovery of the TB bacillus and effective drugs to combat it, hence the disease is related to general improvements in living conditions. TB's socioeconomic significance stems from the fact that, in developing countries, 80% occurs in the most productive age groups (15-59 years), and accounts for more than one-fourth of avoidable adult deaths within this group. Currently, there are about 1.7 billion people infected with TB. From these, 20 million have active TB, which accounts for about 8 million new cases annually, and 3 million deaths. Because of the AIDS epidemic, the number of TB deaths is increasing rapidly, particularly in sub-Saharan Africa.

Transmission: Humans are the major reservoir; in some areas, TB can be spread by infected cattle and their raw milk. Transmission occurs through exposure to tubercule bacilli from droplets of an infected person by coughing, spitting, sneezing, laughing, and talking. Prolonged household exposure among family members may lead to infection. Indirect transfer from soiled personal articles may also occur, but this is of lesser importance. (Bovine tuberculosis results usually from drinking unpasteurized milk from tuberculous cows and sometimes by airborne spread to farmers or animal handlers.) TB bacilli are resistant to drying, but susceptible to sunlight, hence dark, dusty rooms promote the spread. TB usually develops within 3 months of exposure, progressive cases sometimes take years. Infected individuals remain contagious as long as infection is active, which can last intermittently for years. With treatment, communicability is generally reduced within weeks. The general population is susceptible. Incidence is highest in children under three years, lowest later childhood, then again high in adolescents and young adults. Undernourished or persons suffering from a variety of other chronic illnesses are especially susceptible.

Intervention: Reduction of overcrowding and improvements in ventilation, nutrition, and general living conditions are the main preventive intervention. Screening (i.e., lab sputum tests) for active cases and follow up for treatment and immunization of family members are also necessary for effective elimination of the disease. An easy and effective skin test is available that has helped to identify carriers. About 75% of cases must be treated before disease transmission can be sufficiently interrupted to reduce incidence in a community. Control of cattle industry and processing of diary products where appropriate is also important. Education includes the importance of personal hygiene and household ventilation.

APPENDIX A

GUIDELINES FOR DATA COLLECTION AND ANALYSIS

The five tables presented in this Appendix are to be filled out according to the steps indicated below. The last step in the process entails writing Terms of Reference. Tables 3 and 4 have been completely filled in with indicative values to serve as reference. Samples are given in Appendix C.

Step 1: Estimate Top-Ten Causes of Mortality and Morbidity (Tables A-1a and A-1b);

Step 2: Determine Environmental Health Needs Assessment (Table A-2);

Step 3: Summarize Problems and Preventive Interventions (Table A-3);

Step 4: Evaluate Complexity of Interventions (Table A-4);

Step 5: Prepare Component Impact Assessment (Table A-5); and

Step 6: Write Terms of Reference (see sample at Appendix C).

The process for filling in the tables is fully described in this Appendix. The work should be conducted under the supervision of middle-to-higher level health professional with field and administrative experience. Field experience is necessary to gather, evaluate and interpret basic health data. Administrative experience is required to determine the complexity of possible interventions in order to avoid making the component too complicated for inclusion in the project. Annex B provides a blank set of the five tables. Chapter III provides a sample environmental health component.

Step 1. Gather Basic Health Data

The degree of work required to gather basic information depends on the availability of local information or the need to compile such information for the project files. Tables A-1a and A-1b request estimates of the top ten causes of mortality and morbidity for the project area irrespective of their relation to housing, water or sanitation. Extensive surveying is not required, but it will be necessary to interpret the data. High levels of a certain disease, e.g. schistosomiasis, may be due to people working in an urban area but frequently returning to their rural homes. In other cases, e.g., anemia, the information reported may be very general, and it will be necessary to determine a probable source, such as hookworm. Where "diarrheas" or "gastroenteritis" are mentioned, try to be as specific as possible, otherwise, use "Diarrheas - undifferentiated." Finally, local populations may perceive certain conditions as a normal part of life rather than as disease, as in the case of malnutrition or diarrheas.

Since the information gathered will be estimates, the comments in Tables A-1a and A-1b should help explain and localize the disease/condition as best as possible. For example, give some idea of high risk groups (e.g., children, women, workers), or where the disease/condition is most serious (e.g., schools, work place, homes, etc.). If possible, indicate if increase, decrease, stable, cyclical fluctuation. If the population itself has changed, indicate why (e.g., job seekers from rural areas). Indicate if this creates special needs. If actual rates are available, list them.

If reasonable estimates are not available from a local health entity, the information required for Tables A-1a and A-1b can be obtained by interviewing people familiar with the target population. These would include local clinics, schools, church groups, representatives of NGOs or various aid programs operating in the area, and community leaders. In the event that some surveying is deemed appropriate, this Paper provides a set of Health, Environmental, and Social Profiles, presented as a set of sample questions (see Appendix D). The Profiles cover a broad range of topics and call attention to matters that could be overlooked when compiling health data. Bear in mind that the top ten disease are estimates for which there may be no recorded data. Where definitional problems occur, explain local factors on the back of the table. To avoid double counting, as in the case of individual diseases identified separately instead of part of a group, check the appropriate entry and indicate in the "comments" column where the disease is counted (e.g. shigellosis: counted under diarrheas). It is not necessary for each of the tables to contain ten diseases as long as the most important ones are listed. These may include, for example, causes that are not directly disease related, such as traffic accidents or drowning, but are nonetheless serious.

Table A-1a

ESTIMATE OF TOP 10 CAUSES OF MORTALITY IN PROJECT AREA

Disease/Condition	Comments	Trends Over Past 5 Years
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Table A-1b

ESTIMATE OF TOP 10 CAUSES OF MORBIDITY IN PROJECT AREA

Disease/Condition	Comments	Trends Over Past 5 Years
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Step 2. Relate Basic Data to Water/Sanitation/Urban Sectors (Table A-2)

Table A-2 provides a list of 26 of the most prevalent illnesses related to housing, shelter, water and sanitation and is a format used for the remainder of the tables. Using Table A-1a and A-1b as a source, transfer the appropriate diseases to Table A-2. Those diseases or conditions not appropriate to the analysis of an urban, water or sanitation project, e.g., sexually transmitted diseases or cancer, should be dropped. Table A-2, therefore, provides a general health assessment of the project area that will be used as the basis for further consideration in planning the component. Mark the appropriate column with an "x" and explain the reason for seriousness or other appropriate comments in the right-hand column. (If space is insufficient, summarize the comments on the back of or on additional pages labelled Table 2).

Table A-2

ENVIRONMENTAL HEALTH NEEDS ASSESSMENT OF PROJECT AREA

Disease/Condition	Common and Serious	Common But Not Serious	Serious But Not Common	Explain Seriousness or Other Appropriate Information
Chaga's Disease				
Cholera				
Dengue				
Diarrheas:				
a) Undifferentiated				
b) Specific				
Dysentery:				
a) Amebiasis				
b) Shigellosis				
Filariasis				
Food Poisoning				
Giardiasis				
Guinea Worm				
Hepatitis				
Intestinal Worms:				
a) Ascariasis				
b) Hookworm				
Malaria				
Onchocerciasis				
Respiratory Diseases:				
a) Mild Short-Term				
b) Influenza				
c) Pneumonias				
Salmonelloses:				
a) Salmonellosis				
b) Typhoid				
Schistosomiasis				
Sleeping Sickness, Afr.				
Tetanus				
Trachoma				
Tuberculosis				
Others:				
Accidents				
Malnutrition				

Step 3. Determine Source of Problem and Type of Intervention (Tables A-3a and A-3b)

Having determined the portion of the top ten related to housing, water and sanitation (Table A-2). Table A-3a and A-3b relates the main sources of the problem and the focal points of intervention. Fill in Table A-3a and A-3b, indicating source of problem on a scale of 0 (negligible/not applicable), 1 (low), 2 (medium), and 3 (high). An explanation of terms follows the table. Total the columns vertically. The relative scores will give an indication of the nature of the problem and type of intervention required. The actual score is only incidental since the tables are subjective. The main function of the table is to stimulate discussion and analysis of various inputs that can be provided by an urban, water, or sanitation project. High scores will accentuate the main elements of the problems.

Table A-3

SUMMARY -- PROBLEMS AND PREVENTIVE INTERVENTIONS

	Main Source of Problem						Focal Point of Intervention					
Disease/Condition	Water Quality	Water Quantity	Excreta Disposal	Waste Disposal	Housing	Education	Water Supply	Excreta Disposal	Waste Disposal	Housing	Health Care	Education
Chaga's Disease	0	0	0	0	3	2	0	0	0	3	1	2
Cholera	3	1	2	0	1	2	3	2	2	1	3	2
Dengue	0	0	1	2	3	2	0	1	1	2	0	2
Diarrheas:												
a) Undifferentiated	2	3	2	1	1	3	2	2	1	1	2	3
b) Specific	2	3	2	1	1	3	2	2	2	2	2	3
Dysentery:												
a) Amebiasis	2	1	3	0	1	3	1	3	3	1	0	3
b) Shigellosis	3	3	2	0	1	3	2	3	3	1	2	3
Filariasis	0	1	3	3	2	2	0	3	3	2	0	3
Food Poisoning	1	0	1	0	0	3	1	1	1	0	1	3
Giardiasis	3	2	1	0	0	3	2	1	1	0	0	3
Guinea Worm	3	0	0	2	0	3	3	0	0	0	1	3
Hepatatis	1	2	2	0	0	3	1	3	3	0	0	3
Intestinal Worms:												
a) Ascariasis	0	1	3	2	2	3	1	3	3	2	0	3
b) Hookworm	0	1	3	2	2	3	1	2	3	1	0	3
Malaria	0	1	0	1	1	2	1	0	1	2	3	2

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Table A-3 contd.

SUMMARY -- PROBLEMS AND PREVENTIVE INTERVENTIONS

Disease/Condition	Main Source of Problem						Focal Point of Intervention					
	Water Quality	Water Quantity	Excreta Disposal	Waste Disposal	Housing	Education	Water Supply	Excreta Disposal	Waste Disposal	Housing	Health Care	Education
Onchocerciasis	0	0	0	0	1	2	0	2	2	2	0	2
Respiratory Diseases:												
a) Mild Short-Term	0	0	0	0	3	2	0	0	0	3	1	2
b) Influenza	0	0	0	0	3	2	0	0	0	3	1	2
c) Pneumonias	0	0	0	0	3	2	0	0	0	3	2	2
Salmonelloses:												
a) Salmonellosis	0	1	1	0	3	3	1	1	1	3	0	3
b) Typhoid	2	1	1	0	0	3	1	1	0	0	0	2
Schistosomiasis	1	1	3	1	0	3	0	3	3	1	0	3
Sleeping Sickness, Afr.	1	1	0	0	0	2	2	0	0	0	0	3
Tetanus	0	0	1	1	0	3	1	1	1	0	0	2
Trachoma	0	3	0	0	0	3	2	0	0	0	0	3
Tuberculosis	0	0	0	0	3	2	0	0	0	3	2	2
Other:												
Accidents	0	1	0	0	3	2	1	0	0	3	1	3
Malnutrition	3	1	1	1	1	3	1	1	1	2	3	3
Snake Bites												

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Explanation of Terms in Table A-3

Ranking Scale: 3 (High), 2 (Medium), 1 (Low) in importance or complexity as defined below; 0 (Negligible/not applicable) indicates that it plays virtually no role, will pose no problem or could be excluded from the analysis.

* Disease/Condition: list the major diseases being considered (from Table A-2);

* Main Source of Problem: identify main area of deficiency. A rank of 3 indicates the "Main Source of Problem" is potentially important in transmission.

