Contaminant Candidate List 3 Microbes: PCCL to CCL Process

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Abbreviations and Acronyms

ARD – Acute Respiratory Disease
CCL - Contaminant Candidate List
CCL 3 - EPA's Third Contaminant Candidate List
CDC - Centers for Disease Control and Prevention
EPA - United States Environmental Protection Agency
EVs – Enteroviruses
HUS – Hemolytic-uremic syndrome
MMWR - Morbidity and Mortality Weekly Report
NDWAC - National Drinking Water Advisory Committee
NPDWR - National Primary Drinking Water Regulation
NRC - National Research Council
PCCL - Preliminary Candidate Contaminant List
PCR – Polymerase Chain Reaction
PWS - Public Water System
SAB - Science Advisory Board
SDWA - Safe Drinking Water Act
USEPA - United States Environmental Protection Agency
WBDO - Waterborne Disease Outbreak
US - United States of America (includes territories)

CCL 3 Microbes: PCCL to CCL Process

1.0 Background and Scope

The scoring process discussed in this document is the last step in a three-step process designed to select microbial contaminants for the third Contaminant Candidate List (CCL 3). The first step of the process is identification of a universe of potential drinking water contaminants. The document titled, *Contaminant Candidate List 3 Microbes: Identifying the Universe* provides a summary of the statutory and regulatory background leading to development of a microbial CCL and describes the activities required to develop a microbial CCL universe as the initial step in a transparent and scientifically sound CCL process.

A second document titled, *Contaminant Candidate List 3 Microbes: Screening to the PCCL*, describes a process to screen human pathogens from a universe of microbiological contaminants for placement on the Preliminary Contaminant Candidate List (PCCL) as the second step in the CCL process. The universe of pathogens is screened based on the likelihood to be present in drinking water and that are associated with illness attributable to drinking water exposure.

In this third step of the CCL 3 process the PCCL pathogens are evaluated for their occurrence in drinking water, and their ability to produce adverse health effects in humans.

Pathogens on the PCCL were scored for placement on CCL 3. EPA devised a scoring system to assign a numerical value to each pathogen on the PCCL. Pathogens receiving high scores are considered for placement on the CCL 3.

This document describes the set of scoring protocols used to relatively rank pathogens on the PCCL to produce CCL 3. EPA derived this scoring process in part from recommendations of the National Research Council and an expert workgroup established by the National Drinking Water Advisory Council, and two external workshops (June 2006 and March 2007). This document describes the rationale for using scoring protocols to rank pathogens based upon their occurrence, health effects, and waterborne disease outbreaks.

2.0 Rationale Used to Develop Scoring Protocols

Section 1412(b)(1) of SDWA, as amended in 1996, specifies that the list must include contaminants that are not subject to any proposed or promulgated NPDWRs, are known or anticipated to occur in public water systems (PWSs), and may require regulation under SDWA (adverse health effects). The objective is to target microorganisms with the highest potential for exposure and the most serious adverse human health effects.

Each of the pathogens on the PCCL was scored using three scoring protocols, one protocol each for waterborne disease outbreaks (WBDO), occurrence in drinking water, and health effects. The higher of the WBDO score or the occurrence score is added to the normalized health effects score to produce a composite pathogen score. Pathogens receiving high scores were considered for placement on the CCL 3.

Occurrence data includes public health surveillance, molecular techniques, culture-based methods and can be collected as part of public health surveillance, response to a disease outbreak or in connection with research efforts. Evaluating these many types of information is a major challenge in developing the CCL selection process.

Public health surveillance programs and the scientific literature provided a range of exposure information from multiple documented microbial outbreaks to microbes that have limited associations to outbreaks. The sources of information ranged from Centers for Disease Control and Prevention (CDC) to studies identified from the scientific literature.

The CCL 3 selection process considered pathogens causing recent waterborne outbreaks more important than pathogens detected in drinking water without documented disease from that exposure. Direct detection of pathogens indicates the potential for waterborne transmission of disease. Documented waterborne disease outbreaks provide an additional weight of evidence that illness was transmitted and that there was a waterborne route of exposure. EPA developed protocols to define a hierarchy of the relevance that each of these types of data provide in evaluating microbes for CCL 3. Combining these two sources of occurrence information enabled EPA to consider both emerging pathogens that should be considered and are not yet

tracked by public health surveillance programs and WBDO data. This hierarchy also acknowledges that organisms identified as agents in WBDO are a higher priority for the CCL 3.

The combination of documented waterborne disease outbreak data and direct detection data identified and relatively compares organisms that should be considered for CCL 3 based on occurrence. The evaluation of potential occurrence still needed to be balanced against the possible adverse health effects from that exposure. The severity of the disease should also inform the decision of whether or not to list a microbe on CCL 3. Organisms that may be linked to widespread outbreaks of moderate illness (i.e., self-limiting gastrointestinal illness) or organisms that results in debilitating disease (i.e., hepatitis or death) from drinking water exposure are considered for CCL 3.

The assumptions used to develop the CCL 3 scoring process are as follows:

- WBDO data and direct detection of pathogens provide occurrence data that can and should be organized into a hierarchy to evaluate microbes, and
- Combining health effects data with the WBDO/occurrence data provides a system that evaluates both the severity of potential disease and the potential magnitude of exposure through drinking water.

2.1 Waterborne Disease Outbreaks

WBDOs are the documentation of occurrence of pathogens in drinking water by public health officials through adverse health effects in a population and are direct evidence of exposure. For a WBDO to occur an infective dose must be present in water and a susceptible person must be exposed, resulting in clinical manifestations of disease. Recognition of pathogens causing WBDOs is important to the CCL 3 selection process. Because water-related illness may also occur in the absence of recognized outbreaks, the process has been broadened to include recreational water exposures and other exposures if the source of a pathogen is traced to a public drinking water system. Epidemiological investigation must implicate a drinking water source as the probable cause of the outbreak. Recreational water settings include swimming pools, and spas if they were filled with drinking water from a public water system (as defined by the Safe Drinking Water Act). EPA excluded non-drinking water sources such as marine and estuarine water bodies from consideration under the CCL 3.

The Centers for Disease Control and Prevention (CDC), EPA and the Council of State and Territorial Epidemiologists (CSTE) have maintained a collaborative surveillance system for collecting and periodically reporting data related to occurrences and causes of WBDOs since 1971. EPA used the CDC surveillance system as the primary source of data for the waterborne disease outbreaks protocol. Reports from the CDC system are published periodically in *Morbidity and Mortality Weekly Report* (MMWR).

For this protocol, a pathogen is scored as having a WBDO(s) in the US if that pathogen is listed in a CDC waterborne disease drinking water surveillance summary (i.e., in the MMWR).

A pathogen with multiple WBDOs listed by CDC is given the highest score under this protocol. EPA also scored non-CDC reported WBDOs and WBDOs outside the U.S. as well; however, these were given lower scores. WBDOs outside the U.S. were scored when information was available from World Health Organization publications or other peer reviewed publications.

In addition, CDC and EPA acknowledge that the WBDOs reported in the surveillance system represent only a portion of the burden of illness associated with drinking water exposure (CDC, 2004). The surveillance information does not include endemic waterborne disease risks, and reliable estimates of the number of unrecognized WBDOs are not available.

