

75
Azadi Ka
Amrit Mahotsav



WATER for PUBLIC HEALTH

Preparing for Disasters and Pandemics



आपो हिष्टा मयोभुवः

Edited by: V.C. Goyal, Jyoti P. Patil, Varun Goyal
National Institute of Hydrology-Roorkee
(Department of Water Resources, RD & GR, Ministry of Jal Shakti, Govt. of India)





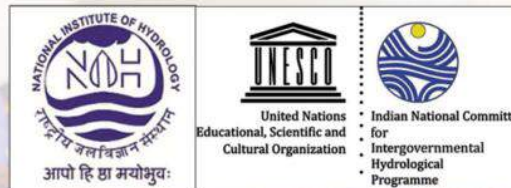
SUSTAINABLE DEVELOPMENT GOALS

Water for Public Health (W4PH)

Preparing for Disasters and Pandemics

Celebrating World Water Day-2022

22 MARCH, 2022



National Institute of Hydrology, Roorkee

(Department of Water Resources, RD & GR, Ministry of Jal Shakti, Govt. of India)

Under the aegis of

Indian National Committee for Intergovernmental Hydrological Programme (IHP) of UNESCO

Suggested citation: Goyal, V.C., Patil, J.P. and Goyal, Varun (2022). Water for public health (W4PH) : Preparing for disasters and pandemics. NIH Roorkee (India), 32pp.

3 GOOD HEALTH AND WELL-BEING

Ensure healthy lives and promote well-being for all at all ages

Disclaimer

The data and information used in this publication have been obtained from different sources including researchers and professionals who contributed to a recent webinar organized by NIH on the same topic . The publication is meant for information to the public without any commercial gains.



FOREWORD



World Water Day, celebrated on 22nd March, became an annual event after the 1992 Earth Summit in Rio de Janeiro, Brazil, and brought home to millions of people the importance of cherishing a valuable resource which affects our very existence. People everywhere can use this day to raise awareness of the high level of disease and misery that results from deteriorated and inadequate water sources. People can learn that they need not be victims, but they can make sincere efforts to consume good, clean water for better health and strive for efficient utilization and conservation of water.

Water is a critical utility in hospitals and healthcare facilities, which consume large amount of water in their daily operations. Hence, water management at healthcare facilities should give the special attention to reduce freshwater consumption, recycle waste-water and reuse for non-critical uses and thereby minimize the operation cost so as to lead to sustainable and environment friendly development.

The healthcare delivery in developing countries takes place in settings where there are inadequate municipal water or treatment facilities. This lack of water and sanitation infrastructure is a major problem that directly impacts hospitals and healthcare systems, either overburdening them with more disease in the population, or because they cannot count on basic water, sewage and waste disposal services to carry out their mission, or both. Many areas that lack safe drinking water, sanitation, and hygiene (WASH) also need to restore and protect fresh water ecosystems and enhance resilience to climate change. The WASH, fresh water conservation, and climate are inextricably linked. Many freshwater ecosystems that provide the water needed for WASH are at risk due to pressure from landuse change, population growth, and climate change. Improper disposal of human waste is also deteriorating fresh water ecosystems. Fortunately, awareness about the importance of integrated efforts to solve these challenges in development projects is increasing, but focused attention is needed now in view of the increasing frequency of disasters and pandemics.

I congratulate Dr. V. C. Goyal, Dr. Jyoti P. Patil and Mr. Varun Goyal, my colleagues from National Institute of Hydrology, on preparing this document on a topic which is of prime importance for public health not only in the present context but also in the coming years.

J. V. Tyagi
Director
National Institute of Hydrology, Roorkee

Preface

A core focus of World Water Day is to support the achievements of SDG-6 : Water and Sanitation for all by 2030. The UN WATER emphasises on 'Valuing Water', which intrinsically highlights the value of water in promoting health and development through safe water. This means we should ponder what does water mean to us? To our life today, and to our future? Just like oxygen supply, we can imagine what will happen if water supply is disrupted at Healthcare Facilities (HCF) during pandemics such as Covid-19. Ensuring a safe and reliable water supply and maintaining water and sanitation has become ever more critical during the pandemic and natural disasters such as cyclones, floods and droughts.

HCF such as hospitals need safe drinking water to care for patients, perform surgeries and sterilize instruments, not only when an emergency strikes a community but also during the normal times. HCF rely on water quality and availability to protect patient health, but should prioritize these needs while reducing wasteful or unnecessary water consumption. In India, the BIS and other standards specify the use of 450 L/patient/day at medium and big-size hospitals, but the actual water consumption is much higher. Hundreds of thousand litres water per day is consumed at medium sized HCF resulting in hefty water and electricity bills, mainly due to the negligence of HCF administration and management and absence of policy regulations. With ever growing population, the HCF are expanding and so is the water demand in this sector, especially with establishment of large-size hospitals in urban areas. Time has come to plan reduction in the water consumption and promoting the use of recycled water at HCF, which will not only reduce the water footprint (and the water bill) but also lead to reduction in electricity bill and the carbon footprint.

