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## *Environmental Factors Influencing the Spread of Communicable Disease*

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### **Abstract**

*Human activities are generating an ever-accelerating crescendo of change in the natural environment, while new technologies and globalization mainly continue to alter economic and social patterns across the planet. It is already known that global climate change and degradation and pollution of air, land and water in many areas are capable of predominantly endangering human health. This paper deals with major environmental factors which lead to or initiate the spread of communicable disease like water borne mode, air borne mode etc.*

**Keywords:-***Communicable disease, Human activities, Environmental factors, air borne, water borne, Vectors.*

### **INTRODUCTION**

In light of this, it is imperative that the best scientific minds examine the potential of these momentous changes to exacerbate the spread of infectious diseases, so that the world's health systems are ready to respond. The world's poorest billion people tend to live in ecologically and socially risky terrains, which are also where the prevalence of infectious disease is highest. Worldwide, nearly 950 million

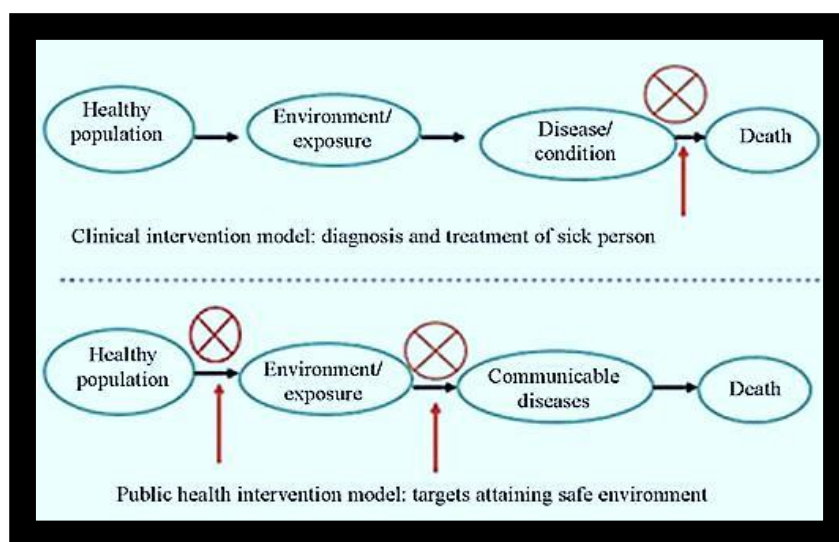
people do not have access to an improved water source, while an estimated 2.6 billion people – half of all people in developing countries – lack access to adequate sanitation (Collignon et al.,2005). Experience shows that the poor living standard people are more vulnerable than anyone when natural disasters strike. They are least able to advocate for sustainable ecological startups and will suffer most as the deleterious effects of environmental

and climate change increase. And yet the world's poorest billion are responsible for just 3-4% of the global carbon footprint. For development to be sustainable, inclusive and effective in lifting people out of poverty, one need to find ways to address these inequities – particularly the links between environmental conditions and the infectious diseases that destroy so many lives and communities(Fig:1).

### ENVIRONMENTAL FACTORS

Viral respiratory tract infections are both ubiquitous and cumbersome, accounting for many millions of lost school- and workdays and millions more physician visits each year. Although there are similarities in the clinical syndromes caused typically by the many viruses capable of infecting and causing disease in the human respiratory tract, they possess

varying transmission patterns among humans. The mode or modes by which a virus transmits from person to person are crucial to understanding how the environment in which they transmit impacts person-to-person spread. The Centers for Disease Control and Prevention (CDC) consensus defines the modes of transmission of influenza virus is broadly applicable to other respiratory (i.e., non-vector-borne) viruses as well. For consistency, one will adhere to the CDC terminology; thus, “contact transmission” comprises both direct and indirect transmission, while “airborne transmission,” comprising both droplet spray and aerosol modes, describes the direct inoculation of virus particles from the air into the respiratory tract without an intermediate(Stokstad,2007).



