WATER- AND EXCRETA-RELATED DISEASES: UNITARY ENVIRONMENTAL CLASSIFICATION

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ABSTRACT: A unitary environmental classification of water- and excreta-related communicable diseases is presented, which comprises seven categories: Feco-oral waterborne and water-washed diseases; non-feco-oral water-washed (skin and eye) diseases; geohelminthiases; taeniases; water-based diseases (bacterial and fungal, as well as helminthic); insect-vector diseases; and rodent-vector diseases. The global burden of some of these diseases in 1990 is reviewed. Water- and excreta-related diseases were responsible for 2,700,000 deaths in that year (5.3% of all deaths) and for the loss of 93,200,000 disability-adjusted life years (6.8% of all DALYs). Almost all these deaths and loss of DALYs occurred in developing countries (99.9 and 99.8%, respectively).

INTRODUCTION

It has been 26 years since Bradley published his environmental classification of water-related diseases (White et al. 1972), and 15 years since Feachem et al. (1983) published their environmental classification of excreta-related diseases. During these 15-26 years several new water-related and excreta-related pathogens have been identified (Table 1). Given the recent and continuing concern with the risks to global public health posed by these and other newly emerging (and re-emerging) pathogens [see, for example, Ewald (1994), Wilson et al. (1994), and Scheld et al. (1998)], it is timely to reappraise these earlier classifications of water- and excreta-related diseases and, due to the fact that many (but not all) water-related diseases are also excreta-related, develop a unitary classification that is both comprehensive and up-to-date, while remaining useful to engineers in the design of water supply and sanitation systems, especially those for low-income communities in developing countries.

ENVIRONMENTAL CLASSIFICATIONS

An environmental classification of disease groups, such as water-related and excreta-related diseases, is more useful to environmental engineers than one based on biological type (virus, bacterium, protozoon, or helminth) because it groups the diseases into categories of common environmental transmission routes. Thus an environmental intervention designed to reduce transmission of pathogens in a particular category is likely to be effective against all pathogens in that category, irrespective of their biological type.

Water-Related Diseases

Bradley (White et al. 1972) developed the first environmental classification, that for water-related diseases (Table 2). Bradley's classification introduced the very important category of ''water-washed'' diseases, i.e., those diseases whose transmission is facilitated by insufficient quantities of water (regardless of its quality) for personal and domestic hygiene. Bradley showed that all the diseases that are commonly considered waterborne can also be transmitted by the water-washed route, and that the latter was epidemiologically more important under conditions of water scarcity as, for example, in rural and periurban areas in developing countries. The water-washed transmission route is also likely to be important even in areas with an adequate water supply but where personal and/or domestic (including food) hygiene is poor—*Operation Clean Hands*, recently launched by the American Society for Microbiology (Cassell and Osterholm 1996), is an example of the recognition of the need to reduce water-washed disease transmission in a highly developed society.

Feachem (1975) modified Bradley's classification by grouping together the waterborne and waterwashed diseases, excluding skin and eye infections, into the single category of feco-oral diseases, in recognition of the fact that these pathogens travel from the anus of one person to the mouth of another (Table 3). Thus feco-oral diseases may be either waterborne (and thus their incidence reduced by improvements in

TABLE 1. Major Water- and Excreta-Related Pathogens Recognized since 1973 (Adapted from Satcher 1995; Grabow 1997; and Lederberg 1997)

Year (1)	Pathogen (2)	Type (3)	Disease (4)
1973	Rotavirus	Virus	Diarrhea
1976	*Cryptosporidium parvum*	Protozoon	Acute enterocolitis
1977	*Legionella pneumophila*	Bacterium	Legionnaires' disease
1977	*Campylobacter jejuni*	Bacterium	Diarrhea
1982	*Escherichia coli* O157:H7	Bacterium	Hemorrhagic colitis, hemolytic uremic syndrome
1983	*Helicobacter pylori*	Bacterium	Gastric ulcers, stomach cancer
1985	*Enterocytozoon bienusi*	Protozoon	Diarrhea
1986	*Cyclospora cayetanenis*	Protozoon	Diarrhea
1988	Hepatitis E	Virus	Enteric hepatitis
1991	*Encephalitozoon hellem*	Protozoon	Conjunctivitis
1992	*Vibrio cholerae* O139	Bacterium	Cholera
1992	Hepatitis F	Virus	Enteric hepatitis

