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Problems of Water Borne Diseases in Bihar

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ABSTRACT: Water is essential to sustain life, and a satisfactory supply must be available to all. According to World Health Organization, the drinking water quality is usually related to acceptable variables i.e. physical, chemical and biological. If any of the contaminant is found to be present in drinking water, it may to water borne diseases. These are the most prevalent infectious diseases in the developing countries. Safe water supplies and environmental sanitation are vital for protecting the environment, improving health and alleviating poverty. Improving access to safe drinking-water can result in tangible benefits to health. Water is potable if it is free of disease-producing microbes and harmful chemical substances. It is a known fact that safe drinking water is essential for healthy living yet millions of people on the earth are deprived of it. Deterioration of ground water quality in recent years due to various human as well as geogenic activities is a threat to humanity especially in rural areas in plains as it is the only available water source within their reach. The governments are struggling to provide adequate safe water to all rural habitations. Depletion of water table in many areas resulting in emergence of chemical impurities like Arsenic and Fluoride in water is making it unsafe whereas water in high water table zone are bacteriologically unsafe. Bihar one of the largest states of Indian Republic with high groundwater potential is facing a serious water quality problem. Water borne diseases are most common cause of death in India nearly 80 %. In this paper a special focus has been placed on water borne diseases, their causes, and prevention.

KEYWORDS: Water, Health, drinking, diseases and prevention.

I. INTRODUCTION

Safe Drinking Water Supply remains a cause of concern for the governments and the water supply agencies through out the world but this task is more challenging in developing and under developed countries especially in rural area. The concept of 24x7 water supply is being adopted for ensuring safe water in many countries where as the rural population in developing countries are struggling for a bare minimum required quantity of safe drinking water for their survival.

In Bihar groundwater is playing a pivotal role in fulfilling the demands of domestic, industrial and agriculture sectors. The rural drinking water supply is mainly dependent on groundwater. During last few decades emphasis was on coverage of rural habitations in terms of water supply. In terms of physical progress, the achievements have been remarkable and almost all the habitations have been now covered. Now sustainability of the source and the system along with poor quality of water have been emerged as a great threat in providing safe and regular supply to all habitations. Unfortunately poor environmental sanitation and unsafe drinking water has been the major health problem. Water and sanitation related infections and diseases of the alimentary tract constitute 60% to 80% of the illness. Many of them such as diarrhea, dysentery, typhoid fever, intestinal helminthiasis, jaundice, cholera are endemic in rural areas.

It is estimated that in Bihar alone, more than 10 thousand children below 5 years die from diarrhoeal disease every year. Despite advancement in the medical sciences morbidity and mortality due to water and excreta related communicable diseases continue to remain a heavy burden for the governments.

Water-borne diseases and water-caused health problems are mostly due to inadequate and incompetent management of water resources and are major causes of morbidity and mortality worldwide. Sometimes the water gets contaminated at source due to various reasons and mainly due to inflow of sewage into the source. Human health can be affected by drinking the polluted water either directly or by use of such water in food or use for the purposes of personal hygiene and recreation. The problem is especially acute where general hygiene and environmental sanitation

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Vol. 9, Issue 3, March 2020

are poor and where there is inadequate supply of safe water. Open drainage in towns and cities can have severe consequences such as water-borne diseases, like cholera, malaria and diarrhea as a result of improper management of the water supply as well as discharge. This matter is of serious concern as these diseases are a common cause of death.

Our health is affected by drinking polluted water either directly or by use of such water in cooking or for other personal purposes. The microorganisms of these diseases multiply in the body of the infected person. The infection is excreted with stool or urine. Therefore, improper disposal of human excreta is the chief cause of contamination of water of rivers, wells, lakes and shallow hand pumps and results in the spreading of these diseases. The extent of contamination in some Indian rivers estimated by fecal coliform. Many diseases like trachoma, scabies, skin sepsis and fungal infection are not water-borne but their incidence depends more on the quantity of water available for use. Among the water related diseases diarrhea, jaundice, guinea worm, Japanese encephalitis, malaria, filariasis, knock-knees are prevalent in our state .