Therefore, EPA also considered data as indicating a WBDO (even though CDC does not list a WBDO in their MMWR) if the non-CDC data showed a link between human illness defined by a common water source, a common time period of exposure and/or similar symptoms. EPA also considered the use of molecular typing methods to link patients and environmental isolates. Only the following two pathogens were given a WBDO score based on U.S. data not listed in CDC's MMWR: *Mycobacterium avium* and *Arcobacter butzlerei*.

The WBDO scoring protocol also uses the CDC definition for outbreak as two or more persons epidemiologically linked by location of exposure to water, time, and illness (CDC, 2006). CDC excludes single cases of illness from the definition of WBDO except for single cases of *Naegleria fowleri* (causing primary amebic meningoencephalitis) and *Vibrio cholerae*.

Exhibit 1. Waterborne Disease Outbreak Scoring Protocol

Category	Score
Has caused multiple (2 or more) documented WBDOs in US since CDC surveillance initiated in 1973	5
Has caused at least one documented WBDOs in US since CDC surveillance initiated in 1973	4
Has caused documented WBDOs at any time in the US	3
Has caused documented WBDO in countries other than the US	2
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease	1

2.2 Occurrence

The occurrence attribute is the direct detection of microbes using cultural, immunochemical, or molecular detection of pathogens in water. It characterizes pathogen introduction, survival, and distribution in the environment. Occurrence implies that pathogens are present in water and that they may be capable of surviving and moving through water to produce illness in persons exposed to water by ingestion, inhalation, or dermal contact.

Pathogen occurrence is considered broadly to include public drinking water, and all

waters using a drinking water source for recreational purposes, ground water, and surface water. This attribute does not characterize the extent to which occurrence of a pathogen poses a public health threat from drinking water exposure. Because viability and infectivity cannot be determined by non-cultural methods, the public health significance of non-cultural detections is unknown.

Exhibit 2. Occurrence Scoring Protocol for Pathogens

Category	Score
Detected in drinking water in the US	3
Detected in source water in the US	2
Not detected in the US	1

2.3 Health Effects

The health effects protocol evaluates the extent of illness produced in humans from drinking water or recreational water exposure. The severity of disease manifestations produced by a pathogen is evaluated across a range of potential endpoints. The seven level hierarchy developed for this protocol begins with mild, self-limiting illness and progresses to death.

The Agency tried to evaluate the potency of an organism, i.e., the concentration of a pathogen during exposure that is necessary to cause illness in a susceptible host (infectious dose). However, infectious doses are not available for many pathogens. Characterizing the attribute of health effects considers the extent of exposure necessary to produce disease and resulting manifestations of disease in a susceptible host. The Agency uses this health effect protocol to score both the severity of disease and the organisms' potency with the best available data.

The final outcome of a host-pathogen relationship resulting from drinking water exposure is a function of viability, infectivity, and pathogenicity of the microbe to which the host is exposed and the host's susceptibility and immune response. SDWA directs EPA to consider subgroups of the population at greater risk of adverse health effects (sensitive populations) in the selection of unregulated contaminants for the CCL. Sensitive populations may have increased susceptibility and may experience increased severity of symptoms, compared to the general population. SDWA refers to several categories of sensitive populations including the following: children and infants, elderly, pregnant women, and persons with a history of serious illness.

Health effects for individuals with marked immunosuppression (e.g., primary or acquired severe immunodeficiency, transplant recipients, individuals undergoing potent cytoreductive treatments) are not included in this health effects scoring. While such populations are considered sensitive subpopulations, immunosuppressed individuals often have a higher standard of ongoing health care and protection required than the other sensitive populations under medical care. More importantly, nearly all pathogens have very high health effect scores for the markedly immunosuppressed individuals; therefore there is little differentiation between pathogens based

on health effects for the immunosuppressed subpopulation.

This protocol scores the representative or common clinical presentation for the specific pathogen for the population category under consideration. Pathogens may produce a range of illness from asymptomatic infection to fulminate illness progressing rapidly to death. The scoring decisions are based upon the more common clinical presentation and clinical course for the population under consideration, rather than the extremes. EPA used recently published clinical microbiology manuals as the primary data source for the common clinical presentation. These manuals take a broad epidemiological view of health effects rather than focusing on narrow research investigations or single cases. The one exception to this approach was EPA's scoring of health effects for *Helicobacter pylori*.

Helicobacter pylori is a pathogen that causes gastric cancer in addition to acute gastric ulcers. EPA placed this pathogen on the draft CCL 3. However, the analysis for *H. pylori* differs from the other pathogens due to the long term and/or chronic nature of its health effects rather than the more common acute effects of most waterborne pathogens. This organism is an emerging pathogen whose impact has only recently begun to be understood. Given the slow development of adverse health effects due to infection by *H. pylori*, it is more difficult to link contamination of drinking water and show a waterborne disease outbreak. Therefore, given the long timeframe of cancer and ulcer development (as opposed to the commonly acute gastrointestinal illness of nearly all the other pathogens on the PCCL) as well as the ongoing nature of the research, EPA used peer-reviewed scientific papers to score the health effects of *H. pylori*. The data used to score *H. pylori* is cited in scoring data sheets at the end of this document.

To obtain a representative characterization of health effects in all populations, EPA evaluated separately the general population and the four sensitive populations (see exhibit 3) on the common clinical presentation of illness for each population. EPA added the general population score to the highest score among the four sensitive subpopulations for an overall health effects score. The resulting score acknowledges that sensitive populations have increased risk for waterborne diseases.

Exhibit 3. Health Effects Scoring Protocol for Pathogens

Outcome Category	Score	Manifestation in Population Class				
		General Population	Children/ Infants	Elderly	Pregnant Women	Chronic Disease
Does the organism cause significant mortality (> 1/1,000 cases)?	7					
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	6					
Does the illness result in long term or permanent dysfunction or disability (i.e., sequelae)?	5					
Does the illness require short term hospitalization (< week)?	4					
Does the illness require physician intervention?	3					
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	2					
Does the illness result in mild symptoms with minimal or no impact on daily activities?	1					

2.4 Combining Protocol Scores to Rank Pathogens

EPA used the three scoring protocols (occurrence, waterborne disease outbreaks, and health effects) to score and rank the PCCL. A workgroup of EPA scientists scored pathogens on the PCCL using the scoring system. The score for each component of the protocols is provided to demonstrate how the total score and relative rankings were developed. These protocols are designed in a hierarchical manner so that each pathogen is evaluated using the same criteria and the criteria range for each protocol varies from high significance to low significance. The three attribute scores are then combined into a total score.

Pathogens are first scored using the WBDO and occurrence protocols, and then the highest score is selected. Selection of the higher score from the WBDO or occurrence protocol elevates pathogens that have been detected in drinking water or source water in the U.S. (occurrence score of 2 or 3) above pathogens that have caused WBDOs in other countries but not in the U.S. (WBDO score of 2) or pathogens that have not caused WBDOs in any country but have been epidemiologically associated with water-related disease (WBDO score of 1). This scoring protocol recognizes the importance of WBDO data in evaluating the public health risk posed by pathogens in drinking water, while ensuring that pathogens that have been detected in public water systems and have not been identified as causative agents WBDOs remain in the CCL process.

Next, pathogens are scored using the health effects protocol. This protocol scores the representative health effect characteristic of each pathogen for the general population, e.g. noroviruses characteristically cause gastrointestinal symptoms that are self-limiting within two days in otherwise healthy adults. All five population categories (general, child, elderly, pregnant women and chronic disease) are scored for each pathogen using the most common clinical presentation for the specific pathogen for the population category under consideration. The lowest population score was used for any specific population for which health effects information was not readily available. The pathogen's score for the general population is added to the highest score among the four sensitive populations to produce a sum score between 2 and 14.