TABLE 2. Bradley's Environmental Classification of Water-Related Diseases (White et al. 1972)

Category (1)	Example (2)
1. Waterborne	
Classical	Typhoid
Nonclassical	Infectious hepatitis
2. Water-washed	
Superficial	Trachoma, scabies
Intestinal	*Shigella* dysentery
3. Water-based	
Water-multiplied percutaneous	Bilharziasis
Ingested	Guinea worm
4. Water-related insect vectors	
Water biting	Gambian sleeping sickness
Water breeding	Onchocerciasis

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water quality through pathogen removal or destruction during water treatment), or water-washed (and hence amenable to reduction in incidence through the provision and use of adequate quantities of water for personal and domestic hygiene).

As noted by Feachem (1975), ''the term 'waterborne disease' has been, and still is, greatly abused by public health and water engineers who have applied it indiscriminately so that it has almost become synonymous with 'water-related disease.''' Regrettably this is true even today; for example, the World Health Organization (WHO) Regional Office for Europe's recent report entitled *Eradication of water-related diseases* (WHO 1997) refers exclusively to waterborne diseases, and so ignores water-washed diseases in particular, even though these are a significant health problem in Europe (Letrilliart et al. 1997). Water engineers need to be aware that water-related diseases are not just simply waterborne diseases, and that other categories of water-related disease, especially water-washed diseases, are generally of greater epidemiological significance, particularly in developing countries. This is not to deny the importance of truly waterborne disease [e.g., Payment et al. (1997) found that between 14 and 40% of gastro-intestinal illnesses were attributable to the consumption of tap water meeting current North American microbiological quality requirements], but to emphasise the greater importance of water-washed diseases.

TABLE 3. Feachem's (1975) Environmental Classification of Water-Related Diseases

Category (1)	Example (2)
1. Feco-oral (waterborne or water-washed)	
Low infective dose	Cholera
High infective dose	Bacillary dysentery
2. Water-washed	
Skin and eye infections	Trachoma, scabies
Other	Louseborne fever
3. Water-based	
Penetrating skin	Schistosomiasis
Ingested	Guinea Worm
4. Water-related insect vectors	
Biting near water	Sleeping sickness
Breeding in water	Malaria

Excreta-Related Diseases

Feachem et al. (1983) developed an environmental classification of excreta-related diseases, grouping them into six categories, to which Mara and Alabaster (1995) added a seventh. These are listed in Table 4, which adopts the nomenclature given in Mara (1996). There are clear distinctions between the feco-oral diseases of Categories 1 and 2, and the helminthic infections of Categories 3–5: Improvements in domestic water supply are more important than improvements in sanitation for the control of the feco-oral diseases as they are commonly transmitted between people by the water-washed route. In contrast, sanitation is more important than water supply in the control of the helminthic infections due to their latency, persistence and, in some cases, their ability to multiply in the extraintestinal environment (latency refers to the fact that these helminths are not infective immediately after excretion—they require time to develop into an infective stage; and persistence refers to their ability to survive outside the human body for quite long periods of time—years in the case of the egg of *Ascaris lumbricoides*, the human roundworm).

TABLE 4. Environmental Classification of Excreta-Related Diseases (Feachem et al. 1983; Mara and Alabaster 1995)

Category (1)	Environmental transmission features (2)	Example (3)
1. Nonbacterial feco-oral diseases	Nonlatent Low to medium persistence Unable to multiply High infectivity No intermediate host	*Viral:* Hepatitis A and E Rotavirus diarrhea *Protozoan:* Amoebiasis Cryptosporidiosis Giardiasis *Helminthic:* Enterobiasis Hymenolepiasis
2. Bacterial feco-oral diseases	Nonlatent Medium to high persistence Able to multiply Medium to low infectivity No intermediate host	Campylobacteriosis Cholera Pathogenic *Escherichia coli* infection Salmonellosis Shigellosis Typhoid Yersiniosis
3. Geohelminthiases	Latent Very persistent Unable to multiply No intermediate host Very high infectivity	Ascariasis Hookworm infection Strongyloidiasis Trichuriasis
4. Taeniases	Latent Persistent Able to multiply Very high infectivity Cow or pig intermediate host	Taeniasis
5. Water-based helminthiases	Latent Persistent Able to multiply High infectivity Intermediate aquatic host(s)	Schistosomiasis Clonorchiasis Fasciolopsiasis
6. Excreta-related insect-vector diseases		Infections in 1–3 transmitted mechanically by flies and cockroaches Bancroftian filariasis transmitted by *Culex quinquefasciatus*
7. Excreta-related rodent-vector diseases		Infections in 1–3 transmitted mechanically by rodents Leptospirosis

