disease prevention news

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Annual Drinking Water Quality Reports: A New Consumer Awareness Requirement

Since 1974 water safety regulations have required consumers to be notified whenever standards have been violated and to be informed of the potential health problems these violations might cause. Beginning on October 19, 1999, public drinking water suppliers must also provide customers with annual water quality reports that document any regulated or "unregulated" microbiological or chemical contaminant found in the drinking water. The new reports also must provide specific information about special health risks, especially for immunocompromised populations. Health officials in Texas familiar with these new requirements anticipate that these annual water quality reports will generate numerous questions among consumers, regulators, health officials, and physicians. This DPN issue provides basic information to help health professionals address these questions.*

The federal Safe Drinking Water Act (SDWA) was passed in 1974 to establish requirements for health-based drinking water standards (Table 1). Responsibility for developing these and subsequent standards was given to the United States Environmental Protection Agency (EPA). Water quality has traditionally been measured in terms of maximum contaminant levels (MCLs). MCLs are numeric standards that set a level for each regulated contaminant. Water that is free of contaminants, or has contaminants at levels less than the MCL, is considered safe and poses no significant risk to the public's health.

Table 1. Brief History of the Federal Safe Drinking Water Act

Year	Public Law	Major Initiatives
1974	PL 93-523	Mandated first national standards regulating public water systems.
1986	PL 99-399	Mandated regulation of 83 specific inorganic, organic, microbiological, and radionuclide contaminants. Mandated monitoring of specific contaminants in addition to the regulated contaminants.
1996	PL 104-182	Revised the regulated contaminant selection process. Mandated regulations for *Cryptosporidium*. Revised unregulated contaminants monitoring requirements. Mandated annual water quality reports.

Amendments to the SDWA in 1986 added a second type of regulatory standard, the treatment technique requirement (TTR). The TTR is necessary when a public health threat in drinking water has been observed, but analytical technology is not yet adequate to support a numeric standard, or MCL. Drinking water regulations for the control of several microbiological contaminants are enforced through TTRs. The 1986 SDWA amendments required EPA to set TTRs for *Giardia lamblia*, enteric viruses, and *Legionella* sp. Since then, EPA has established TTRs for two types of public water systems: 1) those that treat surface water and 2) those that treat groundwater under the direct influence of surface water. These types of water systems are much more likely than others to be contaminated with *Giardia* and enteric viruses. Deep, well-protected groundwater supplies (eg, wells) generally are not at risk of fecal contamination. Treatment techniques for managing corrosion have also been mandated to control lead in drinking water when analytic results of lead or copper (action levels) indicate such an action is necessary.

On August 6, 1996, President Clinton signed amendments to the SDWA that addressed public health threats posed by additional

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*"Unregulated" contaminants are those for which regulatory levels have not yet been determined, but monitoring is nevertheless required.

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pathogens that had been found in drinking water. These amendments required EPA to develop regulations for the control of *Cryptosporidium* sp. in drinking water. In response, EPA proposed more stringent TTRs for this parasite. The 1996 amendments also established a requirement for public water systems to produce and distribute an annual water quality report, referred to in the SDWA as a "consumer confidence report." On August 19, 1998, EPA promulgated final requirements for these annual water quality reports (Table 2). Public water systems must distribute the first of these reports by October 19, 1999.

Table 2. Water Quality Report Components

- Water system contact person and telephone number
- Water source information
- Detected contaminants
- Violations and health effects language
- Special language for immunocompromised persons
- Educational information for special contaminants

A major catalyst for legislation mandating water systems to provide their consumers with annual water quality reports was public concern over the potential severe health effects of *Cryptosporidium* in drinking water. This concern is well justified by documented waterborne cryptosporidiosis outbreaks. Table 3 lists several of these outbreaks.

Cryptosporidiosis is a particular danger for immunocompromised individuals, especially persons with AIDS. Since there is currently no accepted pharmacologic treatment for cryptosporidial infections, a healthy immune system is the only mechanism for eliminating the organism. Persons with $CD4^+$ T cell counts <180 who are exposed to *Cryptosporidium parvum* are not likely to recover from the infection, which can cause prolonged diarrhea, dehydration, and even death. In persons with $CD4^+$ T cell counts <180, the severity of the complications is inversely proportional to the $CD4^+$ T cell count.

