

# Legionella Resources on the World Wide Web

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Internet resources that focus on *Legionella* and legionnaires disease are presented. Web sites were selected on the basis of their content and adherence to suggested standards of medical Internet publishing. Free, accessible, English-language Web sites were categorized according to users' needs as follows: (1) those with comprehensive information on *Legionella* infection (including pathophysiologic characteristics, symptoms, and treatment of legionnaires disease), (2) those with information on outbreaks and epidemiology (including information for travelers), (3) those with information for researchers, (4) those about prevention, and (5) those with information for laypersons.

A World Wide Web search with the term "*Legionella*" on a search engine retrieves >60,000 Web sites. Here, we aim to present only a selection of dependable *Legionella*-related Web sites that we considered to be useful for answering most of the questions about *Legionella* and legionnaires disease that interest infectious diseases physicians. In addition, these Web sites can be used as starting points for further Internet searches for information on *Legionella*-related topics. This review focuses on Web sites in English that are available for free.

## METHODS

Web sites were identified by means of search engines (Google, Yahoo, and Alta Vista) with the terms "*Legionella*," "legionellosis," and "legionnaires disease"; by links from known sites; and by information from colleagues. The Web sites were then selected on the basis of their content and adherence to suggested standards of medical Internet publishing, which require, in particular, information on the authors, references for the content provided, disclosure of sponsorship, and dating of posted material [1–3]. In the present article, we did not include the Web sites of scientific journals, because a discussion of literature-search methods would go beyond the scope of this review. We also did not include commercial Web sites, because an objective,

unbiased evaluation of all services offered on these sites was deemed to be infeasible.

The addresses of all Web sites have been double-checked, but changes may have occurred. The main home page of the site may provide the link to the desired site.

## RESULTS

**Comprehensive Web sites.** Table 1 lists Web sites that contain information on all aspects of *Legionella* infection (including epidemiology, pathophysiologic characteristics, symptoms, and treatment and prevention of legionellosis), and they are also good starting points for further Internet searches. The most complete *Legionella*-related Web site is a site by a group of *Legionella* experts from the University of Pittsburgh (<http://www.legionella.org>), which offers general information for laypersons, links to publications and guidelines on legionellosis prevention, and an extensive list of articles written by members of the Pittsburgh group covering such topics as clinical manifestations of legionnaires disease, disinfection of water distribution systems, laboratory diagnosis, therapy, epidemiology, mode of transmission of legionnaires disease, and environmental sources of *Legionella* species. Many of these articles can be downloaded directly from this site. Through this site, it is also possible to contact the Special Pathogens Laboratory of the VA Medical Center in Pittsburgh and to submit general questions or inquiries about patients to the expert group.

The site of the Centers for Disease Control and Prevention (CDC) on legionellosis gives a general overview for laypersons and a brief summary of the most important points relevant to health care providers. In addition, links are provided to articles

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**Table 1. Web sites with comprehensive information on all aspects of *Legionella* infection, including pathophysiologic characteristics, symptoms, and treatment.**

Title	Address	Publisher	Comments and content
www.legionella.org	<a href="http://www.legionella.org">http://www.legionella.org</a>	<i>Legionella</i> experts of the University of Pittsburgh	Probably the most comprehensive Web site on <i>Legionella</i>
Legionellosis: Legionnaire's Disease and Pontiac Fever	<a href="http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm">http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm</a>	Division of Bacterial and Mycotic Diseases, CDC	Links to MMWR articles on legionellosis and to prevention guidelines
OSHA Technical Manual, Legionnaires' Disease	<a href="http://www.osha-slc.gov/dts/osta/otm/otm_iii/otm_iii_7.html">http://www.osha-slc.gov/dts/osta/otm/otm_iii/otm_iii_7.html</a>	Occupational Safety and Health Administration	Includes information about symptoms, diagnosis, risk factors, prevention, and investigation of an outbreak at the workplace
Legionnaires' Disease	<a href="http://www.q-net.net.au/~legion/">http://www.q-net.net.au/~legion/</a>	Denis Green (Maddington, Australia)	Web site by a layperson with much information and many links
Johns Hopkins Antibiotic Guide	<a href="http://hopkins-abxguide.org/main.cfm">http://hopkins-abxguide.org/main.cfm</a>	Johns Hopkins Division of Infectious Diseases	Updated recommendations on antibiotic treatment, with comments

**NOTE.** CDC, Centers for Disease Control and Prevention; MMWR, *Morbidity and Mortality Weekly Report*.

in the *Morbidity and Mortality Weekly Report* about legionellosis and to recommendations for the prevention of nosocomial legionnaires disease (including specific recommendations for prevention in transplantation units). The site also includes the legionellosis case report form for the use by the state health and territorial health department to report to the CDC.