There is also a distinction between Categories 1–5 and the insect and rodent vector diseases in Categories 6 and 7, for which vector control is important. Sanitation can be an important means of insect control. For example, flies and mosquitoes can be controlled by ventilated, improved pit latrines and any toilet with a waterseal (Mara 1996). However, no toilet is really effective against cockroaches or rodents; to control these vectors a high standard of domestic hygiene, including the hygienic storage of garbage, is essential; even so, insecticide application and rodent trapping may also be generally necessary.

UNITARY ENVIRONMENTAL CLASSIFICATION

Engineers are involved in the design of both water-supply and sanitation improvements; and, as many diseases are both water-related and excreta-related, it would seem useful to develop a single environmental classification covering both wa-

TABLE 5. Unitary Environmental Classification of Water- and Excreta-Related Diseases

Category (1)	Environmental transmission features (2)	Example (3)	Control strategies (4)
A. Feco-oral waterborne and water-washed diseases	Nonlatent (except *Ascaris*) No intermediate host Infectivity: medium to low (bacteria), high (others) Persistence: medium to high (bacteria), low to medium (others, except *Ascaris*: very high) Able (bacteria) and unable (others) to multiply outside host	*Viral:* Hepatitis A, E, and F Poliomyelitis Rotaviral diarrhea Adenoviral diarrhea *Bacterial:* Campylobacteriosis Cholera *Helicobacter pylori* infection Pathogenic *Escherichia coli* infection Salmonellosis Typhoid and paratyphoid Yersiniosis *Protozoan:* Amebiasis Cryptosporidiosis *Cyclospora cayetanensis* diarrhea *Enterocytozoon bienusi* diarrhea Giardiasis *Isospora belli* diarrhea *Helminthic:* Ascariasis Enterobiasis Hymenolepiasis	Improve water quantity, availability, and reliability (water-washed disease control) Improve water quality (waterborne disease control); hygiene education
B. Non-feco-oral water-washed diseases	Nonlatent No intermediate host High infectivity Medium to high persistence Unable to multiply	Skin infections (scabies, leprosy, yaws) Eye infections (trachoma, conjunctivitis, including that caused by *Encephalitozoon hellem*) Louse-borne fevers	Improve water quantity, availability, and reliability; hygiene education
C. Geohelminthiases	Latent Very persistent Unable to multiply No intermediate host Very high infectivity	Ascariasis; trichuriasis; hookworm infection	Sanitation; effective treatment of excreta or wastewater prior to reuse; hygiene education
D. Taeinases	Latent Persistent Able to multiply Very high infectivity Cow or pig intermediate host	Beef and pork tapeworm infections	As C above, plus proper cooking of meat and improved meat inspection
E. Water-based diseases	Latent Persistent Able to multiply High infectivity Intermediate aquatic host(s)	*Bacterial:* Leptospirosis Tularemia Legionellosis *Helminthic:* Schistosomiasis Clonorchiasis Fasciolopsiasis Guinea worm infection *Fungal:* Pulmonary hemorrhage due to *Stachybotrys atra* infection	Decrease contact with contaminated water; improve domestic plumbing; public education Decrease contact with contaminated waters; sanitation; treatment of excreta or wastewater prior to reuse; public education Drying of flood-damaged homes; public education
F. Insect-vector diseases		*Water-related:* Malaria Dengue Rift Valley fever Japanese encephalitis Yellow fever African sleeping sickness Onchocerciasis Bancroftian filariasis *Excreta-related:* Fly-borne and cockroach-borne excreted infections[a] Bancroftian filariasis	Decrease passage through breeding sites; destroy breeding sites; larvicide application; biological control; use of mosquito netting and impregnated bed nets Improve storm-water drainage; public education
G. Rodent-vector diseases		Rodent-borne excreted infections[a] Leptospirosis Tularemia	Rodent control; hygiene education; decreased contact with contaminated water; public education

[a]Excreted infections comprise all those diseases in Categories A, C, and D and helminthic diseases in Category E.

ter- and excreta-related diseases. An attempt in this direction was made by Feachem (1977) but this merely added a fifth category of ''infections promoted by poor excreta disposal'' to Bradley's four categories of water-related diseases. A further development toward a unitary classification was made by Feachem (1983), as a contribution to the International Drinking Water Supply and Sanitation Decade (1981–1990), and he produced a classification of ''Decade-related'' diseases. In this paper we present our development of a more comprehensive (and up-to-date) unitary environmental classification of water- and excreta-related diseases.