Finally, EPA normalizes the Health Effects and WBDO/Occurrence score because the Agency believes they are of equal importance. The highest possible score for WBDO/Occurence is 5 and the highest possible Health Effect score is 14. To equalize this imbalance, the Agency multiplies the combined score by 5/14.

Exhibit 4. Health Effects Scores for PCCL

Pathogen	WBDO	Occur.	Health Effects						**Total Score**
			Gen.	Child	Elderly	Pregnant Women	Chronic Disease	Normalized Health	
Naegleria fowleri	4	3	7	7	7	7	7	5.0	9.0
Legionella pneumophila	5	3	4	4	6	4	6	3.6	8.6
Escherichia coli (0157)	5	3	3	6	6	3	3	3.2	8.2
Hepatitis A virus	5	2	3	3	6	3	3	3.2	8.2
Shigella sonnei	5	3	3	6	6	3	3	3.2	8.2
Helicobacter pylori	1	3	7	3	7	3	3	5.0	8.0
Campylobacter jejuni	5	3	3	4	4	3	3	2.5	7.5
Salmonella enterica	5	3	3	4	4	3	3	2.5	7.5
Caliciviruses	5	3	2	4	4	2	4	2.1	7.1
Entamoeba histolytica	5	3	3	3	3	3	3	2.1	7.1
Vibrio cholerae	5	3	3	3	3	3	3	2.1	7.1
Adenovirus	2	3	6	4	2	2	4	3.6	6.6
Enterovirus	2	3	4	6	2	2	2	3.6	6.6
Cyclospora cayetanensis	4	1	3	4	3	3	3	2.5	6.5
Mycobacterium avium	4	3	3	3	3	3	4	2.5	6.5
Rotavirus	4	2	1	6	1	1	1	2.5	6.5
Yersinia enterocolitica	5	3	2	2	2	2	2	1.4	6.4
Arcobacter butzleri	4	3	3	3	3	3	3	2.1	6.1
Fusarium solani	1	3	4	4	4	4	4	2.9	5.9
Plesiomonas shigelloides	4	3	2	3	3	2	2	1.8	5.8
Hepatitis E virus	2	1	3	3	6	7	3	3.6	5.6
Toxoplasma gondii	2	1	2	2	2	7	2	3.2	5.2
Aspergillus fumigatus group	1	3	3	3	3	3	3	2.1	5.1
Exophiala jeanselmei	1	3	3	3	3	3	3	2.1	5.1
Aeromonas hydrophila	1	3	2	3	2	2	2	1.8	4.8
Astrovirus	2	2	2	2	2	2	2	1.4	3.4
Microsporidia	1	2	2	2	2	2	2	1.4	3.4
Isospora belli	2	0	1	2	1	1	1	1.1	3.1
Blastocystis hominis	1	0	1	1	1	1	1	0.7	1.7

3.0 Selecting the CCL from the Ranked PCCL

The scoring system involves selecting a pathogen and completing three scoring protocols, one protocol each for WBDOs and Occurrence, and one protocol for normal populations and four sensitive populations (children, elderly, pregnant women, and persons with chronic diseases). The higher of the WBDO score or the occurrence score is added to the normalized health effects score to produce a composite pathogen score. This process results in a ranked list of pathogens from which those the Agency may select for placement on a CCL 3.

The scoring process developed by EPA ranks microbial drinking water contaminants in a transparent and scientifically sound manner. The weighing of occurrence and health effects information closely mirrors the risk estimate methods used by EPA during drinking water regulation development. This scoring system will prioritize and restrict the number of pathogens on a CCL 3 to only those that have been strongly associated with water-related diseases. Pathogens failing to meet these criteria will remain on the PCCL until additional occurrence data, epidemiological surveillance data, or health effects data support their reevaluation.

The 29 PCCL pathogens are ranked according to an equal weighting of their summed scores for normalized health effects and the higher of the individual scores for WBDO and occurrence in drinking water. EPA believes this ranking indicates the most important pathogens to consider for the draft CCL 3. To determine which of the 29 PCCL pathogens should be the highest priority for EPA's drinking water program and included on the draft CCL 3, the Agency considered both scientific and policy factors. The factors included the PCCL scores for WBDO, occurrence, and health effects; comments and recommendations from the various expert panels; the specific intent of SDWA; and the need to focus Agency resources on pathogens to provide the most effective opportunities to advance public health protection. After consideration of these factors, EPA has determined that the draft CCL 3 will include the 11 highest ranked pathogens.

Additionally, there are a few "natural" break points in the ranked scores for the 29 pathogens, with the top 11 forming the highest ranked group of pathogens. EPA does believe that the overall rankings strongly reflect the best available scientific data and high quality expert input employed in the CCL selection process, and therefore should be important factors in helping to identify the top priority pathogens for the draft CCL 3.

Exhibit 5. Draft CCL3 Microbes

- Caliciviruses
- *Campylobacter jejuni*
- *Entamoeba histolytica*
- *Escherichia coli* (0157)
- *Helicobacter pylori*
- Hepatitis A virus

- *Legionella pneumophila*
- *Naegleria fowleri*
- *Salmonella enterica*
- *Shigella sonnei*
- *Vibrio cholerae*

4.0 Scoring Data Sheets

This section contains a scoring sheet for each of the pathogens on the PCCL. The scoring sheets are arranged alphabetically by pathogen.

A score for each protocol (WBDOs and occurrence, and health effects) is determined. Bolded text in each protocol box indicates that is the protocol level that was scored for that pathogen. For example, if the question "**Detected in drinking water in the U.S.?"** under the occurrence protocol is bolded than that organism received the occurrence score (i.e., 3). The higher of the WBDO score or the occurrence score is added to the normalized health effects score to produce a composite pathogen score. References for each scoring discussion are provided. Health effects scoring involved scoring for each of 5 populations: General (G), Children/infants (C), Elderly (E), Pregnant Women (P), and persons with Chronic Disease (CD).

Adenovirus Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	USEPA, 2007 CDC, 2004; CDC; 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	**Yes** **Outbreaks in Europe.**	**Kukkula et al., 1997**
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes** **PCR in connection with an outbreak.**	**O'Reilly et al, 2007** **Fong et al., 2007**
Detected in source water in the U.S.?	Yes, 38% of surface water samples collected as part of the Information Collection Rule contained Adenovirus 40/41.	USEPA, 2007
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause pneumonia, meningitis,	**[G] A frequent cause of pneumonia among**	**Gray et al., 2001**

Data Element	Scoring Data	Reference
hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	**(unvaccinated) military recruits. Two deaths in previously-healthy adults** **ARD is still a significant problem in military. Less common manifestations include fatal neonatal disease, meningoencephalitis and myocarditis.**	**Robinson in Murray 2007**
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
Does the illness require short term hospitalization (< week)?	**[CD] Children with chronic disease required respiratory ventilation.** **[C] Young adults may contract acute respiratory disease.**	**CDC, 1983** **CDC, 1998**
Does the illness require physician intervention?	Physician office visits are indicated for ocular infections	Robinson in Murray 2007
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[E, P] Approximately 50% of cases are asymptomatic; symptomatic cases usually present as upper respiratory infections similar to the common cold.**	**Robinson in Murray 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?	N/A	

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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USEPA. 2007. Adenovirus Health and Criteria Document (Draft).

