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Water Related Disease and Health Disorder

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ABSTRACT: World Health Organization (WHO) defines disaster as any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services, on a scale sufficient to warrant extra-ordinary response from outside the affected community or area. Disasters are of two types: Natural Disasters (e.g. Earthquakes, Floods, Volcanoes etc.) and Manmade Disasters (e.g. Famine, Epidemics, Fire, Microbial warfare, etc.). Environmental health disaster are mainly man made but in some situations geophysical processes can result in environmental health diseases such as arsenic poisoning of water in West Bengal, Bangladesh. Irrespective of the nature of hazard, all disasters exert "7Dseffect": Death, Disability, Disease, Distress, Damage to health services, Damage to the economy of the country, and Damage to the environment. Concept of 'hazard' and 'vulnerability' emerged out recently for prevention of disaster. Hazard is the dangerous condition or event, that threat or has the potential for causing injury to life or damage to property or environment. In case of water which is part of environment can be polluted to such a level that it can become hazard to environment and human health. One of the major causes of water pollution is waste. Although nothing is called as waste but for practical purpose, it can be define as are source that is not safely recycled back into the environment or the marketplace. This article describes in detail the various water related health disorders.

Key words: - Water, Health, Transmission , world , epidemic

INTRODUCTION:

Majorityofoutbreaksifnotmanagedontimethenthe yhaveapotentialtobecomeepidemic and if epidemic not controlled then they can turn out to disasters. There for a clear cut definition hastobechartedoutforwaterandwasterelatedoutbr eaksandepidemics.Waterisapotential vehicle and any water pollutant can spread to a wider geographical area via water bodies like canals, rivers or seep into underground water table. A water borne outbreak is defined as a cluster of two or more infections caused by the same agent(s) and linked to the same water exposure. Waterborne diseases can be caused by water contaminated with pathogens, chemicals, or toxins which can be spread through ingestion, contact with, or breathing contaminated water.

Burden of Water related Disease outbreaks

In past, there were 2,200 water-related disasters from 1990 to 2001. (CRED 2002) Their distribution were as follows: a) Floods: 50%, b) Water-borne and vector disease outbreaks: 28%, c) Droughts: 11%, d) Landslide and avalanche events: 9%, and e) Famine: 2%. The geographicaldistributionindicatedthattheyhadaff ectedallregionsoftheworldbutmoreso in Asia(35%)and Africa(29%).In American region they were 20%,andinEurope13%,and in Oceania only3%.

The largest waterborne disease outbreak in United States history occurred in 1993 in Milwaukee, when over 400,000 people became ill with diarrhea when the parasite Cryptosporidium was found in the city's drinking water supply. Similarly, Legionnaire's disease had caused severe outbreak inUSA.

Katrina and other Hurricanes exposed the truth that no country can take water related disasters lightly which directly and indirectly after the environment and human health.7These disasters had huge economic loss also. The American Insurance Services Group (AISG) estimates that Katrina is responsible for $41.1 billion of insured losses in the United States. An estimate of the total damage cost of Katrina in the United States is obtained by doubling

theAISGfiguretoaccountforuninsuredlossesanda ddingtheinsuredlossesfromNFIP.This yields a total damage estimate of $108 billion in the United States forKatrina.

In India, the 1999 Odisha cyclone, also known as Cyclone 05B, and Paradip cyclone, was the deadliest since the 1991 Bangladesh cyclone and deadliest Indian storm since 1971. The Odisha cyclone Approximately 275,000 homes were destroyed, leaving 1.67 million people homeless. A total of 19.5 million people were affected by that cyclone to some degree. A total of 9,803 people officially died from the storm, with 40 others still missing, though it is believed that 15,000 people died.

Another example is Cloud burst in Leh region of Laddak where 400 families were badly affectedduetoflushfloodandsubsubsequentlymas sivelandslidemadethesituationworstfor reliefmeasures.IndianRedCrossSocietyprovidedcl eandrinkingwatertotheaffectedpopulation. Infloodthedrinkingwaterisamajorchallengetoprev entwaterbornediseaseepidemics.