  -- Water Quality: biological and chemical quality of drinking water;

  -- Water Quantity: amount and accessibility of water for domestic use. In the absence of proper drainage, provision of water can have a negative impact. Where provision of water without adequate drainage is the problem, use the column for "waste disposal";

  -- Excreta Disposal: disposal of human and animal feces;

  -- Waste Disposal: sullage, grey water, waste water, solid waste and the adequacy of drainage. Waste disposal can also refer to the provision of potable water without adequate drainage. Bear in mind that this will vary in dry or wet environments. Sullage disposal can have a negative impact in the absence of good drainage or other waste disposal;

  -- Housing: the overall living environment inside the home and its immediate surroundings;

  -- Education: refers to overall educational level of population, and in particular, to the understanding and practice of personal and domestic hygiene. Since all programs theoretically require education, ranking implies its potential efficacy. For example, personal hygiene should markedly reduce diarrheas (rank 3), but awareness of vector transmission would probably not have as high an effect on malaria reduction (rank 1 or 2);

* Focal Point of Intervention: identifies main thrust of program of intervention, may be more than one category. A rank of 3 indicates that the intervention is potentially important in reducing transmission;

  -- Water Supply: adequate supply of potable water;

-- Excreta Disposal: sanitation, sewerage, excreta disposal;

-- Waste Disposal: sullage, drainage, waste water, solid waste;

-- Housing: overall improvement of the home and immediate surrounding areas, with appropriate consideration given to sunlight and air circulation;

-- Health Care: preventive measures. Does not refer to general health care; reflects curative interventions, e.g., epidemics or rapid dehydration, only when they pertain to interrupting transmission; and

-- Education: general education, especially in personal and domestic hygiene.

Step 4. Determine Complexity of Interventions (Table A-4)

Having determined the main problems and potential interventions, the next and perhaps most important step is to determine the complexity of interventions and whether they are appropriate within the project. Complexity in this case refers to the number of separate factors requiring coordination in component administration. Malaria and malnutrition, for example, may both be equally complex, but it would be more complicated to administer a malaria control program. Fill in Table A-4a and A-4b also on a score of 0 to 3. Total the individual diseases horizontally. This should give a relative measure of the complexity of interventions. The actual score is incidental since the tables are subjective.

The main function of the table is to stimulate discussion and analysis of various inputs to an urban, water or sanitation project. In general, diseases with high scores would be unlikely candidates for components. Should they be important public health problems, it may be appropriate to identify these as potential elements for a health project to be considered separately rather than as an environmental health component.

Table A-4

SUMMARY -- COMPLEXITY OF INTERVENTIONS

Disease/Condition	Area of Focus: User	Area of Focus: Environment	Area of Focus: Health System	Time Span: Long Short	Time Span: Recurrent	Time Span: Initiate	Time Span: Impact	Integration: Hard=3 Easy=1	Critical Mass: High=3 Low=1	Inputs: Labor Skilled=3 Unskilled=1	Inputs: Material Outside Local	Perceived Priority: Need	Perceived Priority: Program
Chaga's Disease	2	1	1	2	2	2	2	3	1	2	1	2	2
Cholera	3	2	3	1	2	1	1	3	1	3	2	3	1
Dengue	3	2	2	2	3	2	1	2	2	2	1	2	2
Diarrheas:													
a) Undifferentiated	3	2	1	3	2	1	1	1	1	2	1	2	3
b) Specific	3	2	1	3	2	1	1	1	1	2	1	2	3
Dysentery:													
a) Amebiasis	2	1	1	2	2	1	1	1	1	1	1	3	3
b) Shigellosis	2	1	1	2	2	1	1	1	1	1	1	3	3
Filariasis	1	3	1	2	3	2	2	2	2	2	2	3	2
Food Poisoning	2	1	3	1	1	1	1	3	1	3	1	1	1
Giardiasis	2	1	1	3	2	2	2	1	2	1	1	3	3
Guinea Worm	3	3	2	3	3	3	3	3	2	2	2	2	2
Hepatitis	1	1	2	3	2	2	3	1	2	1	2	2	2
Intestinal Worms:													
a) Ascariasis	2	3	1	2	3	2	2	2	1	2	1	3	3
b) Hookworm	2	3	1	2	3	2	2	2	1	2	1	3	3
Malaria	1	3	2	3	3	3	3	3	3	3	3	3	3

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Table A-4 contd.

SUMMARY -- COMPLEXITY OF INTERVENTIONS

Disease/Condition	Area of Focus: User	Area of Focus: Environment	Area of Focus: Health System	Time Span: Long Short	Time Span: Recurrent	Time Span: Initiate	Time Span: Impact	Integration: Hard=3 Easy=1	Critical Mass: High=3 Low=1	Inputs: Labor Skilled=3 Unskilled=1	Inputs: Material Outside Local	Perceived Priority: Need	Perceived Priority: Program
Onchocerciasis	2	2	2	3	3	3	3	3	3	3	3	2	2
Respiratory Diseases:													
a) Mild Short-Term	2	1	1	1	1	1	2	1	1	1	2	2	2
b) Influenza	2	1	1	1	1	1	2	1	1	1	2	2	2
c) Pneumonias	2	1	1	1	1	1	2	1	1	1	2	2	2
Salmonelloses:													
a) Salmonellosis	1	1	1	3	1	2	3	1	1	1	2	3	3
b) Typhoid	2	0	1	3	2	1	3	2	1	2	2	3	2
Schistosomiasis	2	3	2	3	3	3	3	3	3	3	3	2	2
Sleeping Sickness, Afr.	2	3	2	3	3	3	3	3	3	3	3	3	
Trachoma	2	1	1	1	1	1	1	1	1	1	2	3	3
Tuberculosis	2	2	3	2	3	2	2	2	2	3	3	3	2
Other:													
Accidents	3	2	1	1	0	1	1	1	1	2	0	2	1
Malnutrition	3	2	2	1	2	1	1	2	2	3	1	2	2
Snake Bites													

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Explanation of Terms in Table A-4

Ranking Scale: 3 (High), 2 (Medium), 1 (Low) in importance or complexity as defined below; 0 (Negligible/not applicable) implies that the topic plays virtually no role, will pose no problems or could be excluded from the analysis. Complexity, in this case, refers to the number of separate factors requiring coordination in component administration.

* Disease/Condition: list major diseases being considered from (Tables A-1a and A-1b);

* Area of Focus: indicates the overall focus or cast of characters necessary for an intervention program;

  -- User: people rather than physical or environmental changes. A rank of 3 implies that a high level of education will be needed requiring preparation of the community and time for behavioral habits to change;

  -- Living Environment: the physical environment where people spend most of their time. A rank of 3 implies high level of physical intervention is required, e.g., vector control, requiring inter-agency cooperation; and

  -- Health System: collaboration of health care delivery system rather than education per se or environmental changes. A rank of 3 implies a high level of collaboration;

* Time Span: gives a rough idea of the time range for an intervention program;

  -- Short/long: indicates how long it takes to conduct a program. A rank of 3 implies a long program, such as a malaria campaign; a rank of 1 implies a short program, such as an immunization program without follow-up;

  -- Recurrent: indicates the necessity of a follow-up program or special budget. A rank of 3 would definitely require extended follow-up;

  -- Initiate: indicates the level of organization required to initiate the program. A rank of 3 implies a long period; and

  -- Impact: indicates period needed to have impact. A rank of 3 implies long-term.

* Integration: implies that other programs can be combined together in an intervention program, i.e. using the same resources. A rank of 3 implies that it is hard to integrate with other programs and therefore require separate efforts;

* Critical Mass: indicates whether a major campaign is necessary for an effective intervention. A rank of 1 indicates that the campaign can be conducted by existing health care delivery service or that no major campaign is necessary. A rank of 3 indicates a major campaign is necessary;

* Inputs: measures the difficulty of securing adequate staff and material;

  -- Labor: identifies sources as skilled or unskilled as a measure of potential snags in supply that may adversely effect program. A rank of 3 indicates the need for skilled labor;

  -- Material: identifies sources as local or outside as a measure of potential snags in supply that may adversely effect program. A rank of 3 implies materials that are expensive or hard to get; and

* Perceived Priority: another indicator of the extent of community involvement and change of personal habits;

  -- Need: refers to the disease itself (classic case is that malnutrition is frequently not recognized as a problem). A rank of 3 implies that the local people do not consider the disease important or that they do not know they can combat it;

  -- Program: refers to the need for a program and the capacity of the local government to back one. A rank of 3 implies the difficulty of initiating a program.

Step 5. List Possible Components (Table A-5)

Step 5 is the final step in analyzing prospective components. Compare totals for problems (Table A-3a and A-3b) with interventions (Table A-4a and A-4b). With an understanding of problems, potential interventions and their complexity, it should be possible to derive a short-list of components. The more complicated the intervention, the more likely it should be viewed for consideration outside the project. In some cases, such as malaria control, where problems are serious but their interventions are too complicated as environmental health components, a demonstration project may provide a feasible response. In these cases, an environmental health component as a demonstration project would aim at education the beneficiaries and also attempt to secure appropriate collaboration in tandem with the project. For example, an urban or water project could contain a demonstration project on appropriate sanitation technologies, and practical methods to store water and eliminate breeding/feeding grounds for mosquitoes that occur from inadequate drainage. The follow up would consist of efforts to develop the demonstration project into a separate project.

Table A-5

ENVIRONMENTAL HEALTH COMPONENT IMPACT ASSESSMENT

Disease/Condition (Use appropriate diseases from Tables 2)	Short-term Impact		Long-term Impact		Recommendations		
	Component with no follow-up	Demo. proj. alone	Component with follow-up	Demo. proj. plus follow-up	Component	Demo. Proj.	Outside Project

A fuller explanation of the project components would be included elsewhere as part of the health component proposal.

Explanation of Terms in Table A-5

* Short-Term Impact: implies components that would have an impact within the life of the project. "Follow-up" refers to a formal program rather than normal maintenance per se, which is subsumed as requirement of a project operations. List short title of environmental health component under the appropriate column;

  -- Component with no follow-up: indicates a relatively straightforward, self-contained component, such as drainage or construction of a clinic, that does not require a formal program of follow-up after the project is completed; and

  -- Demonstration Project Alone: similarly implies the organization or construction of a demonstration project with no institutionalized follow-up after the project, e.g., construction of sanitation technologies in schools;

* Long-Term Impact: indicates the need for supervision and administration beyond the project cycle. "Follow-up" refers to a formal program rather than normal maintenance per se, which is subsumed as a requirement of project operations. List short title of the environmental health component under the appropriate column;

  -- Component with Follow-up: indicates a somewhat more complicated component whose benefits would not be apparent during the project cycle or which would require some type of follow-up after the project is completed. Any component requiring behavioral change or recurrent expenses would fall in this category, e.g., administration of a health clinic, nutrition program, etc.; and

  -- Demonstration Project plus Follow-up: implies a slightly more complicated demonstration project not limited to construction, and which requires administration beyond the project. A demonstration sanitation project that moved from school to school would be such an example.

* Recommendations: provides the short list of components and indicates whether the solution to health problems can be an integral part of the project or to be the responsibility of an agency outside the project. Check the appropriate column. The higher the need for follow-up, the greater the likelihood that the component should be administered outside the project.

Step 6: Prepare Proposal for Environmental Health Component (Terms of Reference)

Outline an environmental health component, indicating specifically if it is to be entirely within the project or outside it. Sample Terms of Reference and a check list of factors to be considered are presented as Appendix C.