Aeromonas hydrophila Scoring Data

Bolded Text indicates data used to score

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	**Yes**	**Gavriel et al, 1998**
Occurrence		
Detected in drinking water in the U.S.?	**Yes** **EPA found A. *hydrophila* in the distribution systems of 42 out of 293 public water systems tested.**	**EPA, 2006 and EPA, 2003**
Detected in source water in the U.S.?	Yes	Holmes et al., 1996 EPA, 2006
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Wound infections are usually preceded by injury that occurs in contact with water. These infections range from cellulitis to myronecrotic infections	Horneman in Murray 2007

Data Element	Scoring Data	Reference
	with a poor prognosis.	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Septicemia occurs rarely in immunocompetent hosts. Can cause HUS.	Horneman in Murray 2007
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	**[C] Children may require hopitalization due to dehydration**	**Horneman in Murray 2007**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[G, P, E, CD] Acute watery diarrhea is the most common form as well as abdominal pain, vomiting, fever.**	**Horneman in Murray 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?	N/A	

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

CDC, 2004. Surveillance for Waterborne-Disease Outbreaks Associated with Drinking Water --- United States, 2001—2002. *MMWR Surveillance Summaries*, 53(SS08); 23-45.

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Arcobacter butzleri Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	**Yes** **Not listed by CDC MMWR, however, linked to outbreak and drinking water. Presumptive Campylobacter stool samples later Arcobacter. Symptom severity also suggests Arcobacter**	**Fong et al., 2007**
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Fong, et.al, 2007**
Detected in source water in the U.S.?	Yes, *Arcobacter butzleri* was isolated from ground water in Idaho after a WBDO.	Rice et al., 1999.
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Unknown	
Does the organism cause pneumonia, meningitis,	Persons with underlying disease such as liver disease,	Hsueh et al., 1997 Lerner et al., 1994

Data Element	Scoring Data	Reference
hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	cirrhosis, or alcoholism may be at increased risk of complications. Has been isolated from patients with bacteremia, endocarditis, peritonitis and diarrhea. Clinical significance unknown.	Yan et al., 1999 Fitzgerald in Murray 2007
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	**[All populations] Displays clinical features similar to *Campylobacter jejuni*, however is more frequently associated with a persistent diarrhea. 26 percent of Belgian patients required antibiotics.**	**Vandenberg, et al., 2004**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	[G] Usual symptoms are diarrhea, abdominal pain, vomiting, and nausea resolving in < 3 days.	Wybo et al., 2004 Rice et al., 1999
Does the illness result in mild symptoms with minimal or no impact on daily activities?	N/A	

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Yan, J., W. Ko, A. Huang, H. Chen, Y. Jin and J. Wu. 1999. *Arcobacter butzleri* bacteremia in a patient with liver cirrhosis. Journal of the Formosan Medical Association 99(2): 166-169.

Aspergillus fumigatus Scoring Data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	**Yes** **Study on two bone marrow transplantation units at a Little Rock, AR hospital.**	**Anaissie et al., 2002** **Anaissie et al., 2003** **Warris et al., 2003**
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Anaissie et al., 2002** **Anaissie et al., 2003** **Nagy and Olson, 1982** **Rosenzweig et al., 1986** **Doggett, 2000** **Vesper et al., 2007**
Detected in source water in the U.S.?	Yes	Nagy and Olson, 1982
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Invasive infections caused by Aspergillus species are associated with high rates of morbidity and mortality, especially in immunosuppressed patients.	Verweij and Brandt in Murray 2007
Does the organism cause	Sporadic cases of invasive	Bodey and Vartivarian, 1989

Data Element	Scoring Data	Reference
pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	aspergillosis have been reported in immunocompetent hosts (chronic meningitis, endocarditis, pericarditis, osteomyelitys). Invasive aspergillosis is primarily an infection of severely immunocompromised patients. Serious infection can also occur in patients with more modest impairments of host immune system such as diabetics.	Nagy and Olson 1982
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	None reported	
Does the illness require short term hospitalization (< week)?	Need for hospitalization depends upon the manifestation of disease. (e.g. superficial skin and ear infections do not require hospitalization).	Bodey and Vartivarian, 1989
Does the illness require physician intervention?	**[All Populations] Most infections and allergies caused by this organism require physician intervention.**	**Bodey and Vartivarian, 1989**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	N/A	
Does the illness result in mild symptoms with minimal or no impact on daily activities?	*Aspergillus* spores are allergens and persons who become sensitized experience symptoms of allergy and	Horner et al., 1995

Data Element	Scoring Data	Reference
	asthma.	

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

Anaissie, E., S. Stratton, M. Dignani, R. Summerbell, J. Rex, T. Monson, T. Spencer, M, Kasai, A. Francesconi, and T. Walsh. 2002. Pathogenic *Aspergillus* species recovered from a hospital water system: a 3-year prospectie study. Clin. Infect. Dis. 34:780-789.

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Astrovirus Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	None reported, however CDC reported two outbreaks attributed to 'small round-structured viruses', and it is possible these were astroviruses, though they could also be caused by rotavirus, or enterovirus.	CDC, 2004; CDC, 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	**Yes (England and Wales)**	**Smith et al., 2006**
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Gofti-Laroche et al., 2003
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	**Yes, Astrovirus was detected in 15 of 29 samples collected under the Information Collection Rule.**	**Chapron et al., 2000**
Not detected in the U.S.?		
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause	No	

Data Element	Scoring Data	Reference
pneumonia, meningitis, hepatitis, encephalitis, Noendocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
Does the illness require short term hospitalization (< week)?	No	
Does the illness require physician intervention?	No	
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[All populations] Asymptomatic infections common. Moderate self-limiting gastroenteritis (vomiting and diarrhea).**	**Farkas in Murray 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?	N/A	

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

CDC, 2004. Surveillance for Waterborne-Disease Outbreaks Associated with Drinking Water --- United States, 2001—2002. *MMWR Surveillance Summaries,* 53(SS08); 23-45.

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Blastocystis hominis Scoring Data

Bolded Text indicates data used to score

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	**Yes, drinking untreated water has been associated with infection.**	**Leelayoova et al., 2004 Stenzel and Boreham, 1996 Taamasri et al., 2000**
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	No	
Not detected in the U.S.?	No	Karanis, 2006
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No	
Does the illness result in long	No	

Data Element	Scoring Data	Reference
term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?	No	
Does the illness require physician intervention?	No	
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Symptoms may be more pronounced and prolonged in immunocompromised; neoplasia and abnormal intestinal tract function	Leber in Murray 2007
Does the illness result in mild symptoms with minimal or no impact on daily activities?	**[All populations] Pathogenicity of *B. hominis* is controversial. Symptoms may include diarrhea, vomiting and abdominal pain.**	**Leber in Murray 2007**

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

CDC, 2004. Surveillance for Waterborne-Disease Outbreaks Associated with Drinking Water --- United States, 2001—2002. *MMWR Surveillance Summaries*, 53(SS08); 23-45.

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Taamasri, P., M. Mungthin, R. Rangsin, B. Tongupprakarn, W. Areekul, and S. Leelayoova. 2000. Transmission of intestinal blastocystosis related to the quality of drinking water. Southeast Asian Journal of Tropical Medicine & Public Health 31(1):112-117.