Treatment and reuse of wastewater generated in the hospitals and HCF is another area of efficient water use. In order to achieve the goal of judicious water utilization and efficient water conservation and management at HCF, both the water utilities and HCF will have to establish effective communication amongst themselves in terms of technology applications, conducting water audits, designing water conservation structures, development of water security plans, and development of strong awareness and advocacy IEC material for medical professionals, healthcare staff, patients, visitors, etc. For this purpose, NIH recently conducted a webinar on the theme of Water for Public Health, which brought together doctors and other medical professionals, water researchers and specialists policy planners, communication and outreach professionals, technology providers.

With a view to further propagate this idea, we have prepared this document, which highlights the context and brings out the inherent concepts and actions required in Indian context. This document intends to raise awareness amongst water professionals and health practitioners, to answer questions such as

- Are doctors and healthcare workers aware of appropriate water use for patients and services?
- Are HCF in India aware of water regulations for their patients and healthcare workers?
- Are hospitals and HCF in India practicing desired water conservation, and wastewater management, at their premises?

V C Goyal
Jyoti P Patil
Varun Goyal

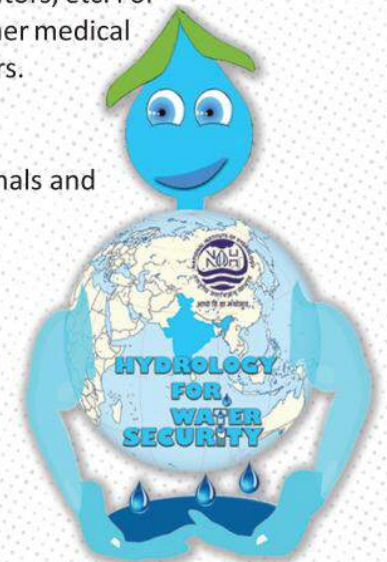


Table of Contents



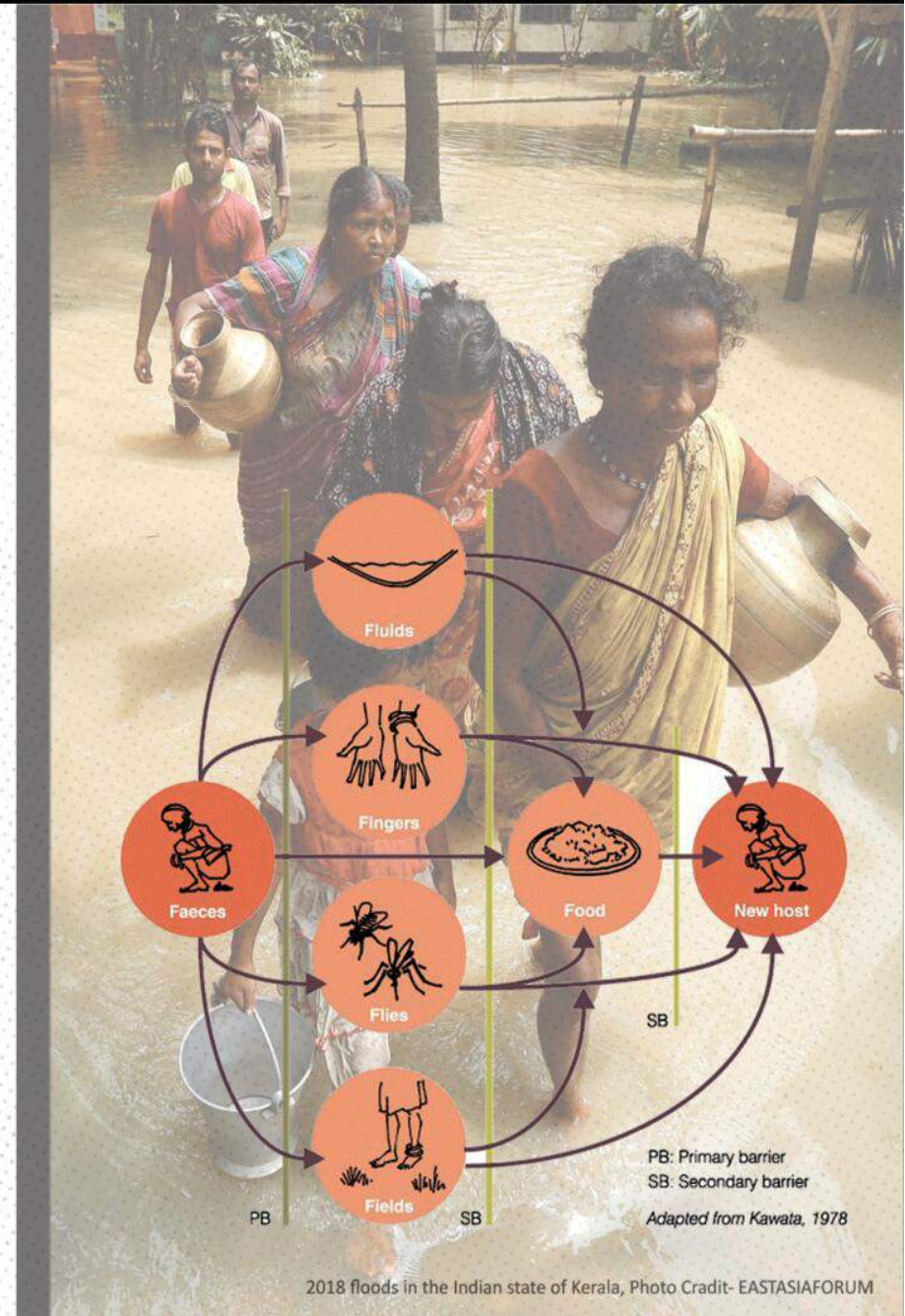
Water for Public Health and Water for Healthcare.....	1
Safe Water Use and Water Conservation Practices at Hospitals and HCF.....	3
Water Quality Monitoring for Public Health.....	7
Innovative Geospatial, AI/ML Applications in PH/WASH Sector.....	9
Nature Based Solutions for Wastewater Treatment at Hospitals and HCF.....	12
Climate Change and Health Implications.....	15
Water Security and Safety Plan for HCF.....	17
Outreach and Engagement Approaches at Hospitals and HCF.....	19
Green and Climate Resilient Healthcare Facilities.....	21
International and National Guidance on Water for Public Health.....	22
Takeaway Points.....	25