Causes of Water related Disease outbreaks

Water related disease outbreaks occur due to pollution. Water pollution refers to the state of water in which undesirable and sufficiently large amount of pollutants (soluble, insoluble, toxin and pathogens) are present which may cause damage to the health of human being or environment. Natural disasters directly and indirectly affect the water leading to disease outbreaks and epidemics. As water is essential commodity of life, any damage to its quality and quantity may have serious effect on human health and environment. Similarly manmade conditions are also damaging the water. Following are the important causes for water related disease outbreaks:

Geographical characteristics: Arsenic concentrations in ground waters in Bengal, SoutheastAsia,andelsewhereconstituteamajorha zardtothehealthofpeopleusingthese waters for drinking, cooking, or irrigation. A comparison of occurrences in the Ganges- Brahmaputra, Mekong, and Red River basins indicates various reasons: (1) riverdrainage from the rapidly weathering Himalayas, (2) rapidly buried organic-bearing and relatively young sediments, and (3) very low, basin-wide hydraulic gradients. Anaerobic microbial respiration,utilizingeithersedimentaryorsurface-derivedorganiccarbon,isoneimportant process contributing to the mobilization of arsenic from host minerals, notably hydrous iron oxides. The extensive groundwater pumping in these areas could be another reason for change. However, there is sufficient evidence to make a prima facie case that human activity might exacerbate arsenic release into thesegroundwaters. Excessivelevelofarsenicindrinkingwaterisamajorp ublichealthdisasterinthoseareas. Severalviableapproachestomitigationcoulddrastic allyreducearsenicexposure,butthey all require periodic testing. Similarly developing treatment technologies for alternative surface-water supplies need to be urgentlyrequired.

Water supply and sanitation problem: Deficiencies in established norms and quality of potable water and difficulties in the disposal of excreta and other wastes result in the deterioration of sanitation, contributing to conditions favorable to the spread of enteric and other diseases. For example, immediately after the devastating earthquake in Turkey in August 1999, an infectious disease surveillance system mainly focused on diarrheal diseases analyzed 1,468 stool cultures and found main cause of diarrheal outbreak was Shigella species. This study has emphasized the necessity to set up infectious disease surveillance systems after such development of alternate mechanism of water supply andsanitation.

Water-Borne Infection is a range of syndromes, including acute dehydrating diarrhea

(cholera),prolongedfebrileillnesswithabdominalsymptoms(typhoidfever),acutebloody diarrhea (dysentery), and chronic diarrhea (Brainerd diarrhea). Common viral infections are hepatitis A and E,poliomyelitis, CommonbacterialagentsfordiarrheaincludeVibrio cholerae,Campylobacter,Salmonella, Shigella,andthediarrheogenicEscherichiacoli.Eachyear,estimated3-5billionepisodes of diarrhea result in an estimated 3 million deaths, mostly among children. Waterborne bacterial infections may account for as many as half of these episodes and deaths. Many deaths among infants and young children are due to dehydration, diarrhea associated malnutrition, or other complications of waterborne bacterialinfections.

Contaminated surface water sources and large poorly functioning municipal water distribution systems contribute to transmission of waterborne bacterial diseases. Chlorination and safe water handling can eliminate the risk of waterborne bacterial diseases. Over 2 billion persons living in poverty in the developing world are at high risk. Despite global efforts during the water and sanitation decade, improvements in water and sanitationinfrastructurehavebarelykeptpacewith populationincreasesandmigrationsin the developingworld.

Food and nutrition problems: Food shortages in the immediate aftermath are very common. Food stock destruction within the disaster area may reduce the absolute amount of food available, or disruption of distribution systems may curtail access to food, even if thereisnoabsoluteshortage.Floodingandseasurgesoftendamagehouseholdfoodstocks and crops, disrupt distribution, and cause major local shortages. Contaminated water and improper waste disposal can be source of food and nutritionproblems.