Bihar is the third largest state of Republic India having population over 86 million. 89% of its population Bihar is blessed with abundant surface and ground water resources that are sufficient to cater to demands for various end uses. The state receives average rainfall of 12501350 m but 87% of this precipitation is limited to three monsoon months. Water table in the state varies from as low as 5M in the North Eastern region to 20M in the Southern districts. Bihar lies in the transitional climate zone between humid West Bengal in the east and sub humid Uttarpradesh in the west. Recurrent floods are a serious problem in Bihar. These can render about 9.4 lakh ha water logged and affect as much as quarter of the population in some years. Hydrogeologically, the various lithounits of the State can be grouped as unconsolidated / Alluvial formation; semiconsolidated formations and consolidated/fissured formations. The main alluvial tract covers entire north Bihar and a sizeable area south of the Ganga River. These alluvial formations constitute prolific aquifers where the tubewell can yield between 120247m³/ hr. The potentiality of these aquifer decreases due south in the marginal tract. Auto flow conditions occur in the subTarai region of Madhubani, Sitamarhi and West Champaran districts. In the hard rock areas of South Bihar, borewells located near lineaments/fractures can yield between 1050 m³/hr. resides in rural area.

II. REVIEW OF LITERATURE

Review of selected literature is an essential part of every research process. It helps us to examine and evaluate what has been said earlier on the research subject.

Payment (1997) estimated that the burden of tap water related waterborne disease could be costing Canadians several million dollars annually due to the costs associated with lost work days, hospitalizations and costs of medications.

National Research Council, (USA) (2004) "Most European countries do not have an adequate surveillance system for waterborne disease, while the situation in developing countries is even worse.

Messner et al. (2006), from the United States Environmental Protection Agency (USEPA), proposed a method for developing a national estimate of waterborne disease attributable to the consumption of drinking water. This approach focused on community drinking water supplies, predicting that 16.4 million cases per year of acute gastroenteritis are a result of the consumption of drinking water in the United States.

Bartram J. et.al. (2015) Drinking water disease outbreaks (DWDOs) occur when bacterial, protozoan or viral pathogens or toxic chemicals contaminate drinking water ingested by humans. This type of disease transmission differs from water-washed, water-based and water-related diseases, whose transmission pathways involve inadequate personal hygiene, parasites living within intermediate aquatic organisms, or water-related insect vectors, respectively.

III. MATERIALS AND METHODS

The method used in this paper is descriptive-evaluative method. The study is mainly review based. It is purely supported by secondary source of data, i.e. books, journals, papers and articles and internet.

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IV. RESULTS AND DISCUSSION

Water supply status:

It is the responsibility of the State Government to provide safe drinking water to its people. Till last decade coverage of habitations was the priority of the government. Safe water and other related issues like sanitation and hygiene have been not taken care of. The rural population of the state is served by public as well as private hand pumps (India Mark III and shallow well handpumps). The nos of Govt handpumps in the state is more than 800000 in addition to over 700 rural piped water supply schemes. The contribution of private handpumps in water supply is also significant as they are quite high in numbers. The accessibility of drinking water is easy due to groundwater availability at low depth. The major problem in the sector is to ensure adequate, safe and uninterrupted availability of water and adequate sanitation facilities. Due lack of knowledge and low affordability, the private water sources are mostly shallow in nature hence there is high risk of fecal contamination. Lack of adequate sanitation facilities and hygiene practices makes the situation more critical. The sanitation coverage in rural areas is only 14%, hence the task of providing safe drinking water becomes more challenging. The recurrent floods poses significant challenges to rural water supply and sanitation service delivery in large parts of the state. This not only interrupts service delivery during the floods but also causes damage to RWSS infrastructures and has heavy health implications during and after the recession of floods. Sustainability of sources and the water supply system is also a key issue in maintaining regular supply of drinking water. The aging of the water supply assets, their timely replacement and regular maintenance of the water supply assets, minimising the down time of the water supply system are the major area to be addressed.