The aim of the technical manual issued by the Occupational Safety and Health Administration (OSHA) is to assist industrial hygienists in the assessment of work sites for possible legionnaires disease. The manual provides information on disease recognition (symptoms, risk factors, diagnosis, and transmission), source identification, investigation protocols, and control strategies. It also presents detailed protocols for legionnaires disease case identification, physical survey of water services, water sampling, and water treatment after an outbreak, and for creating an employee awareness program.

The most colorful Web site on *Legionella* is that maintained by Denis Green, an Australian layperson, whose Web site offers a variety of information about legionellosis and links to Web sites maintained by several institutions and organizations dealing with *Legionella*. Time is required to perform an overview of the site and navigation is difficult. The information includes, among other things, a history of the hotel in Philadelphia where the first described outbreak of legionellosis occurred, a detailed list and description of outbreaks of legionellosis in the world, and a list of official prevention guidelines from Australia, the United States, and countries in Europe and Asia.

Finally, updated recommendations (with comments) for the antibiotic treatment of legionnaires disease can be obtained online from the Antibiotic Guide of the Johns Hopkins University Division of Infectious Diseases.

**Web sites with epidemiologic data.** Two kinds of epidemiologic data may be of interest to the infectious diseases physician: (1) general epidemiologic data on incidence and prevalence of legionellosis, and (2) information on outbreaks of legionnaires disease worldwide (in particular, information regarding the evaluation of patients returning from a region where an outbreak is suspected and information for counseling travelers). These data are available from the Web sites listed in table 2.

Information on the worldwide epidemiologic situation can be obtained from the electronic edition of the *Weekly Epidemiological Record* published by the World Health Organization (WHO) or from the Disease Outbreak News Web site, where the most recent information is provided. It is easier to search the Disease Outbreak News Web site because the news reports are also indexed by disease. Outbreaks occurring worldwide are also reported on the Travelers' Health section of the CDC Web site and on the site of the Program for Monitoring Emerging Diseases (ProMED-mail). ProMED-mail is an electronic outbreak-reporting system of the International Society for Infec-

tious Diseases. This site is attractive because of the rapidity of its dissemination of information and because it is easy to search the ProMED-mail archives for reports. However, the sources of information are not only official reports; the sources also include media reports and reports by local observers and ProMED-mail subscribers.

Because outbreaks of legionnaires disease have also been associated with cruise ships [4], travelers may be interested in the level of sanitation of a certain ship. Every vessel that has a foreign itinerary (and carries  $\geq 13$  passengers) is subject to semiannual inspections by the CDC's Vessel Sanitation Program; these inspections include a check of the water supply systems and of the maintenance of swimming pools and spas. The scores and inspection reports for each ship are available on the Vessel Sanitation Program's Web site. A surveillance scheme for travel-associated legionnaires disease with 45 participating centers in 33 European countries is run by the European Working Group for *Legionella* Infections, which posts the results on its Web site, where links to European epidemiologic data published by the WHO are also available.

**Web sites with information for researchers.** Table 3 lists Web sites that may be of particular interest to researchers active in the field of *Legionella* infection. A summary of results of research on *Legionella* control (e.g., efficacy of different biocides against biofilm *Legionella* and disinfection methods for *Legionella* in potable water systems) is presented by the Pittsburgh group at <http://www.legionella.org>. The progress in the sequencing of the *Legionella* genome can be followed at the Web site of the Columbia Genome Center. Other useful resources are a downloadable database of  $\sim 5300$  *Legionella* references (in Reference Manager, version 9) and a list of addresses of scientists doing work involving *Legionella* species (most of the entries include an indication of the specific field of research or interest). Both are available on Dr. Paul Edelstein's Web site (University of Pennsylvania).