Damage to health infrastructure: Health systems are also among the most vulnerable to naturaldisasters.Forexample,afterthe2004Indian Oceantsunami,alargenumberofhealth institutions were damaged. These included hospitals, drug stores, cold rooms, preventive health care offices, health staff accommodation facilities and district health offices. In addition,alargenumberofvehicles(ambulances,vans,motorbikes)andmostofthemedical equipment and office equipment in the affected areas were totally destroyed. The loss of healthpersonnelincludedmedicalofficers,nurses, midwivesandsupportstaff.Transportationandtelecommunicationsmayseriouslybejeopardizedduringacatastrophic eventwhichmayimpedepublichealthsector'sabilitytorespondtodisaster.Thepotential health risks of different disaster can be summarized as shown in table 1. This is evident thatriskofwaterrelatedoutbreaksisalwaysthereinalmostalldisasters.

Waste:wasteisamaterialthatmaybediscardedasunwantedbutwhichmayhavevalueorpurpose inothercontent.Wastecametobeviewedasdiscardedmaterials,howevermuchofwhichcan bereusedorrecycled(cardboard,paper,plastic,etc.) orgeneratefertilizerbycompostingwaste.

Following are various categories of wastes which potential to contaminate water bodies:

- Biomedical waste is generated in the diagnosis, treatment or immunization of human beings or animals, in research or in the production or testing of biological products including all categories of infected, blood products, dated/expired pharmaceutical drugs and toxic waste that is potential threat to human beings and environment. Such wastes if not managed carefully may have potential to contaminate waterbodies.
- Chemical waste: Inorganic: Nitrates, phosphates, chloride and fluoride, Organic: Pesticides, dyes, chloro-compounds, phenols, paints and plastics. Heavy metals: soluble heavy metal ions such as mercury, lead, cadmium, copper, zinc and their organometallic

compounds. Products of industry and agriculture, such as dioxins and dioxin-like compounds (PCBs) are potential cause of health and environmenteffects.

- Organic mercury and heavy metals, such as lead and cadmium are well known water contaminants leading to disaster like situations. One of the examples of worst sea water contamination is Minimata disease that was first discovered in Minimata city in Kumamoto prefecture Japan in 1956. It was caused by the release of methyl-mercury industrialwastewaterfromtheChissoCorporation's chemicalfactoryintheMinimata sea, which continued from 1932 to 1968. This toxic chemical accumulated in shellfish and fish in Minimata Bay and the Shiranui Sea, which when eaten by the local people resulted in mercury poisoning. While cat, dog, pig, and human deaths continued over more than 30 years from the disease. As of March 2001, 2,265 victims had been officially recognized(1,784ofwhomhaddied)andmanymoret imesweredisabledhad received financial compensation. By 2004, Chisso Corporation had paid $86 million in compensation, and in the same year was ordered to clean up its contamination. On March 29, 2010, a settlement was reached to compensate as-yet uncertified victims.
- Another example is Itai-itai disease which was caused by Cadmium poisoning due to mining in Toyama Prefecture. In various mining processes for gold, silver, lead, copper, zinc, the cadmium was released in significant quantities. This subsequently increasedthepollutionoftheJinzuRiveranditstribu taries.Theriverwasusedmainly for irrigation of rice fields, but also for drinking water, washing, fishing, and other uses by downstream populations.The cadmium accumulated in the people eating contaminated rice lead to kidney diseases and bone deformities.
- Dioxinsanddioxin-likecompounds(Polychlorinatedbiphenyls,PCBs)a reby-products ofvariousindustrialprocesses,andarecommonlyre gardedashighlytoxiccompounds thatarepersistentorganicpollutants.Theacuteexp osuretoPCBshasbeenreportedin Japanfollowingtheingestionofriceoilcontaminated byPCBs.InSwedenbirthweight has been found to be reduced and the perinatal mortality rate higher than expected in regions with high consumption of fatty fish from the Baltic Sea. In addition, from studies around Lake Michigan, it has been shown that children who had been exposed to PCBs in utero have retarded cognitive development.
- LiquidWastesareusuallywastewaters,generat edfrommunicipalities,laboratoriesand industries,whichcontainlessthan1%suspendedso lids.Becauseitcontainedbacteria, viruses,chemicals,metals,etc.,ifdisposedoffinwate rbodieswithouttreatmentitcan be dangerous to human health and environment.
- Radioactive waste and accidental release in water body: liquid, solid and gaseous wastes, contaminated with radionuclides from nuclear medical diagnostic, therapeutic proceduresorpowergeneration.Recentlytsunamic ausedhavocinJapanbydestroying three nuclear power plants. These effects have to be estimatedyet.
- Solid Wastes are waste materials having less than approximately 70% water. Thisclass includes municipal solid wastes such as household garbage, industrial waste, mining wastes, and oil field wastes. They are also potential sources of water contamination if directly dumped in waterbodies.
- Physicalwaste:wasteheatfromindustrialplant s,turbidityetc.alsocauseswaterpollution which affect the aquatic life and make the water unfit for humanconsumption.

