

Promoting the healthy, safe use of recreational waters¹

Recreational water activities can offer substantial benefits for individual health and well-being. For example, lakes and rivers can provide environments for rest and relaxation, physical activity, and fun. In addition, many countries around the world depend on their long, sandy beaches to attract tourists and the spending that those visitors contribute to the local economy. Nevertheless, those water activities can also present risks to health, with polluted or unsafe recreational waters leading to infection and illness, injuries, and even death.

Those concerns are certainly valid for a number of countries in the Americas. The pollution of the rivers and seas in Latin America and the Caribbean caused by the uncontrolled discharge of untreated domestic sewage is a serious problem, especially given that more than 60% of the residents of those areas live in coastal zones and that a large majority of those areas' biggest cities are located near rivers and coastlines (1). For example, in October 2003 many people stayed away from beaches in Rio de Janeiro, Brazil, when heavy rains fell and the city's overloaded sewerage system could not provide the needed level of water treatment (2). Also this year controversy erupted in Mexico when a series of reports from the national Government described high levels of sewage, garbage, and industrial waste at some popular beach resorts (3, 4). In the United States of America there were more than 13 000 beach closures and advisories at ocean and freshwater beaches in 2001, according to a report from an independent environmental group, the National Resources Defense Council (3).

To help deal with these kinds of problems the World Health Organization (WHO) recently issued a report entitled *Guidelines for Safe Recreational Water Environments*. The new text is aimed at reducing bathing-related death and injuries as well as making beaches and recreational waters safer places to relax, exercise, and have fun.

"Risks such as infection, injuries, and death from accidents and drowning present a large burden of disease worldwide," said Dr. Jamie Bartram, who is the coordinator of the WHO Water and Sanitation for Health program. "Because recreational bathing has so many potential health benefits in terms of exercise and relaxation, it becomes all the more important to ensure that recreational bathing becomes safer."

The new WHO report covers risks that include drowning and injury; exposure to cold, heat,

Key words: water pollution, fresh water, seawater, recreation, guidelines.

¹ Based on: (1) World Health Organization. Guidelines for safe recreational water environments. Volume 1. Coastal and fresh waters. Geneva: WHO; 2003. (2) World Health Organization. Healthy recreational waters [Web page]. Available from: <http://www.who.int/features/2003/10/en>. Accessed 4 November 2003. (3) World Health Organization. Drownings and injury could be spared through new WHO risk protection plan. Beaches and recreational waters could be much safer [press release]. Available from: <http://www.who.int/mediacentre/releases/2003/pr75/en/>. Accessed 4 November 2003.

and sunlight; water quality; contamination of beach sand; and exposure to algae, chemical and physical agents, and dangerous aquatic organisms. The guidelines in the WHO report are intended to be used as the basis for developing international and national approaches, including standards and regulations, for controlling the health risks from hazards that may be encountered in recreational water environments as well as providing a framework for local decision-making. The guidelines may also be used as reference materials for industries and operators preparing development projects in recreational water areas, as a checklist for understanding and assessing potential health impacts of recreational projects, and in the conduct of environmental impact and environmental health impact assessments.

DROWNING AND INJURIES

Drowning is one of the unmistakable dangers of recreational water use. Worldwide, some 400 000 people drown each year. In children, drowning is one of the leading causes of accidental deaths.

Most cases of drowning are the result of poor parental supervision or of drinking alcohol. Tides and currents are also important hazards and can cause even strong swimmers to drown. The clarity of the water can also be a factor. In murky water, people may not see that someone needs help. Overcrowded swimming areas present a similar problem.

Water-based recreational activities can also result in a variety of injuries. Diving or jumping into waters of unknown depth can produce spinal injuries or other serious injuries that may result in paraplegia or quadriplegia. Diving into shallow water is the most common cause of spinal injuries. More common, but usually less severe, are injuries arising from discarded glass, cans, and needles on beaches or near bathing areas.