**Web sites with information and guidelines on prevention.** Several institutions and organizations issued recommendations or guidelines for the prevention of legionellosis (table 4). According to their specific target, 3 main groups of recommendations can be identified. The first group concerns the prevention of legionnaires disease at the workplace, such as the recommendations published in the United States by OSHA and in Australia by WorkSafe Western Australia. The second group includes recommendations for the prevention of nosocomial legionellosis. A detailed discussion of epidemiology, modes of transmission, diagnosis, and measures for the prevention and control of legionellosis in hospitals is available on the CDC's Division of Healthcare Quality Promotion Web site and in the report of the Maryland Scientific Group to study *Legionella* in water systems in health care institutions. The third group of recommendations involves the control of *Legionella* species in

**Table 2. Web sites with information on outbreaks and epidemiology of *Legionella*.**

Title	Address	Publisher	Comments and content
Disease Outbreak News Communicable Disease Surveillance and Response	<a href="http://www.who.int/disease-outbreak-news/">http://www.who.int/disease-outbreak-news/</a>	World Health Organization	Most recent official outbreak information
<i>Weekly Epidemiological Record</i>	<a href="http://www.who.int/wer/">http://www.who.int/wer/</a>	World Health Organization	Global information on epidemiology and outbreaks
Travelers' Health—Outbreaks	<a href="http://www.cdc.gov/travel/outbreaks.htm">http://www.cdc.gov/travel/outbreaks.htm</a>	CDC, National Center for Infectious Diseases	
ProMED-mail	<a href="http://www.promedmail.org">http://www.promedmail.org</a>	Program of the International Society for Infectious Diseases	Immediate outbreak information (sources may be unofficial)
<i>Morbidity and Mortality Weekly Report</i>	<a href="http://www.cdc.gov/mmwr/">http://www.cdc.gov/mmwr/</a>	CDC	Information about outbreaks and epidemiology of legionellosis in the United States (data available under "Disease trends: morbidity and mortality tables; summary of notifiable diseases")
<i>Canada Communicable Disease Report</i>	<a href="http://www.hc-sc.gc.ca/hpb/cdc/publicat/ccdr/">http://www.hc-sc.gc.ca/hpb/cdc/publicat/ccdr/</a>	Health Canada, Population and Public Health Branch	Information about outbreaks and epidemiology of legionellosis in Canada (data available under "Notifiable Diseases")
Communicable Diseases—Australia	<a href="http://www.health.gov.au/pubhth/cdi/cdihtml.htm">http://www.health.gov.au/pubhth/cdi/cdihtml.htm</a>	Australian Department of Health and Ageing	Information about outbreaks and epidemiology of legionellosis in Australia
EuroSurveillance	<a href="http://www.eurosurveillance.org">http://www.eurosurveillance.org</a>	Scientific team funded by the European Commission	Information about outbreaks and epidemiology of legionellosis in the states of the European Union and Norway
<i>Communicable Disease Report</i>	<a href="http://www.phls.co.uk/publications/cdr/w.htm">http://www.phls.co.uk/publications/cdr/w.htm</a>	Public Health Laboratory Service	Information about outbreaks in the United Kingdom
Legionnaires' Disease Disease Facts	<a href="http://www.phls.org.uk/facts/Legionella/legi.htm">http://www.phls.org.uk/facts/Legionella/legi.htm</a>	Public Health Laboratory Service	Information about epidemiology of legionellosis in England and Wales
EWGLI	<a href="http://www.ewgli.org">http://www.ewgli.org</a>	European Working Group for Legionella Infections	Travel-associated legionnaires disease in Europe; links to <i>Weekly Epidemiological Record</i> of the World Health Organization with data on legionnaires disease in Europe
Vessel Sanitation Program	<a href="http://www.cdc.gov/nceh/vsp">http://www.cdc.gov/nceh/vsp</a>	CDC, National Center for Environmental Health	Sanitation inspection scores of international cruise ships ("Green Sheet")

**NOTE.** CDC, Centers for Disease Control and Prevention; ProMED, Program for Monitoring Emerging Diseases.

**Table 3. Web sites with information for researchers about *Legionella*.**

Title or description	Address	Publisher	Comments and content
www.legionella.org	<a href="http://www.legionella.org">http://www.legionella.org</a>	<i>Legionella</i> experts of the University of Pittsburgh	Extensive list of publications by members of the Pittsburgh group
<i>Legionella</i> Genome Project	<a href="http://genome3.cpmc.columbia.edu/~legion/">http://genome3.cpmc.columbia.edu/~legion/</a>	Columbia Genome Center	
Legionnaires' Disease Database	<a href="http://www.uphs.upenn.edu/bugdrug/legionella/drefman.html">http://www.uphs.upenn.edu/bugdrug/legionella/drefman.html</a>	P. H. Edelstein (University of Pennsylvania)	~5300 references to legionnaires disease
Contact information for people interested in legionnaires disease	<a href="http://mail.med.upenn.edu/~phe/legionella_ad.html">http://mail.med.upenn.edu/~phe/legionella_ad.html</a>	P. H. Edelstein (University of Pennsylvania)	Addresses of ~55 scientists working on <i>Legionella</i> , mostly in Europe and the United States, but also in Japan and Australia; several scientists work in national <i>Legionella</i> reference centers, and several entries include an indication of the specific field of research or interest