Aral Sea Disaster: Aral Sea is an example of manmade environmental water related disaster. Until 1960 the Aral Sea was considered the 4th largest lake in the world by surface area. From early 1960s because of extensive water use--unreturned withdrawal of waterforirrigationandconsequentdryingupofmanytributariesbeforereachingthemain rivers--the water level in the Aral Sea began falling very rapidly. By 1990 the level of the AralSeawaterfellbymorethan17m,thevolumeofwaterdecreasedby75%,thesalinity of seawater increased up to 30 g/l, and the surface area of the sea reduced from 66,400 sq. km to 31,500 sq. km. Irrigated soils become deserts, deterioration of underground and surface water quality, reduction of available water for domestic and agricultural needs, loss of Aral Sea fishing and finally human activities put the health of present and future generations under threat.Children are more prone to poverty and exposure of chemicals and pesticides which were heavily used for agriculture and industries near the Aral Sea resulted congenital defects and malnutrition inthem

Pesticides: are used for many purposes for example to gain agricultural productivity and to keep homes free from mosquitoes and other pests. But pesticides are toxic substances to human and environment. The World Health Organization and the United Nation Environment Program estimate that each year, 3 million workers in agriculture in the developing world experience severe poisoning from pesticides, about 18,000 of whom die.In India, water was found contaminated with pesticides. Even the bottled water whichisconsideredtobesafewasalsohadalltypesofpesticidessuchasHCH(Lindane), DDT and its metabolites, Endosulfan, Malathion and Chlorpyrifos.Pesticides are also linked with the rising incidence of cancers in Punjab.

Water-Based Disease (non-fecal contamination) refers to the infections transmitted throughanaquaticinvertebrateanimale.g.schistosomiasisanddracunculiasis.Dracunculus medinensis is the causative organism of Guinea worm disease, and is unique in being the only pathogen of non-fecal origin and ingested through water.

Water-Breeding" diseases are those which are transmitted by mosquitoes or flies living near aquatic conditions. They are the part of water-related diseases which refer to the infectionsspreadbyinsectsthatdependonwater.Insectvectorsbreedinginwatertransmit malaria, filariasis, onchocerciasis, sleeping sickness, yellow fever and dengue fever. The infection may also occur by inhalation through microbes on water droplets, such as those produced by showers, air conditioning systems or the irrigation of agriculture land. All these diseases have potential to cause epidemic in a wide geographicalareas.

Current status of management of water related outbreaks in India

The ferocity and impact of catastrophic events have increased in recent times in the country. Traditionally, disasters have been looked upon as aberrations or interruption in normal day to day activity of the society to be responded primarily with relief. But, there was growing realizationthatdevelopmentcannotbesustainedunlessallthephasesofDisasterManagement Cycle continuum are comprehensively addressed considering the large number of casualties and economic losses which the country has experienced in the recent past.TheGovernment of India thereupon adopted a more pro-active multidisciplinary and holistic approach for prevention, mitigation and preparedness. This paradigm shift in the national approach to disastermanagementledtoenactmentofDisasterManagementAct,on23rdDec,2005,which envisaged the creation of an apex body National Disaster

Management Authority with Prime Ministerasachairpersonandlikewiseconstitutionof StateDisasterManagementAuthorities (SDMA) and District Disaster Management Authorities(DDMA).

With the backdrop that the common denominator of all disasters is human suffering,there is a need of concerted actions from SDMA/DDMA and medical fraternity for prevention and management of mass casualty inflicted due todisasters.

The Indian Red Cross Society is implementing Disaster Risk Reduction program in 3 states- Maharashtra, Andhra Pradesh and Odisha which is supported by Hong Kong and Canadian red Cross.