APPENDIX B

BLANK TABLES

Table B-1a

ESTIMATE OF TOP 10 CAUSES OF MORTALITY IN PROJECT AREA

Disease/Condition	Comments	Trends Over Past 5 Years
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Table B-1b

ESTIMATE OF TOP 10 CAUSES OF MORBIDITY IN PROJECT AREA

Disease/Condition	Comments	Trends Over Past 5 Years
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Table B-2

ENVIRONMENTAL HEALTH NEEDS ASSESSMENT OF PROJECT AREA

Disease/Condition	Common and Serious	Common But Not Serious	Serious But Not Common	Explain Seriousness or Other Appropriate Information
Chaga's Disease				
Cholera				
Dengue				
Diarrheas:				
a) Undifferentiated				
b) Specific				
Dysentery:				
a) Amebiasis				
b) Shigellosis				
Filariasis				
Food Poisoning				
Giardiasis				
Guinea Worm				
Hepatitis				
Intestinal Worms:				
a) Ascariasis				
b) Hookworm				
Malaria				
Onchocerciasis				
Respiratory Diseases:				
a) Mild Short-Term				
b) Influenza				
c) Pneumonias				
Salmonelloses:				
a) Salmonellosis				
b) Typhoid				
Schistosomiasis				
Sleeping Sickness, Afr.				
Tetanus				
Trachoma				
Tuberculosis				
Others:				
Accidents				
Malnutrition				

Table B-3

SUMMARY -- PROBLEMS AND PREVENTIVE INTERVENTIONS

	Main Source of Problem						Focal Point of Intervention					
Disease/Condition	Water Quality	Water Quantity	Excreta Disposal	Waste Disposal	Housing	Education	Water Supply	Excreta Disposal	Waste Disposal	Housing	Health Care	Education
Chaga's Disease												
Cholera												
Dengue												
Diarrheas:												
a) Undifferentiated												
b) Specific												
Dysentery:												
a) Amebiasis												
b) Shigellosis												
Filariasis												
Food Poisoning												
Giardiasis												
Guinea Worm												
Hepatatis												
Intestinal Worms:												
a) Ascariasis												
b) Hookworm												
Malaria												

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Table B-3 contd.

SUMMARY -- PROBLEMS AND PREVENTIVE INTERVENTIONS

	Main Source of Problem						Focal Point of Intervention					
Disease/Condition	Water Quality	Water Quantity	Excreta Disposal	Waste Disposal	Housing	Education	Water Supply	Excreta Disposal	Waste Disposal	Housing	Health Care	Education
Onchocerciasis												
Respiratory Diseases:												
a) Mild Short-Term												
b) Influenza												
c) Pneumonias												
Salmonelloses:												
a) Salmonellosis												
b) Typhoid												
Schistosomiasis												
Sleeping Sickness, Afr.												
Tetanus												
Trachoma												
Tuberculosis												
Other:												
Accidents												
Malnutrition												
Snake Bites												

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Table B-4

SUMMARY -- COMPLEXITY OF INTERVENTIONS

Disease/Condition	Area of Focus: User	Area of Focus: Environment	Area of Focus: Health System	Time Span: Long Short	Time Span: Recurrent	Time Span: Initiate	Time Span: Impact	Integration: Hard=3 Easy=1	Critical Mass: High=3 Low=1	Inputs: Labor Skilled=3 Unskilled=1	Inputs: Material Outside Local	Perceived Priority: Need	Perceived Priority: Program
Chaga's Disease													
Cholera													
Dengue													
Diarrheas:													
a) Undifferentiated													
b) Specific													
Dysentery:													
a) Amebiasis													
b) Shigellosis													
Filariasis													
Food Poisoning													
Giardiasis													
Guinea Worm													
Hepatitis													
Intestinal Worms:													
a) Ascariasis													
b) Hookworm													
Malaria													

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Table B-4 contd.

SUMMARY -- COMPLEXITY OF INTERVENTIONS

Disease/Condition	Area of Focus: User	Area of Focus: Environment	Area of Focus: Health System	Time Span: Long Short	Time Span: Recurrent	Time Span: Initiate	Time Span: Impact	Integration: Hard=3 Easy=1	Critical Mass: High=3 Low=1	Inputs: Labor Skilled=3 Unskilled=1	Inputs: Material Outside	Inputs: Material Local	Perceived Priority: Need	Perceived Priority: Program
Onchocerciasis														
Respiratory Diseases:														
a) Mild Short-Term														
b) Influenza														
c) Pneumonias														
Salmonelloses:														
a) Salmonellosis														
b) Typhoid														
Schistosomiasis														
Sleeping Sickness, Afr.														
Trachoma														
Tuberculosis														
Other:														
Accidents														
Malnutrition														
Snake Bites														

THE VALUES INDICATED IN THIS TABLE ARE SUBJECTIVE AND COULD CHANGE COMPLETELY DEPENDING ON LOCAL CIRCUMSTANCES.

Table B-5

ENVIRONMENTAL HEALTH COMPONENT IMPACT ASSESSMENT

Disease/Condition (Use appropriate diseases from Tables 2)	Short-term Impact		Long-term Impact		Recommendations		
	Component with no follow-up	Demo. proj. alone	Component with follow-up	Demo. proj. plus follow-up	Component	Demo. Proj.	Outside Project

A fuller explanation of the project components would be included elsewhere as part of the health component proposal.

APPENDIX C

TERMS OF REFERENCE

The following section provides an example of terms of reference for an urban development project which would include slum upgrading, water supply, sanitation and drainage. In addition, lists of issues and questions, respectively, are provided for various topics related to environmental health components. These issues should selectively be covered in specific terms of reference. Issues are listed in preference to actual terms of reference because the latter are so site-specific as to require individual drafting for each project rather than using a standard format. Terms of reference for housing, water and sanitation are not included because their preparation falls within the expertise of the client government.

The following terms of reference and lists are attached:

1. Construction and Administration of Health Facilities

2. Lists of Issues:

   (a) General;
   (b) Deworming and Immunization;
   (c) Household and Community Safety.

SAMPLE TERMS OF REFERENCE

Construction and Administration of Health Facilities

Introduction

1. Port City is planning to improve its water supply and sanitation services in the Beyond the Bay district, to upgrade the area's housing and to provide increased public transportation facilities for easier access to the city center. The project is called Beyond the Bay Water Supply, Sanitation and Urban Development Project.

2. An environmental health assessment undertaken during the initial phases of project preparation reveals that worm infestation in children of all ages and diarrhea rates of infants and pre-schoolers as well as a number of other health deficiencies are substantially higher than the average for the metropolitan area (for details, see attached Health Status of Beyond the Bay Population*). The report also revealed a rate of drownings and traffic accidents which is of concern. As a consequence, the authors of the report recommend that health services in Beyond the Bay be improved.

3. The objective of this assignment is to develop an environmental health component for Beyond the Bay Water Supply, Sanitation and Urban Development Project. The project component should be designed to provide specific services needed to improve the health of the area's population.

Project Environmental Health Component

4. The environmental health component may be executed by the Port City Development Authority, the public health service or other organization. Physical facilities should preferably be built as part of the project by the Authority and administration of the program executed by a health agency. The appropriate agency (or its consultants) should discuss alternatives among the various organizations and recommend suitable actions for consideration by the Authority.

Scope of Work

5. The work should include the following principal items:

(a) General Information providing an overview of the health situation and needed actions to improve the conditions;

(b) Budget proposal providing information on capital works (construction) and continuing program (operations);

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* Not attached in this sample, but standard TORs would have a reference document.

(c) Design of facilities and equipment needed; and

(d) Program of Implementation of construction program and operation including a description of institutional arrangements and responsibilities with a timetable for reaching agreement among various institutions involved.

6. In undertaking the work, the appropriate health agency (or its consultants) should consider the following issues, answer the applicable questions, and cover other topics which are pertinent but not listed below.

A. General

-- What are the national and local objectives with regard to the provision of health facilities? (e.g., general policy, per capita or geographic distribution.) Provide an organizational chart if possible.

-- How does the proposed component meet these objectives?

-- How does the proposed component compare with these standards? Does the proposal call for more or less facilities and equipment than is normally required for clinics (e.g., dental facilities, or X-ray equipment). Does solving local needs differ from national objectives?

-- What other private and public health facilities are available within 1 km of the project area? (Estimates of private practitioners will do; the important aspect of this question is to establish the general availability of health services. Provide a map if possible.)

-- In addition to conventional modern services (i.e., doctors, clinics, hospitals), what other alternatives for health care are available (e.g., midwives, dispensaries, traditional healers)? Give a brief description of the types and, to the best extent possible, the patterns of use by the community.

-- What are the costs of the above services? (e.g., average cost per visit?) If possible, get the average cost for a five-day bout with the flu using each of the appropriate services used by the community. How does this relate to local incomes? Does the cost determine community preferences between private and public services?

-- If charging user fees for government services is an issue, please explain.

-- By and large, are other government facilities similar to those being proposed underutilized or overutilized? What is

the average patient load per day? What are the main illnesses treated? What are the main reasons for their use (e.g., family planning, MCH programs, treatment, nutrition programs)? If they are underutilized, what are the main reasons (e.g., poor location, high cost of treatment, no medications)?

-- Give a breakdown of the recurrent budget for the proposed component according to staff on site, supervision of clinic, program budgets, transportation, medications, other. Will this draw personnel or budget from other local areas of equal need?

-- Will assurances of staff and budget for the proposed component draw resources from other government facilities?

-- Are there any special circumstances that should be mentioned, e.g., high staff turnover caused by poor location or low salaries, transportation a problem for access by staff, clientele, or outreach/screening/home visit programs; government standards do not include budget for maintenance and clean-up of clinic grounds; building plan for government clinics does not provide space for record-keeping or adequate waiting room space? In light of these, are there any special requests that should be made for alteration of government standards to improve these circumstances?

-- Explain local standards for clinic operation: please include basic design (e.g., three rooms covering about 700 sq ft), staff composition (e.g., 1 MD, 2 nurses, 4 auxiliaries/part-time or full-time), hours of operation (e.g., Monday through Saturday, 7 AM to 1 PM), services provided (e.g., general medical care, MCH, nutrition education and feeding, dental care, referrals to hospital) budget, etc.

-- Are out-patient departments of local hospitals over-utilized or under-utilized when compared with local clinics?

-- What are the main reasons for clinic use? Given the range of services provided, do people tend to use the clinic for one service but not others? (e.g., people come about 12 a day for MCH, child examination and supplementary feeding but do not use the clinic for general medical care because it frequently has no medications.)

-- What is the average waiting time at the local clinics? Is this a factor in determining their use?

-- Is refrigeration, a problem? If so, please explain.

A. Budget

-- Please provide a sample budget of facilities similar to those being proposed.

-- For the facilities being proposed, indicate the following budget commitments for five years:

(i) staff: MDs, nurses, other auxiliaries, other support staff;

(ii) construction/upgrading: building expenses;

(iii) equipment: list equipment to be installed or replaced and, where appropriate indicate the type of equipment that will have to be replaced within five years;

(iv) maintenance: give estimated fuel, electricity, water and other costs concerned with upkeep (e.g., mops, soap, paper, administrative supplies);

(v) medications: list average stock and amount of budget to be devoted to medical supplies or laboratory facilities; and

(vi) other: include incidentals such as transportation, vehicles and give brief explanation of use.

-- Will meeting this budget or a staff commitment necessitate drawing resources from other areas of equal need?

-- Under normal conditions, how long will the supply of medications last? If possible, please list category or function in budget by major disease.

-- What provisions are made for supervision of the clinic staff by the city or state administration; and also for health volunteers or auxiliaries working in the community by the clinic staff?

-- Is this supervision effective? Yes_____ No_____; if No, please explain the prime reasons. (e.g., neither city nor clinic staff has adequate transportation to do supervision and staff cannot afford the money for local transportation, or, the nurses are afraid to go into the neighborhoods.)

C. Design of Facilities

-- Indicate land requirements for the proposed health facilities.

-- Describe procedures and potential problems for land acquisition for the proposed facilities.

-- Indicate any equipment either in construction or operation that will pose any problems for procurement or later operation.