Water for public health and water for healthcare

Water has a profound influence on the human health, and a safe and easily accessible potable water supply is essential for good health. At a very basic level, a minimum amount of water is required for consumption on a daily basis for survival and, therefore, access to some form of water is essential for life. However, water has much broader influences on health and well-being and issues such as the quantity and quality of the water supplied are important in determining the health of individuals and whole communities.

Using unsafe drinking or bathing water can impose serious risks to human health. Globally, the most commonly occurring diseases transmitted through drinking of unsafe water are infectious hepatitis, cholera, bacillary dysentery, typhoid, paratyphoid, salmonellosis colibacillosis, giardiasis, cryptosporidiosis, and amoebiasis. Contaminated water may also cause many more bacterial, viral, and parasitic diseases. Hence, water quality is a critical issue to ensure public health. Diarrhea alone kills more children than malaria and tuberculosis together worldwide. Majority of the diarrheal deaths occurred worldwide are mainly associated with unsafe drinking water, inadequate sanitation, and poor hygiene. Since water is closely associated with daily human activities, providing safe drinking water is one of the important public health priorities.

The prevention of waterborne diseases may include improving access to safe water, improving water quality at the source, treating household water and storing it safely, improving access to adequate sanitation facilities, and encouraging good hygiene practices, particularly proper hand washing with antiseptic solution. Regular monitoring of drinking water for various infectious agents should be applied as it will certainly reduce the incidence of waterborne diseases.



Water for public health and water for healthcare

Lack of safe water to meet daily needs is a reality for many people around the world, and has serious health consequences. The situation is getting worse due to population growth, urbanization, and increased domestic and industrial water use. The World Bank estimates 21% of communicable diseases in India are water related. Certain populations are more vulnerable to harm from unsafe drinking water such as children, the elderly, laborers and field workers, and pregnant women.

The United Nations 2030 Agenda for Sustainable Development reinforces this importance through Sustainable Development Goal 6: “Ensure availability and sustainable management of water and sanitation for all.” Access to safe water and sanitation, and sound management of freshwater resources, are priority challenges that must be met before several other Sustainable Development Goals (SDGs) can be achieved.



Water and sanitation-related diseases

Group	Diseases
<i>Water-borne diseases</i> (diseases transmitted by water)	Cholera; Typhoid; Bacillary dysentery Infectious hepatitis; Giardiasis
<i>Water-washed diseases</i> (caused by lack of water)	Scabies; Skin sepsis and ulcers; Yaws; Leprosy; Lice and thypus; Trachoma; Dysenteries; Ascariasis Parathphoid
<i>Water based diseases</i>	Schistomiasis; Dracunuliasis; Bilharziosis; Filariasis; Threadworm
<i>Water-related insect vector diseases</i>	Yellow fever Dengue fever Bancroftian filariasis Malaria Onchocerciasis