**Table 4. Web sites with information and guidelines on prevention of *Legionella*.**

Title	Address	Publisher	Comments and content
OSHA Technical Manual, Legionnaires' Disease	<a href="http://www.osha-slc.gov/dts/osta/otm/otm_iii/otm_iii_7.html">http://www.osha-slc.gov/dts/osta/otm/otm_iii/otm_iii_7.html</a>	Occupational Safety and Health Administration	Investigation of an outbreak at the workplace, control of water sources, prevention of <i>Legionella</i> amplification in water systems (including domestic systems), water sampling procedures, and water treatment protocols
OSHA, Legionnaires' Disease	<a href="http://www.osha-slc.gov/SLIC/legionnairesdisease/index.html">http://www.osha-slc.gov/SLIC/legionnairesdisease/index.html</a>	Occupational Safety and Health Administration	Informations and links regarding to exposure to <i>Legionella</i> and prevention of legionnaires disease in the workplace (including hospitals)
Safetyline online, Code of Practice, Prevention and Control of Legionnaires' Disease	<a href="http://www.safetyline.wa.gov.au/pagebin/pg007754.htm">http://www.safetyline.wa.gov.au/pagebin/pg007754.htm</a>	WorkSafe Western Australia, State of Western Australia	Principles of design, installation, operation and maintenance of cooling towers, air-handling systems, and water services
Issues in Healthcare Settings: Legionnaires' Disease	<a href="http://www.cdc.gov/ncidod/hip/pneumonia/1_legion.htm">http://www.cdc.gov/ncidod/hip/pneumonia/1_legion.htm</a>	CDC, Division of Healthcare Quality Promotion	Diagnosis, epidemiology, and prevention of nosocomial legionellosis
Report of the Maryland Scientific Group to Study <i>Legionella</i> in Water Systems in Healthcare Institutions	<a href="http://www.dhmh.state.md.us/html/legionella.htm">http://www.dhmh.state.md.us/html/legionella.htm</a>	State of Maryland, Department of Health and Mental Hygiene	Diagnosis, epidemiology, and prevention of nosocomial legionellosis
Legionellosis: Legionnaire's Disease and Pontiac Fever	<a href="http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm">http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm</a>	CDC, Division of Bacterial and Mycotic Diseases	Links to guidelines for prevention of nosocomial legionellosis (including prevention in transplantation units)
ASHRAE	<a href="http://www.ashrae.org">http://www.ashrae.org</a>	American Society of Heating, Refrigerating and Air-Conditioning Engineers	General recommendations to control <i>Legionella</i> in heating, ventilating, air-conditioning, and refrigerating systems
AIRAH	<a href="http://www.airah.org.au/">http://www.airah.org.au/</a>	Australian Institute of Refrigeration, Air-Conditioning and Heating	Recommendations to control <i>Legionella</i> in cooling towers
EWGLI	<a href="http://www.ewgli.org">http://www.ewgli.org</a>	European Working Group for <i>Legionella</i> Infections	Guidelines for hoteliers