Calicivirus Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **9 (Norwalk) Community outbreaks** **16 (Norwalk) Noncommunity outbreaks** **1 (Norovirus) Community**	**Craun et al., 2003** **CDC, 2004** **CDC, 2006**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes, detection by PCR.**	**Huffman et al., 2003**
Detected in source water in the U.S.?	Yes, detected in ground water by PCR.	Borchardt et al., 2003 Fout et al., 2003
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other	No long term sequelae have been reported.	CDC, 2001

Data Element	Scoring Data	Reference
severe manifestations of illness necessitating long term hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	CDC, 2001
Does the illness require short term hospitalization (< week)?	**[E, CD] (Norwalk) Although rare, severe dehydration can be fatal, with this outcome occurring among susceptible persons (e.g., older persons with debilitiating health conditions).** **[C] Sappoviruses cause disease mainly in children.**	**CDC 2001; CDC 2003** **Farkas in Murray et al., 2007**
Does the illness require physician intervention?	No	
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[G, P] Acute gastroenteritis. Highly contagious, able to cause large outbreaks and environmentally stable.**	**Farkas in Murray et al., 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?	No	

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Huffman, D., K. Nelson, and J. Rose. 2003. Calicivirus – an emerging contaminant in water: state of the art. Environ. Engr. Sci. 20:503-515.

Campylobacter jejuni Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **9 Community and 7 Noncommunity outbreaks** **1 Noncommunity** **2 Community outbreaks** **1 Noncommunity**	**Craun, 2003** **CDC, 2004** **CDC, 2006**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	Yes. Finland.	Kuusi, 2005
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Sacks et al., 1986** **O'Reilly, 2007**
Detected in source water in the U.S.?	Yes	Carter et al., 1987
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Death is uncommon.	Fitzgerald in Murray, 2007
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other	Complications include hepatitis, bacterimia cholecystitis, pancreatitis, nephritis, abortion and	Fitzgerald in Murray 2007

Data Element	Scoring Data	Reference
severe manifestations of illness necessitating long term hospitalization (> week)?	neonatal sepsis, urinary tract infection, meningitis and septic arthiritis. Bacteremia occur in 0.15% of intestinal infections with elderly mostly affected	
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	N/A	
Does the illness require short term hospitalization (< week)?	**[C, E] Most cases do not require hospitalization, pediatric cases and elderly are more likely to require hospitalization than normal adult cases.** **The highest incidence is in children and infants.** **Bacteremia occurs at 1.5 per 1,000 cases with the highest rate occurring in the elderly.**	**Fitzgerald in Murray, 2007**
Does the illness require physician intervention?	**[G, P, CD] Guillain-Barre syndrome, reactive arthritis. Guillain-Barre 1/1000 cases. Reactive arthritis 1/100 cases**	**Fitzgerald in Murray, 2007** **Altekruse et al., 1999**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Duration 2-5 days, usually self-limiting. Several days to more than 1 week, self-limiting, relapse in 5-10% cases	Heymann 2005 Fitzgerald in Murray 2007
Does the illness result in mild symptoms with minimal or no impact on daily activities?	Illnesses range from asymptomatic to acute diarrhea, abdominal pain, malaise, and fever	Fitzgerald in Murray 2007

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

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Cyclospora cayetanensis Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006;
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	**Yes, one drinking water associated outbreak occurred in IL presumably due to contamination of a water storage tank by birds.**	**Craun, G., et al., 2003**
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	No	
Not detected in the U.S.?	**Detected in drinking water in Guatemala**	**Dowd et al., 2003**
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term	No	

Data Element	Scoring Data	Reference
hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Guillain-Barre and Reiter syndromes have been reported.	Connor et al., 2001
Does the illness require short term hospitalization (< week)?	**[C] Most cases do not required hospitalization, infants may require hospitalization for rehydration therapy.**	**Fisk et al., 2005**
Does the illness require physician intervention?	**[G and all other populations] can cause diarrhea and biliary disease. In patients not treated, illness can be protracted with relapsing symptoms.**	**Lindsay in Murray 2007** **Heymann 2005**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	.	
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Entamoeba histolytica Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **1 Community outbreak** **1 Community outbreak** **1 Noncommunity outbreak**	 **Craun, 2003** **CDC, 2006**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes. Found during WBDO.**	**CDC, 2006**
Detected in source water in the U.S.?	N/A	
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	500 million infected (dispar and histolytica) each year with approximately 50 million cases of colitis and liver abscess and 100,000 deaths worldwide.	Leber, in Murray 2007
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis,	Infections in the U.S. rarely progress to complications, amebic colitis may result in	Heymann, 2005

Data Element	Scoring Data	Reference
endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	perforation of the intestinal wall, resulting in peritonitis, dissemination to extraintestinal sites may involve the liver, lungs, or brain. Liver abscess is the most common complication.	
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Abdominal perforations and peritonitis are rare complications. Up to 5% develop liver abscess.	Leber, in Murray 2007
Does the illness require short term hospitalization (< week)?	Intestinal invasion can lead to lesions, ulcers.	Leber in Murray 2007
Does the illness require physician intervention?	**[All populations] Clinical symptoms are dysentery, colitis or rarely ameboma). Fulminant colitis occurs most often in children who present with diffuse abdominal pain, profuse bloody diarrhea, and fever.**	**Leber, in Murray, 2007** **Marshall, 1997**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Most human infections (90%) are asymptomatic, symptomatic non-invasive strains cause gastrointestinal symptoms such as cramping and increased frequency of bowel movements, constipation may alternate with diarrhea, invasive strains may cause ameobic dysentery.	Heymann, 2005
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Enterovirus Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2006; CDC, 2004; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	**Yes. Switzerland and others.**	**Hafliger et al., 2000**
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Mack et al., 1972; Lieberman, et al. 2002; Keswick et al., 1984**
Detected in source water in the U.S.?	Yes	Borchardt et al., 2003
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?		
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long	**[C] Aseptic meningitis and neonatal sepsis are the most common complications.** **EVs are the most common cause of meningitis in the**	**Heymann, 2005** **Romero, in Murray 2007**

Data Element	Scoring Data	Reference
term hospitalization (> week)?	**US, over 80% of all viral meningitides (estimated 30,000 to 50,000 hospitalizations for Nonpolio EV each year (principally echo and coxsackie). Enterovirus causes myocarditis, viral meningitis, encephalitis and meningioencephalitis.**	**Khetsuriani et al, 2002; Kim et al 2001; Khetsuriani 2003**
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Diabetes has been associated with enterovirus infection.	Heymann, 2005
Does the illness require short term hospitalization (< week)?	**[G] Hospitalization may be required for severe manifestations of disease. Approximately 20-30% of meningitis outbreak cases in young adults require hospitalization.** During the Summer and Fall, responsible for 50 – 60% of hospital admissions for evaluation of febrile illnesses for infants and children	**Sawyer, 2002** Romero, in Murray 2007
Does the illness require physician intervention?	Children with acute pharyngitis may be taken to a physician to differentiate between streptococcal and viral sore throat. Upper respiratory illness lasts 4-6 days, lower respiratory illness lasts 5-7 days, and meningitis lasts 7-10 days.	Romero, in Murray 2007 Heymann, 2005
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[E, P, CD] Most cases are asymptomatic. Most common symptoms are acute nonspecific febrile illness.**	**Romero, in Murray 2007**