**Fig: 1 Environmental Factor**

The trends in infection rates that one observes are partially explained by the effect of social connectedness on the risk of transmission of many pathogens. Localized migration facilitated by roads can typically lead to a community whose residents have few social connections, which is one measure of social capital. Previous researchers have shown that communities with more social capital tend to be successful in creating adequate water and sanitation infrastructure because they tend to know one another, are accustomed to working together, and share social norms. On the other causal pathway, road proximity can elate the contact that individuals within a village have with those outside the village, increasing the rate of introduction of pathogens.

The study villages show some evidence of these hypothesized relationships among demographic characteristics, social connectedness, and movement of people. Village data typically suggest that connectedness, as measured by the average number of individuals a given person spends time with (social network degree), is positively associated with remoteness (Rock,2009). Moreover, villages closer to the road have increased movement of people, which provides opportunities for pathogen incursion(Diaz et al.,2008). The

slope of the line reflects the strength of the relationship: twice as many connection exist in the most of the remote village compared with the least remote. Likewise, 29% of the remote villagers said they had left the village in the last week, compared with 49% of the least remote villagers (Anderson, 2004). Pathogen specific outcomes garner additional insight into the relationship between remoteness and transmission. Observed trends were strongest for E. Coli, followed by rotavirus and then Giardia.

This differential can be partially explained by the biological and environmental factors that govern transmission dynamics and level of  $R_0$ ; e.g., pathogen infectivity, as measured and assessed by infectious in oculum, shedding rates, and environmental persistence, as measured by the ability of the pathogen to remain viable in the environment, all directly affect  $R_0$ . Infectivity data suggest that Giardia, with a low ID<sub>50</sub>(the in oculum at which about 50% of exposed subjects are infected) and long shedding duration, and rotavirus, with a low ID<sub>50</sub>and high shedding rates, are more infectious than diarrhea-causing E. coli. Diarrheagenic E. Coli species tend to persist in the environmental for shorter periods of time than either Giardia or rotavirus (Estes,1991). The observations

on both infectivity and environmental persistence suggest that Giardia is able to maintain transmission within the more remote villages despite limited outside social contact and higher levels of social connectedness. E. coli would be less able to maintain transmission, and rotavirus would lie somewhere in between (Enriquez et al., 1995).

The key difference in E. coli infection rates between Borbon and the other communities and the lack of difference in Giardia infection rates are consistent with this hypothesis (McFeters et al., 1975). The pivotal and consistent trends across viral, bacterial, and protozoan pathogens suggest the significance of considering a broad range of health outcomes when assessing environmental impact (Guhl et al., 2009). Each of our marker pathogens has a different epidemiology that is typically affected by environmental changes in different ways (Steinfeld, 2006).

A stratified assessment that looks across pathogen types, and not just at a broader disease category like diarrhea, allows for a more sensitive measure of change and can elucidate more specific interventions to alleviate these environmental impacts (de Regnier et al., 1989).

A number of environmental factors mainly influence the spread of communicable diseases that are prone to cause epidemics (Karch et al., 1995).

***The most important of these are:***

- water supply
- sanitation facilities
- food
- climate

A deprivation of safe water, inadequate excreta disposal facilities, poor hygiene, poor living conditions and unsafe food can all cause diarrhoeal diseases. These diseases are a main cause of suffering and death in an emergency situation (Haas et al., 1999).

Climate can affect disease transmission in a variety of ways. The distribution and population size of disease vectors can be typically heavily affected by local climate (Feachem, 1983). Flooding after heavy rains can result in sewage overflow and widespread water contamination. In addition, there is little evidence to suggest that pathogens can be spread from one region to another along air streams or by wind (DuPont et al., 1971).

**DISEASE AND DISEASE TRANSMISSION**

An ubiquitous variety of organisms exists, including some which can survive and even develop in the body of people or animals. If the organism can cause infection, it is an infectious agent (Wright et al., 2001). In these manual infectious agents which cause infection and illness are termed pathogens. Diseases caused by pathogens, or the toxins they produce, are communicable or infectious diseases. In this manual these will be called disease and infection (Ansari et al., 1991).