**NOTE.** CDC, Centers for Disease Control and Prevention.

**Table 5. Web sites with information about *Legionella* for laypersons.**

Title	Address	Publisher	Comments
Legionellosis: Legionnaire's Disease and Pontiac Fever www.legionella.org	<a href="http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm">http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm</a>	CDC, Division of Bacterial and Mycotic Diseases	
OSH Answers	<a href="http://www.legionella.org">http://www.legionella.org</a> <a href="http://www.ccohs.ca/oshanswers/diseases/legion.html">http://www.ccohs.ca/oshanswers/diseases/legion.html</a>	<i>Legionella</i> experts of the University of Pittsburgh Canadian Centre for Occupational Health and Safety	Includes a description of cooling towers and evaporative condensers
<i>Legionella</i> (legionellosis)	<a href="http://www.dhs.vic.gov.au/phd/hprot/inf_dis/legion/contents.htm">http://www.dhs.vic.gov.au/phd/hprot/inf_dis/legion/contents.htm</a>	Public Health Division, Government of Victoria, Australia	Links to the Australian <i>Legionella</i> Risk Management Project and to Australian legislation regarding legionnaires Disease; recommendations for prevention of transmission from potting soil mixture
Legionnaires' Disease Health Alert Information	<a href="http://www.dhs.vic.gov.au/phd/9903031/index.htm">http://www.dhs.vic.gov.au/phd/9903031/index.htm</a>	Public Health Division, Government of Victoria, Australia	One-page information sheet for use in the event of an outbreak (available in English, Arabic, Chinese, Greek, Italian, and Vietnamese)
Legionellosis	<a href="http://www.tdh.state.tx.us/ideas/factsht/legion.htm">http://www.tdh.state.tx.us/ideas/factsht/legion.htm</a>	Texas Department of Health	Fact sheet

**NOTE.** CDC, Centers for Disease Control and Prevention.

heating, ventilating, air-conditioning, and refrigerating systems in general; these recommendations are published by professional organizations of engineers who plan and maintain these systems. Finally, the European Working Group for *Legionella* Infections provides on its Web site (in the "Advice" section) short guidelines for hoteliers issued by the Public Health Laboratory in England and Wales to reduce the risk of *Legionella* transmission in hotels.

**Web sites with information for laypersons.** Complete and comprehensive information on legionellosis for laypersons is available on the Web sites listed in table 5. The site of the Canadian Centre for Occupational Health and Safety includes a schematic description of how cooling towers and evaporative condensers work. Recommendations for the prevention of transmission of *Legionella* species from potting soil are listed on the Australian site of the Public Health Division of the Government of Victoria. These recommendations are specifically relevant to Australia, because *Legionella longbeachae* appears to be a common cause of *Legionella* pneumonia in Australia, and infections with this *Legionella* species have been associated with gardening and the use of potting soil. However, infections with *L. longbeachae* transmitted from potting soil were also reported in Japan and the United States (3 cases; 1 each in California, Oregon, and Washington), whereas 19 (100%) of 19 potting-soil samples from Europe (from Greece, Switzerland, and the United Kingdom) tested negative for *L. longbeachae* [5, 6].

The Public Health Division of the Government of Victoria also provides a 1-page information sheet for the population in the event of an outbreak of Legionnaire's disease. The sheet can be downloaded in a variety of languages (English, Arabic, Chinese, Greek, Italian, and Vietnamese).

## CONCLUSION

A vast amount of information on *Legionella* and legionellosis is available on the World Wide Web. Besides information obtained online from the published literature via well-developed literature search services, such as PubMed or the Cochrane Library, useful information is provided by many Web sites maintained by different private and state institutions, universities, professional organizations, and individuals. We have presented a selection of Web sites that adhere to recommended standards of Internet publishing, which we classified according to the users' needs. This selection is certainly subjective and incomplete. However, the listed Web sites may be helpful in answering the most relevant questions on legionellosis and are good starting points for further Internet searches.

## References

1. Silberg WM, Lundberg GD, Musacchio RA. Assessing, controlling, and assuring the quality of medical information on the Internet: caveat lector et viewer—let the reader and viewer beware. *JAMA* **1997**;277:1244–5.
2. Jadad AR, Gagliardi A. Rating health information on the Internet: navigating to knowledge or to Babel? *JAMA* **1998**;279:611–4.
3. Health on the Net Foundation (HON). HON code of conduct (HON-code) for medical and health websites. Available at <http://www.hon.ch/HONcode/Conduct.html>; accessed 20 January 2002.
4. Centers for Disease Control and Prevention. Update: outbreak of Legionnaires' disease associated with a cruise ship, 1994. *MMWR Morb Mortal Wkly Rep* **1994**;43:574–5.
5. Centers for Disease Control and Prevention. Legionnaires' disease associated with potting soil—California, Oregon and Washington, May–June 2000. *MMWR Morb Mortal Wkly Rep* **2000**;49:777–8.
6. Steele TW, Moore CV, Sangster N. Distribution of *Legionella longbeachae* serogroup 1 and other legionellae in potting soils in Australia. *Appl Environ Microbiol* **1990**;56:2984–8.