Water quality status :

Even after being rich in water reserves, the summer is water stressed in the southern part of the state and during rainy season floods in the northern Bihar drinking water becomes unsafe due to fecal contamination causing increase in incidents of diseases like diarrhea, dysentery, typhoid fever, intestinal helminthiasis, jaundice, cholera etc. The emergence of chemical contamination in the ground water also posing challenges in providing safe drinking water. The state Government recent findings of the water quality mapping of the whole state (226145 samples were tested during November 2007-February 2008, covering all the 38 districts) indicates that the drinking water sources in rural areas are not safe in most of the area and the health of the rural population is at risk. Out of the 38 districts, water sources of 1750 habitations of 80 blocks in 13 districts situated along the river Ganges are partially affected by arsenic contamination (As >50 ppb) whereas the drinking water sources of 6373 habitations of 22 districts are affected with excess Fluoride (>1.5 ppm) and presence of excess iron in groundwater is in majority of the districts. Apart from chemical impurities fecal contamination of water is prevalent in many water sources. (Envirotech Report 2008). It was found in Arsenic affected areas that the water of open wells are safer in respect of Arsenic. The Deep tubewells (Depth > 125M) are yielding Arsenic free water whereas in fluoride affected areas the fluoride content is increasing with depth.

In Arsenic affected area, sanitary dug wells are being constructed for immediate short term measures, Multi village piped water supply schemes using surface water is being implemented in few districts. Deep tubewells are also adopted as one of the alternate options. In Fluoride affected area domestic fluoride removal filters are being distributed as a short term measures. As long term measure community water supply schemes with solar powered motor and pumps and adsorption based treatment units are being constructed. Apart from that the contaminated water sources are marked red to make people aware of the quality problem in the water source.

Causes:

Water-borne diseases are infectious diseases spread primarily through contaminated water. However, apart from that, water borne diseases can be spread through other means such as via clothes, hands, foods, materials used for cooking, eating, and drinking. Pathological microorganisms can enter the body through an open wound, eyes, and nose as well. Typhoid fever, dysentery, diarrhea, cholera, hepatitis, worms, and polio are some of the widespread water

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Vol. 9, Issue 3, March 2020

borne diseases. Though these diseases are spread either directly or through flies or filth, water is the chief medium for spread of these diseases and hence they are termed as water-borne diseases.

Water Borne Diseases

Exposure to polluted water can cause diarrhoea, skin irritation, respiratory problems, and other diseases, depending on the pollutant that is in the water body. Stagnant water and other untreated water provide a habitat for the mosquito and a host of other parasites and insects that cause a large number of diseases especially in the tropical regions.

Water-borne diseases like cholera, gastroenteritis, diarrhoea erupt every year during summer and rainy seasons in Bihar due to poor quality drinking water supply and sanitation. Most dangerous water related diseases that occur in Bihar is described as follows:

Malaria

Malarial fever is spread by the Plasmodium parasite mosquito that breeds in water bodies like lakes, paddy fish and stagnant water. Malaria can kill a child who does not have the immunity against malaria.

Typhoid

Fluctuating high fever, exhaustion, sleepiness, diarrhea etc are the signs of typhoid. The infection spreads through contaminated food and water or through close contact with an infected person. Typhoid vaccine is available for protection against the disease.

Filariasis

Filariasis is a parasitic disease and affects people who live near unsanitary water bodies or sewages. It can lead to loss of sight, and rapid skin pigmentation and the filarial worms can affect various parts of the body. It is a concern for the rural population in India whose major occupation is agriculture.

Hepatitis A and E

Hepatitis means inflammation of the liver. Different viruses such as hepatitis A, B, C, D and E cause the disease. Both Hepatitis virus A and E are water-borne diseases. Consumption of water or food contaminated by the HAV or HEV infected person causes hepatitis. Vaccine is available for hepatitis A. However, there is no vaccine for hepatitis E infection.

Poliomyelitis

Polio is a communicable disease which is categorized as a disease of civilization. Polio spreads through human-to-human contact, usually entering the body through the mouth due to fecally contaminated water or food (fecal-oral transmission). Polio is a horrific disease because it tends to infect children under five, causing lifelong crippling conditions. There is no cure for polio, but there are two vaccines, meaning the strategy to eradicate the disease is focused on prevention.

Rotavirus Diarrhea

Rotavirus is the most common cause of severe diarrhea among infants and children throughout the world. Most unvaccinated children become infected with rotavirus by age of three. Rotavirus causes fever, vomiting, and watery diarrhea. Rotavirus infection is highly contagious.