Prevention is the best way to reduce the incidence of injury and death related to water-based recreational activities, and the majority of injuries can be prevented by appropriate measures at the local level. Physical hazards should first be removed or reduced if possible, or measures should be taken to prevent or reduce human exposure. Physical hazards that cannot be completely dealt with in this way should be subjected to additional preventive or remedial measures. These include drowning prevention programs, public information and warnings (such as signs and flags as well as general education efforts and awareness raising), providing effective lifeguard supervision and rescue services, and establishing separate recreation zones for different recreational activities by using lines, buoys, and markers.

SUN, HEAT, AND COLD

The recreational use of water environments sometimes leads to exposure to extreme solar radiation and to extreme conditions of heat or cold. Overexposure to ultraviolet radiation may result in acute and chronic damage to the skin, the eyes, and the immune system. The most noticeable acute effects include erythema, photokeratitis, and photoconjunctivitis. Chronic effects include two major public health problems: skin cancers (both non-melanoma skin cancers and malignant melanoma) and cataracts.

Simple protective measures are available. These include minimizing the amount of time spent in the sun, including complete avoidance of mid-day sun exposure; seeking shade; and wearing loose-fitting and tightly woven clothing, a broad-brimmed hat, and wrap-around sunglasses. A broad-spectrum sunscreen with a sun protection factor of 15 or more should be applied liberally on all areas of the body not covered by clothing, and the sunscreen should be reapplied often. Sun protection programs to raise awareness and achieve changes in lifestyle are urgently needed to slow down and eventually reverse the trend towards more skin cancers.

The immediate effect of sudden immersion in cold water can be a debilitating reflex response called "cold shock," which includes life-threatening respiratory and cardiovascular effects and may lead to drowning. Sudden immersion in cold water often results in impaired swimming ability, which is believed to be responsible for the majority of sudden cold-water immersion deaths. Safety precautions include wearing suitable protective garments when swimming in cold water and using a life-jacket when boating in order to keep the breathing airways clear of water if a person is unconscious.

In a hot environment, people can suffer serious physical ailments that include heat cramps, heat exhaustion, and heat stroke. Disorders due to heat occur most frequently when there are rapid changes in thermal conditions such as during heat waves. Avoidance measures include consumption of nonalcoholic, noncaffeinated beverages; replacement of salt lost through sweating; and moving to a shaded area.

FECAL POLLUTION AND WATER QUALITY

The most frequent adverse health outcome associated with exposure to fecally contaminated recreational water is enteric illness. There is consistency in the overall body of evidence concerning health effects from fecally polluted recreational wa-

ters, and a series of randomized controlled trials performed in the United Kingdom form the key studies for derivation of guideline values for the microbiological quality of recreational waters.

However, the guideline values should be interpreted or modified in light of regional and/or local factors. Such factors include the nature and seriousness of local endemic illness; population behavior; exposure patterns; sociocultural, economic, environmental, and technical aspects; and competing health risk from other diseases that are not associated with recreational water.

The initial classification of a recreational water environment is based upon the combination of (1) evidence for the degree of influence of human fecal material (by sanitary inspection of beach and water catchment) and (2) counts of suitable fecal index bacteria (a microbial quality assessment). Information to be collected during sanitary inspections should cover at least the three most important sources of human fecal contamination of recreational water environments for public health purposes: sewage; riverine discharges (where the river is receiving sewage discharges and either is used directly for recreation or discharges near a coastal or lake area used for recreation); and bather contamination, including excreta. Where human inputs are minimal, investigation of animal fecal inputs should be explored.

Population groups that may be at higher risk of disease include the young, the elderly, the immunocompromised, and visiting populations susceptible to locally endemic disease. If such groups are significant water users, this should be taken into account in risk assessment and management.

Management action in response to unacceptable fecal contamination can be both immediate, such as public health advisories, and long term, such as pollution abatement.

FREE-LIVING MICROORGANISMS

In addition to microorganisms introduced to recreational waters through human or animal fecal contamination, a number of pathogenic microorganisms are indigenous to such areas or, once introduced, are capable of colonizing the environment. These microorganisms include *Vibrio* species; *Aeromonas* spp.; free-living amoebae that are members of the genus *Acanthamoeba*, *Naegleria fowleri*, and *Balamuthia mandrillaris*; and leptospires.

Evidence suggests that although infection with free-living microorganisms or pathogenic leptospires via recreational water use may be life-threatening, the incidence of such infection is very low and, in many cases, is limited to specific areas.