While persons with HIV / AIDS comprise one of the largest populations with inadequate immune responses, there are other types of immunocompromised individuals for whom exposure to *Cryptosporidium* is also of concern. These people include chemotherapy patients, organ transplant recipients treated with immunosuppressants, infants, and certain elderly people. The following special notice in the water quality reports is required to notify these populations about the risk of exposure to *Cryptosporidium*.

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Table 3. Waterborne Cryptosporidiosis Outbreaks

Year	Location	Estimated No. of Illnesses	Source
1984	Braun Station, TX[5]	2,000	Ground
1987	Carrollton, GA[6]	13,000	Surface
1993	Milwaukee, WI[7]	403,000	Surface
1994	Las Vegas, NV[8]	120	Surface
1998	Brushy Creek, TX[9]	1,300	GUI *

*Groundwater under the direct influence of surface water

Special Notice for the Elderly, Infants, Cancer Patients, and People with HIV/AIDS or Other Immune Problems:

Some people are more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/Centers for Disease Control and Prevention (CDC) guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline (800/426-4791).

The Texas Department of Health (TDH) and the Texas Natural Resource Conservation Commission (TNRCC) will accept referral calls from the EPA Hotline (listed in Special Notice above) as well as offer training and educational materials to local and regional health departments. Physicians and other health professionals are likely to get calls from patients wanting more information on *Cryptosporidium* in response to the special notice.

Because all detections of regulated and unregulated contaminants must now be publicized in the water quality reports, health professionals should also expect an increase in calls from patients concerned about contaminants other than *Cryptosporidium*. A violation of any MCL requires specific health effects information to be placed in the report. Regulations also require health effects language to be included in the report when the levels of certain contaminants reach 50% of the established MCL or action level.

Ninety-six percent of the water provided by public water systems in Texas meets all quality standards. However, the new requirement for annual water quality reports that include identification of some contaminants with levels below the MCL will inevitably raise consumer concern. Health professionals now face the important task of assuring that the additional information contained in the annual water quality reports will encourage at-risk individuals to take appropriate action to protect their health but not cause unnecessary concern in the general population.

Prepared by Anthony E. Bennett, RS, TNRCC Water Utilities Division

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Personal Use Water Filters

Only microstraining filters capable of removing particles less than or equal to 1 μm in size should be used by immunocompromised persons and other persons who choose to use a personal-use filter (ie, home or office water filters) to reduce the risk for transmission of *Cryptosporidium*. Filters in this category that provide the greatest certainty of *Cryptosporidium* removal include those that produce water by reverse osmosis, those labeled according to filter manufacturing industry standards as "Absolute" 1 μm filters, and those labeled as meeting the ANSI / NSF standard #53 for "Cyst Removal" established by the American National Standards Institute. The "Nominal" 1 μm filter rating is not standardized, and many filters in this category might not reliably remove oocysts. Filters that use only ultraviolet light, activated carbon, or pentiodide-impregnated resins are not effective against *Cryptosporidium*. Not all filters advertised as effective against *Giardia* are effective against *Cryptosporidium*. People should carefully follow the manufacturer's instructions for filter replacement and use because bacterial overgrowth on filters can be an additional health risk and because oocysts are likely to concentrate on the outside of filter cartridges. Ideally, immunocompromised patients should have someone else change the used cartridges. They should use disposable gloves if they must change the cartridges themselves.

From Assessing the Public Health Threat Associated with Waterborne Cryptosporidiosis: Report of a Workshop. MMWR 1995 June 6; 44(RR-6):1-19.

Waterborne Cryptosporidiosis and the Risk of Infection in the Healthy Population

The first major outbreak...was in Milwaukee in 1993.

In the past decade, people have become increasingly concerned about the health risk of *Cryptosporidium* in the public water supplies. *Cryptosporidium* is an intestinal protozoan parasite that causes diarrheal illness. This acute public awareness came about as a result of community outbreaks of cryptosporidiosis, some of which have involved a large number of individuals.[1,2] The first major outbreak of waterborne cryptosporidiosis reported in the United States was in Milwaukee in 1993.[3] There have even been rare reports of foodborne cryptosporidiosis in instances where agricultural products have not been thoroughly washed[4] or where clean foodstuffs have been contaminated during preparation[5].