E. coli Diarrhea

Diarrheal infection is spread through food and drinking water that has been contaminated. A diarrheal attack can last up to 2 weeks and leave the person completely dehydrated.

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Vol. 9, Issue 3, March 2020

Dysentery

Ingestion of water contaminated with four different species of Shigella bacteria can cause dysentery. The symptoms include stomach pain followed by watering diarrhea. Treatment is similar to that of diarrhea.

Cholera

Cholera is water related disease, caused by Vibrio cholera bacteria and is diarrheal in nature. It can kill in hours if left unattended. Cholera strikes when one ingests water that is infested with the bacterium. Epidemics of cholera are common during floods and monsoon season. People living in poverty, residing in crowded areas without adequate sanitation are more susceptible to cholera. Cholera vaccine offers protection.

Amebiasis

Amebiasis or amebic dysentery is caused by the protozoan Entamoeba histolytica. Amebiasis is an intestinal infection in which cysts are passed in the feces. Amebiasis is the third leading parasitic cause of death worldwide, surpassed only by malaria and schistosomiasis. On a global basis, amebiasis affects approximately 50 million persons each year, resulting in nearly 100,000 deaths.

Improved sanitation and clean water supply decrease the incidence of amebiasis. Drinking water can be rendered safe by boiling or iodination with tetraglycine hydroperiodide. Nevertheless, drinking water is usually not much of the problem.

Giardiasis

It is a diarrheal infection of the duodenum and small intestine caused by a single-celled organism called Giardia lamblia (a flagellated protozoan parasite). Infection ranges from asymptomatic colonization to acute or chronic diarrhea and malabsorption. It is more prevalent in children. It can be prevented by proper hand washing, purify public water supplies adequately include chlorination and filtration and by brisk boiling of water for at least 1 min.

Cryptosporidiosis

It also known as crypto, a parasitic disease caused by Cryptosporidium, a coccidian protozoan parasite (Sporozoa). Crypto affects the intestines and is typically an acute short-term infection. Cryptosporidium can infect several different hosts; can survive most environments for long periods. It is spread through the fecal-oral route, often through contaminated water in swimming pools.

Weils Disease

Weil's disease is a severe form of a bacterial infection known as leptospirosis. Leptospirosis is caused by bacteria from the genus Leptospira. The infection typically only causes mild flu-like symptoms, including headaches and chills. In severe cases, such as in Weil's disease, it can lead to organ failure and bleeding. Leptospirosis is spread to humans by contact with soil or water contaminated with the urine of certain wild animals, including cattle, pigs, dogs, and rats. Symptoms include fever, chills, muscle aches, headaches, nausea and vomiting, cough, loss of appetite. Severe infections, which are referred to as Weil's disease, only occur in about 10 percent of cases. People who work with animals can help prevent infection by wearing protective gear, like water-proof shoes, goggles, and gloves. Proper sanitation and rat-control measures are also helpful to prevent spread of the bacteria.

Schistosomiasis

Schistosomiasis is a chronic, debilitating parasitic disease infecting more than 200 million people and is second only to malaria in terms of public health importance. Of the estimated 200 million infected people, more than half have symptoms and 20 million exhibit severe disease manifestations. It continues to threaten millions of people particularly the rural poor in the developing countries. There are five species of schistosomes that can infect humans, of which S.mansoni, S.japonicum and S. haematobium are the most important ones.

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Vol. 9, Issue 3, March 2020

Ascariasis

Ascariasis is an intestinal infection caused by a parasitic roundworm. Globally it is the most common human infection caused by worms. It occurs most often in areas with poor sanitation or crowded living conditions. Children are more likely than adults to develop gastrointestinal symptoms with an ascariasis infection. Ascariasis is common in warmer or tropical climates, particularly in developing nations, where it can affect large segments of the population. Ascariasis is rare in the United States, due to strict sanitation rules and regulations. The most important measure of protection against ascariasis is the safe and sanitary disposal of human waste, which can transmit eggs.