-- Indicate any special requirements for construction that would pose a problem for overall scheduling with the project.

-- Describe eventual ownership of the facilities and indicate the potential for future problems.

-- Do local laws require special compliance, variances or licenses for health facilities? If so, please describe.

D. Program of Implementation

-- Separate the component into two stages; i) construction, and ii) operation and maintenance. Give timetable if possible.

-- Describe overall division of responsibilities according to: i) those that are part of the project, ii) those to be continued after the project. Describe provisions to account for the different stages and distribution of responsibility.

-- Describe institutional arrangements. Indicate which institution will be responsible for which parts of the project; what agreements have been reached and remain yet to be negotiated.

-- Provide a timetable showing the timing of project execution and related actions.

Reporting

7. The conclusions and recommendations of the executing agency (or its consultants) should be presented in a report which should also include description of the health services to be provided and the physical facilities to be built (with necessary plans and contract documents). The report should clearly distinguish between action to be taken as part of the project and subsequent health services programs to be undertaken by others.

Implementation

8. The Authority (or its consultants) shall commence work within 10 days from signature of the contract and complete it within six months from that date. The appropriate agency (or its consultants) shall provide the

Authority with a monthly program report in which the work-program is described and any issues on which guidance from the Authority is required.

List of Issues

A. General Issues

1. Identify staff needs, describe procedures for recruitment and selection of consultants; include support, offices, equipment and budget for same. Separate costs into capital and recurrent.

2. Define particulars of geographic areas affected by the component; include seasonal factors.

3. Identify government, international and non-government organizations (NGOs) that are, could be, or should be involved with the component.

4. Based on preliminary needs assessment, enumerate all agencies currently working in the health area and that could possibly be considered as potentially working with the project.

5. Designate aspects of proposed component that would require formal cooperation with agencies not already participating with the project.

6. Give proposed timetable of events, include necessary follow-up.

7. Designate required and optional data, monitoring, and follow-up aspects.

8. If any volunteer programs are proposed, assess their efficacy in terms of past experience in the project area or country. Be sure to include the issue of honoraria or other forms of payment.

9. Designate training needs that may be required for component. Give justification, budget, time table.

10. Identify any institutional or legal arrangements and land acquisition that will be necessary to implement the component.

11. Describe pertinent research and studies, obtain copies if possible.

12. If appropriate, identify any site acquisition requirements.

13. List any practical safety hazards involved with project construction and later operation. Indicate any required procedures to compensate for safety hazards, including budget and any other important particulars.

14. Indicate any particular circumstances or high risks not covered in the above. This should include the community's own perception of problems and their solutions.

15. List typical recurrent problems of daily operations and practicable ways the component could help overcome them.

16. Describe potential for community involvement with planning, implementation and eventual use/operation of the proposed facilities.

B. Deworming and Immunization Issues

1. List the pertinent local diseases; cite their incidence and prevalence in the project area.

2. Indicate those diseases for which deworming or immunization is possible.

3. Describe past experiences with similar programs and cite level of recidivism.

4. For the proposed deworming or immunization program, describe overall plan of action, including major focal points (e.g., schools, workplaces), means of implementation (e.g., school nurses, separate task force), and scheduling of same.

5. Indicate follow-up measures that will be required, including scheduling.

6. Indicate data collection, monitoring criteria or other studies that would be desirable and those that would be essential.

7. If appropriate, indicate other health programs to which the deworming or immunization program could be added, or conversely, other programs that could be added to the deworming or immunization programs.

8. Give staffing and equipment budget for the above.

9. Cite any special requirements, potential problems or typical recurrent problems. Be specific, e.g., purchase/use of vehicles; funds for maintenance/repair of vehicles and fuel; if appropriate, supply of sterilized needles.

10. Give budget for the proposed program.

11. List any programs currently involved with deworming or immunization.

12. List the executing agency or agencies that would be likely collaborators.

C. Household and Community Safety Issues

1. Describe basic living conditions of project area and overall safety hazards. Include considerations of traffic (motor vehicles and others) fire, water (e.g., drowning, flooding and other hazards), accidents, lighting, general access (e.g., foot paths), mud slides, etc.).

2. Indicate the community's perception of these problems, and their own priorities about resolving them.

3. Identify high risk groups.

4. Describe basic conditions of individual houses. Include specific conditions of building materials/overall construction, exposure to sunlight/fresh air.

5. Describe local methods for cooking. Include specific description of the stove and relate this to the risk of burns, especially of children, and to the production of smoke or noxious fumes.

6. If possible, cite past cases of injury or death resulting from accidents related to the above.

7. Relate any of these potentially hazardous conditions specifically to the cost of fuel or building materials.

8. Relate any safety hazards to project construction and implementation.

9. Describe the level of community organization and any groups working in the area.

10. Review General Issues for details.

11. Propose solutions to the above with consideration to items listed in General in these Terms of Reference.

APPENDIX D

PROFILES

The Profiles are intended to serve as sample questionnaires to help gather information necessary for decision-making, prior to filling in the six analytical tables. Depending on the local requirements and availability of information, individual project officers may opt to proceed directly to the six analytical tables. Of the three profiles, health, environment and social, the health profile is the most extensive. This is based on the assumption that individual projects are not designed to generate health data, whereas data on environment and social conditions will probably already have been compiled. In any event, the questionnaires are intended as prompts to elicit additional information rather than as a list of required data.

To help put preparation of an environmental health component into context, the vignettes below cite some typical problems encountered in past components.

-- Accurate data remain a serious deficiency in structuring effective health components. One Ministry of Health and Social Welfare, for example, indicates that there is "gross under-reporting" of death from notifiable diseases. They list "pneumonia" and "dysentery and diarrhea" as first and second cause of death in the country over a four-year period. Yet the national records show no cases or deaths for either category, nor for tuberculosis, tetanus, gonorrhea, syphillis or trachoma which are also very common.

-- Because of lack of transportation to visit schools, the public health sister was unable to visit the majority of the 82 primary schools under her jurisdiction. At the same time, some teachers responsible for distributing medications in the primary schools hoard them (mostly aspirin and anti-malaria medications) for fear of being accused of witchcraft.

-- Despite programs to bring government-supported community health facilities within easy access to communities, outpatient departments of local hospitals are often overtaxed with patients, while the neighborhood clinics are underutilized.

-- A health sister in Western Africa expressed her total frustration at the inability of teaching personal hygiene while almost completely surrounded by heaps of garbage.

-- Local health staff defined their problems as follows: there is a high staff turnover because of poor location of the clinic and low salaries. Government budgets do not allow for maintenance and clean up of clinic grounds and if we ask the community to do it, it creates a second rate image of health services. Building plans do not provide space for records or adequate waiting room for MCH counselling and some mothers are afraid to bring in their children because they think they will catch a disease at the clinic.

-- In Southeast Asia, a deworming campaign was conducted at the outset of a project with a prevalence of 95% parasite infestation in primary school children. Initially effective, the rate returned to 90% a year later because of reinfection since the water and sanitation facilities had not yet been completed.

-- In a residential area where an urban project was being implemented, there are 33 community organizations (21 government, 12 private sector); 22 of these deal with health, nutrition, and family planning-related matters. Eventually an Inter-Agency Council had to be created to coordinate their

activities and reduce community confusion. In fact, local staff complained bitterly that their rapport with the beneficiaries was compromised because the population was suffering from "survey fatigue", but noted little action.

-- A slum with a population of 540,000 has existed in a South Asian city for about 30 years. Its residents speak of the slum as home, even though they come from all over the country and return regularly to their family villages. There is a sense of cohesiveness and a reasonably well established amount of community organization and political activity. By comparison, a slum in another city exhibits undercurrents of distrust of the government and its programs. The city, the country's largest commercial center, has a history going back centuries. Yet, people still speak of their ancestral villages as "home." Merchants would sooner contribute to their home village water supply than to contribute to the commercial center for improvements in water supply, sanitation and refuse disposal.

-- In another major commercial center, a high turnover of job seekers, according to health officials, is the chief impediment to improving health (because of the constant need to teach the same lessons to new patients before lessons have time to be absorbed), or in conducting effective TB screening programs.

-- In another city with a well established system of community organization, a city health official indicated that it takes at least eighteen months to organize local officials before the community health workers and local health care delivery programs can be effectively administered.

-- Social and religious customs exert an enormous influence on perception of disease, and willingness to participate in or avail themselves of project services. In one city, clinic construction was delayed because of community pressure for schools and lighting before health services. In another city, when asked by a local health official to describe common childhood sicknesses, several mothers spoke of fever and measles, but not vomiting and diarrhea because they were seen as part of childhood. In a third city, parents spoke of bloating and orange brittle hair (signs of malnutrition) as a regular stage in growth from childhood to adolescence.

-- Dispersed local administrative procedures often complicate rather than facilitate the implementation of health components. For example, water is under the jurisdiction of the State Ministry of Water, solid waste under the

jurisdiction of the State Ministry of Environment, and sanitation under the State Ministry of Health. All these entities answer ultimately to the City Council. However, the Ministry of Health plays an advisory role with no real authority except in the case of epidemics.

HEALTH PROFILE

The information requested in this profile is aimed at gathering background data to have a better understanding of the project area. It is not intended that all questions be answered if the information is not readily available. Estimates may be used to fill in the questionnaire where hard data are unavailable. The profile will be kept on file as a reference.

The purpose of the health profile is threefold:

-- to determine the most common and most serious sources of disease and death in the project area;

-- to establish the current level and use of formal and informal health services; and

-- to see how an environmental health component can help current national and local programs to address these problems.

The majority of this information should be readily obtained from local health personnel. If it is not available for the specific project areas, then local hospitals or clinics should be consulted for suitable estimates.

Sample Health Questionnaire

Health Status (Diseases/Conditions)

-- List the major causes of morbidity and mortality in the project area (see Appendix A, Tables A-1a, A-1b and A-2).

-- What are the levels of immunization in the project zones? For what diseases? For those that require a booster or re-immunization, has the follow-up been planned?

-- What is the level of water supply and sanitation?

-- Are there any portions of the population who should be considered high risk but do not appear so from the statistics (e.g., meat packers, or many people who return to their villages and contract schistosomiasis)?

-- If there are any changes in disease patterns over the past five years, are they due to a change in the population rather than specific health activities?

-- What are the levels of malnutrition in the project areas?

-- Are there any specific nutrition programs for the areas? If so, what are they? What are their general aims and who runs them?

-- What constitutes the daily diet of the project area? What is the average cost per person?

-- What are the local sources of protein? Are these always available throughout the year? What is the cost of proteins? Are these affordable to the local population?

-- What is the cost of cooking fuel? Does this determine the frequency of meals cooked at home? Does it determine proper nutrition in other ways?

-- What prepared meals are available from local vendors? What are the costs? How frequently are they used?

-- What is the level of breast feeding in the project zone?

-- What are the main types of accidents in the project zone?

-- How do these accidents relate to living conditions, to working conditions?

-- Explain if roads, highways, or other transportation facilities are a problem.

Health Care Delivery

-- provide an organizational chart of health activities showing responsibilities for providing health services.

-- What are the national or local objectives with regard to provision of health care? (e.g., general policy, per capita or geographic distribution, concentration on specific diseases or conditions.)

-- What public and private health facilities are available to the project population within a reasonable distance of the project site? (Define "reasonable distance.") Include: the private practitioners, hospitals, schools, midwives, herbalists, indigenous health practitioners, religious organizations, national, international, local or volunteer special projects such as a nutrition program by a university or aid organizations. Give a brief explanation of their functions. Estimates of these will do. The important aspect of the question is to reflect the general availability of health services to the population. Provide a map of these if possible.