Data Element	Scoring Data	Reference
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Escherichia coli (O157) Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **4 Community and 4 Non-community**	**Craun, G., et al., 2003**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Bopp et al., 2003**
Detected in source water in the U.S.?	Yes, as a result of animal fecal contamination.	Kramer et al., 1996
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No. Approximately 60 deaths per 73,000 cases per year (nearly >1/1,000) are reported due to *E. coli* STEC (O157). A case fatality rate of 0.5 has been reported for outbreaks-related cases caused by *E. coli* O157:H7.	Nataro, in Murray 2007 Rangel et al., 2005

Data Element	Scoring Data	Reference
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	**[C, E] Patients at extremes of age have an increased risk for infection and associated complications.** **Children under 5 are most frequently diagnosed with infection and are at greatest risk of developing HUS.** **The elderly also appear to be a increased risk of complications.** **HUS develops in 10% of patients under the age of 10.**	**Chinyu 1995** **Heymann, 2005** **Nataro and Kaper, 1998**
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	25% of HUS survivors develop long term renal sequelae. 3.2% of children with diarrhea plus HUS develop diabetes. Adults have a greater likelihood of hypertension and reduced renal function.	Garg et al, 2003 Suri et al., 2005 Garg et al, 2005
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	**[G, P, CD] Fluid replacement is the cornerstone of treatment for EHEC diarrhea; some clinicians choose to hospitalize all patients with E. coli 0157:H7 for hydratrion to prevent HUS.**	**Heymann, 2005**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
Does the illness result in mild symptoms with minimal or no	Can present as mild non-bloody diarrhea.	Nataro, in Murray 2007

Data Element	Scoring Data	Reference
impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Exophiala jeanselmei Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	**Yes**	**Nucci et al., 2002**
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**West, 1986**
Detected in source water in the U.S.?	Yes	Nucci et al., 2001
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Infections increase in severity in patients with impaired immunity and metabolic diseases such as diabetes	De Hoog, in Murray 2007
Does the illness result in long	No	

Data Element	Scoring Data	Reference
term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?	No	
Does the illness require physician intervention?	**[All populations] A chronic spreading mycosis. The frequency of infection is low, yet potential severe outcome and high degrees of resistence to antifungal drugs requires medical attention.**	**Heymann, 2005.** **De Hoog, in Murray 2007**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Fusarium solani Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC 2006 and Craun 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	**Yes** **Houston, TX**	**Annaissie et al., 2001**
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Nagy and Olson, 1982** **Annaissie et al., 2001**
Detected in source water in the U.S.?	N/A	
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Mortality associated with cutaneous *Fusarium* infection is high in immunocompromised patients but it is very low for immunocompetent hosts.	Nucci and Annaissie, 2002
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term	Most severe disease occurs in severely immunocompromised. *Fusarium* has been associated with pneumonia and disseminated infections.	Fridkin and Jarvis, 1996; Annaissie et al., 2001 Verweij and Brandt, in Murray 2007

Data Element	Scoring Data	Reference
hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?	**[G, C, P, E, CD] Can cause infections that may require hospitalization, particularly in immunocompromised patients (endophtalmitis, central nervous system infections, endocarditis)**	**Dignani and Anaissie, 2004**
Does the illness require physician intervention?	Treatment and/or removal of the foreign body is usually required as well as antifungal therapy. In inmunocompentent patients manifestations include keratitis, localized skin lesions, onychomycosis, and occasionally cellulitis and peritonitis.	Dignani and Anaissie, 2004
Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

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Helicobacter pylori Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC, 2006 and Craun, 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	**Yes**	**Klein and Graham, 1991 Hulten et al., 1996 Rolle-Kampczyk, 2004.**
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Hegarty and Baker, 1999**
Detected in source water in the U.S.?	N/A	
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	**[G, E] 6500 deaths per year. 1.2 Million acute cases per year (>1/1,000 deaths). 46% of deaths occur before age of 64.**	**CDC, 1997 Stratton et al, 2000**
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term	40 – 50% infection rates in the elderly. More likely to suffer from gastric ulcer , gastric adenocarcinomass and MALT.	Fox, in Murray 2007.

Data Element	Scoring Data	Reference
hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Main cause for peptic ulcers and a major risk factor for gastric cancer.	Fox, in Murray 2007
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	**[C, P, CD] Many patients have recurrent abdominal symptoms 16% develop duodenal ulcers. NIH (1994) recommends diagnosis and antimicrobial treatment for anyone with peptic ulcers.**	**Fox, in Murray, 2007.**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	No. Infection persists lifelong without treatment.	Fox, in Murray 2007
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

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Hepatitis A Virus Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **10 Community and 10 Noncommunity outbreaks**	**Craun et al., 2003**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?		
Detected in source water in the U.S.?	**Yes**	**Abbaszadegan et al., 2003** **Borchardt et al., 2004**
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Reported case fatality is normally low, 0.1%–0.3%; it can reach 1.8% for adults over 50	Heymann, 2005
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term	**[E] Fulminant hepatitis may develop. Disease severity shows a general increase with age.**	**Anderson, in Murray 2007**

Data Element	Scoring Data	Reference
hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	**[G, C, P, CD] Commonly begins with "flu-like" symptoms. May develop jaundice. Physician office visit is common for diagnosis and/or vaccination.**	**Anderson, in Murray 2007.**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

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Hepatitis E Virus Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC, 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	**Yes, waterborne outbreaks have occurred in Asia and Africa**	**Guthmann et al., 2006 Panda et al., 2006**
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	California camping.	Tsang et al., 2000
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	No	
Not detected in the U.S.?	**Yes, India.**	**Jothikumar et al., 2000**
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	**[P] May progress to fulminant disease in pregnant women when infection occurs during the third trimester. High mortality (for fetus) when infection occurs during pregnancy.** **The case-fatality rate is similar to that of hepatitis A**	**Anderson, in Murray 2007** **Heymann, 2005**

Data Element	Scoring Data	Reference
	except in pregnant women, where it may reach 20% among those infected during the third trimester of pregnancy.	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	**[E] Fulminant hepatitis may develop. Disease severity shows a general increase with age.**	**Anderson, in Murray 2007**
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	**[G, C] Commonly begins with "flu-like" symptoms. May develop jaundice. Physician office visit is common for diagnosis and/or vaccination.**	**Anderson, in Murray et al., 2007**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

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Isospora belli Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC, 2006 and Craun, 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	**Yes**	**Karanis, 2006**
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	No	
Not detected in the U.S.?	No	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?		
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?		

