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Full length Research paper

Communal health consequence of viral pollution of Water-borne

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Water-borne enteric infections represent a risk to both human and creature life causing an extensive variety of sicknesses. Groundwater is the commonest transmission course for these infections. Around half of groundwater related infection flare-ups are inferable from infections. Late investigations in created nations have concentrated on open water frameworks, shockingly, absent much thoughtfulness regarding private family unit wells and storerooms. This paper surveys ailment flare-ups ascribed to water-borne infections, the general wellbeing importance of enteric viral ailments and issues experienced in the improvement of analytic examines. The goal of this audit is to present the justification for more research to give solid benchmark data on the importance of water-borne infections in the creating scene. Since the virological nature of drinking water can never again be endangered, fast and touchy strategies for identifying enteric infections in drinking water, recreational water and their sources is a need. As a preventive measure, ground, surface and treated drinking water must be shielded from viral defilement. Requirement of administrative measures for standard viral observing of savoring water the business will guarantee wellbeing of customers.

Key words: Viruses, viral diseases, communal health, diarrhea, drinking water.

INTRODUCTION

A wide assortment of enteric infections have been embro -iled in the etiology of looseness of the bowels. Water bor -ne infections are in charge of a few episodes of gastroenteritis, respiratory sicknesses, neurological ailments and loss of motion among others (Bosch, 1998; Griffin et al., 2003; Sack et al., 1997). The nearness of enteric infections in the water condition in this manner has turned into a general wellbeing risk all things considered new and progressed atomic tests are being created to distinguish enteric infections in the water condition in the created world. In any case, it is hard to build up an important hazard evaluation for a particular enteric infection since larger part of these infections don't develop well in cell culture (Griffin et al., 2003; Macler, 1993). Be that as it may, the United States Environmental Protection Agency (U.S EPA) has proposed the utilization of an applied engineered infection as a methods for deciding satisfactory levels for human enteric infections in water. (Installment et al., 1997). This in any case, it is neces-sary to set preventive measures against viral contamination of treated water and their sources.

Diarrhoeal illness is a noteworthy reason for baby grimness and mortality. Out of 1.8 million individuals who bite the dust each year from diarrhoeal sicknesses, 90% are kids under five years old generally in creating nations (WHO, 2004). Looseness of the bowels additionally speaks to a monetary weight in creating nations. The causative operators of looseness of the bowels incorporate an extensive variety of microbes and infections. The principle goal of this survey is to give the method of reasoning to more research to give solid standard data on the general wellbeing centrality of water-borne infections in the creating scene. Since the virological nature of drinking water can never again be dismissed, fast and delicate techniques for recognizing enteric infections in drinking water, recreational water and their sources is a need. As a preventive measure, ground and surface water and additionally treated drinking water must be shielded from viral tainting. Authoritative measures for standard viral checking as a feature of microbial hazard evaluation of savoring water the business ought to likewise be upheld by national quality observing bodies.

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BURDEN OF DIARRHOEA

Loose bowels is a noteworthy reason for youth horribleness and mortality in creating nations. Around a billion diarrhoeal cases happen every year among kids beneath five years, bringing about roughly 2.5 million passings (Kosek et al., 2003; O'Ryan et al., 2005). Diarrhoeal ailments are as of now in charge of around 90% of all passings of kids under five years in creating coun-attempts (WHO/UNICEF, 2008). In the vicinity of 2000 and 2003, 769,000 and 683,000 youngsters under five years old kicked the bucket in sub-Saharan Africa and South Asia separately every year from diarrhoeal illnesses (WHO/UNICEF, 2008). Amid a similar period, just 700 youngsters under five years old kicked the bucket from diarrhoeal malady in created nations (WHO/UNICEF, 2008). Diarrhoeal ailment likewise speaks to a financial weight for creating nations where patients are treated with costly intravenous liquids and incapable home grown inventions that may without anyone else posture dangers to the wellbeing of the patients. Albeit diarrhoeal sickness is generally less destructive to grown-ups than to youngsters, it can likewise influence a nation's economy by decreasing work hours.