-- In addition to conventional or modern services (i.e., doctors, clinics, hospitals, etc.) what other alternatives are available (e.g., midwives, pharmacies, dispensaries, traditional healers) and give a brief description of the types and, as best as possible, the extent of use. Estimates will do; the important aspect of this question is to determine the preferences and general use patterns by the project population of the services available to them.

-- Indicate if costs of the above services are a determining factor in their use.

-- What is the average time and distance to available medical care?

-- Generally, are the government facilities over-utilized or under-utilized? What are the average patient loads per day? If they are under-utilized, what are the main reasons for this (e.g., people go to the outpatient department of a hospital nearby. Or, the nearest health service, a clinic, is hard to reach because of a highway/river/hill. Or, the wait is too long for service. Or, they frequently run out of medication)?

-- What special services are available for TB screening, oral rehydration, malaria and MCH (especially identification and rehabilitation of malnourished children)?

-- What is the ratio of trained birth attendants, doctors, nurses and of other trained medical personnel available to the project population?

-- What type of emergency services are available in the project zone?

-- According to local municipal administration, who has control over health facilities, water, sanitation (distinguish between human waste and refuse)? Does this administrative breakdown pose problems to effective operation of these services?

General

-- Indicate any special circumstances that have not been mentioned above.

ENVIRONMENTAL PROFILE

The information requested in this profile is aimed at gathering background data to have a better understanding of the project area. It is not intended that all questions be answered if the information is not readily available. Estimates may be used to fill in the questionnaire where hard data are unavailable. The profile will be kept on file as a reference.

The purpose of the environmental profile is threefold:

-- to describe basic environmental conditions and provision of services in housing, water, sanitation and solid waste disposal; and

-- to assess local managerial capacity in coordinating or implementing these services;

-- to evaluate their impact on health.

Sample Environmental Questionnaire

Water

-- What is the current level of provision of water in the project zones (e.g., standpipes, wells, boreholes, house connections, vendors, other sources such as streams, lakes, rivers)?

-- Does the majority of the population use one or several sources? Explain which.

-- Describe the operational status of services (e.g., there are 103 standpipes, but 28 are broken, and many of the pipes leak and pass through drainage gullies. Generally, the pipes provide water according to this schedule: MFW 9-1, TTh 3-7, SS 9-7).

-- What is the cost of water? From what source? Would people use more water if it were cheaper? If it were closer?

-- What is per capita consumption?

-- What is the average distance from homes to a water source?

-- What is the average wait for water at public sources? Does the waiting time affect users' choice of service?

-- Among the various sources, which are considered pure enough for human consumption by local health officials?

-- Are there special seasonal problems affecting water use (e.g., water supply is substantially reduced in dry season and people tend to use the river water which is contaminated. Or, the entire area is prone to flooding in rainy season; this contaminates wells and boreholes.)

-- Mention any geographical features that would be appropriate as a particular source of contamination of water (e.g., part of the city is on a hill and the run-off during rains contaminates streams that are used for drinking water. Or, the major garbage dump is near the main food market or hospital and is an annoying source of flies and mosquitoes).

Excreta/Waste Disposal

-- Describe the overall state of sanitation and solid waste and sullage disposal.

-- What are the major methods for disposal of human waste (e.g., pit privies, streams, etc.)?

-- What are the major methods for disposal of solid waste (e.g., trash, refuse, garbage, etc.; more than likely solid waste will be contaminated with human waste)?

-- Are there any special characteristics for the project areas that relate to health and water (e.g., there is a major dumping ground near the project zone. Or, wastes from a meat packing plant regularly contaminate a river which also serves as a source of water)?

-- Are there local conditions that predetermine choices of sanitation and solid waste disposal (e.g., soil conditions, water table, housing density)?

-- According to present use of these choices, is it possible to predict the types of problems that might result even if they were improved (e.g., people do use pit privies and would continue to do so. However, unless more effective means of removal accompanies the project, the privies and garbage heaps will continue to pollute the ground wells which are the principal source of water for household use)?

-- Do people keep animals? If so, explain briefly what kinds, where they are kept, and if local health officials see these as a health problem (many people keep pigs near their houses. They are a constant source of flies and dirt. Many neighbors object, but can do nothing about it. Health officials say they spread disease because of flies and mosquitoes which feed and breed there, but there are no local laws prohibiting farm animals to be kept near houses).

-- Are there any naturally occurring toxic substances in the area? List them with their health and environmental implications.

-- If appropriate, list local industry that may produce environmental pollutants, and degree of current or potential problems. Include occupational hazards, specific hazardous wastes, and any risks to the community at large due to accidents at such industries.

-- Describe socio-economic circumstances that are appropriate. (See Social Profile for reference. For example, cite religious practices or local customs, sanitation facilities in schools, costs, success or failure of past programs.)

Housing

-- Describe the overall physical state of housing. Try to be specific in mentioning type of construction (e.g., cinder block, makeshift cardboard and wood) and protection from rain/dampness, ventilation, exposure of inside to sunlight.

-- What is the average housing density? (If possible, give persons per room.) Explain any cultural aspects of housing density and living patterns which would affect the number and sharing of rooms.

-- What is the average family size?

-- If possible, give a brief summary of household use (e.g., the typical dwelling consists of two rooms; one for general family use, e.g., meals, and one for sleeping.)

-- According to demands on land, would it be possible to construct or upgrade housing to allow for improved ventilation and exposure of rooms to sunlight (e.g., scarcity of land is too great to allow for practical construction of streets and walkways that would improve ventilation or expose houses to sunlight. Or, current land availability is plentiful and such construction is possible but land will probably be claimed in the next few years.)

-- Are fires a problem? Are landslides a problem? If so, is this because of density or use of building materials?

-- Are any hazardous materials used in housing construction. List and indicate if these pose a potential health hazard.

General

-- Explain any special risks such as toxic waste disposal, air or water pollution, industrial accidents or potential hazards. Cite also probability of fire or flooding.

-- What is the local administrative structure concerning housing, solid waste, sanitation, water and health? List the appropriate municipal authority, its scope of responsibility and give some indication of its real power of enforcement.

-- Does local administration provide effective management of these services?

Yes_____ No_____

If no, indicate the major problems (e.g., inadequate number of dump trucks; or, dump trucks are sufficient, but roads are impassable from congestion or flooding. Or, government salaries are too low to attract labor for such a dirty job).

-- Explain any special circumstances you think should be mentioned.

SOCIAL PROFILE

The information requested in this profile is aimed at gathering background data to have a better understanding of the project area. It is not intended that all questions be answered if the information is not readily available. Estimates may be used to fill in the questionnaire where hard data are unavailable. The profile will be kept on file as a reference.

By and large, the purpose of the social profile is threefold:

-- to describe the homogeneity and social cohesiveness of the target project beneficiaries as a potential for community organization and self help;

-- to describe local ethnic or religious customs that would have either a positive or negative bearing on health practices, such as personal hygiene, perception of disease, environmental cleanliness; and

-- based on the above, to establish the need for community organization and education to prepare for health programs.

This does not imply a major sociological study; the information should be readily available from local personnel familiar with the population.

Sample Social Questionnaire

-- What is the population of the project zone(s)? (Give age and sex breakdown if possible, including children under 5).

-- How long has the project zone(s) existed as a settlement/village?

-- Describe the mobility of the population (e.g., most are in-migrants from the countryside looking for work; many leave after six months. Or, the community is composed mostly of low-level civil servants, part-time workers and unemployed who live here most of the time with extended visits from family members in rural areas.)

-- What are the main religious/ethnic/tribal groups in the project area? (Give rough breakdown by population numbers and percentages, if possible.) Explain any important practices that would positively or negatively affect health or hygiene education promotion.

-- Is there internal friction among segments of the population according to religion, ethnic/tribal affiliation or dialect? Would this affect use of health facilities or response to health workers? Does the gender of health workers affect the use of facilities?

-- It may be necessary to collect additional base-line data. For the average family, what family member(s) is home during the day? Will surveying pose a problem? If so, explain why.

-- Do both men and women work and if so, what are the average work hours?

-- At what time of the day or evening would one expect to find the entire household at home? Presumably this would be in the evenings. If so, would this pose a difficulty to nurses or community health workers for their outreach/education/or screening programs?

-- What are the normal child care practices for pre-school children? (This assumes that most school-age children attend school; if they do not, say so.) For example: mothers who do not work care for their own children; many mothers work (in a local factory/at a small stand selling various merchandise) and the children are cared for by relatives/friends.

-- Are there any government or community supported child care facilities?

Yes _____ (Give cost per day or week if possible:_____)
No_____

-- If yes, is there any stigma attached to attending it (e.g., there is a child care center run by the local Health Department, but many mothers are afraid to send their children there because they are afraid their children will get sick or because it is for people who have no money and families are embarrassed to send their children there)?

-- Are mothers in the area economically active?

-- What is the average family size?

-- What is the average housing density?

-- How much time has been lost from work and school from illness?

-- Do the residents rely on government facilities for health care or do they prefer midwives, herbalists or local indigenous medical practitioners?

-- Is there a high level of political/neighborhood/community activity in the project zone that could be tapped for educational programs?

-- Describe any high risk groups or special problems of womem, children, the aged, or workers.

-- Explain any special circumstances you think should be mentioned.

-- Are definitions of problems and their solutions of the community the same as they are for the government? If not, how do the priorities of the local population differ from those of the government?

APPENDIX E

COMPARATIVE STATISTICS ON COMMON HEALTH INDICATORS

COMPARATIVE STATISTICS ON COMMON HEALTH INDICATORS

Item Measured	Definition Formula	Representative No. for Poor Developing Country	Representative No. for Developed Country	Comments
Infant mortality	Number of deaths in infants under 1 year old per 1,000 live births (in a given year)	115/1,000	15/1,000	1985 World average 75. Good indicator of maternal and child health and socio-economic status. Unfortunately, for accurate reporting, a relatively large sample size (e.g., 50,000 people) is necessary.
Child death rate	Number of deaths in children aged 1-4 per 1,000 children in the same age group in a given year.	20/1,000	0.4/1,000	Good indicator of environmental health hazards; desirable sample of 5,000 children for accuracy.
Proportionate mortality of under-fives	Number of deaths in children aged under 5 per total number of deaths	30%	2%	Good indicator of: high child mortality, high proportion of children 0-4, shorter life expectancy. Should be based on at least 200 total deaths.
Crude death rate	Number of deaths per 1,000 population in a given year.	16/1,000	9/1,000	Can be misleading population with high percentage of older population dying of natural causes.

COMPARATIVE STATISTICS ON COMMON HEALTH INDICATORS contd.

Item Measured	Definition Formula	Representative No. for Poor Developing Country	Representative No. for Developed Country	Comments
Maternal mortality	Number of deaths of mothers due to pregnancy and child births up 6 weeks after delivery (usually expressed per 1,000 live births per year)	5/1,000	0.1/1,000	Should be based on at least 50 maternal deaths. Reasonable indicator of socio-economic conditions and availability of effective health care facilities.
Crude birth	Number of live births per population (usually expressed per 1,000 per year).	42/1,000	14/1,000	Current world average about 27/ 1,000. High birth rate indicates: high dependency burden, high infant and child mortality,
Life expectancy at birth	Number of years a new-born infant would live if patterns of mortality prevailing for all people at the time of birth were to stay the same throughout life.	45 years	76 years	Good indicator of health status of population, especially infants and children
Percentage low birth weight	Live-born babies weighing less than 2,500 g per total number of live-born babies (usually expressed per 100)	30%	4%	1979 global average about 17%. Should be based on sample of at least 500 new-born. High rate indicates: poor nutritional status of mother, too close spacing of births, inadequate prenatal care.

