



REVIEW ARTICLE

THE BURDEN OF INFECTIOUS DISEASES IN INDIA – AN OVERVIEW

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ABSTRACT

The infectious disease burden in India is very high and victims are mainly of rural population. Different factors that influence the survival of microorganisms which spread the diseases are climatic change, poor sanitation, lack of fresh water, deforestation, urbanization, change in life style etc. Good % of the infectious epidemics are unreported because the cases occur in remote areas. Drug resistance causes the re-emergence of the infection. In this review infectious diseases among Indian population are discussed. Major infectious diseases prevalent in India include Malaria, Cholera, Dengue, Jaundice, Hepatitis, Typhoid, Japanese Encephalitis, Plague, HIV, Rabies. Nipah virus infection emerged newly in India.

Key words: Infectious diseases, Viral and Bacterial infection, Prevalence of infection in India, Causes of epidemic.

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INTRODUCTION

The infectious disease burden in India is very high. The infectious epidemic reasons are of different categories like lack of sanitation, lack of fresh water, deforestation, urbanization, change in life style etc. Good % of the infectious epidemics are unreported because of its cases occur in remote areas. Infection is recognized only after symptomatic. Drug resistance is one of the reasons for re-emerging of the epidemic. Degree of risk of disease is decided by considering the foreign nature, severity of infection and probability of re-infection (Lederberg *et al.*, 2003). Major infectious diseases prevalent in India include Malaria, Dengue, Chikungunya, Japanese Encephalitis, Plague, Jaundice, Cholera, Hepatitis, Typhoid, HIV, Tuberculosis, Diarrhoeal diseases, Influenza Rabies etc. About 1.2 billion people across the world are at risk of infection because of lack of fresh water. The current threat in India is of Nipa virus fever outbreak occurred in southern India.

Malaria

Malaria is one of the common infectious diseases in the developing countries like India. The word mal-aria means bad air and it is a vector borne disease. Ronald Ross in the year 1897 discovered the transmission of this disease was through mosquitoes (<http://www.yourarticlelibrary.com/diseases>). Malaria is caused by single-cell parasitic protozoa *Plasmodium* and transmitted to human via female Anopheles mosquito bite. The parasite multiply in the liver and affects the functioning of vital organs. It attacks the red blood cells resulting in fever, chills followed by anemia.

Damage to vital organs and insufficient blood supply to brain cause death (http://www.indexmundi.com/india/major_infectious_diseases). Malaria kills about 1 million children a year in the developing countries. In India risk of getting malaria extends to almost the entire population. The highest malarial cases reported in India were at the following states; Madya Pradesh, Maharashtra, Orissa, Karnataka, Rajasthan, Assam, Gujarat and Andhra Pradesh. Several factors that cause the global resurgence of malaria include emergence of insecticide and drug resistance, increase in human population and unhealthy environment, climatic changes like temperature rise, humidity etc (Change, 2001). Medication available to treat malaria includes Aralen, Coartem, Amonate, Artesunate. But the choice of treatment depends on the *Plasmodium* species.

Dengue and Chikungunya

Dengue and Chikungunya both are transmitted by common vector i.e. *Aedes aegypti* mosquito. In the recent past reported cases of dengue in India have been very high. There are 4 different types of dengue viruses which spread this life-threatening disease. The symptoms include sudden onset of fever and severe headache, also results in shock and hemorrhage leading to 5% death in the infected population. About 390 million dengue cases are reported across the world every year (http://www.indexmundi.com/india/major_infectious_diseases). There are about 50 dengue outbreaks reported in India since 1960 (Majra and Gur, 2009). The repeated outbreaks may be due to the temperature variation that supports the virus activity and distribution (Gage *et al.*, 2008). By destroying the mosquito habitat in the common dengue affecting areas can prevent the disease. Research is

progressing for the development of dengue vaccine. The first reported case of chikungunya in India was in 1963 in Kolkata with the continuous cases until 1973 (Mavalankar *et al.*, 2007). Even though the disease was under controlled, it reemerged in 2005 and has spread rapidly with reported cases more than one million (Mavalankar *et al.*, 2007; Epstein, 2007). There is no vaccine to prevent or medicine to treat this disease. Rest and rehydrate the body by drinking plenty of water can reduce the severity. Administration of medicines like acetaminophen or paracetamol can reduce the fever and pain.

Japanese Encephalitis (JE)

Japanese encephalitis is a mosquito-borne (*Culex tritaeniorhynchus*) viral diseases (<http://www.who.int/en/news-room/fact-sheets/detail/japanese-encephalitis>). JE is an infection of brain caused by Japanese encephalitis virus. It is one of the leading viral encephalitis in Asia with reported cases of about 70,000 yearly (Campbell *et al.*, 2011). Depends on the population and age fatality rate ranges from 0.3% to 60%. Acute encephalitis may lead to paralysis, coma, and death. The hospitalization of the infected individual with utmost care and close observation is required. There is no specific treatments available.