The primary elements for high occurrence of diarrhoeal cases are utilization of harmed nourishment and water coming about because of insufficient sanitation, for example, ill-advised waste dis-posal. The immediate causes incorporate an assortment of pathogenic microorganisms. The scope of microscopic organisms that have been involved in the etiology of diarrhoeal infection incorporate enterotoxigenic Escherichia coli, Salmonella, Shigella, Cholera, and other vibrio microorganisms and in addition parasites like Cryptosporidium and Giardia (Pedalino et al., 2003). A wide scope of infections have additionally been embroiled in the etiology of diarrhoeal malady (Sack et al., 1997) of which the most essential is rotavirus. Rotaviruses have been evaluated to cause 25 - 35% of all instances of serious diarrhoeal sickness (Glass et al., 2005). Astroviruses, caliciviruses and a few strains of adenoviruses (types 40 and 41) have likewise been related with diarrhoeal infection (Pedalino et al., 2003; Poocharoen et al., 1986; Sebire et al., 2004).

mass of water-borne infections

As indicated by Catley-Carlson (1993), Hillel Shuval represented the effect of water-borne sicknesses in view of bona fide gauges amid the 1993 Stockholm water symposium that around 50,000 individuals on the planet bite the dust every day because of water-borne illnesses. Cases incorporate the flare-up of 300,000 instances of hepatitis An infection (HAV) and 25,000 instances of viral gastroenteritis in Shanghai, China (Halliday et al., 1991).

In 1991, an episode of 79,000 instances of hepatitis E infection (HEV) in Kanpur, India was credited to dirtied drinking water (Grabow et al., 1994). In the vicinity of 1980 and 1994, 28 announced episodes and 11,195 affirmed instances of water-borne viral ailments were accounted for in the United States. Of these, 9,038 cases were credited to the Norwalk-Like Viruses (NLVs) and 396 cases were attri-buted to HAV. Hepatitis An infection episodes have happened in day-mind focuses and establishments because of a breakdown in clean conditions or the defilement of nourishment and/or water. A flare-up of gastroenteritis among grown-ups emerging from rotavirus defilement of a city water supply was accounted for by Hopkins et al. (1984).

From 1974 to the finish of 1995, there were 21 detailed flare-ups and 1,358 affirmed instances of water - borne ailment caused by enteric infections in Canada for the most part because of defilement of open drinking water supplies (Health Canada Food-borne and Water-borne Disease in Canada, Annual Summaries 1974 - 1995).

Two serious episodes of neurological infections and fast passing in Asia have likewise been accounted for and were ascribed to enteric infections (Hsiung and Wang, 2000). In August 1998, a substantial flare-up of viral related gastro-enteritis happened in a Swiss Village where over half of tenants were influenced. A study led inside the town demonstrated that one out of each two drinking water tests was sullied with enteric infections (Hafliger et al., 2000).

An examination directed in Egypt uncovered that en-teric infection stack 1km far from two plants was nearly the same as the crude water (Ali et al., 2004). Human astrovirus (1-5, 7 and 8) was distinguished and written in 16 out of 21 natural examples in Pretoria (Nadan et al., 2003). This examination showed the pervasiveness of enteric infections in slime and streams, which could continue and taint traditional treated water and their sources. Two extreme norovirus gastroenteritis flare-ups additionally happened in South Africa and are frequently alluded to as de "Christmas" and "Grootbrak". The two episodes were credited to polluted drinking water and nourishments, for example, shellfish and plates of mixed greens (Wolfaardt et al., 1995). This may have being because of angling from polluted streams caused by disgraceful sewage transfer and the utilization of wastewater for vegetable planting.

In the wake of repeating in the human gut, enteric infections are discharged into sewage and might be scattered into the water condition if sewage isn't enough treated. Viral numbers have been distinguished in focuses more than 103 – 104 viral particles/L of wastewater (Toze, 1997). Flare-ups in the mid 1990s showed the part of uncalled for human sewage release in proliferating

norovirus illness (Berg et al., 2000; CDC, 1997). In Durham, New Hampshire, Chapron et al. (2000) too

identified astroviruses and adenoviruses in 48.3 and 51.7% of surface water tests, individually.