APPENDIX F

SELECTED BIBLIOGRAPHY OF WORLD BANK PUBLICATIONS

ON HEALTH ASPECTS OF WATER SUPPLY, SANITATION, and URBAN SECTORS

The following is a list of pertinent World Bank references dealing with health aspects of projects from the Urban, Water, and Sanitation sectors. As of the Bank's reorganization in 1987, these sectors are now classified under the Infrastructure and Urban Development Sector or the Population and Human Resources Sector.

Publications designated with an asterisk (*) have been published jointly with the United Nations Development Programme as a contribution to the International Drinking Water Supply and Sanitation Decade.

All Technical Papers and most other publications are available from the World Bank Headquarters and Bookstore in Washington or the Paris Office, any of its Resident Missions, depository libraries, and authorized distributors or, when indicated, through a commercial publisher. Publications designated with (I) are available from the Water and Sanitation Program within the Infrastructure and Urban Development Department, with (E) from the Environment Department, with (IFC) from the International Finance Corporation, with (EDI) from the Economic Development Institute, and with (P) from the Population, Health and Nutrition Department.

Some publications have been produced first as departmental publications prior to being issued as World Bank Technical Papers or, in other cases, as parts of separate series that have since been consolidated. Consequently, there may be some duplication of numbers or repetition of titles in this bibliography.

SECTION I: WRITTEN MATERIALS

World Bank Technical Papers

Title	No.	Author(s)
The African Trypanasomiases: Methods and Concepts of Control and Eradication in Relation to Development. (1983)	4.	C. W. Lee and J. M. Maurice, eds.
Environmental Management of Urban Solid Wastes in Developing Countries: A Project Guide. (1982)	5.	Sandra J. Cointreau
Opportunities for Biological Control of Agricultural Pests in Developing Countries. (1983)	11.	D. J. Greathead and J. K. Waage
Water Quality in Hydroelectric Plants: Considerations for Planning in Tropical Forest Regions. (1984)	20.	Camilo E. Garzon
Techniques for Assessing Industrial Hazards, A Manual. (1988)	55.	Technica, Ltd.
Community Piped Water Supply Systems in Developing Countries: A Planning Manual. (1987)	60.	Daniel A. Okun and Walter R. Ernst
Water Pollution Control: Guidelines for Project Planning and Financing. (1987)	73.	Ralph C. Palange and Alfonso Zavala
The Safe Disposal of Hazardous Wastes: The Special Need and Problems of Developing Countries, vols. 1-3. (1989) (forthcoming in Spanish)	93.	Roger Batstone, James E. Smith, Jr., and David Wilson, eds.
Dams and the Environment: Considerations in World Bank Projects. (1989)	110.	John A. Dixon, Lee M. Talbot, and Guy J.-M. Le Moigne
Dam Safety and the Environment. (1990)	115.	Guy J.-M. Le Moigne, Herve Plusquellec, and Shawki Barghouti

Transport and the Environment Series:

Environmental Considerations for Port and Harbor Developments. (1990)	126. John D. Davis, Scott MacKnight, IMO Staff, et al.

Appropriate Technology for Water Supply and Sanitation Series: *

Technical and Economic Options (1980). Also Published by Johns Hopkins University Press as Appropriate Sanitation Alternatives: A Technical and Economic Appraisal. (1982)	1. John M. Kalbermatten, DeAnne S. Julius, and Charles C. Gunnerson
A Summary of Technical and Economic Options. (1980) (also available in French)	1a. John M. Kalbermatten and DeAnne S. Julius
Sanitation Alternatives for Low-income Communities -- A Brief Introduction. (1982) (also available in Spanish).	1b. D. Duncan Mara
A Planner's Guide. (1980)	2. John M. Kalbermatten and DeAnne S. Julius
Health Aspects of Excreta and Sullage Management -- A-State-of-the-Art Review. (1980) Published by John Wiley & Sons as Sanitation and Disease: Health Aspects of Excreta and Wastewater Management. (1983)	3. Richard G. Feachem, David J. Bradley, Henda Garelick, and D. Duncan Mara
Low-Cost Technology Options for Sanitation: A State-of-the-Art Review and Annotated Bibliography. (1982)	4. Witold Rybezynski, Chongrak Polpresert, and Michael McGarry
Sociocultural Aspects of Water Supply and Excreta Disposal. (1980)	5. Mary Elmendorf and Patricia Buckles
Night-Soil Composting. (1981)	10. Hillel I. Shuval, Charles, G. Gunnerson, and DeAnne S. Julius
A Sanitation Field Manual. (1980)	11. John M. Kalbermatten, Deanne S. Julius, and Charles G. Gunnerson
Meeting the Needs of the Poor for Water Supply and Waste Disposal. (1983)	13. Frederick L. Golladay
Urban Sanitation Planning Manual Based on the Jakarta Case. (1984)	18. Vincent Zajac, Susanto Mertodiningrat, H. Soewasti Susanto, and Harvey F. Ludwig

Water Supply and Sanitation Project Preparation Handbook: *

Volume I. Guidelines. (1983)	2. Brian Grover
Volume II. Case Studies, Identification Report for Port City, Immediate Improvement Project for Port City, Pre-Feasibility Report for Farmville, Pre-Feasibility Report for Port City., (1983) (also available in Spanish)	13. Brian Grover, Nicholas Burnett, and Michael McGarry
Volume III. Case Study: Feasibility Report for Port City. (1983) (also available in Spanish)	14. Brian Grover, Nicholas Burnett, and Michael McGarry

Integrated Resource Recovery Series: *

Recycling From Municipal Refuse: A State-of-the-Art Review and Annotated Bibliography. (1984)	30. Sandra J. Cointreau, Charles G. Gunnerson, John M. Huls, and Neil N. Seldman
Remanufacturing: The Experience of the United States and Implications for Developing Countries. (1984)	31. Robert T. Lund
Aquaculture: A Component of Low Cost Sanitation Technology. (1985)	36. Peter Edwards
Municipal Waste Processing in Europe: A Status Report on Selected Materials and Energy Recovery Projects. (1985)	37. James G. Abert
Anaerobic Digestion: Principles and Practices for Biogas Systems. (1986)	49. Charles G. Gunnerson and David C. Stuchey
Wastewater Irrigation in Developing Countries: Health Effects and Technical Solutions. (1986)	51. Hillel I. Shuval, Avner Adin, Bardi Fattal, Eliyahu Rawitz, and Perez Yekutiel
The Co-composting of Domestic Solid Human Wastes. (1987)	57. Letitia A. Obeng and Frederick W. Wright
Wastewater Management for Coastal Cities: The Ocean Disposal Option. (1980)	77. Charles C. Gunnerson, ed.

Water Supply and Sanitation Program: *

Rural Water Sanitation in Pakistan: Some Lessons from Experience. (1989)	105. Hafiz A. Pasha and Michael McGarry

Poverty and Basic Needs Series:

Water Supply and Waste Disposal. (1980) (also available in French and Spanish)	World Bank

Departmental Publications

Environment Department Publications: (E)

Environmental Industrial Waste Control Guidelines. (1988)	Department Staff
Environment, Health and Safety Guidelines for Use of Hazardous Materials in Small and Medium Scale Industries. (1985)	Department Staff
Occupational Health and Safety Guidelines. (1988)	Department Staff

Water Supply and Sanitation Research: (I)

Aquaculture with Treated Wastewater: A Status Report on Studies Conducted in Lima, Peru. (1987)*	3. Sandra J. Cointreau
Water Supply and Waste Disposal Sector, Appraisal Checklist, Rural Water Supply and Sanitation. (1981)	TWT/G/1 (Out of print, file copy only.)
Guidelines for Sector Work in the Water Supply and Waste Disposal Sector. (1973)	GAS 4 (Out print, file copy only.)
Water Supply and Waste Disposal Sector Appraisal Handbook. (1978)	GAS 16 (Out of print, file copy only.)
Country Studies in Appropriate Sanitation Alternatives. (1980)	RES 21 (Out of print, file copy only.)
Alternative Sanitation Technologies For Urban Areas in Africa. (1979)	RES 22 (out of print, file copy only.)
Eight Case Studies of Rural and Urban Fringe Areas in Latin America. (1979)	RES23 (Out of print, file copy only.)
Measurement of the Health Benefits of Investments in Water Supply. (1976)	PUN 20 (Out of print, file copy only.)
Water Supply Service for the Urban Poor: Issues. (1977)	PUN 31 (Out of print, file copy only.)

Technical Advisory Group (TAG) Technical Notes: * (I)

Methods for Gathering Socio-Cultural Data for Water Supply and Sanitation Projects. (1983) (also available in French)	1.	Mayling Simpson-Hebert
Planning of Communication Support (Information, Motivation and Education) in Sanitation Projects and Programs. (1983) (also available in French and Portuguese)	2.	Heli Perrett
The Ventilated Improved Double Pit Latrine: A Construction Manual for Botswana. (1983) (also available in French)	3.	John van Nostrand & James Wilson
Pit Latrine Ventilation: Field Investigation Methodology. (1983) (also available in French)	4.	Beverly Ryan & D. Duncan Mara
Social Feasibility Analysis of Low-Cost Sanitation Projects. (1983) (also available in French and Portuguese)	5.	Heli Perrett
Ventilated Improved Pit Latrines: Vent Pipe Design Guidelines. (1983) (also available in French)	6.	Beverly Ryan & D. Duncan Mara
Community-Based Workshops for Evaluating and Planning Sanitation Programs: A Case Study of Primary Schools Sanitation in Lesotho. (1983)	7.	Piers Cross
Rural Ventilated Improved Pit Latrines: A Field Manual for Bostwana. (1983)	8.	John Van Nostrand & James Wilson
Handbook for District Sanitation Coordinators. (1983)	9.	Debadire Basaako, Ronald Parker, Robert Waller, & James Wilson
Manual on the Design, Construction and Maintenance of Low-Cost Pour-Flush Waterseal Latrines in India. (1984) (also available in French)	10.	A. K. Roy
Monitoring and Evaluation of Communications Support Activities in Low-Cost Sanitation Projects. (1984)	11.	Heli Perrett
India: Monitoring and Evaluation. (1984)	12.	Ronald Parlato

The Design of Ventilated Improved Pit Latrines. (1984) (also available in Spanish)	13.	D. Duncan Mara
The Design of Small Bore Sewer Systems. (1985) (also available in Spanish)	14.	Richard J. Otis & D. Duncan Mara
The Design of Pour-Flush Latrines. (1985)	15.	D. Duncan Mara
Sensitivity of Water Distribution Costs to Design and Service Standards: A Philippine Case Study. (1986) (also available also in French)	16.	Paul V. Hebert and Cesar Ynigue

TAG Discussion Papers: * (I)

Ventilated Improved Pit Latrines: Zimbabwean Brick Designs. (1985)	1.	Peter Morgan and D. Duncan Mara
Involving Women in Water Supply Projects. (1985)	3.	Heli Perrett

TAG Working Papers: * (I)

A Model for the Development of a Self-Help Water Supply Program. (1982)	1.	Colin Glennie
Ventilated Improved Pit Recent Developments in Zimbabwe. (1982)	2.	Peter Morgan and D. Duncan Mara

Rural Water Supply Handpumps Project *

Draft Sample Bidding Documents for the Procurement of Handpumps. (1986)	Rural Water Supply Handpumps Project Team
Community Water Supply: The Handpump Option. (1987) (also available in in French and Spanish)	S. Arlosoroff, G. Tschannerl, D. Grey, W. Journey, A. Karp, O. Langenegger and R. Roche

Water and Sanitation Program Discussion Paper Series: *

Wastewater Irrigation in Developing Countries --- Health Effects and Technical Solutions (Summary of World Bank Technical Paper No. 51). (1990)	2.	Hillel I. Shuval

Rural Sanitation in Lesotho: From Pilot Project to National Program (1990)	3.	UNDP World Bank Water and Sanitation Program and PROWESS
Catalog: Information and Training Materials for Low-Cost Water Supply and Sanitation. (1986) (also available in French and Spanish)		International Training Network
Water and Sanitation Publications.		UNDP World Bank Water and Sanitation Program

Urban Development Technical Papers: (I)

Notes on the Design and Operation of Waste Stabilization Ponds in Warm Climates of Developing Countries. (1983)	6.	J. P. Arthur

Infrastructure and Urban Development Technical Papers: (I)

The Environmentally Sound Disposal of Dredged Materials. (1989)	54.	Scott MacKnight, et al.