Safe water use and water conservation practices at hospitals and HCF

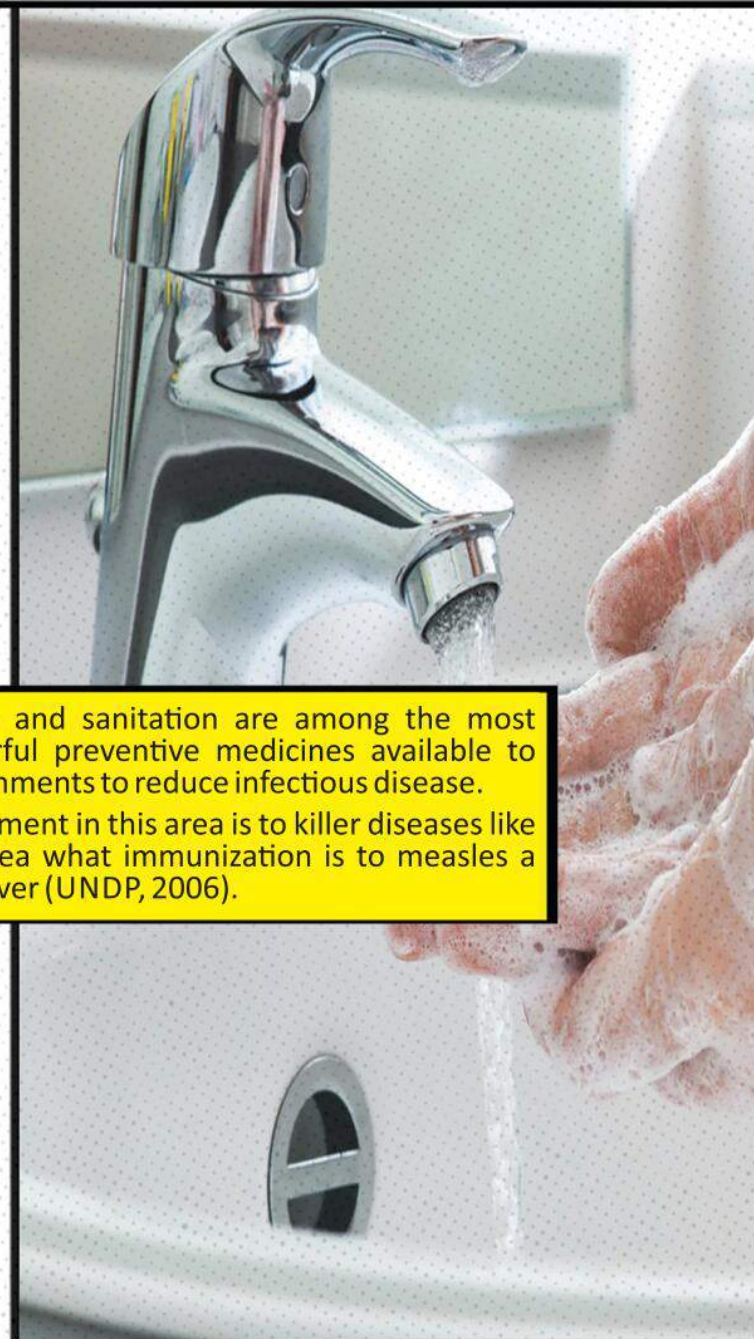
The WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene is responsible for monitoring the SDG targets for water, sanitation, and hygiene (WASH). These targets include both household and non-household settings including schools, workplaces, and health care facilities (WHO/UNICEF, 2016). World-wide, development agencies have increased their investment in this 'powerful preventive medicine (water)' to address the growing threat from infectious diseases.

Health care facilities operate 24/7, with a continual stream of people working and visiting, and life-saving procedures being performed. Water plays an important role in health care facilities- from patient care and safety to daily operations, which causes them to use a significant amount of it. Focusing on water efficiency in these buildings is becoming increasingly urgent due to the volume of water they require.



Water and sanitation are among the most powerful preventive medicines available to governments to reduce infectious disease. Investment in this area is to killer diseases like diarrhea what immunization is to measles a life-saver (UNDP, 2006).

Water consumption plays a primary role in the energy management of healthcare facilities. One of the important ways of making efficient water usage at hospitals and HCF is to reduce the consumption of freshwater for inappropriate uses. The largest water consumption is attributable to the following activities: hygiene (washing cleaning); sanitation (toilets, handwashing); ingestion (drinking, food preparation); process (cleaning sanitizing, sterilizing, laundering, heating, cooling, water filtering and softening) and irrigation (gardens, lawns).