Our unitary environmental classification of water- and excreta-related diseases is given in Table 5. Categories A and B are the waterborne and water-washed feco-oral diseases, and the water-washed non-feco-oral diseases, respectively, corresponding exactly to Feachem's (1975) first two categories. We include in Category A infection with *Helicobacter pylori*, which is transmitted feco-orally (and also oro-orally) and which causes gastritis and stomach cancer (Blaser 1998); its prevalence is high (30–90% in industrialized countries and 80–90% in developing countries), and it is the only bacterium designated as a known human carcinogen (IARC 1994; Mara and Clapham 1997). Category A also includes several other ''new'' pathogens (see Table 1): rotavirus and *Campylobacter jejuni* (the most common global causes of viral and bacterial diarrhea, respectively); new strains or types of known pathogens, such as hepatitis E and F virus, *Escherichia coli* O157 and *Vibrio cholerae* O139; and two new protozoa—*Cryptosporidium parvum* [responsible for the largest recorded outbreak of waterborne disease in the United States, that in Milwaukee in 1993 when over 400,000 people were infected (Mackenzie et al. 1994), and recently reported to be also disseminated by waterfowl (Graczyk et al. 1998)]; and *Cyclospora cayetanensis*, which may be waterborne (Benenson 1995) or foodborne (Majkowski 1997), and is unusual in that it is not immediately infective upon excretion but is latent for a few days to a few weeks. Diarrhea due to the protozoon *Isospora belli* is also included, an example of a reemerging pathogen, especially (but not only) in immunocompromised persons (Marcial-Seoane and Serrano-Olmo 1995; Goodgame 1996; Marshall et al. 1997). Two other new protozoa, both mainly affecting the immunocompromised, are also included for completeness: *Enterocytozoon bienusi*, which causes diarrhea, in Category A (Collins 1997); and *Encephalitozoon hellem*, which causes conjunctivitis, in Category B (Didier et al. 1991).

Categories C, D, and E are the geohelminthiases, taeniases, and water-based diseases, respectively, which correspond to categories 3, 4, and 5 of Feachem et al.'s (1983) excreta-related disease classification, with category E also corresponding to Bradley's water-related disease category 3 but broadened to include bacterial water-based diseases such as legionellosis [which can be transmitted in a sauna (Den Boer et al. 1998)], leptospirosis, as recommended by Mara and Alabaster (1995), and Buruli ulcer due to *Mycobacterium ulcerans* in swamp waters (Wright 1998). In category E we also include pulmonary hemorrhage/hemosiderois due to the toxigenic fungus *Stachbotrys atra*, which occurs in infants living in homes subjected to flood-induced water damage that promotes the growth of this fungus (*Update* 1997).

Categories F and G comprise the water- and excreta-related insect vector and excreta-related rodent-vector diseases, respectively, with category F corresponding both to Bradley's water-related disease category 4 and to Feachem et al.'s excreta-related disease category 6. Category F includes dengue fever and dengue hemorrhagic fever, which is now the most important human insect-vector viral disease; the dengue pandemic has intensified over the last two decades, and currently there are 50–100 million cases of dengue fever and several hundred thousand cases of dengue hemorrhagic fever each year (Gubler and Kuno 1997). In category F, Bancroftian filariasis appears under both the water-related and the excreta-related subcategories, as in some parts of the world its mosquito vector is *Aedes aegypti* (which breeds preferentially in ''clean'' water), whereas in others it is *Culex quinquifasciatus*, which prefers to breed in ''dirty'' (i.e., excreta- or wastewater-contaminated) water—although this distinction between clean water and dirty water breeding mosquitoes is now less clearcut than it used to be.