WUD Technical Notes: (I)

Rural Water Supply and Sanitation: Possibilities for Collaboration with Non-Governmental Organizations (NGOs) Part One: Africa. (1985)	1.	A. Saravanapavan

Policy, Planning, and Research Working Papers: (P)

The Selection and Use of Pesticides in Bank-Financed Public Health Projects. (1988)	11.	Bernhard Liese and Norman Gratz

IFC Discussion Papers:

Strengthening Health Services in Developing Countries through the Private Sector. (1989)	4.	Charles C. Griffin

EDI Training Materials: (See also Section II: Audiovisual Materials)

Health Aspects of Watershed Development and Irrigation Projects. (1982)	480/007	Donal T. O'Leary
Community Water Supply and Sanitation -- Problems and Issues. (1979)	815/009	John W. Huang

Nuclear Power -- Nuclear Siting, Containment, Safety. (1982)	235/003	Edward A. Minnig
Nuclear Power -- Safety and Risk. (1982)	235/005	Edward A. Minnig
Industrial Pollution Control. (1983)	226/006	Donal T. O'Leary

Glossaries (English-French-Spanish):

Glossary of Urban Infrastructure Maintenance	World Bank
Population Terminology	World Bank
Terminology of Water Supply and Sanitation (English-French)	World Bank - UNICEF

Miscellaneous Publications

Staff Working Papers:

Pollution Control in Sao Paolo, Brazil: Costs, Benefits, and Effects of Industrial Location. (1981)	501. V. Thomas
The Effect of Piped Water on Early Childhood Mortality in Urban Brazil: 1970-1976. (1983)	594. Thomas Merrick
Rapid Population Growth and Human Carrying Capacity: Two Perspectives. (1985)	690. D. Mahar, R. Muscat, R. Goodland, J. Kirchner, G. Ledec, and J. Drake

Non-series:

Environment, Public Health and Human Ecology: Considerations for Economic Development. (1985)	James A. Lee
Environmental, Health, and Human Ecologic Considerations in Economic Development Projects. (1984)	World Bank
Tribal Peoples and Economic Development: Human Ecologic Considerations. (1982)	R. Goodland, et al.
Village Water Supply: Economics and Policy in the Developing World. (1975) (also available in French and Spanish and Portugese)	Robert J. Saunders and Jeremy J. Warford

Water Supply and Sewerage: Sector Working Paper. (1971)	World Bank (Out of print, file copy only.)
The Environmental Program for the Mediterreanean: Preserving a Shared Heritage and Managing a Common Resource. (1990)	World Bank and the European Investment Bank

SECTION II: AUDIOVISUAL MATERIALS

Water Supply and Sanitation Program

Information and Training Materials for Low-Cost Water Supply and Sanitation: (available in French and Spanish, forthcoming in Portugese) * (I)

I. The Technical Package

1. Introduction to Low-Cost Water Supply and Sanitation
   - 1.1 Introduction

2. Management and Community Participation
   - 2.1 Project Preparation and Information
   - 2.2 Institutional and Financial Aspects
   - 2.3 Economic Appraisal of Projects
   - 2.4 User Participation

3. Health and Hygiene
   - 3.1 Health Aspects of Water Supply and Sanitation
   - 3.2 Hygiene Education

4. Water Supply
   - 4.1 Rainwater Roof Catchment Systems
   - 4.2 Wells and Handpumps
   - 4.3 Gravity-Flow Water Supply
   - 4.4 Water Distribution Network
   - 4.5 Water Treatment

5. Sanitation
   - 5.1 On-Site Sanitation
   - 5.2 Waterborne Sanitation
   - 5.3 Sanitation Technology Selection
   - 5.4 Waste Treatment and Resource Recovery

6. Case Studies
   - 6.1 User Participation Case Studies

7. Training Information
   - 7.1 Instructor's Guide

8. Training Films
   - People and Problems
   - Problems and Solutions
   - Solutions and People

II. The User Participation Package

III. The Decision-Makers Presentation

Economic Development Institute Training Materials

Multimedia Training Modules in Water Supply and Sanitation
(also available in French and Spanish) :

15. Low-cost Sanitation. (1984)

16. Productive Use of Human Waste. (1988)

17. Rural Water Supply and Sanitation. (1989)

World Bank Films:

A Plague Upon the Land (River Blindness)

Global Links Series:

2. Curse of the Tropics

4. Earth: The Changing Environment

6. The Urban Dilemma

APPENDIX G

GLOSSARY OF TERMS

APPENDIX G

GLOSSARY OF TERMS

-- **Acute**	Short term, often severe illness. (As opposed to long term or **chronic**).
-- **Aerobic**	Micro-organisms which can grow only in the presence of molecular oxygen.
-- **Anaerobic**	Organisms which will not grow in the presence of molecular oxygen.
-- **Bacteria**	A group of micro-organisms (approx. 1 micron across) that can be free-living, parasitic or saprophytic (i.e., they live on dead or decaying matter).
-- **Chronic**	Long-term, drawn out illness, can be mild or severe, as opposed to short term or **acute**.
-- **Clinical**	Refers to detectable or visible manifestations of symptoms of an infection or disease, e. g. clinical infection.
-- **Contagious**	Communicable by contact. (Synonymous with **infectious**).
-- **Enteric**	Pertaining to the intestines.
-- **Enteric fevers**	General class of fevers due to infection of the intestines, most commonly refers to typhoid and paratyphoid (i.e., salmonella infections). The distinguishing feature of these infections is fever, rather than diarrhea.
-- **Enteritis**	General term for inflammation of the intestines. (As opposed to **gastroenteritis**, which refers to the stomach and intestines.)
-- **Epidemic**	Temporary outbreak of a disease beyond normal levels.
-- **Fomite**	An article which has been in contact with and is capable of transmitting a disease.
-- **Gastric**	Pertaining to the stomach.

* Any term printed in bold indicates that term is defined elsewhere in the Glossary.

-- **Gastritis** Inflammation of the stomach, particularly the mucous membranes.

-- **Gastroenteritis** Inflammation of the stomach and small intestines, particularly the mucous membranes.

-- **Germ** A one-celled micro-organism, usually refers to a pathogen.

-- **Incidence** A measure of new cases of a disease in a given period, usually expressed in cases/100,000, as opposed to **prevalence** which gives overall estimate.

-- **Infection** A successful invasion of a host and growth within it by a pathogen.

-- **Infectious** Communicable or can cause infection through direct and indirect contact. (Synonymous with **infectious**).

-- **Infestation** Invasion of a host without necessarily producing infection.

-- **Pandemic** A world-wide **epidemic**.

-- **Parasitology** The study which treats pathogens that live on or within another living organism for nourishment. This includes the study of diseases caused by protozoans (e.g., giardiasis, Chaga's disease and malaria); worms and flukes (e.g., ascariasis, schistosomiasis, hookworm); and arthropods (e.g., lice). It does not treat diseases caused by bacteria; e.g., tuberculosis, cholera, or viruses, e.g., many diarrheas and respiratory infections.

-- **Parasite** An organism which gets food or shelter from a host. In general could refer to bacteria; viruses, worms, insects, or protozoans. In strict medical terminology, however, parasite refers only to worms, protozoans and arthropods that compose the field of **parasitology**.

-- **Pathogen** Any disease-causing organism.

-- **Prevalence** Overall estimate of occurrence of a disease, usually expressed in cases/100,000. (By comparison, **incidence** measures new cases.)

-- **Vector** A vehicle of transmission of a disease which is an integral part of the life-cycle of the disease, e.g., the mosquito is a vector for malaria.

-- **Virus**	A group of ultra microscopic organisms. Their size is important because they have been able to pass through all filters and have been generally untreatable by drugs once inside the body. Viruses can only reproduce within a living cell. The field of virology is rapidly changing because of advances in diagnostic techniques, e.g., the electron microscope, have made analysis possible.
-- **Virulence**	Refers to the strength of a pathogen to overcome the body's defense mechanisms or resistance. Some pathogens and thus epidemics exhibit a natural increase and decrease in virulence.

REFERENCES

See also Appendix F, Selected Bibliography of World Bank Publications on Health Aspects of Water Supply, Sanitation and Urban Sectors.

American Public Health Association. 1980. Guidelines for Managers: Evaluation of Primary Health Care in Developing Countries. Washington, D.C.: APHA, International Health Programs.

American Society of Tropical Medicine and Hygiene. 1967. Health Hints for the Tropics. Bethesda, Maryland: National Institutes of Health.

Benenson, Abram S., Ed. 1981. Control of Communicable Diseases in Man, 13th ed. Washington, D.C.: American Public Health Association.

Blum, Deborah and Feachem, Richard G. 1983. "Measuring the Impact of Water Supply and Sanitation Investments on Diarrhoeal Disease: Problems of Methodology." International Journal of Epidemiology, 12:3, 357-365.

Brown, Roy E. and Wray, Joe D. 1974. "The Starving Roots of Population Growth." Natural History, 48.

Brown, Harold W. 1969. Basic Clinical Parasitology, 3rd ed. New York: Appleton-Century-Crofts.

Cabrera, Benjamin. 1984. "Ascaris: Most 'popular' worm." World Health, 8-10.

Cairncross, Sandy, and Feachem, Richard. 1978. Small Water Supplies. (Ross Bulletin 10) London: Ross Institute of Tropical Hygiene.

Clinton, Jarrett. 1979. Health Population and Nutrition Systems in LDC's: A Handbook. Washington, D.C.: Family Health Care, Inc.

Cort, W.W.; Otto, G.F.; and Spindler, L.A. 1930. Investigations on Ascaris lumbricoides and the Associated Intestinal Helminths of Man in Southwestern Virginia. The American Journal of Hygiene, 11:1, 1-55.

_____; and Stoll, N.R. 1931. Studies on Ascaris lumbricoides and Trichuris trichuria in China. The American Journal of Hygiene, 655-689.

Crewe, W., and Haddock, D.R. 1985. Parasites and Human Disease. London: Edward Arold.

Davies, John E.; Freed, Virgil H.; and Whittemore, Fred W. [No date.] An Agromedical Approach to Pesticide Management: Some Health and Environmental Considerations. Miami, Florida: University of Miami School of Medicine.

de Goarnisson-Blanc, Louis Aujoulat. 1979. Manuel de l'Equipe de Sante: Edition Nouvelle de Guide Medical Africain. Issy les Moulineaux, France: Editions Saint-Paul in collaboration with the World Health Organization.

de Lautre, H., and Robineau, L. 1979. Materiel d'Education pour la Sante en Afrique. (Etudes et Recherches, No. 45-79) Dakar: Environment Africain (ENDA).

EL Gamal, Ahmed Amin. 1981. The Health Impact of Water and Sanitation. (NAT.DONS.DEV.WSSP./7) Cairo: Ministry of Health, WHO and UNDP.

El Gohary, Fatma. 1981. Problems of Water Supply and Sanitation in Egypt. (NAT.CONS.DEV.WSSP/13). Cairo: Ministry or Health, WHO and UNDP.

Enan, Osman H., and Mitwally, Hassan. 1970. Environmental Factors Affecting Fly Population in Alexandria, U.A.R. The Journal of the Egyptian Public HBEalth Association, XLV:6, 500-513.