As such, no specific guideline values have been recommended, although authorities should be aware of the potential hazards posed by these organisms and act accordingly. Assessment of the likely hazard and education of water users and health professionals are important control measures.

MICROBIAL ASPECTS OF BEACH SAND QUALITY

Bacteria, fungi, parasites, and viruses have all been isolated from beach sand. A number of them are potential pathogens. Factors promoting the survival and dispersion of pathogens include the nature of the beach, tidal phenomena, the presence of sewage outlets, the season, the presence of animals, and the number of swimmers. However, the capacity of microorganisms that have been isolated from beach sand to infect bathers remains undemonstrated, and the real extent of their threat to public health is unknown. There is therefore no evidence to support establishment of a guideline value for index organisms or pathogenic microorganisms on beach sand.

The principal microbial risk to human health encountered on beaches and similar areas comes from contact with animal excreta, particularly from dogs. Suitable preventive management actions include public awareness, beach cleaning, and regulations that restrict access seasonally on frequently used beaches or obligate the owner to remove animal excreta.

ALGAE AND CYANOBACTERIA IN COASTAL AND ESTUARINE WATERS

Several human diseases have been reported in association with toxic species of dinoflagellates, diatoms, nanoflagellates, and cyanobacteria (blue-green algae) that occur in the marine environment. The toxicity of these algae to humans is due to the presence of algal toxins. Marine algal toxins become a problem primarily because they concentrate in shellfish and fish that are subsequently eaten by humans.

Available data indicate that the risk for human health associated with the occurrence of marine toxic algae or cyanobacteria during recreational activities is limited to a few species and geographical areas. In areas subject to the occurrence of marine toxic algae or cyanobacteria, it is important to carry out adequate monitoring activities and surveillance programs. In affected areas, it is appropriate to provide health information to general practitioners and the general public, in particular

recreational water users. Precautionary measures include avoiding areas with visible algal concentrations and/or algal scums in the sea as well as on the shore, avoiding sitting downwind from any algal material drying on the shore, and showering to remove any algal material.

ALGAE AND CYANOBACTERIA IN FRESH WATER

Many species of freshwater algae may proliferate quite intensively in nutrient-rich waters. However, these algae do not form dense surface scums or "blooms," as do some cyanobacteria. Toxins they may contain therefore are not accumulated to potentially hazardous concentrations. For this reason most adverse health impacts from recreational use of fresh waters have been associated with cyanobacteria rather than with freshwater algae.

Allergic or irritative dermal reactions of varying severity have been reported from a number of freshwater cyanobacterial genera after recreational exposure. Bathing suits, and particularly wet suits, tend to aggravate such effects by accumulating cyanobacterial material and enhancing disruption of cells and liberation of cell content. It is probable that these symptoms are not due to recognized cyanotoxins but rather to currently largely unidentified substances. In contrast to dermal contact, uptake of cyanobacteria through ingestion or aspiration involves a risk of intoxication by cyanotoxins. Most documented cases of human injury through cyanotoxins involved exposure through drinking water.

Because adequate surveillance is difficult and few immediate management options are available (other than precluding or discouraging use or canceling water sports activities such as competitions), provision of adequate public information is a key short-term measure. Medium- to long-term measures include identification of the sources of nutrient pollution and significant reduction of nutrient input in order to effectively reduce proliferation not only of cyanobacteria but of potentially harmful algae as well.

AESTHETIC ISSUES

The aesthetic value of recreational waters implies freedom from visible materials that will settle to form objectionable deposits; floating debris; oil; scum; substances producing objectionable color, odor, taste, or turbidity; and substances or conditions that produce undesirable aquatic life. Clean beaches are one of the prime parameters that are de-

sired by recreational users. Local economies may depend on the aesthetic quality of recreational water areas, and the environmental degradation of beaches is known to lead to loss of income from tourism. Water in swimming areas should ideally be clear enough for users to estimate depth, to see subsurface hazards easily, and to detect the submerged bodies of swimmers or divers who may be in difficulty. In addition to the safety factor, clear water fosters enjoyment of the aquatic environment.