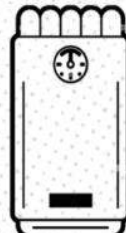


Safe water use and water conservation practices at hospitals and HCF

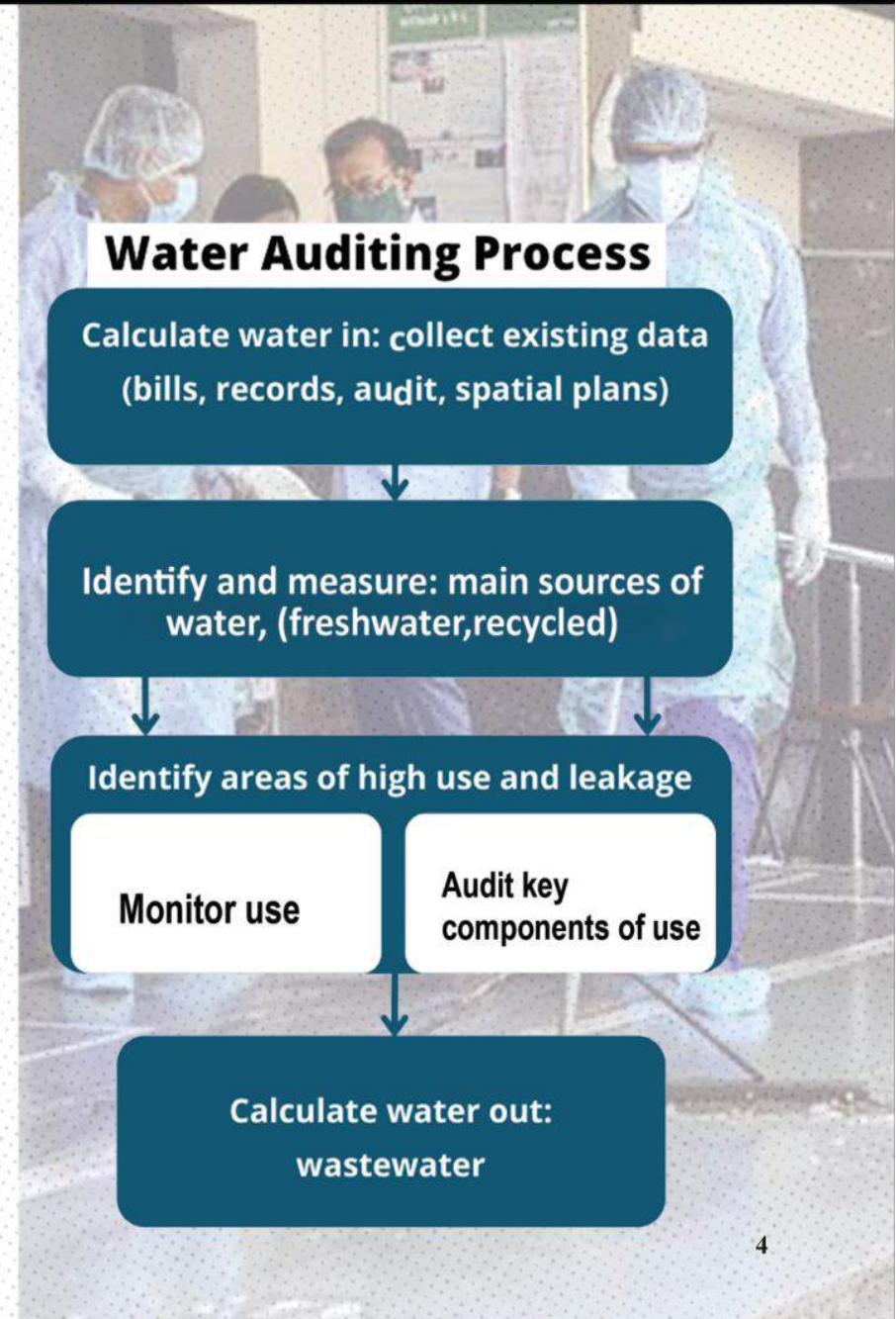
For ablutions, Hospitals and HCF increasingly are looking for ways to improve efficiency and reduce overall costs while also improving the overall patient experience. One such opportunity is environmental sustainability, which includes “green” initiatives and ways to become more environmental friendly. Hospitals and HCF are facing incredible financial and regulatory pressures to make changes as the health care environment shifts from a volume-based market to a value-based market.

Hospitals rely on water quality and availability to protect patient health, and should prioritize these needs while reducing wasteful or unnecessary water consumption. Treatment and reuse of wastewater generated in the hospitals and HCF is another area of efficient water use. Other water related activities considered to be effective include:

- Eliminating equipment and piping leaks
- Minimizing water used for laundry
- Insulating hot water system equipment and piping



Water conservation can help hospitals and HCF save operating costs and energy. Decreasing consumption also provides environmental benefits by decreasing the strain on municipal water supplies and reducing the energy needed to treat and deliver water. Hospitals and HCF using newer water technologies can also reap clinical benefits, such as better infection prevention that comes with faucets that reduce splashing in hand-washing. A detailed water audit identifies uses, usage patterns, and quantifies potential water-saving opportunities.