GLOBAL BURDEN OF WATER- AND EXCRETA-RELATED DISEASES

Murray and Lopez (1996b) present data on the incidence and prevalence of several major water- and excreta-related dis-

TABLE 6. Global Water- and Excreta-Related Disease Statistics for 1990[a] (Murray and Lopez 1996b)

Disease (1)	Number (2)	Remarks (3)
Diarrhea	4,073,920,110 episodes	56% in children aged 0-4 94% in developing countries
Malaria	213,743,000 episodes	All in developing countries 87% in sub-Saharan Africa
African sleeping sickness	267,000 persons infected	All in sub-Saharan Africa
Schistosomiasis	208,276,000 persons infected	87% in sub-Saharan Africa
Onchocerciasis	5,802,000 persons infected	>99% in sub-Saharan Africa
	478,000 persons with impaired vision	>99% in sub-Saharan Africa
	356,000 blind persons	>99% in sub-Saharan Africa
Leprosy	2,434,000 persons infected	70% in Asia
Dengue	415,000 episodes	92% in Asia
Japanese encephalitis	58,000,000 episodes	All in Asia
Trachoma	292,000 persons with impaired vision	34% in sub-Saharan Africa; 34% in China; 24% in MEC[b]
	192,000 blind persons	34% in sub-Saharan Africa; 34% in China; 24% in MEC[b]
Ascariasis	61,847,000 persons with high-intensity infection	73% in children aged 5–14 All in developing countries
Trichuriasis	45,421,000 persons with high-intensity infection	79% in children aged 5–14 All in developing countries
Human hookworm infection	152,492,000 persons with high-intensity infection	84% in adults aged 15–59
	36,014,000 persons with anaemia	All in developing countries 72% in adults aged 15–44 All in developing countries

[a]World population in 1990 was 5.3 billion, of which 3.9 billion (74%) were in developing countries.
[b]Middle East Crescent, covering North Africa, the Middle East, Pakistan, and Central Asian republics of former Soviet Union.

TABLE 7. Burden of Disease Attributable to Poor Water Supply, Sanitation, and Personal and Domestic Hygiene in 1990 (Murray and Lopez 1996a)

Region[a] (1)	Deaths (2)	Percentage of all deaths (3)	DALYs[b] (4)	Percentage of all DALYs (5)
EME	1,100	<0.1	101,000	0.1
FSE	2,400	0.1	128,000	0.2
IND	839,900	9.0	27,463,000	9.5
CHN	81,400	0.9	4,231,000	2.0
OAI	354,300	6.4	13,192,000	7.4
SSA	875,600	10.7	28,870,000	10.1
LAC	135,300	4.5	5,183,000	5.3
MEC	378,200	8.5	13,224,000	8.8
World	2,668,200	5.3	93,392,000	6.8
Developed regions	3,500	<0.1	229,000	0.1
Developing regions	2,664,700	6.7	93,163,000	7.6

[a]EME, established market economies; FSE, formerly socialist economies of Europe; IND, India; CHN, China; OAI, other Asia and islands; SSA, Sub-Saharan Africa; LAC, Latin America and the Caribbean; MEC, Middle Eastern Crescent.

[b]DALYs, disability-adjusted life years (see Appendix 1).

eases in 1990. These are listed in Table 6. While these data are awesome in their sheer magnitude, they tell us little about disease *burden*. WHO (1980) claimed that as much as 80% of all morbidity in developing countries was due to water- and excreta-related disease, but the epidemiological evidence for this figure was not given. More recently, Murray and Lopez (1996a) give data on the global burden of disease, including that fraction attributable to poor water supply, sanitation, and personal and domestic hygiene in 1990 (Table 7). Globally, 5.3% of all mortality was due in that year to poor water supply, sanitation, and hygiene. In the developing world as a whole, the corresponding percentage was 6.7 [but much higher in the Middle Eastern Crescent (8.3), India (9.0), and sub-Saharan Africa (10.7)], and in developing countries this risk factor was second only to malnutrition (14.9% of all deaths).

When the burden of disease is expressed in disability-adjusted life years (DALYs), which equal the sum of discounted years of life lost due to premature death and discounted years lived with disability (see Appendix I), a similar picture emerges (Table 7), since with water- and excreta-related diseases the principal component (>90%) of DALYs is years of life lost, rather than years lived with disability: the percentage of total DALYs lost (i.e., DALYs lost due to all causes) attributable to poor water supply, sanitation, and hygiene is 6.8 globally and 7.6 in developing countries as a whole [and again higher in the Middle Eastern Crescent (8.8), India (9.5), and sub-Saharan Africa (10.1)].