Table 1. Diseases caused by human enteric viruses.

Enteric virus	Illness
Parvovirus	Gastroenteritis
Coronavirus	Gastroenteritis, respiratory disease
Echovirus	Meningitis, encephalitis, rash, gastroenteritis
Adenovirus	Gastroenteritis, respiratory disease, conjunctivitis
Reoviruses	Gastroenteritis, respiratory disease
Enterovirus 71	Guillain-Barré Syndrome, aseptic meningitis
Torovirus	Gastroenteritis
Hepatitis A and E Viruses	Hepatitis
Poliovirus	Poliomyelitis
Coxsackie virus	Meningitis, respiratory disease
Astrovirus, calicivirus, rotavirus	Gastroenteritis
Coxsackievirus B	Meningitis, encephalitis, diabetes mellitus

GENERAL HEALTH CONSEQUENCE OF ENTERIC VIRAL DISEASES

The outcome of enteric infections as causative specialists of essential human maladies can't be exaggerated. Since the discovery of NLVs in 1972 (Kapikian et al., 1972) and rotavirus in 1973 (Bishop et al., 1973), the viral aetiology of acute non-bacterial gastroenteritis has been well established. Although rotavirus is the leading cause of severe diarrhoea among children (Parashar et al., 1998), data from various studies demonstrate that NLVs might also play an important role in infant gastroenteritis (Pang et al., 1999). Enterovirus 71 (EV71) which was discovered in 1974 in patients with severe neurological disease (Ho, 2000; Thong, 2000) has propensity to cause paralytic disease, as do Coxsackievirus A7 and Entero 70 (Muir et al., 1996). The most commonly implicating viral agents of serious infections with neurological involvement or even fatal disease are polioviruses and EV71. Table 1 summarises some common diseases caused by enteric viruses. Studies have revealed the presence of viruses in raw; surface and ground water and treated drinking water meeting quality standards for coliform bacteria (Cho et al., 2000; Gerba and Rose, 1990). For instance, work carried out in Germany showed that even though microbiological parameters such as *E. coli*, *enterococci* and *coliphages* indicated acceptable microbiological water quality, the virological data of this study suggested that surface waters might still be sources for enteric viral infections (Pusch et al., 2005). These studies also revealed that several outbreaks were caused by tap water contaminated with viruses in spite of compliance with water treatment procedures, an indication that viruses are being introduced into ground waters and treated water.

Low concentrations of all types of bacteriophages in groundwater have also limited their power to be used to predict the presence of enteric viruses. Common treatment processes, including chlorination, have not been shown to completely eliminate enteric viruses in sewage (De Leon and Jaykus, 1997). In fact, findings have confirmed that depending upon the treatment methods for domestic sewage, only between 50 and 99.99% of these viruses can be inactivated (Gerba, 1983). Therefore, the potential exists that an infectious virus will remain after treatment of sewage and possibly contaminate source water or treated drinking water.

The presence of enteric viruses in the water environment is a public health hazard. Enteric viruses can cause illnesses in susceptible individuals even at low viral loads. A low viral dose, typically between 1 and 50 infectious particles is enough to cause illness (Moe, 1991).

The water environment (source, drinking and recreational water) therefore poses a risk in the transmission of enteric viruses not only because there is uncertainty on acceptable virus levels but also due to the fact that enteric viruses are resistant to commonly employed disinfection methods. Generally, there is also a failure to report and investigate outbreaks of mild gastrointestinal disease, especially in the developing world. This makes it more difficult to source track the transmission of these viruses, to determine the risks associated with their occurrence and consequently preclude the institution of preventive measures against enteric viral transmission from domestic sources.

Even though the mortality of many water-borne diseases is relatively low, the socio-economic impact of even non-fatal water-borne disease infections is phenomenal.