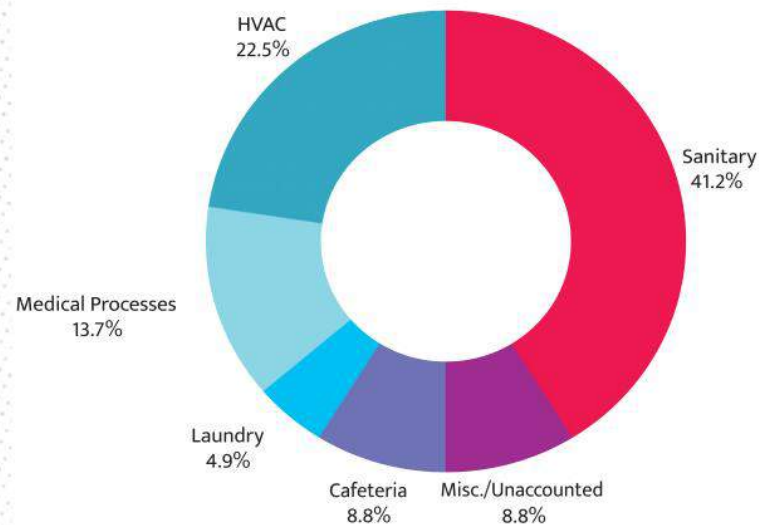
Safe water use and water conservation practices at hospitals and HCF

As hospitals and HCFs utilize vast quantities of water, these can conserve water by harvesting rainwater and recycling water for non-drinking purposes. At Bhopal's Sambhavna Trust Clinic for example, rainwater is harvested during the monsoon season and stored for use during the dry months of the year, and recycled greywater is used for gardening and cleaning.

While hospital water use supports a number of vital functions-including the HVAC system, process cooling, sterilization, and sanitation, there's much room for improvement. Water shortages are common in almost all regions of India, and increased demand is being placed on already stressed municipal water supply and treatment systems.

When a healthcare facility is designed with both energy and water efficiency in mind, low-flow water fixtures lead to smaller pumps and boilers throughout the facility. When changes are made to reduce hot-water use, the hot-water boiler capacities and associated system piping need is reduced as well, saving installation and operating costs. An indirect benefit of decreasing water use in a facility is a reduction in the amount of wastewater generated, reducing both water and sewage conveyance costs. Water conservation is also an emerging risk-management strategy, and investments in hospital water efficiency programs can provide attractive returns. Investment in water and sanitation leads to significant economic benefits as evident from a report by WaterAid that estimates annualised net benefits of \$86 million from 2021-2040 owing to provision of safely managed sanitation services.