Threadworm Disease

Threadworm infection, which is also called strongyloidiasis, occurs in most countries of the world but is natural to (endemic in) tropical and subtropical climates. Human beings are universally susceptible to threadworm infection, although adults and older children are at greater risk of infection than younger children. Threadworm infection is caused by *Strongyloides stercoralis*, a roundworm that lives in soil and can survive there for several generations. Threadworm infections are treated with medications. Patients with severe infections should be given protein replacement, blood transfusions, and fluids to replace losses from nausea, vomiting, and diarrhea.

There is no effective immunization against thread-worm infection. Prevention of the disease requires careful attention to personal and institutional hygiene in endemic areas, including hand washing after defecating and before handling food.

Hydatid Disease

Hydatid disease is also referred to as echinococcosis or echinococcal disease. It results from an infection due to a tapeworm of genus *Echinococcus*. Human echinococcosis is a zoonotic infection (i.e it is a disease of animal kingdom that sometimes can be transmitted to humans). This microscopic tapeworm is found in foxes, dogs and cats. Human cases are rare.

Dracunculiasis

Dracunculiasis, also called guinea worm disease (GWD), is a nodular dermatosis produced by the development of *Dracunculus* parasite in the subcutaneous tissue of mammals. The primary mode of prevention is through behavior change, alongside the provision of clean water sources and the treatment of contaminated drinking water with larvicides.

Diphyllobothrium

Diphyllobothrium is a genus of tapeworm which can cause *Diphyllobothriasis* in humans through consumption of raw or undercooked fish. The principal species causing *diphyllobothriosis* is *Diphyllobothrium latum*, known as the broad or fish tapeworm, or broad fish tapeworm. Symptoms of *diphyllobothriasis* are generally mild, and can include diarrhea, abdominal pain, vomiting, weight loss, fatigue, constipation and discomfort. Diagnosis is usually made by identifying proglottid segments, or characteristic eggs in the feces.

Chemicals In Drinking Water

Chemicals in water can be both naturally occurring or introduced by human interference and can have serious health effects. Various elements and their effects on health are described here:

Fluoride. Fluoride in the water is essential for protection against dental caries and weakening of the bones, but higher levels can have an adverse effect on health. In India, high fluoride content is found naturally in the waters in Rajasthan. Maximum permissible limit of fluoride in drinking water is 1.5 mg/l as prescribed by BIS (2012).

Arsenic occurs naturally or is possibly aggravated by phosphorus from fertilizers. Its high concentrations in water can have liver and nervous system damage, vascular diseases, skin diseases, vomiting, diarrhea, numbness in hands and feet, partial paralysis, blindness and also cancers of the bladder, lungs, skin, kidney, nasal passages, liver,

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Vol. 9, Issue 3, March 2020

and prostate in human being. Arsenic occurs in higher concentrations in drinking water in West Bengal. BIS (2012) have set the arsenic standard for drinking water at 0.05 mg/l (permissible in the absence of alternate source).

Lead. Pipes, fittings, solder, and the service connections of some household plumbing systems contain lead that contaminates the drinking water source. It causes decreased bone and muscle growth, kidney and nervous system damage, high blood pressure and other digestive problems when found in higher amount. Although it is very useful metal for human being but there is no safe level of lead and not permissible level in absence of alternate source (BIS, 2012).

Low levels of manganese in the diet are considered to be nutritionally essential in humans. On the other hand, chronic inhalation exposure of humans to manganese results primarily in effects on the nervous system. Slower visual reaction time, poorer hand steadiness, and impaired eye-hand coordination were reported in several studies of workers occupationally exposed to manganese dust in air. Other chronic effects reported in humans from inhalation exposure to manganese are respiratory effects such as an increased incidence of cough, bronchitis, dyspnea during exercise, and an increased susceptibility to infectious lung disease. Metallic manganese is used primarily in steel production to improve hardness, stiffness, and strength. Total concentration of Manganese (as Mn) shall not exceed 0.3 mg/l in drinking water (BIS, 2012).

Iron is an essential part of hemoglobin; the red colouring agent of the blood that transports oxygen through our bodies. Iron may cause conjunctivitis, choroiditis, and retinitis if it contacts and remains in the tissues. Chronic inhalation of excessive concentrations of iron oxide fumes or dusts may result in development of a benign pneumoconiosis, called siderosis. Total concentration of Iron (as Fe) shall not exceed 0.3 mg/l in drinking water (BIS, 2012).