The annual cost of outpatient care for pediatric diarrheoa in the United States has been estimated to be between $0.6 and $1.0 billion. Twenty-one percent (21%) of the annual cost of pediatric diarrheoa in the United States is attributed to rotavirus infection (Avendano et al., 1993). The public health and socio-economic burden of pathogenic microorganisms in drinking water have been reviewed to be greater than the impact of diseasesassociated with the chemical quality of water (Bern and Glass, 1994; von Schirnding et al., 1993).

Figure 1. A broken pipe from construction work (Noguchi Memorial Institute for Medical Research, Legon, Accra, 2006). Arrow indicates direction of leakage on pipe.

Figure 3. A broken metal distribution pipe (Danquah circle, Accra, 2006). Arrow indicates direction of leakage or breakage on pipe.

Figure 2. A broken pipe submerged in sewage water (Danquah circle, Accra, 2006). Arrow indicates direction of leakage or breakage on pipe.

Figure 4. A broken pipe from improper sealing at a joint (New Fadama, Accra, 2006). Arrow indicates direction of leakage or breakage on pipe.

SOURCES OF VIRAL POLLUTION OF DRINKING WATER

A variety of means through which viruses may be introduced into ground waters have being identified. They include, leaking septic tanks, landfills and artificial aquifer recharge of ground waters with wastewaters. Treated drinking water may also be contaminated with viruses through sewage, wastewater treatment facilities, runoffs from farmlands, homes and yards, leakages of pipes, floods and discharges from industrial processes. Other ways include a variety of industrial processes as well as defective well casings (Center and Knox, 1991; Chapron et al., 2000) . In most developing countries, most potable water pipes are made of plastic and are often subjected to various degrees of physical damage (Figure 1), aggravated by poor urban planning and drainage systems (Figures 2, 3, 4) which predispose treated water to contamination with sewage.

Although contaminated food and water have been associated with outbreaks, the risks attributed to drinking water contamination in the transmission of viruses have not been fully assessed in developing countries like Ghana. Much has been reported on the physico-chemical and bacteriological contaminants. However, little information exists on the viral contamination. This is probably due to the absence of infrastructure and /or technology for assessing viral contamination of drinking water sources for the detection and recording of such infections in developing countries.

ASSESSMENT OF VIROLOGICAL QUALITY OF DRINKING WATER

New and advanced molecular assays are being developed to help detect enteric viruses in drinking water and their sources. Molecular methods employed include RT-PCR, Nucleic acid hybridization assays and DNA sequencing techniques. At least 37 different human enteric viruses with over 100 species have been isolated from the water environment around the world (Bosch, 1998; Tsai et al., 1994). Selecting appropriate risk management options is especially difficult due to poor knowledge of virus removal and inactivation during treatment of drinking water (Macler, 1993).

The U.S EPA has proposed the use of a conceptual synthetic virus for determining acceptable levels of human enteric viruses. The proposed model virus combines the characteristics of various enteric viruses. This model relies upon dose-response data for rotavirus as a surrogate for other infectious enteric viruses. However, there are some limitations to the use of this method to assess exposure risk. For example, preparing a cell culture of viruses from water has efficiency less than 100% (Payment et al., 1997). Furthermore, risk assessment models assume a random distribution of viruses. In fact, available data suggest that micro organisms do not occur randomly in water but are clustered (Gale, 1996). Lastly, the model is based upon risk of infection rather than risk of illness. The manifestation of symptoms involves a complex interaction dependent on the age and immune status of the infected individual, the virus strain and virulence. Thus the search goes on.

CONCLUSION

Since the occurrence of viruses in treated drinking water can no longer be ignored, it is necessary to use more effective disinfection methods e.g. ultraviolet disinfection. Increase in chlorine dosage should be considered by water companies. Legislative measures for regular viral monitoring of drinking water should be enforced by the national quality monitoring bodies. It is also necessary to conduct epidemiological studies relating virus occurrence in water to a defined health end-point. Cell culture and quantitative RT-PCR, large sample volumes and sequential analysis of viral genomes would also be required to provide reliable baseline information.

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