Visitor enjoyment of any beach is generally marred by litter. The variety of litter found in recreational water or washed up on the beach is considerable and includes discarded food or wrapping, bottles and cans, cigarette butts, dead fish, discarded condoms, and syringes, needles, and other medical wastes. Unlike most litter, medical waste and broken glass also represent hazards to health. Objectionable smells associated with untreated sewage effluent; decaying organic matter such as vegetation, dead animals, or fish; and discharged gasoline or diesel oil can deter recreational water and bathing beach users. Marine debris monitoring can be used to provide information on the types, quantities, and distribution of marine debris; to identify sources of marine debris; to explore public health issues relating to marine debris; and to increase public awareness of the condition of the coastline. Management options include manual or mechanical beach cleaning.

CHEMICAL AND PHYSICAL AGENTS

Chemical contaminants can enter surface waters or be deposited on beaches from both natural and anthropogenic sources. Exposure is one of the key issues in determining the risk of toxic effects from chemicals in recreational waters. The form of recreational activity will therefore play a significant role. Among the routes of exposure are direct surface contact, including skin, eyes, and mucous membranes; inhalation; and ingestion. In assessing the risk from a particular contaminant, the frequency, extent, and likelihood of exposure are crucial parts of the evaluation.

The potential risks from chemical contamination of coastal and freshwater recreational waters will be very much smaller than the potential risks from microbial contaminants. In most cases the concentration of chemical contaminants will be below the levels set by drinking-water guidelines. As long as care is taken in their application, WHO's *Guidelines for Drinking-water Quality* can provide a starting point for deriving values that could be used to make a preliminary risk assessment under specific circumstances.

An assessment of the chemical hazards in recreational water may involve inspecting the immediate area to determine if there are any nearby sources of chemical contamination, such as outfalls; considering the pattern and type of recreational use of the water to determine whether there will be extensive contact with the water and/or a significant risk of ingestion; and chemically analyzing the water to support a quantitative risk assessment. It is important in evaluating chemical hazards that the risks not be overestimated. The risks should be related to risks from other hazards such as drowning or microbial contamination, which will almost invariably be much greater.

DANGEROUS AQUATIC ORGANISMS

Dangerous aquatic organisms may be encountered during recreational use of freshwater and coastal recreational environments. Such organisms vary widely and are generally of local or regional importance. The likelihood and nature of human exposure often depend significantly on the type of recreational activity concerned.

Two types of risks can be distinguished in relation to dangerous aquatic species: (1) injury or intoxication resulting from direct encounters with predators or venomous species and (2) infectious diseases transmitted by species that have life cycles that are linked to the aquatic environment.

Injuries from encounters with dangerous aquatic organisms are generally sustained by accidentally brushing past a venomous sessile or floating organism when bathing; inadvertently treading on a stingray, weeverfish, or sea urchin; unnecessary handling of venomous organisms during seashore exploration; invading the territory of large animals, such as alligators or crocodiles, when swimming or at the waterside; swimming in waters used as hunting grounds by large predators; or intentionally interfering with or provoking dangerous aquatic organisms.

Disease vectors include mosquitoes and certain species of freshwater snails. Mosquitoes transmit malaria parasites and the viruses responsible for dengue fever, yellow fever, and various types of encephalitis. Some species of freshwater snails host the larval development of trematode parasites of the genus *Schistosoma*.

APPLICATION OF GUIDELINES AND MANAGEMENT OPTIONS

The possible negative health outcomes associated with the use of recreational water environ-

ments result in the need for guidelines that can be converted into locally appropriate and applicable standards and the associated management of sites to ensure a safe, healthy, and aesthetically pleasing environment.

A number of points need to be considered in converting guidelines into regulations adapted to local circumstances. Using the recreational water quality classification system for fecal pollution as an example, the principal requirements that would need to be incorporated into provisions would normally include:

- the establishment of a water quality classification system
- the obligation for appropriate regulatory authorities to maintain a listing of all recognized recreational water areas
- the definition of responsibility for establishing a plan for recreational water safety management and its implementation
- independent surveillance and provision of information to the public
- the obligation to act, including immediately consulting with public health officials and informing the public when conditions that are potentially hazardous to health are detected

Several types of management interventions are possible, including regulatory compliance, control and abatement technology, enhancing the capacity of individuals to make informed choices, and providing public health advice.

