Environmental Health Sciences Core Course: Waterborne Disease

Dr. Sylvie Le Blancq

LECTURE ABSTRACT

Waterborne Disease Lecture

Approximately 33% of deaths across the world are caused by infectious and parasitic diseases; most of them occur in developing countries. These diseases account for approximately 43% and 1% of deaths per year in developing and developed countries, respectively, and they contribute to high child mortality and reduced life expectancy. In order to develop ways to reduce the levels of disease it is necessary to examine their natural history and understand how they are affected by different geographic and economic contexts. The modes of transmission of infectious diseases can be divided into – food-, water- and soil-borne (22% of infectious disease deaths; ~3.7 million); insect-borne (13% of deaths; ~ 2.3 million); animal-borne (0.3% of deaths ~ 0.06 million); person-to-person (65% of deaths; ~11.2 million). Diarrhea is a leading cause of morbidity (~4 $x10^9$ episodes/year) and a significant source of mortality ($3x10^6$ /year). It is most common in young children in under-privileged communities living in conditions of poor environmental hygiene in the tropics and subtropics. Diarrheal diseases are associated with unsafe and inadequate water supplies, poor-sanitation (excreta disposal); poor food-handling and poor hygiene. Case studies of three organisms – *Escherichia coli*, *Vibrio cholerae* and *Cryptosporidium parvum*, that cause diarrhea, illustrate aspects of the natural history of waterborne diseases. *E. coli*, a commensal bacteria that is part of the normal microflora of mammalian gut, is pathogenic when it contains additional genetic information. The bacteria *Vibrio cholerae* causes cholera, a notorious waterborne epidemic disease. After an absence of a hundred years cholera appeared in coastal Peru in 1991 and spread across Latin America. *Cryptosporidium parvum*, a protozoan pathogen, causes cryptosporidiosis, a form of gastroenteritis. It is an opportunistic infection in immunosuppressed populations. Many features of the biology of *C. parvum* favor its transmissibility, and present major challenges for the prevention and control of cryptosporidiosis.

Questions:

1. Why does *Cryptosporidium parvum* pose such intractable public health problems worldwide?

2. Is drinking water in the US safe enough? Discuss with particular reference to cryptosporidiosis and cholera.

Readings:

Aragon, T.J. *et al.* 2003. Endemic cryptosporidiosis and exposure to municipal tap water in persons with acquired immunodeficiency syndrome (AIDS): A case-control study. BMC Public Health, 3:2

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Lee, S.H. *et al*. Surveillance for Waterborne-Disease outbreaks – United States, 199-2000. In *Surveillance Summaries*, November 22, 2002. Morbidity and Mortality Weekly Report 2002:51 (No. SS-8)

Mahon BE, *et al*. 1996. Reported cholera in the United States, 1992-1994: a reflection of global changes in cholera epidemiology. JAMA. Jul 24-31;276(4):307-12.

Meinhardt, P.L., *et al*.,. 1996. Epidemiologic aspects of human cryptosporidiosis and the role of waterborne transmission. Epidemiologic Reviews. 18: 118-136

Perz, J.F. *et al*. 1998. *Cryptosporidium* in tap water: comparison of predicted risks to observed levels of disease. American Journal of Epidemiology, 147: 289-301.

Steinberg EB, *et al.* 2001 Cholera in the United States, 1995-2000: trends at the end of the twentieth century. J Infect Dis. Sep 15;184(6):799-802.