Survival of *Helicobacter pylori* in Drinking Water and Its Prevalence in Community

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This review attempts to describe current knowledge about survival of *Helicobacter pylori* in drinking water and the relative safety of drinking water in both developed and developing countries. Continued development of molecular techniques has resulted in an increasing ability to detect pathogen drinking water, and it is likely that many new pathogens will be identified in the future.

Water pollution is considered a major cause of deaths in developing countries. Diseases linked to water cause an estimated 12 million deaths a year. According to WHO recommendations, water must be treated in order to make it free from disease producing organisms and toxic chemicals before human consumption. In Pakistan such treatment is seldom done and no such international standards are followed for microbiological and chemical limits of drinking water. A study by the National Health Laboratories in Rawalpindi/Islamabad showed that 81% untreated water and 38% of treated water samples contain coliforms. In rural areas, where about 70% population lives, no proper water supply schemes are being followed. It is believed and reported that 62% of Pakistani population has access to clean drinking water and an estimated 60% deaths are associated with the use of contaminated water.

By drinking water treatment methods similar to other bacteria a proportion of the *H. pylori* present in the water source will be removed. *H. pylori* has a higher tolerance than *Escherichia coli* to common disinfectants used in distribution systems. Owing to the slow growth of the organism and difficulties in isolating the organism, to date, no single method exists for monitoring the organism in water and this is one of the primary problems in understanding the exposing pathways and potential for waterborne disease.

*H. pylori* colonize in gastric mucosa of approximately half the world population. In developed countries, less than 50% of the population is typically infected, with higher prevalence in developing countries (90%). Human infection with *H. pylori* has been linked to gastritis, duodenal ulcers and an increased risk of gastric adenocarcinoma. These health effects reflect the ability of *H. pylori* to colonize the human stomach and establish chronic infection associated with an inflammatory response. Infections with *H. pylori* are generally acquired during childhood, with a lower frequency of infection in adults. In children, *H. pylori* can cause antral gastritis and duodenal ulcer disease, although most infections in children are asymptomatic.

Prevalence of *Helicobacter pylori*

*H. pylori* appears hygiene-related and poor sanitation is thought to be an important risk factor for *H. pylori*. Fecal-oral agents have also been suggested responsible for *H. pylori* transmission. On the basis of seroprevalence it is found that the consumption of uncooked vegetables, potentially contaminated via irrigation with untreated sewage, is a risk for *H. pylori* infection. In Mexico, prevalence of *H. pylori* infection was measured by the presence of IgG antibodies against whole cell extracts. According to the results, 20% of children are seropositive for *H. pylori* by the age of 1 year and 50% are infected by the age of 10 years. More than 80% of adults are seropositive by the age of 25 years.
Significant correlation has been found between the prevalence of *H. pylori* in well water detected by polymerase chain reaction (PCR) and colonization of population using the water. *H. pylori* has been detected in well water, municipal water and treated waste water in Sweden. The detection of DNA in samples from drinking water storage pot in rural Gambia and from cast iron water pipe sections in Scotland also suggest presence of *H. pylori* DNA in biofilms within water distribution systems. The epidemiological studies support the evidence that water is a vehicle for transmission of *H. pylori*.

### Variable Forms of *H. pylori* and Its Survival in Water

Bacterium undergoes morphological transformation from the bacillary to the coccal form and rapidly loses its culturability during water storage. Two morphologically distinct forms of *H. pylori*, a spiral shape and a coccoid forms have been identified. The spiral shape is cultured routinely from clinical samples. To date the coccoid form has been found to be non-culturable. Transformation from the spiral-shaped bacterium grown in culture to the non-culturable coccoid form is thought to result from variations in the environment, such as oxygen stress, temperature changes, the presence of antibiotics and other stress-inducing conditions. The bacterium has been isolated directly from environmental water in only one study. Under laboratory conditions, *H. pylori* has been shown to survive for days, up to weeks, in sterile river water, saline solution and distilled water at a variety of pH levels and in temperatures ranging from 4°C to 15°C. Despite the requirement for a microaerobic atmosphere, *Helicobacters* can possibly survive for short periods in water as they may be in a viable but nonculturable coccoid form which would follow its passage through the water distribution system and enable them to remain undetectable by current culture techniques.

### Detection of *H. pylori* from Water Source

Only molecular and non cultural analysis detects or quantifies the bacteria in water. The limitation of the *Helicobacter* assays is that, although they have been validated on pure cultures and gastric biopsies, they have not been performed before on environmental samples. Because of the clinical importance of *H. pylori* infection and the need for increasingly sensitive techniques for its detection in clinical, biological and environmental samples, diagnostic procedures based on nucleic acid technology have been developed. Molecular techniques such PCR have demonstrated the presence of *H. pylori* in drinking distribution systems especially in systems with biofilms. However, DNA solutions alone does not indicate whether the bacterium is viable or not. In recent years Fluorescence In Situ Hybridization (FISH) has successfully helped detection of this pathogen in drinking water distribution system and other bodies of water and has provided some indication of viability due to the maintenance of high rRNA content.

### Conclusion

Overall, the predominant transmission route for *H. pylori* seems to be situation dependent, with person-to-person transmission playing a key role in many circumstances. Water and food appear to be of lesser direct importance but they can still play a significant role in situations with improper sanitation and lax hygiene. *H. pylori* should be considered as a waterborne pathogen throughout its viable period, independent of its shape and culturability. Its worldwide distribution, high level of prevalence and the importance of associated pathologies make the elimination of *H. pylori* a very useful approach to treating and controlling these gastroduodenal disease vector, since its eradication results in a marked reduction in the rate of recurrence of duodenal and gastric ulcer. To accurately assess risks from waterborne diseases, it is necessary to understand pathogen distribution and survival strategies within water distribution systems and to apply methodologies that can detect not only the presence but also the viability and infectivity of the pathogen. Problems in developing countries can often be linked to either limited or a complete absence of wastewater treatment.
REFERENCES