Eshuis, Jan, and Manschot, Peter. 1978. Communicable Diseases: A Manual for Rural Health Workers. (Rural Health Series 7.) Nairobi: African Medical and Research Foundation.

Family Health Care, Inc. 1979. Health Impact Guidelines for the Design of Development Projects in the Sahel; Vol. 1: Sector Specific Reviews & Methodology; and Vol. 2: Reference Manual. Washington, D.C.: Family Health Care Inc. for USAID.

Feachem, Richard G.; Bradley, David J.; Garelick, Hemda; Mara, D. Duncan. 1983. Sanitation and Disease: Health Aspects of Excreta and Waste-Water Management. Chichester, England: Published for The World Bank by John Wiley & Sons.

Feachem, Richard; Burns, Elisabeth; Cairncross, Sandy; Cronin, Aron; Cross, Piers; Curtis, Donald; Khan, M. Khalid; Lamb, Douglas,; Southall, Hilary. 1978. Water, Health and Development: An Interdisciplinary Evaluation. London: Tri-Med Books.

Feachem, Richard, and Cairncross, Sandy. 1978. Small Excreta Disposal Systems. (Ross Bulletin 8). London: The Ross Institute for Tropical Hygiene.

Groupe de Rechereche et d'Appui pour l'Autopromotion Paysanne (GRAAP). [No date.] Ameliorer la Sante au Village ---Fiches Pedagogiques. Bobo-Dioulasso, Haute Volta (now Burkina Fasso): GRAAP.

Guerraut, Richard L. 1988. Baillieres Clinical Tropical Medicine and Communicable Diseases: International Practice and Research --- Diarrhoeal Diseases. London: Bailliere Tindall

Howe, G. M., Ed. 1977. A World Geography of Human Diseases. London/New York: Academic Press.

Hughes, James. M. 1984. "Potential Impacts of Improved Water Supply and Excreta Disposal on Diarrhoeal Disease Morbidity: An Assessment Based on a Review of Published Studies." Unpublished consultant's report prepared for World Health Organization, Diarrheal Diseases Control Programme.

Hunter, John M., Ed. 1974. The Geography of Health and Disease. (Studies in Geography, No. 6.) Chapel Hill, North Carolina: Universsity of North Carolina.

Hussein, M. 1981. Public Health Implications of Water Resources Management in Egypt. (NAT.CONS.DEV.WSSP/14) Cairo: Ministry of Health, WHO and UNDP.

Jelliffe, D.B.S. and Stanfield, J.P. 1978 Diseases of Children in the Subtropics and Tropics. London: Edward Arnold.

Kass, Edward H. 1971. "Infectious Diseases and Social Change." Journal of Infectious Diseases, 123:1, 110-114.

King, Maurice. 1973. A Medical Laboratory for Developing Countries. London, Delhi, Kuala Lumpur: Oxford University Press.

_____; and King, Felicity; and Martodipoero, Soebagio. 1978. Primary Child Care: a Manual for Health Workers, Oxford, Delhi, Kuala Lumpur: Oxford University Press.

Lariviere, Michel. 1978. Parasitologie Tropicale. Paris: Les Editions Foucher.

Levi, Gino. 1976. "Health - An Integral Part of Development." WHO Features, 7, 2.

Listorti, James A. 1977. Perspectives on Environment and Development in the Third World: a Comparison between Nneteenth Century England and the Modern World. (Dissertation) New York: Columbia University, 39-73.

Lucas, Adetokunbo O., Gilles, Herbert M. 1984. A Short Textbook of Preventive Medicine for the Tropics (2nd Edition). London: Hodder & Stoughton.

Maegraith, Brian. 1984. Clinical Tropical Diseases (8th Edition). Oxford: Blackwell Scientific Publications.

Mahmoud, A.A.F., Ed. 1987. Baillieres Clinical Tropical Medicine and Communicable Diseases: International Practice and Research --- Schistosomiasis. London: Bailliere Tindall

Mandell, Gerald L.; Douglas, R. Gordon; and Bennett, John E. 1985. Principles and Practice of Infectious Diseases (2nd Edition) New York: John Wiley & Sons.

Manson, John P., and Stephens, Betsy. 1981. Housing and Health: An Analysis for Use in the Planning, Design, and Evaluation of Low-Income Housing Programs. Washington, D.C.: The Cooperative Housing Foundation.

Manson-Bahr, P.E.C. 1982. Manson's Topical Diseases, 18th Ed. Bailliere Tindall, London.

Martinez-Paloma, A. 1986. Human Parasitic Diseases. Amsterdam: Elsevier.

May, J.M. 1958. The Ecology of Human Disease. New York: MD Publications, Inc.

McDermott, W. 1966. "Modern Medicine and the Demographic Disease Pattern of Overly Traditional Societies: A Technologic Misfit." Journal of Medical Education 41 Supp, 137.

McGlashan, N. D. 1983. Geographical Aspects of Health. London: Academic Press.

McJunkin, Eugene F. 1982. Water and Human Health, Prepared by National Demonstration Water Project for U.S.A.I.D. Washington, D.C.: Development Information Center, AID.

McKeown, Thomas. 1965. "Medicine and World Population." Journal of Chronic Diseases, 18, 1067-1077.

_____ and Record, R.G. 1962. "Reasons for the Decline in Mortality in England and Wales during the Nineteenth Century." Population Studies, 16:2, 94-122.

Meegama, S. A. 1967. "Malaria Eradication and Its Effect on Mortality Levels." Population Studies, 21:3, 237.

Miller, F. DeWolfe. 1980 (?). Analysis of Environmental Data from Egyptian Villages. Ann Arbor, Michigan: University of Michigan School of Public Health, in cooperation with USAID.

Mitwally, Hassan, and El-Sharkawi, Fahmy. 1970. Methodology and Application of Measuring Housing Conditions for Rural Areas in U.A.R. and Similar Developing Countries. The Journal of the Egyptian Public Health Association, XLV:5, 422-420-431.

Mohamed, Ahmed M.; El-Sharkawi, F.M.; and El-Fiki, S.A. 1978. Egypt. J. Bilh., 5:1-2, 85-90.

Parry, E.H.O. 1984. Principles of Medicine in Africa (2nd Edition). Oxford: University Press.

Pawlowski, Zbigniews. 1987. Baillieres Clinical Tropical Medicine and Communicable Diseases: International Practice and Research --- Intestinal Helminths. London: Bailliere Tindall

Rose, Geoffrey, and Barker, D.J.P. 1979. Edidemiology for the Unitiated. London: British Medical Assciation.

Sahabat Alam Malaysia (Friends of the Earth). 1984. Pesticide Dilemma in the Third World: A Case Study of Malaysia. Pulan Pinang, Malaysia: Sahabat Alam Malaysia.

Schull, C.R. 1987. Common Medical Problems in the Tropics. London: MacMillan.

Scrimshaw, Susan C.M. and Hurtado, Elena. 1987. Rapid Assessment Procedures for Nutrition and Primary Health Care: Anthropological Approaches to Improving Programme Effectiveness. Tokyo: the United Nations University, UNICEF, and University of California (Los Angeles) Latin American Center Publications.

Sim, Foo Gaik. 1985. The Pesticide Poisoning Report: A Survey of Some Asian Countries. Penang, Malaysia: International Organization of Consumers Unions.

Stephenson, Lani S. 1987. The Impact of Helminth Infections on Human Nutrition: Schistosomes and Soil-transmitted Helminths. London: Taylor & Francis.

Stoll, Norman P. 1947. "This Wormy World," The Journal of Parasitology, 33:1, 1-18.

Storms, Doris M. 1979. Training anda Use of Auxiliary Health Workers: Lessons from Developing Countries. (International Health Programs Monograph Series, No. 3) Washington, D.C.: American Public Health Association.

Strickland, G.T. 1984. Hunter's Tropical Medicine, 6th ed. Philadelphia: W. B. Saunders Co.

Peters, Wallace and Gilles, Herbert M. 1981. A Colour Atlas of Tropical Medicine and Parasitology, Second Edition, Wolfe Medical Atlases - 17. London: Wolfe Medical Publications Ltd, Year Book Medical Publishers, Inc.

Rosen, George. 1971. "Historical Trends and Future Prospects in Public Health" in Gordon McLachlan and Thomas McKeown, Eds. Medical History and Medical Care: A Symposium of Perspectives. Oxford: Oxford University Press, 59-70.

Stanley Consultants. 1982. Main Report: Environmental Assessment--- Greater Cairo Wastewater System, West Bank. Washington: USAID.

Uberoi, I.S,; Laliberte, D.; Desweemer, C.; Masih, N.; Kielman, A.; Vohra, S.; Foreman, A.; Bohnert, S. 1977. Child HEalth Care in Rural Areas. Bombay: Asia Publishing House.

Ukoli, F. M. A. 1984. Introduction to Parasitology in Tropical Africa. Chichester, England: Wiley.

UNDP/World Bank/WHO. 1989. Tropical Diseases: Progress in International Research, 1987-1988. Geneva: WHO.

_____ 1978. Action Against Tropical Diseases. Geneva: WHO.

Wallace, Helen M., and Giri, Kanti. 1990. Health Care of Women and Children in Developing Countries. Oakland, California: Third Party Publishing Co.

Warren, Kenneth S., and Mahmoud, Adel A.F. 1984. Tropical Geographical Medicine. New York: Mc Graw-Hill.

Werner, David. 1976. La, ou il n'y a pas de docteur. Dakar: Environment Africain.

White, Gilbert, F., Ed. 1969. Water, Health and Scoiety: Selected Papers by Abel Wolman. Bloomington, Illinois: The Indiana University Press.

Winkelstein, Warren. 1972. "Epidemiological Considerations Underlying the Allocation of Health and Disease Care Resources." International Journal of Health Services, 1:1, 69-74.

World Bank. 1976. "Measurement of the Health Benefits of Investments in Water Supply." Washington, D.C.: The World Bank, Energy, Water and Telecommunications Department, P.U. Report PUN20 (out of print).

World Bank and World Health Organization. 1988. The Engelberg Report: Health Aspects of Wastewater and Excreta Use in Agriculture and Aquaculture. Dubendorf, Switzerland: International Reference Centre for Waste Disposal.

World Health Organization. 1988. (Michael Lipton and Emanuel de Kadt) Agriculture-Health Linkages. Geneva: WHO Offset Publication No. 104.

_____ 1985. A Review of the WHO/World bank Cooperative Programme in Community Water Supply and Sanitation, 1971-1984. (WHO/CWS/85.1) Geneva: WHO.

_____ 1974. (J. Bainbridge and S. Sapirie). Health Project Management: A Manual of Procedures for Formulating and Implementing Health Projects. Geneva: WHO.

_____ 1983. Housing Hygiene in Mediterranean Countries (Report of a WHO Workshop ICP/BSM 002 [5] -- 6411L). Copenhagen: WHO Regional Office for Europe.

_____ 1986. Intersectoral Action for Health: The Role of Intersectoral Cooperation in National Strategies for Health for All. Geneva: WHO.

_____ 1980. Report of the Second Meeting of the Technical Advisory Group. (Diarrhoeal Diseases Programme) (WHO/CDD/80.2) Geneva: WHO.

_____ 1983. Selected Techniques for Environmental Management: Training Manual. (EFP/83.50) Geneva: WHO

_____ 1981. Si vous etes charge de... --- Guide de gestion a l'usage des responsables des soins de sante primaires au niveau intermediare. Geneva: WHO.

_____ 1983. Training Course for Village Health Workers

_____ 1990. World Health Report on Tropical Diseases. Geneva: WHO.

_____ 1990. Global Estimates for Health Situation Assessment and Projections. Geneva: WHO.

_____ 1977. Health and the Environment. (Public Health in Europe 8) Copenhagen: WHO Regional Office for Europe.

World Health Statistics Quarterly. 1985, 38:2.

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