Medical preparedness of Disasters in India

The pro-active approach adopted by Government of India (GOI) and Naitonal Disaster Management Authority (NDMA) culminated into formulation of the National Guidelines on Medical Preparedness and Mass Casualty Management.These guidelines encompasses medical management in four phases, that is, initially at the Incident site by the Medical First Responders within the 'golden hour' preferably a critical period between injury and life/limb saving surgery that decides the patient's outcome; then evacuation in the ambulances fitted with critical care equipment; followed by prompt treatment in the hospitals and sequelae of resultantdisease/disability;andlastly,preventionof epidemics,managementofchronichealth effects and provisioning psychosocial care (medicalpreparedness).

Disease surveillance can predict outbreaks and epidemic in the community after disaster. For that fully furnished laboratories network with peripheral units are required. Bio-safety laboratorieswithfewBSL-3andBSL-4arebeingestablishedatdesignatednodalinstitutions.

IntegratedDiseaseSurveillanceProjectalongwithupgradedlaboratorieshasprovedveryuseful in the management of water related epidemic control. Most of the deaths due to shock can be preventedbyintravenousfluidinfusionandbloodtransfusion.Licensedbloodbankscriticalfor managementofshockhavebeennetworkedtocaterforsurgerequirementduringdisasters.

Transportation for casualty evacuation by the Integrated Ambulance Network having basic medical equipment for resuscitation, essential drugs, and two way communication vis-à-vis the hitherto before Ambulances which functioned only ferried patients. Of late, casualty evacuations by air, especially by helicopters ambulances, have greatly improved patient care management capabilities.

Additional thrust is on telemedicine which entails putting diagnostic equipment and Information Communication Technology for connectivity between the disaster site and advancedmedicalinstituteswheresuchlinkuphave beeninstalled.TraininginFirstAidofthe community to improve their response to disaster is also useful.

Water related outbreaks and epidemics are investigated at the district and state level by District or State Rapid Response Team under Integrated Disease Surveillance Program (IDSP) under the umbrella of National Rural Health Mission. The major objectives of the IDSPare:a)toestablishadecentralizedstatebasedsystemofsurveillanceforcommunicable and noncommunicable diseases, so that timely and effective public health actions can be initiated in response to health challenges in the country at the state and national level; and b) toimprovetheefficiencyoftheexistingsurveillanceactivitiesofdiseasecontrolprogramsand facilitatesharingofrelevantinformationwiththehealthadministration,communityandother stakeholders so as to detect disease trends over time and evaluate controlstrategies.

The program has three types of surveillances:

SyndromicSurveillance: Healthworkersinthefieldthesurveillanceonthebasisofsyndromewhichtheycanidentifyforexample,increasenumberofloosestoolswithorwithoutblood.

ClinicalSurveillance: Thisiscarriedoutbymedicalofficersandbasedonhis/herclinical skills, they diagnose the diarrhea or water related disease case clinically andreport.

LaboratorySurveillance: Thisisbasedonthelaboratorydiagnosiswhichismoreconfirmed about the disease pathology or etiology. For all practical purpose such diagnoses are not requiredforanepidemicresponse.Howeverlaboratoryconfirmationisalwaysrequiredto determine the cause.

Functions of National Surveillance Unit (NSU)

NSU execute the approved annual plan of action for IDSP and also monitor progress of implementation of the project. It is its duty to obtain physical reports and expenditure statements from states and report regularly to National Disease Surveillance Committee. The unitprovidesprototypeguidelines,manualsandmodules.Procurementofgoods,trainingand IEC,analysisofdatafromthestatesandprovidefeedbackontrendsobservedandcoordinating with National Center for Disease Control, ICMR and othersbodies.

Functions of State Surveillance Unit

Chairperson of the State Surveillance Committee is State Secretary Health. He is supported by Joint Director (State Surveillance Officer). There are 2 consultants (for Technical & Training and Finance & Procurement) and one data manager, two data entry operators, one officeassistantandclassIVemployees.StateSurveillanceUnitcollatesandanalysesthedata receivedfromdistrictandtransmittingtoCentralSurveillanceUnit.Itcoordinatesactivitiesof rapidresponseteamsanddeputingthemtothefield. Monitoringandreviewingtheactivitiesof thedistrictsurveillanceunitsincludingchecksonvalidityofdata,responsiveness,functioning of the laboratories, training are also its functions.