Plague

Plague is a bacterial disease transmitted by fleas and the causative bacteria is *Yersinia pestis*. The common symptoms are fever, weakness, headache etc. Bubonic and septicemic plague are usually spread through flea bite or by handling of an infected animal, whereas the pneumonic form of plague spread through infectious air by person to person interaction. In bubonic plague, swelling of lymph nodes occurs and in septicemic form tissues turn black and die. In pneumonic form cough, chest pain followed by shortness of breath occurs (Symptoms Plague, 2015). 50% of death rate reported (Plague in India, 2017). The suspected persons should be treated isolated. Antibiotics include streptomycin sulfate in combination with tetracycline is effective.

Jaundice

Jaundice, which is also known as icterus is a condition of yellowish coloration of skin and whites of eyes. It is not a disease by itself but a condition which can be caused by a part of some viral infection or by some other liver problems. The coloration is caused by excess amount of bilirubin, the bile pigment in the blood. Bilirubin is formed by the breakdown of haemoglobin and removal of iron during the destruction of worn-out red blood cells (Winger and Michelfelder, 2011).

Cholera

Cholera is a water-borne bacterial disease caused by the bacteria *Vibrio cholera*. The main symptom is watery diarrhea along with vomiting that lasts for few days. The epidemic of cholera happens abruptly and hence create a public health problem. Cholera spreads with high potential and cause deaths. Since the outbreak occurs abruptly, it reaches the peak and subsides gradually when the severity of infection declines (Nelson *et al.*, 2011). Cholera can be prevented by improved sanitation and usage of clean water etc (Zuckerman *et al.*, 2007). Studies have shown that bacteria occur naturally in aquatic environments where as the population peaks in spring

and fall in association with plankton blooms (Lipp *et al.*, 2002). Rehydration of the body either orally or intravenous is the important treatment. Doxycycline can be taken as first-line treatment for adults and azithromycin for children and pregnant women.

Hepatitis

Hepatitis is the inflammation of the liver cells. This disease is caused by virus infection (five different viruses termed as A, B, C, D and E), bacterial infection, continuous exposure to alcohol, drugs, toxic chemicals such as those present in aerosol sprays and paint thinners etc (<https://www.medicalnewstoday.com/articles/145869.php>). Hepatitis can be temporary (acute) or long lasting (chronic). Acute hepatitis may recover on its own or progress to chronic. Overtime chronic hepatitis may progress to scarring of liver, liver failure or liver cancer (Bernal and Wendon, 2013). The symptoms include weakness, loss of appetite, fever, jaundice etc. Hepatitis A found across the world is a self-limiting disease and it is transmitted through infected water, sometimes through parenterally. Hepatitis B transmission is through intimate contact and from mother to new born, sometimes through orally (infected water) as well. Hepatitis C spreads through transfusion or parenteral drug abuse. Hepatitis D or delta hepatitis caused by hepatitis D virus. It usually accompanies with hepatitis B by increasing its severity. Hepatitis E is transmitted by contaminated water. There will not chronic infection in the case of hepatitis E, but it can be fatal to pregnant women (Kasper *et al.*, 2015). Hepatitis A usually recover by itself and bed rest is recommended. Acute hepatitis B get cured by itself whereas chronic B should be treated with antiviral medication, hepatitis B can be prevented by vaccination. Also antiviral is used to treat acute and chronic hepatitis C, and no vaccination for C. Hepatitis D can be prevented by the hepatitis B vaccine, since B infection is needed for D to develop.

Typhoid

Typhoid fever or Typhoid is a bacterial infection by the bacteria *Salmonella typhi*. The symptoms include fever with abdominal pain, constipation, headache etc (Wain *et al.*, 2015). The infection spreads through ingestion of food or water contaminated with human excreta of infected individuals. The infection occurs for the entire age of population. The main reason of infection is poor sanitation. Almost 80% of typhoid cases across the world occurs in Asia, among this India has a significant number of cases with a fatality rate of less than 1%. The treatment is the administration of antibiotics like ciprofloxacin and ceftriaxone. Also rehydrate the body with drinking plenty of water. Also typhoid vaccine is recommended.