Data Element	Scoring Data	Reference
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	Can cause serious and sometimes fatal disease in immunocompetant humans, more severe in immunocompromised patients.	Lindsay, in Murray 2007
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[C] Symptoms are more severe in infants and children.**	**Lindsay, in Murray 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?	**[G] Symptoms include diarrhea, steatorrhea, headache, fever, malaise, abdominal pain, vomiting, dehydration, and weight loss.**	**Lindsay, in Murray, 2007**

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Legionella pneumophila Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **6 Community outbreaks** **7 Community outbreaks**	**CDC, 2004** **CDC, 2006**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**AwwaRF, 2004** **Lin et al, 1998** **Maier et al., 2000**
Detected in source water in the U.S.?	Yes	Maier et al., 2000
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Avg. 12% fatality rate; death rates of 15% (general pop.) up to 75% immunocompromised) if untreated. AwwaRF: Avg. 25% death rate (between 20-40% during an outbreak CDC: 10 – 15% death rate Fatality rate has been as high	Edelstein, in Murray, 2007 CDC, 2005 AwwaRF, 2004 Heymann, 2005

Data Element	Scoring Data	Reference
	as 39% in hospitalized cases; it is generally higher in those with compromised immunity.	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	**[E, CD] Acute pneumonia may progress to respiratory collapse and death if diagnosis and effective antibiotic therapy are delayed. The elderly and individuals with chronic diseases are at higher risk.**	**Edelstein, in Murray, 2007** **CDC, 2005**
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
Does the illness require short term hospitalization (< week)?	**[G, C, P] Hospitalization is required for treatment of acute pneumonia.**	**Edelstein, in Murray, 2007**
Does the illness require physician intervention?		
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Pontiac fever resolves without treatment and has flu-like symptoms.	Edelstein, in Murray 2007 Heymann, 2005
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

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Microsporidia Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006; Craun, 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	**Yes**	**Cotte, et al., 1999 Enriquez et al., 1998 Hutin et al., 1998**
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	**Yes**	**Didier et al., 2004 Dowd et al., 1998**
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?		

Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	Antimicrobial therapy available for immunodeficient patients.	Weber, in Murray 2007
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[G, C, E, P, CD] Diarrhea and weight loss lasting in up to 2 – 3 weeks in immunocompetent hosts. Has been identified among elderly persons with acute or chronic diarrhea.**	**Weber, in Murray 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Mycobacterium avium Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC, 2006 and Craun, 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	**Yes. Not listed by CDC MMWR data however, data linking patient, outbreak and drinking water.**	**Tobin-D'Angelo et al., 2004**
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	No	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	Yes	Glover et al., 1994 Aronson et al., 1999 von Reyn et al., 1994
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Glover et al., 1994 Covert et al., 1999 Falkinham et al., 2001**
Detected in source water in the U.S.?	Yes	Covert et al., 1999 Falkinham et al., 2004
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?		
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Disseminated MAC infections are a major problem in HIV-Infected individuals.	Heymann, 2005

Data Element	Scoring Data	Reference
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	None reported	
Does the illness require short term hospitalization (< week)?	**[CD] Tuberculosis-like upper lobe fibrocavitary disease occurs typically in men 45 – 60 who have preexisiting lung disease.**	**Pfyffer, in Murray 2007**
Does the illness require physician intervention?	**[G]Symptoms of infection include pulmonary disease, lymphadenitis, post-traumatic wound infection. Diagnosis of disease and treatment requires physician intervention.**	**Pfyffer, in Murray 2007** **Heymann, 2005**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Naegleria fowleri Scoring Data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC, 2006; Craun et al., 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	**Yes** **1 Community outbreak**	**CDC, 2004;** **Marciano-Cabral et al., 2003**
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes** **Storage in Arizona.** **Sampled pre-treatment multiple-well study in Arizona.**	**Gerba, 2007**
Detected in source water in the U.S.?	Yes	Schuster and Visvesvara, 2004
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	**[All populations] Recovery from primary amoebic meningoencephalitis is rare.**	**Heymann, 2007**
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of	Acute fulminating disease. Only a few patients have survived.	Visvesvara, in Murray, 2007

Data Element	Scoring Data	Reference
illness necessitating long term hospitalization (> week)?		
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No.	
Does the illness require short term hospitalization (< week)?	All cases are hospitalized for diagnosis and treatment.	Visvesvara, in Murray 2007
Does the illness require physician intervention?	N/A	
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	N/A	
Does the illness result in mild symptoms with minimal or no impact on daily activities?	N/A	

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

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CDC, 2004. Surveillance for Waterborne-Disease Outbreaks Associated with Drinking Water --- United States, 2001—2002. *MMWR Surveillance Summaries*, 53(SS08); 23-45.

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Plesiomonas shigelloides Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC, 2006
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	**Yes** **1 Noncommunity outbreak**	**Craun, G., et al., 2003**
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**CDC,1998**
Detected in source water in the U.S.?	Yes	
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No	

Data Element	Scoring Data	Reference
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
Does the illness require short term hospitalization (< week)?	Hospitalization may be required for severe infections and/or underlying diseases.	Abbott, 2003
Does the illness require physician intervention?	**[C, E] Physician office visit may be required for diagnosis and treatment of dysenteric form of the disease in children or the elderly. Bacteremia more common with advanced age.**	**Abbott, in Murray 2007**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[G] Diarrhea may persist up to two weeks.**	**Abbott, in Murray 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?	*Plesiomonas* is associated with travelers' diarrhea or a history of seafood consumption, most infections are self-limiting.	Abbott, in Murray 2007

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Rotavirus Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC, 2006
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	**Yes** **1 Community**	**Craun et al., 2003**
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	**Yes**	**Abbaszadegan et al., 2003** **Gerba et al., 1996**
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No For children under 5 years of age: Estimated 37 deaths in 60,000 hospitalized cases per year in U.S. (1/1621 hospitalizations)	Fischer et al., 2007
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or	**[C] Rotavirus infects all children; causes severe gastroenteritis in infants. Significant numbers of**	

Data Element	Scoring Data	Reference
other severe manifestations of illness necessitating long term hospitalization (> week)?	**physician visits and hospitalizations and high medical and societal costs. A sporadic, seasonal, often severe gastroenteritis of infants and young children, characterized by vomiting, fever and watery diarrhea.** **Rotaviral enteritis is occasionally associated with severe dehydration and death in young children. In developing countries, an estimated 600,000-870,000 diarrheal deaths each year.**	**Farkas, in Murray 2007** **Heymann, 2005**
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
Does the illness require short term hospitalization (< week)?	No	
Does the illness require physician intervention?	No	
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	No	
Does the illness result in mild symptoms with minimal or no impact on daily activities?	**[G, E, P, CD]** **Self-limiting acute watery diarrhea, vomiting, fever.**	**Heymann, 2000**

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Gerba, C. P., J. B. Rose, C. N. Haas, and K. D. Crabtree. 1996. Waterborne rotavirus: a risk assessment. Wat. Res. 30:2929

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Salmonella enterica Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **11 Community outbreaks and 2 Non-community outbreaks** **1 Non-community outbreak**	**Craun, G., et al., 2003** **CDC, 2006**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes.**	**Angulo et al., 1997** **CDC, 1998.**
Detected in source water in the U.S.?	N/A	
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	Each year, 1.4 M cases of illness and 600 deaths are caused by non-typhoidal salmonellosis in the U.S. Estimated 800 cases per year of typhoid fever in the U.S., with fewer than 5 deaths/yr.; >70% of U.S. cases related to foreign travel.	Nataro, in Murray 2007

Data Element	Scoring Data	Reference
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Non-typhoidal salmonellosis usually causes intestinal infection; can cause extraintestinal infections in rare cases (bacteremia, UTI, osteomyelitis), especially in immunocompromised persons.	Nataro, in Murray 2007
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	None reported	
Does the illness require short term hospitalization (< week)?	**[C] Extra-intestinal infections highest in infants and young children.** **[E] Dehydration, especially among infants or in the elderly, may be severe. Deaths are uncommon, except in the young and old, the debilitated and immunosuppressed.**	**Nataro, in Murray 2007** **Heymann 2005, p 469.**
Does the illness require physician intervention?	**[G, P, CD] antibiotic and rehydration may be necessary.**	**Heymann, 2007**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Non-typhoidal Salmonella usually cause intestinal infection that often lasts 1 week or longer.	Nataro, in Murray 2007
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Shigella sonnei Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **14 Community outbreaks and 24 Noncommunity outbreaks**	**Craun, 2003**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Craun, 2003**
Detected in source water in the U.S.?	Yes	Black et al., 1978
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	In U.S. approximately 450,000 cases occur each year with 70 deaths.	Nataro, in Murray 2007
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long	**[C, E] *S. dysentariae* is associated with more serious symptoms than other species with complications such as toxic megacolon, hemolytic uremic syndrome and**	**Heymann, 2005**