Functions of District Surveillance Unit

Chairperson District Surveillance Committee is District Collector or District Magistrate. Deputy Chief Medical Officer acts as District Surveillance Officer. District surveillance unit collates and analyses data received from all reporting units and transmitting to state, constitutes rapid response teams and deputing them to the field whenneverneeded.

In rural areas primary health centers /community health centers, Sub-divisional and district hospitals including sentinel private practitioners or private hospitals are responsible for data collection and response the outbreak. In urban areas hospitals, ESI, Railway, CGHS hospitals and dispensaries, other hospitals medical collages, Municipal Corporation hospitals and dispensaries, including some sentinel private nursing homes, sentinel Hospitals, medical Colleges, NGOs, and private laboratories are also collected the data and reported to the authorities for rapid action.

Epidemic Response

Epidemiological response include following actions:

- Verification ofdiagnosis
- Definition ofoutbreak;
- To confirm that an epidemic actuallyexists;
- Toassessthemagnitudeofproblemintermsofmorbidityandmortalityanditsgeographical spread using working casedefinition;
- Toidentifythesourceofinfectionandmodeoftransmissionbydevelopinghypothesisand testing of hypothesis; and
- To institute area and situation specific control measures andcommunication.

Preventive Measures

Provision of safe drinking water: Safety of drinking water can be ensured either at the point of storage or distribution. Prescribing boiling of water or use of chlorine tablets for chlorination

at household level is one of the most important preventable steps. Chlorinometer is used to measures chlorine content in waterregularly.

Disposal of waste and human excreta needs specialattention.

Fly proofing is done by regular bleaching powder spray in theareas.

Health education: Use of mass media like radio, TV, Newspapers, pamphlets, leaflets containing small repeated messageon:

- Personalhygiene
- Water consumption
- Use of boiled water and use of chlorinetablets
- Food consumption: Food should be safe, fresh and lesscostly.
- Surveillance: a close watch should be kept every day on disease occurrence and trends should beinstituted.
- Immunization against diseases for high risk group population.
- Preparedness for occurrence of disease epidemic based on the community's coping capabilities and required institutional capacities.
- Administrative arrangements need to ensurefollowing:
- Identification of targetgroups/communities.

Continuous and adequate procurement from medical stores: It is expected that 10% of the affected population may require medical treatment. Most common diseases are diarrheal diseases including gastroenteritis, dysenteries, cholera, typhoid, infective hepatitis and poliomyelitis, respiratory infections, skin infections, malaria, insect bites, and snakebites. Electrolyticgeneratorsthatproducesodiumhypochloritefromsaltwater are now affordable and available for use in the developing world. Use of homemade ORS and other safe rehydration solutions can markedly reduce diarrhealdeaths.

- Availability of vaccine for immunization with qualityservice.
- Establishment of medical and health camps.
- Setting up of epidemiologicalsurveillance.
- Publicity and need based healtheducation.
- Involvement of other departments for handling veterinary problems, transport problems, water and sanitation problems,etc.
- More Involvement of community groups, NGOs and other voluntary groups in relief activities.
- Monitoring andreview.

Waterrelatedoutbreaksandepidemicsarerealthreatstothehumanhealth.Environmental degradation is one of the major causes of such disasters. A comprehensive strategy for the prevention of environment pollution not only decreases environment health but also water related disasters. Medical preparedness for early response to such outbreaks decreaseshuman lossestoagreatextent.So,allstakeholdersofpublichealthmustworkincoordinatedmanner in prevention and control of environmental disasters.

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Table 1: Risk of Water related diseases in various disasters

Health (related) effects	**Earthquake**	**Floods**	**Land-slides**	**Epidemics**	**Conflict situation**
Damage to water systems	Severe	Light	Severe (but localized)	None	Limited (depends on the factions fighting)
Damage to health facilities	Severe (structural& equipment)	Severe (equipment usually)	Severe (but localized)	None	Limited (depends on the factions fighting)
Damage to health services	High	High	Low	Moderate	High
Increased risk of epidemics	Yes	Yes	Yes	------	Yes