Hospital water usage - an example



Source: Massachusetts Water Resource Authority

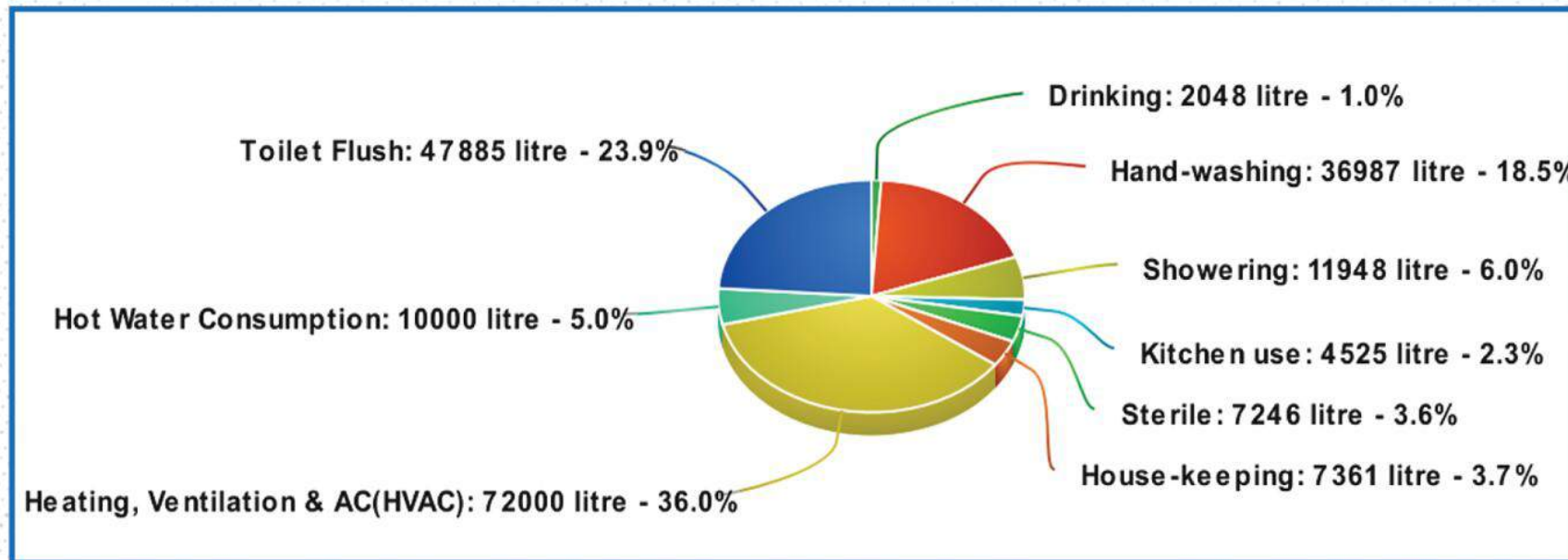


Sambhavna Trust Clinic, Bhopal, Madhya Pradesh

Case study: water usage in a 183-bed cancer hospital in Kolkata (WB,India)*

Total filtered water used per day: **2,00,000 L** (~1,093 L/patient/day)

BIS Specifications: **450 L/patient/day**



- Drinking
- Hand-washing
- Showering
- Kitchen use
- Sterile
- House-keeping
- Heating, Ventilation & AC(HVAC)
- Hot Water Consumption
- Toilet Flush

Total monthly water cost:
INR **682,911** (year 2015-16)

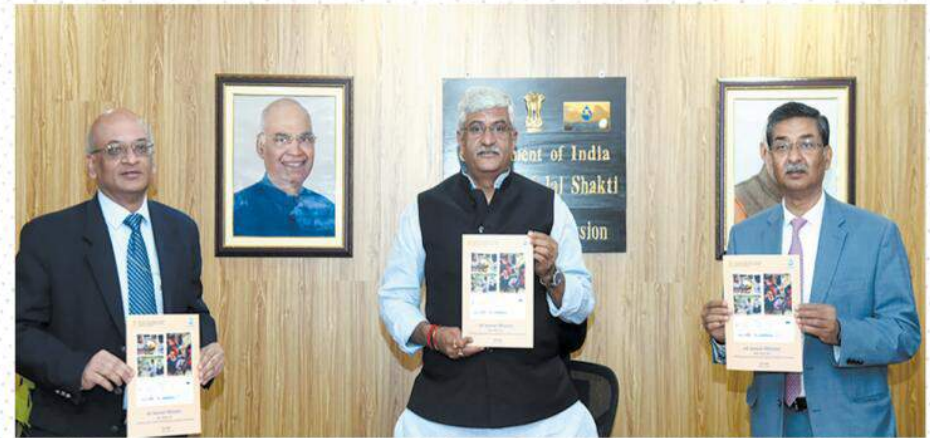
Rainwater harvesting potential:
44,09,120L for rainy season (Jul-Oct)

Less water consumption (with water-efficient technologies; recycle & reuse of wastewater; less wastage) means less cost

* (Source: Collett S, Samarin I, Balchandra R, Soundaranayagam JR, Garai S, Chandy M, Bhattacharya S (2016). Water usage in a multi-speciality hospital and its effective management. J Acad Clin Microbiol, 18 (2):135-137.

Water quality monitoring for public health

Access to clean water and adequate sanitation is an essential component of human health, and SDG6 is fully devoted to this aspect. Inadequate WASH in healthcare facilities has been linked to the spread of antimicrobial-resistant infections, placing patients and staff at risk of serious infections. Healthcare providers working under such conditions are also unable to maintain hygiene and prevent infections, which at times, can be life-threatening.



Piped water supply to all rural households by 2024

Integrated demand and supply side management of water at the local level

JAL JEEVAN MISSION

Will converge with other Central and State Government Schemes

Creation of local infrastructure for rainwater harvesting, groundwater recharge and management of household waste water for reuse in agriculture

The infographic features a central illustration of a silver faucet with a large blue water drop falling from it. Inside the drop are several colorful pills. To the left is an icon of a water tap with a drop, and to the right is an icon of hands holding a water drop. At the bottom, there are icons of a person and a tree over water.

Drinking-water suppliers are usually required to verify that the quality of water supplied to consumers meets specific numerical standards. Yet, by the time tests are completed and results indicate the water is not safe to drink; thousands of people may have already consumed the water and become sick. For these reasons, water quality monitoring is important in monitoring the safety of drinking water, investigation of disease outbreaks, and taking preventive measures.

The WHO Guidelines for Drinking Water Quality and the IWA Bonn Charter recommend pro-active efforts to reduce risks and prevent contamination before water reaches the consumer. This is being followed under the Govt's flagship scheme Jal Jeevan Mission (JJM) where Water Quality Monitoring & Surveillance (WQMS) is being implemented. In this scheme, the water quality is monitored at the source; within a piped distribution system; and/or at the delivery point. Also, monitoring the quality of water (and wastewater) at HCF is extremely important as many functions and facilities require high-quality water.