***Transmission Cycle of Disease***

To be able to persist or live on, pathogens must be mainly able to leave an infected host, survive transmission in the environment, enter a susceptible person or animal, and develop and/or multiply in the newly infected host (Brady et al., 1990). The transmission of pathogens from recent to future host follows a repeating cycle. This cycle can be simple, with a direct transmission from current to future host, or complex, where transmission occurs through (multiple) intermediate hosts or vectors. This cycle is called the transmission cycle of disease, or transmission cycle (Meissner et al., 1984). The transmission cycle has different elements:

***The pathogen:*** the organism mainly causing the infection

***The host:*** the infected person or animal ‘carrying’ the pathogen

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***The exit:*** the method the pathogen uses to leave the body of the host

***Transmission:*** how the pathogen is transferred from host to susceptible person or animal, which can include developmental stages in the environment, in intermediate hosts, or in vectors (Tellier, 2009).

***Transmission of disease***

To survive as a species, pathogens must infect new people or animals. To perform the activity, they must leave the body of the host, find their way to a new susceptible person or animal, and enter the body of that person or animal (Tellier, 2006). As the exit, transmission, and entry of the pathogens are closely allied, we will cover them together. Water and environmental sanitation interventions that aim to improve the health of a population usually try to reduce the risk of transmission of infection (Goldmann, 2000).

## **CONTROLLING AND PREVENTING DISEASE**

For a water and sanitation specialist the most useful categorization is mainly based on the transmission cycles of the infections (Belser et al., 2010). Generally, diseases with similar transmission cycles can be controlled by similar preventive measures, and will occur in similar environments (Brankston et al., 2007). The infections are categorized and their transmission routes described at the same time. Some terms relating to the transmission or classification of infections are delineated here: Food-borne infections: infections which can be transmitted through eating food containing the pathogen (Forgie et al., 2009).

Vector-borne infections: infections transmitted through vectors. Vector-borne infections only for infections with a biological vector that is a vector in which the pathogen goes through a development before further transmission is possible (e.g. mosquitoes, tsetse fly, body louse). One do not classify as vector-borne those infections which are transmitted by mechanical vectors, that is the animal is only a vehicle for transporting the pathogen (e.g. domestic flies, cockroaches) (Musher, 2003).

Water-borne infections: infections which can be transmitted through drinking-water which contains the pathogen. Water-washed infections: infections caused by pathogens whose transmission can be prevented by improving personal hygiene. Infections can have either direct or indirect transmission routes (Sand rock et al., 2008).

## **CONCLUSION**

There are several environmental factors which paves the way for severe communicable disease. There are several water borne, air borne disease which act as promising environmental factors. This paper discusses the various aspects of environmental factors influence and the communicable disease initiated by environmental factors.

## **REFERENCES**

- I. Sandrock C, Stollenwerk N. Acute febrile respiratory illness in the ICU: reducing disease transmission. *Chest.* 2008; 133:1221–1231.
- II. Musher DM. How contagious are common respiratory tract infections? *N Engl J Med.* 2003; 348:1256–1266.
- III. Forgie S, Marrie TJ. Healthcare-associated atypical pneumonia.