Data Element	Scoring Data	Reference
term hospitalization (> week)?	**intestinal perforation. Cases may be severe in infants and the elderly and convulsions may occur in young children.**	
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	Reiter syndrome	Heymann, 2005
Does the illness require short term hospitalization (< week)?	Hospitalization is usually required for intravenous antibiotic therapy due to bacteremia, which is uncommon.	Heymann, 2005
Does the illness require physician intervention?	**[G] Most cases occur in children under 10 years, infants under 6 months rarely infected, increased severity in children and elderly, high secondary case rate in outbreaks, outbreaks occur in daycare centers, institutions, and refugee camps. 20% of U.S. cases result from international travel, specific antibiotic therapy available for prolonged or severe cases, multi-antibiotic resistance occurs.**	**Heymann, 2005**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	Acute diarrhea, fever, nausea, vomiting, cramps and tenesmus, stools contain blood and mucus (dysentery), usually self-limiting in 4-7 days without treatment.	Heymann, 2005
Does the illness result in mild symptoms with minimal or no impact on daily activities?	*S. sonnei* causes most of the shigellosis cases in the U.S., cases may be asymptomatic or mildly symptomatic, but they are frequently acute.	Heymann, 2005

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Toxoplasma gondii Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	No	CDC, 2004; CDC; 2006; Craun, 2003
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	No	
Has caused documented WBDOs at any time in the U.S.?	No	
Has caused WBDOs in countries other than the U.S.?	**Yes** **Canada** **Brazil**	**Bowie et al., 1997** **de Moura, 2006**
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	No	
Detected in source water in the U.S.?	No	
Not detected in the U.S.?	**Yes.** **Ground water in Poland.** **Canada.**	**Sroka, 2006** **Isaac-Renton, 1998**
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	**[P]Congenital infection of neonates severe.** **Infection during early pregnancy may lead to fetal infection with death of the fetus or other severe manifestations. Later in**	**Wilson, in Murray 2007.** **Heymann, 2005**

Data Element	Scoring Data	Reference
	pregnancy, maternal infection results in mild or subclinical fetal disease.	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	Immunocompromised hosts may experience CNS, pneumonitis, and myocarditis.	Wilson, in Murray 2007.
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?		
Does the illness require short term hospitalization (< week)?		
Does the illness require physician intervention?	Treatment is indicated only for pregnant women, infants and immunocompromised hosts.	Wilson, in Murray 2007
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[G all populations except PW] Infection is generally asymptomatic however 10 – 20% of patients with acute infection may develop cervical lymphadenopathy and/or flu-like symptoms.**	**Wilson, in Murray 2007**
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Vibrio cholerae Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **1 Community and 1 Non-community outbreak** **1 Community outbreak**	**Craun, 2003** **CDC, 2004**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes (outbreak data)**	
Detected in source water in the U.S.?	Yes	Rhodes et al., 1986 Kaper et al., 1982
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No. *V. cholerae* Non-O1: third most commonly isolated in U.S. - Septicemia case fatality rate from 47-65%.	Abbott, in Murray 2007
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of	*No. V. cholerae* O1: Extremely rare cases causes severe extraintestinal infection. If untreated, *V. cholerae* O1 infection causes	Abbott, in Murray 2007

Data Element	Scoring Data	Reference
illness necessitating long term hospitalization (> week)?	severe dehydration which leads to hypovolemic shock, acidosis, circulatory collapse, and death. Unlike O1 strains, non-O1 isolates are commonly associated with extrainstestinal infections such a septicemia.	
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No	
Does the illness require short term hospitalization (< week)?	No. In severe dehydrated cases (cholera gravis), death may occur within a few hours, and the case-fatality rate may exceed 50%. With proper and timely rehydration, this can be less than 1%.	Heymann, 2007
Does the illness require physician intervention?	**[All populations] In most cases infection is asymptomatic or causes mild diarrhea. Treatment consists of fluid replacement by oral rehydration therapy and/or intravenous fluids.**	**Heymann, 2007** **Abbott, in Murray 2007**
Is the illness self-limiting within 72 hours (without requiring medical intervention)?		
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

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Yersinia enterocolitica Scoring Data

Bolded Text indicates scored data

Data Element	Scoring Data	Reference
Waterborne Disease Outbreaks		
Has caused multiple (2 or more) documented WBDOs in the U.S. since CDC surveillance initiated in 1973?	**Yes** **1 Noncommunity outbreak** **1 Noncommunity outbreak**	**Craun, 2003** **CDC, 2004**
Has caused at least one documented WBDO in the U.S. since CDC surveillance initiated in 1973?	N/A	
Has caused documented WBDOs at any time in the U.S.?	N/A	
Has caused WBDOs in countries other than the U.S.?	N/A	
Has never caused WBDOs in any country, but has been epidemiologically associated with water related disease?	N/A	
Occurrence		
Detected in drinking water in the U.S.?	**Yes**	**Highsmith, et al., 1977** **Eden, et al., 1977**
Detected in source water in the U.S.?	Yes	Meadows and Snudden, 1982
Not detected in the U.S.?	N/A	
Health Effects		
Does the organism cause significant mortality (> 1/1,000 cases)?	No	
Does the organism cause pneumonia, meningitis, hepatitis, encephalitis, endocarditis, cancer, or other severe manifestations of illness necessitating long term hospitalization (> week)?	No. An uncommon complication of gastroenteritis is septicemia for which the elderly and immunocompromised are at higher risk, particularly those with metabolic diseases	Wanger, in Murray 2007.

Data Element	Scoring Data	Reference
	associated with iron overload (hemochromatosis), cancer, liver disease and steroid therapy.	
Does the illness result in long term or permanent dysfunction or disability, i.e. sequelae?	No. Uncommon sequelae include: reactive arthritis, inflammatory bowel disease, autoimmune thyroid disorders.	Wanger, in Murray 2007
Does the illness require short term hospitalization (< week)?	No	
Does the illness require physician intervention?	No. The elderly are at greater risk for septicemia.	Wanger, in Murray 2007
Is the illness self-limiting within 72 hours (without requiring medical intervention)?	**[G, C other populations not mentioned] Young children most commonly develop gastroenteritis and present with fever, diarrhea, and abdominal pain. Symptoms typically resolve within 7 days.** **Infection typically manifested by acute febrile diarrhea with abdominal pain (especially in young children). Diarrhea may be absent in up to a third of Y. enterocolitica infections.**	**Wanger, in Murray 2007** **Heymann, 2005**
Does the illness result in mild symptoms with minimal or no impact on daily activities?		

Populations: G – General, C- Child, E-Elderly, P- Pregnant Women, CD-Chronic Disease

References

CDC, 2004. Surveillance for Waterborne-Disease Outbreaks Associated with Drinking Water --- United States, 2001—2002. *MMWR Surveillance Summaries*, 53(SS08); 23-45.

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