Transmission is fecal-oral and can occur between an infected animal and a human, from one human to another, or through contaminated drinking or recreational water supplies. At present, it is not clear what portion each of these transmission routes contributes to human infections. Indeed, current studies cosponsored by the Centers for Disease Control and Prevention (CDC) and the Environmental Protection Agency (EPA) are being designed to assess the relative contribution of water in *Cryptosporidium* transmission. Given the present level of understanding, it is widely believed that the most common source of community-wide exposure is water used for drinking or recreation. *Cryptosporidium* oocysts are resistant to chlorine disinfection and can be removed only through filtration; even then a portion of the parasites can escape into the drinking water supply.

Human exposure to *Cryptosporidium* is common. Seroprevalence studies carried out in the United States indicate that approximately 25% to 35% of the population has been exposed to this parasite at some point in the past.[1,6,7] Similar studies in developing countries, especially studies of children, yield even

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higher seroprevalence rates (65% to 75% or more.[8,9] That the majority of the population in some developing countries are antibody positive is indicative of pervasive unsanitary conditions, particularly a lack of safe water.

As helpful as serologic studies are in identifying the relative levels of exposure, many questions are left unanswered. For example, it is unclear how many times one must be exposed before developing a measurable serum antibody response. Nor do we know how long this response persists in individuals after the exposure has taken place. These questions and others regarding the standardization of laboratory methods used to carry out such studies make interpretation of serologic results risky. Such analyses can provide only a crude understanding of the actual exposure of the community to this pathogen.

Cryptosporidia Infectivity Studies

The rest of this article summarizes a series of studies performed at the University of Texas Health Science Center-Houston to determine the number of *Cryptosporidium* oocysts that would have to be present in the water supply to constitute a risk to the public. Healthy volunteers aged 18 to 55 years were enrolled after undergoing a thorough medical examination. All volunteers had to meet two important criteria: normal immune function and no evidence of previous exposure to *Cryptosporidium*. The subjects were then fed capsules containing live *Cryptosporidium* oocysts and were carefully monitored for infection and/or illness for 6 weeks. Three different *Cryptosporidium* isolates used in these studies were collected from geographically diverse areas of the country. All of the *Cryptosporidium parvum* isolates belonged to the genotype 2 subgroup, which includes isolates capable of transmission between animals and humans.[10,11]

Infectivity of an organism is measured by the dose of organisms necessary to cause infection in 50% of volunteers (ID_{50}). In the volunteer studies, the ID_{50} varied dramatically with the *Cryptosporidium* isolate and ranged from 9 to 1049 oocysts.[12,13] The isolates also varied in their ability to cause a diarrheal illness. Interestingly, the isolate with the lowest ID_{50} also caused the highest rate of illness. These results showed that not all *Cryptosporidia* are alike. At low concentrations (as is usually found in water), some isolates may be capable of causing an outbreak of diarrhea, while other isolates would affect few, if any, of the exposed healthy population.

These results indicated that the risk of infection and illness depends on the relative virulence of the isolate rather than the number of oocysts. Several health and safety agencies, including the EPA, have used the results of these volunteer studies for risk assessment modeling of waterborne transmission. Because only a few oocysts of some isolates are required for infectivity, the EPA has recently instituted an "Interim Enhanced Surface Water Treatment Rule"[14] stating that the maximum containment level goal (MCLG) for *C. parvum* oocysts is zero. This rule will go into effect in December 2001 or 2003 for large and small water systems, respectively.

...the risk of infection and illness depends on the relative virulence of the isolate....

The volunteer studies also investigated whether someone who had already been infected with *Cryptosporidium* in the past could be reinfected at a later date. This question was addressed in two ways. A group of volunteers receiving one of the isolates (Iowa isolate) was rechallenged with the same isolate one year later[15]. Surprisingly, an equivalent portion of volunteers became ill after both the first and second challenge. However, the severity of illness and the number of volunteers shedding oocysts were significantly reduced on rechallenge. Thus, the illness was not only milder, but the chances of secondary transmission to others was considerably lessened during subsequent infections.