Tuberculosis

In India Tuberculosis is one of the biggest public health problem. It is a bacterial infection caused by the bacterium *Mycobacterium tuberculosis*. This infection affects the lungs primarily but infects other parts also. About 10% of the latent infection turns to active disease if untreated. The major symptoms are chronic cough with blooded sputum, fever, weight loss etc. The majority of reported cases are from rural areas and slum-dwellers of urban areas. One of the important risk factor of this infection is individuals infected with HIV are

more susceptible to tuberculosis (<http://www.who.int/en/news-room/fact-sheets/detail/tuberculosis>; World Health Organization 2011). The common medications taken for curing tuberculosis are, Isoniazid, Rifampin, Ethambutanol, Pyrazinamid.

HIV

The human immunodeficiency virus (HIV) is a sub group of retro virus. This causes HIV infection and progress to AIDS. AIDS is a serious life-threatening condition in which the immune system gets failed gradually. In most of the infection it is transmitted via body fluids, blood transfusion etc. HIV positive mother transmit HIV to her baby. HIV infects the vital immune cells such as the helper T-cells, macrophages and dendritic cells and hence the body progressively will susceptible to various infection (Weiss, 2015; <https://www.hiv.gov/hiv-basics/hiv-prevention/reducing-mother-to-child-risk/preventing-mother-to-child-transmission-of-hiv>; Doitsh *et al.*, 2014). It is recommended that the person infected with HIV should start with antiretroviral therapy (ART) which slows down the progression of the disease.

Diarrhoeal diseases

In India diarrhoea is a major health problem among children under the age of 5 years. Diarrhoea is defined as passage of loose, liquid or watery stools passed more than three times a day. This may lasts for about 3 to 7 days or may be for two weeks. The real victims are children those of 6 to 11 months (<http://www.who.int/en/news-room/fact-sheets/detail/diarrhoeal-disease>). Most of the cases are caused by infection in the gastrointestinal tract by bacteria, viruses or parasitic organism. This often happens by consuming food or water that has been contaminated by feces or directly from an infected individual (<http://www.who.int/en/news-room/fact-sheets/detail/diarrhoeal-disease>). About 15% of pediatrics beds in India are accommodated by diarrhoeal patients. The child victims have problems like stunted growth and poor intellectual development (<https://www.cdc.gov/healthywater/global/diarrhoea-burden.html>). Administration of ORS formulation with zinc supplements reduces the severity of the disease.

Influenza

Influenza is a respiratory tract infectious disease caused by any one of three influenza viruses A,B and C. The common symptoms include high fever, cough, runny nose, sore throat, muscle pain which begin after two days of exposure to the virus. All pandemics are caused by influenza A strain. Complications of influenza include viral pneumonia, bacterial pneumonia, asthma and even heart failure (Influenza, 2014). Usually virus spreads through air from cough or sneeze, also by touching the contaminated areas and touching mouth or eye without washing the hand. Good sanitation lowers the risk of infection (Longo, 2012; Brankston *et al.*, 2007). The infected individuals should rehydrate the body by drinking plenty of water. Antiviral medicines like oseltamivir, zanamivir, peramivir are used to treat flu. Acetaminophen can be taken to recover fever, headache and body pain.

Rabies

Rabies is a infectious disease caused by *lyssaviruses* including rabies virus and Australian bat *lyssaviruses*. Infection cause inflammation of the brain in humans and other mammals.

Symptoms include fever, scratchy at the site of exposure and further violent movements, fear of water, inability to move body parts etc Globally dogs are the most common animal that spreads this disease. This virus travels to the brain through peripheral nerves. Diagnosis of this disease can be done only after the appearance of symptoms (World Health Organization, 2013). Rodents are hardly affected with rabies virus. Animal vaccination programs decreased the risk of rabies from dogs significantly globally (Tintinalli, Judith, 2010). After infected with rabies virus a series of injections are given, first which is given at near the site of animal bite is rabies immune globulin that prevents the virus infection to the individual. After this four injections which are rabies vaccines are taken over the next two weeks that help the body to fight against the virus (<http://www.who.int/emergencies/diseases/en/>).

Nipah virus (NiV) infection

NiV infection emerged newly in Kerala, India. This infection cause serious disease both in animals and human. The characteristic features of victims ranges from asymptomatic to acute respiratory and fatal encephalitis. The only treatment for human is intensive care to the infected individuals.

Summary and implications for improved health care

In a developing country like India with high population density the health care programs should be considered very seriously. There are many factors which supports the survival of microorganisms which spread infections. These factors include poor sanitation, lack of cleanliness, climatic changes due to deforestation and lack of rainfall, lack of fresh water, water contamination with human and animal waste etc. By monitoring the spread of infectious disease helps in early warning to the population and hence have both economic and health benefits. Awareness programs could help the population to follow a healthy lifestyle and hence lower the risk of diseases (Dhara *et al.*, 2013).

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