Of the total number of deaths attributable to poor water supply, sanitation, and hygiene, i.e., attributable to water- and excreta-related diseases, 99.9% occur in developing countries. For total DALYs the corresponding percentage is 99.8.

CONCLUDING REMARKS

Our unitary environmental classification of water- and excreta-related diseases is a comprehensive categorization of these diseases into seven categories of common environmental transmission patterns. We feel that it will be more useful to tropical public health engineers and other professionals than the two existing separate environmental classifications, as it highlights the facts that many of these diseases are both water- and excreta-related, and that these diseases are best controlled in the long term by sustainable (and indeed sustained, i.e., well operated and maintained) improvements in both water supply and sanitation, which are supplemented by effective programs of hygiene education (e.g., Nyamwaga and Akuma 1986; Boot and Cairncross 1995). Although convincing arguments can be made for broadening the disease concept from water- and excreta-related diseases to housing-related diseases (see Mara and Alabaster 1995), or, more generally, to cover urban or periurban health (see Harpham and Tanner 1995), the fact remains that water- and excreta-related diseases are the most important of these diseases. It is in this context that we hope that our unitary environmental classification of these diseases will be most useful.

APPENDIX I. DEFINITION OF DISABILITY-ADJUSTED LIFE YEARS

Disability-adjusted life years (DALYs) is now the preferred unit of measurement of the health burden of a disease (see World Bank 1993; Murray and Lopez 1996a, chap. 1). The basic equation is

$$\mathrm{DALY}_i = \mathrm{YLL}_i + \mathrm{YLD}_i \tag{1}$$

where YLL_i = years of life lost as a result of disease or disability condition i, and YLD_i = years of life lived with disability due to i. YLL are calculated on the basis of standard life expectancies at the age of death (e.g., 80 and 82.5 years for men and women, respectively, at birth) and a discount rate of 3%. The general equation is

$$\mathrm{YLL} = [KCe^{ra}/(r+\beta)^2] \times \{e^{-(r+\beta)(L+a)}[-(r+\beta)(L+a)-1] - e^{-(r+\beta)L}[-(r+\beta)a-1]\} + [(1-K)/r][1-e^{-rL}] \tag{2}$$

where K = age-weight modulation factor (=1); C = constant (=0.1658); r = discount rate (=0.03); β = age-weight function parameter (=0.04); a = age at death (years); and L = life expectancy (years) at age a. The numerical values given are those used in the World Bank/WHO/Harvard Global Burden of Disease study (Murray and Lopez 1996a). To calculate the number of YLLs due to a particular disease, the number of YLLs per death at each age is multiplied by the number of deaths at each age and then summed for all ages.

Years lived with disability (YLDs) is the time lived in a health state worse than perfect health, weighted by a preference weight for each health state. The equation is the same as (2) except that the l.h.s. is YLD and the r.h.s. is multiplied by D, which is the disability weight (e.g., D = 0.066 for diarrhea and 0.895 for quadriplegia). L is now interpreted as the duration of the disability in years, and a is the age at onset of the disability. To determine the number of YLDs due to a particular disability, the number of YLDs per case is multiplied by the number of cases.

APPENDIX II. REFERENCES

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NOTE

For environmental engineers, Benenson (1995) is a very useful compendium of current knowledge on communicable disease control; updates can be found on the World Wide Web at http://www.alpha.org/news/publications/ccdm/ccdmintro2.html. The journal *Emerging Infectious Diseases*, launched in 1995 by the Centers for Disease Control and Prevention, Atlanta, Ga, is also very useful (and available on the web at http://www.cdc.gov/ncidod/EID/eid.htm). Updates on several water- and excreta-related diseases can also be found at http://www.cdc.gov/ncidod/diseases/diseases.htm. The e-mail list PROMED is highly recommended for its regular reports on infectious disease outbreaks in most parts of the world. To join this list, send the message ''subscribe promed-digest'' by e-mail to majordomo@usa.healthnet.org (in case of difficulty send an e-mail message to owner-promed@usa.healthnet.org).