Other Heavy metals. These contaminants come from industrial activity, mining waste and tailings, landfills, or hazardous waste dumps.

Petrochemicals contaminate the groundwater from underground petroleum storage tanks. They can be absorbed through the skin or might be ingested, they can accumulate in human tissues and organs such as the brain and liver and can cause brain, nerve and liver damage, birth defects, cancer, asthma, hormonal disorders, and allergies.

Chlorinated solvents are used for a wide variety of commercial and industrial purposes, including degreasers, cleaning solutions, paint thinners, pesticides, resins, glues, and a host of other mixing and thinning solutions. Workers can be exposed to chlorinated solvents through the absorption of solvents, through inhalation and skin contact. Short-term side effects may include dizziness, fatigue, headaches, and/or skin rashes. Long-term side effects may include chronic skin problems, and/or damage to the nervous system, kidneys, or liver. Some chlorinated solvents are also known to cause cancer, in both humans and animals. It makes the fresh water unusable for drinking and irrigation purposes.

Drinking water that gets contaminated with nitrates can prove fatal especially to infants that drink formula milk as it restricts the amount of oxygen that reaches the brain causing the 'blue baby' syndrome or methemoglobinemia. It is also linked to digestive tract cancers. It causes algae to bloom resulting in eutrophication in surface water. Acceptable limit of nitrate in drinking water is 45 mg/l as prescribed by BIS (2012).

Studies have found that people who work with organophosphates and the carbonates present in pesticides have a higher risk for many different types of cancers, including leukemia, kidney, brain, testicular, prostate and cervical cancers, and Non-Hodgkin's Lymphoma (NHL). Some of the pesticides contain carcinogens that exceed recommended levels. They contain chlorides that cause reproductive and endocrinal damage.

Preventive Measures

News published in daily news paper tells that as result of a survey conducted in Kolkata, it was observed that waterborne diseases like cholera, jaundice, typhoid, diarrhea as well as common cold, cough and fever accounted for 79% ailments with malaria, dengue and other diseases making up the rest (The Times of India, 2013). These are the main cause of childhood death, especially with diarrhea. They are caused by various bacteria, viruses, and pathogenic microorganisms inhabiting poorly treated drinking water and wastewater or occurs after a natural disaster, like flooding. They are contagious in nature hence their prevention requires high standards of hygiene and sanitation. Due to

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Vol. 9, Issue 3, March 2020

spreading nature they are extremely harmful and lead to severe illness and sometimes may even be fatal. Therefore, prevention of waterborne diseases is vital. Keeping this in mind proper management of water resources has become the need of the hour as this would ultimately lead to a cleaner and healthier environment.

Common household items such as chlorine bleach, tincture of iodine, and iodine tablets can be used to disinfect water. Another important measure that should be taken to avoid the spreading of pathological microorganisms are: Wash hands properly before eating.

V. CONCLUSION

The unavailability of safe potable water, individuals are forced to extract groundwater at very unsafe location and depth. Poor quality water sources combined with ineffective water treatment, results in the consumption of unsafe drinking water by many residents. People with under-developed or weakened immune systems are especially vulnerable to pathogen exposure with infants having risk factors that can be orders of magnitude greater than healthy adults. The arsenic affected wells in particular and the contaminated aquifer in general, to be avoided. Arsenic free deep aquifer, which has sufficient potentiality, can be tapped for community water supply. But care should be taken for leakage of contaminated water from shallow aquifer downwards due to faulty design/construction of the wells. Arsenic treatment based solution may not be viable because of several constraints such as difficulty in operation, safe disposal of sludge and maintenance of the system. At last efficient water management is required for preventing further deterioration of water quality and its sustainable use. There is an urgent need to identify the presence of viruses, bacteria and protozoan parasites in rural water sources. It is also required to develop water treatment technologies that can form effective barriers for these microbes. There is a need of regular enforcement of environmental sanitation laws. The local, state and the government agencies should coordinate and collaborate in the areas of sanitation and water supply so as to avert any outbreak of water borne diseases originating from communities. Finally, the government should put up a national action plan to check the possible spread of water borne diseases and sponsor research in the rural areas on water borne diseases as a means of disaster risk reduction.

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