- Semin Respir Crit Care Med. 2009;30:67–85.
- IV. Belser JA, Maines TR, Tumpey TM, Katz JM. Influenza A virus transmission: contributing factors and clinical implications. *Expert Rev Mol Med*. 2010;12:e39.
- V. This comprehensive review presents recent progress made in understanding the viral and environmental factors that impact upon efficient person-to-person transmission of influenza virus, as well as the clinical implications of these findings.
- VI. Brankston G, Gitterman L, Hirji Z, Lemieux C, Gardam M. Transmission of influenza A in human beings. *Lancet Infect Dis*. 2007;7:257–265.
- VII. Goldmann DA. Transmission of viral respiratory infections in the home. *Pediatr Infect Dis J*. 2000;19:S97–102. This review, although less recent, provides one of the few comprehensive summaries of prior published work regarding the modes of transmission of RSV, rhinovirus, and influenza virus.
- VIII. Tellier R. Review of aerosol transmission of influenza A virus. *Emerg Infect Dis*. 2006;12:1657–1662.
- IX. Tellier R. Aerosol transmission of influenza A virus: a review of new studies. *J R Soc Interface*. 2009;6(Suppl 6):S783–790. This paper provides an updated review of the literature, particularly with reference to new evidence supporting the role of influenza virus transmission through the aerosol/droplet routes.
- X. Meissner HC, Murray SA, Kiernan MA, Snyderman DR, McIntosh K. A simultaneous outbreak of respiratory syncytial virus and parainfluenza virus type 3 in a newborn nursery. *J Pediatr*. 1984;104:680–684.
- XI. Brady MT, Evans J, Cuartas J. Survival and disinfection of parainfluenza viruses on environmental surfaces. *Am J Infect Control*. 1990;18:18–23.
- XII. Ansari SA, Springthorpe VS, Sattar SA, Rivard S, Rahman M. Potential role of hands in the spread of respiratory viral infections: studies with human parainfluenza virus 3 and rhinovirus 14. *J Clin Microbiol*. 1991;29:2115–2119.

- XIII. Wright M, Piedimonte G. Respiratory syncytial virus prevention and therapy: past, present, and future. *Pediatr Pulmonol.* 2011;46:324–347
- XIV. DuPont HL, Formal SB, Hornick RB, Snyder MJ, Libonati JP, Sheahan DG, LaBrec EH, Kalas JP (1971)*N Engl J Med*285:1–9.
- XV. DuPont HL, Levine MM, Hornick RB, Formal SB (1989)*J Infect Dis*159:1126 –1128.
- XVI. Feachem RG (1983)*Sanitation and Disease: Health Aspects of Excreta and Wastewater Management*(Wiley, Chichester, UK).
- XVII. Haas CN, Rose JB, Gerba CP (1999)*Quantitative Microbial Risk Assessment*(Wiley, New York).
- XVIII. Karch H, Russmann H, Schmidt H, Schwarzkopf A, Heesemann J (1995)*J Clin Microbiol*33:1602–1605.
- XIX. deRegnier DP, Cole L, Schupp DG, Erlandsen SL (1989)*Appl Environ Microbiol*55:1223–1229.
- XX. Estes MK (1991) in *Fundamental Virology*, eds Fields BN, Knipe DM (Raven, New York), pp 619 – 644.
- XXI. Enriquez CE, Hurst CJ, Gerba CP (1995)*Water Res*29:2548 –2553.
- XXII. McFeters GA, Bissonnette GK, Jezeski JJ, Thomson CA, Stuart DG (1974)*Appl Microbiol*27:823–829
- XXIII. Guhl F, Pinto N, Aguilera G. Sylvatic triatominae: a new challenge in vector control transmission. *Memorias do Instituto Oswaldo Cruz, Rio de Janeiro*, 2009, 104(Suppl. I):71–75.
- XXIV. Steinfeld H. *Livestock’s long shadow*. Rome, Food and Agriculture Organization of the United Nations, 2006.
- XXV. Diaz RJ, Rosenberg R. Spreading dead zones and consequences for marine ecosystems. *Science*, 2008, 321(5891):926–929.
- XXVI. Rock M. Animal-human connections, “one health,” and the syndemic approach to prevention. *Social Science & Medicine*, 2009, 68(6):991–995.
- XXVII. Anderson PK et al. Emerging infectious diseases of plants: pathogen pollution, climate change and agro technology drivers. *Trends in Ecology and Evolution*, 2004, 19(10):536–544.
- XXVIII. Stokstad E. Plant pathology. Deadly wheat fungus threatens world’s bread baskets. *Science*, 2007, 315(5820):1786–1787.

- XXIX. Collignon P et al. The routine use of antibiotics to promote animal growth does little to benefit protein undernutrition in the developing world. *Clinical Infectious Diseases*, 2005, 41(7):1007–1013.