In a second experiment, protective immunity was studied in volunteers who had high levels of serum IgG before

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the challenge.[16] In this group, both infection and illness occurred only in volunteers receiving high oocyst doses, and the ID_{50} was increased 20-fold over that of serologically negative individuals. Thus, even though a second infection was possible, subjects receiving the lower dosage levels (at levels that might be associated with waterborne exposure) were protected from infection and illness. Of those who did become reinfected and/or ill, fewer volunteers shed detectable oocysts during the second infection, a result that was also seen in the rechallenge study.

The *Cryptosporidium* volunteer studies have provided the EPA with new information that is being used to set safe drinking water standards in the US. The studies have also contributed a wealth of data toward understanding *Cryptosporidium* infection in healthy individuals and have provided many valuable specimens that can be used in posing new research questions about the immune response to this parasite. Only by understanding the immune control mechanisms in healthy people is it possible to identify the immune defect that results in serious and even life-threatening cryptosporidiosis in immuno-compromised persons. It is hoped that this type of research, which continues to shed light on this common parasitic disease, will one day play an important role in its control and prevention.

Prepared by Cynthia L. Chappell, PhD, Associate Professor and Acting Director, Center for Infectious Diseases
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1999 HPS Case Highlights Importance of Reporting

On July 23, 1999, the Texas Department of Health (TDH) Laboratory confirmed the first case of hantavirus pulmonary syndrome (HPS) identified in the state since October 1997. Subsequent serology performed at the University of New Mexico School of Medicine on July 29 identified the etiologic agent as Sin Nombre virus.

The patient, a 51-year-old, White, non-Hispanic man from the Texas Panhandle, first exhibited symptoms of illness on April 19, 1999. On April 22 he was examined by a nurse practitioner who diagnosed “influenza” and advised him to rest and take aspirin. On April 26 he was taken to the local hospital where fluid described as “molasses” was aspirated from his lungs. The patient was immediately transferred to an Amarillo hospital and placed on full life support. He was discharged on May 7.

Serological specimens, which the hospital submitted to a commercial laboratory on April 29, were positive for hantavirus. Another sample was submitted on May 21 to a different commercial laboratory, which reported a positive result for Sin Nombre virus.

Concerned about the publicity HPS cases usually generate, the man had asked his physician to not report his case to TDH. Unfortunately, the physician complied with the patient's request. TDH Zoonosis Control staff first learned of the case when the patient contacted the TDH regional office. The man was concerned about his potential for further exposure to the virus in his residence.

Arrangements were then made to obtain serological specimens from the patient for confirmation testing at the TDH Laboratory. An environmental evaluation was conducted on July 22. The man lives on a farm with an abundant rodent population and several possible points of exposure: rodents within his residence; dust generated when oat seed is loaded and unloaded; and dust created when hay is removed from a barn.

Serum samples from members of a family living in a separate dwelling on the farm were tested. For two of the individuals (males), the serology results were negative; one female had "equivocal" results. In addition, a serum sample from the patient’s daughter has been submitted. (She had spent one or more nights at the residence.) Laboratory results for this sample are pending.

Environmental cleaning and rodent control by a professional pest management company have been instituted on the property. Since Sin Nombre virus has been previously identified in rodent populations in the Texas Panhandle, additional surveillance was not performed at this site.

Prepared by James Alexander, DVM, MPVM, Director, West Texas Rabies Response Center, TDH Zoonosis Control Division (915/659-8830)

For additional information regarding HPS in Texas, contact Beverly Ray in the Infectious Disease Epidemiology and Surveilance Division at 512/458-7328. Call 512/458-7255 for information about zoonotic disease.

Physicians are reminded that they have a statutory requirement to report HPS and all the other diseases listed in *Rules and Regulations Governing the Control and Reporting of Notifiable Conditions*. Call (800) 705-8868 to report. *For further information and a copy of this document, refer to the IDEAS website:* http://www.tdh.state.tx.us/ideas/report/report.htm. *You can also obtain reporting information and the list of reportable diseases by calling your local health department or by calling (800) 252-8239.*

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Erratum

In the July 19, 1999, DPN (Vol. 59, No. 15), the cooking instructions for ground meat (in the shaded box) contained a serious typographical error. The statement should read, "Cook ground meat for another 15 seconds after the temperature inside the meat reaches **155°F.** (**Not** 115°F) The online version of this issue was corrected on August 9, 1999.

DPN Subscription Renewal Period Is Just Around the Corner!

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