The entire WHO report can be viewed or downloaded for free from the WHO Web site, at: http://www.who.int/water_sanitation_health/bathing/srwe1/en/. Print copies of the report can also be ordered from WHO Marketing & Dissemination, 1211 Geneva 27, Switzerland. The cost of the printed report is Swiss Francs 70 (Sw.Fr. 49 in developing countries).

In 2004, WHO plans to publish a second volume of the *Guidelines*, which will address the safety of swimming pools, spas, and similar recreational water environments.

SINOPSIS

Por un uso saludable y seguro de las aguas de recreo

Las actividades acuáticas recreativas pueden ofrecer beneficios considerables para la salud y el bienestar de las personas. Por ejemplo, los lagos y los ríos pueden brindar un ambiente adecuado para el descanso, la actividad física y el esparcimiento. Además, muchos países de todas las latitudes

dependen de sus extensas playas cubiertas de arena para atraer a los turistas, y los desembolsos de esos visitantes contribuyen a la economía local. Sin embargo, esas actividades acuáticas también pueden representar riesgos para la salud, ya que aguas contaminadas o poco seguras en lugares de recreo pueden conducir a infecciones y enfermedades, lesiones e incluso la muerte. Para ayudar a lidiar con este tipo de problemas, la Organización Mundial de la Salud (OMS) emitió recientemente un informe titulado *Directrices para un Medio Acuático Recreativo Seguro (Guidelines for Safe Recreational Water Environments)*. El texto está dirigido a reducir las muertes y lesiones de los bañistas, así como a hacer las playas y los espacios recreativos acuáticos más seguros para el descanso, los ejercicios y el esparcimiento. El nuevo informe de la OMS trata sobre riesgos tales como el de ahogarse y recibir lesiones; la exposición al frío, el calor y las radiaciones solares; la calidad del agua;

la contaminación de la arena de las playas; y la exposición a algas, agentes químicos y físicos, así como a organismos acuáticos peligrosos. Las directrices propuestas en el informe de la OMS deben servir de base para desarrollar estrategias nacionales e internacionales —como estándares y regulaciones—, para controlar los riesgos para la salud que se pueden encontrar en los medios acuáticos de recreo y, al mismo tiempo, deben ofrecer un marco de trabajo para las autoridades locales encargadas de tomar decisiones. Estas directrices también se pueden utilizar como material de referencia para las industrias y los operadores que preparan proyectos de desarrollo en áreas con medios acuáticos recreativos, como una lista de comprobación para interpretar y evaluar el eventual impacto para la salud de los proyectos recreativos y de cómo llevar a cabo la estimación de su impacto sobre el medio ambiente y la salud ambiental.

REFERENCES

1. Galvão LE. A water pollution crisis in the Americas. *Habitat Debate* 2003;9(3):10.
2. Ellis M. Rio beach hit by flood of sewage. *The Mirror* 2003 October 25. Available from: <http://www.mirror.co.uk> [Internet site]. Accessed 5 November 2003.
3. Iliff L. Headed to a Mexico beach? More warnings about water. Some officials, environmentalists say pollution levels unsafe. *Dallas Morning News* 2003 March 10. Page 1A.
4. Iliff L. Mexico beaches: it's all dirty lies. Some swimming areas say pollution reports seek to aid new resorts. *Dallas Morning News* 2003 May 11. Page 11A.

International Conference on Emerging Infectious Diseases

Dates: 29 February–3 March 2004
Location: Marriott Marquis Hotel
Atlanta, Georgia, United States of America

The World Health Organization, the American Society for Microbiology, the Council of State and Territorial Epidemiologists, and the National Center for Infectious Diseases of the Centers for Disease Control and Prevention will cosponsor the International Conference on Emerging Infectious Diseases. The conference will include general and plenary sessions, symposia, panels of speakers, oral and poster presentations, and exhibits. Among the major topics will be current work on surveillance, epidemiology, research, communication and training, bioterrorism, and prevention and control of emerging infectious diseases.

The registration fee for the meeting is US\$ 350 if paid by 14 February 2004, and it is US\$ 400 after that date.

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