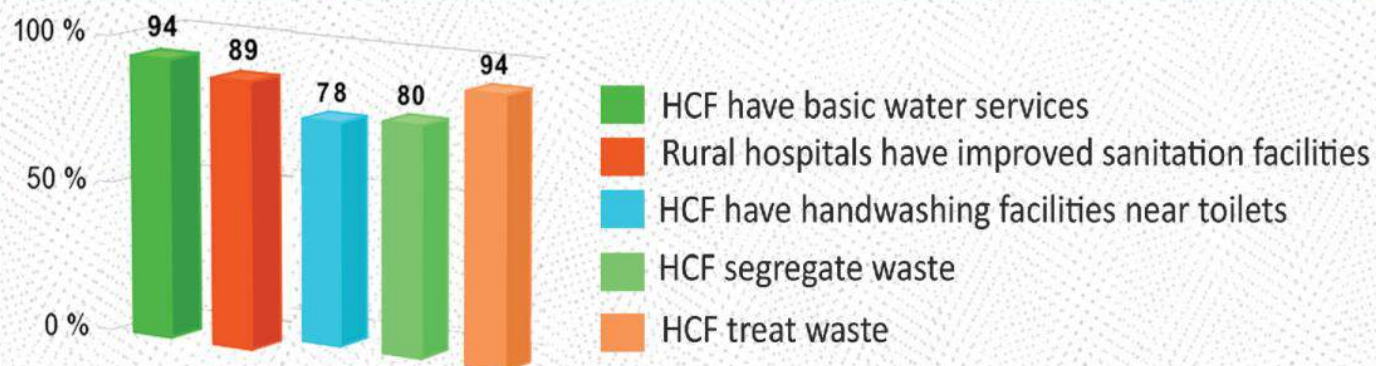
Water quality monitoring for public health

WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene indicate that WASH services in healthcare facilities are sub-standard in every region. Across all regions, WASH services in healthcare facilities fall short of WHO and national standards. Due to data scarcity and the difficulty of data collection, the global indicators for basic WASH do not consider all aspects of minimum standards for WASH in healthcare facilities.

POTENTIAL REDUCTION IN MORBIDITY FOR DIFFERENT DISEASES AS A RESULT OF IMPROVEMENTS IN WATER SUPPLY AND SANITATION

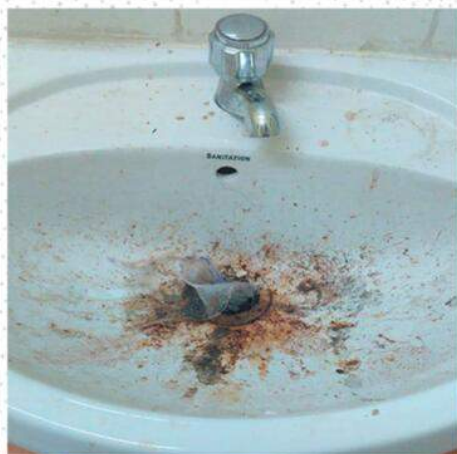
DISEASES	Projected reduction in morbidity(%)
Cholera, Typhoid	80-100
Diarrhoeal diseases dysentery, gastroenteritis	40-50
Dracunculiasis	100
Schistosomiasis	60-70

In a recent report on WASH in HCF, the JMP reported status of WASH as:



Global progress report on WASH in healthcare facilities.

Source: <https://washdata.org/Sites/Default/files/2020-12/WHO-UNICEF-2020-Wash-in-hcf.pdf>



Water Quality
For Ecosystem and Human Health

United Nations Environment Programme
GEMS/Water Programme

Technology often plays an important role by providing resource-efficient solutions to some of the challenges associated with WASH.

Geo-IOT as a tool

Monitoring

Real-time decision making at the measurement and monitoring location



Data Quality

Improved data quality and overall consistency



Configuration

Remote configuration capability



Emerging Technologies & Water Resources

Sensors

Meters and sensors are currently being intensively applied to regulate different activities of water distribution systems such as hydraulic pressure and flow, water quality, head losses, and water and energy consumptions

Water Information

Convey prompt, reliable, and information-secured water metered information to avoid any potential damages, foresee expected disasters, detect leakages and provide accountability

This is emphasized in the targets for SDG 6, including support for technologies in areas such as water harvesting, desalination, efficient use, treatment and recycling. Digital technology is showing the capacity to extract the most intimate information from both individuals and communities about their state of health, genetics, nutrition habits, substance abuse, etc.

Geospatial technologies can aid in epidemiological investigation and outbreak response thereby reducing the health hazards in the communities before, during and after epidemic episodes.

Narrowing the Healthcare Digital Divide with Intentional Technology and Innovation

April 2022

HIMSS



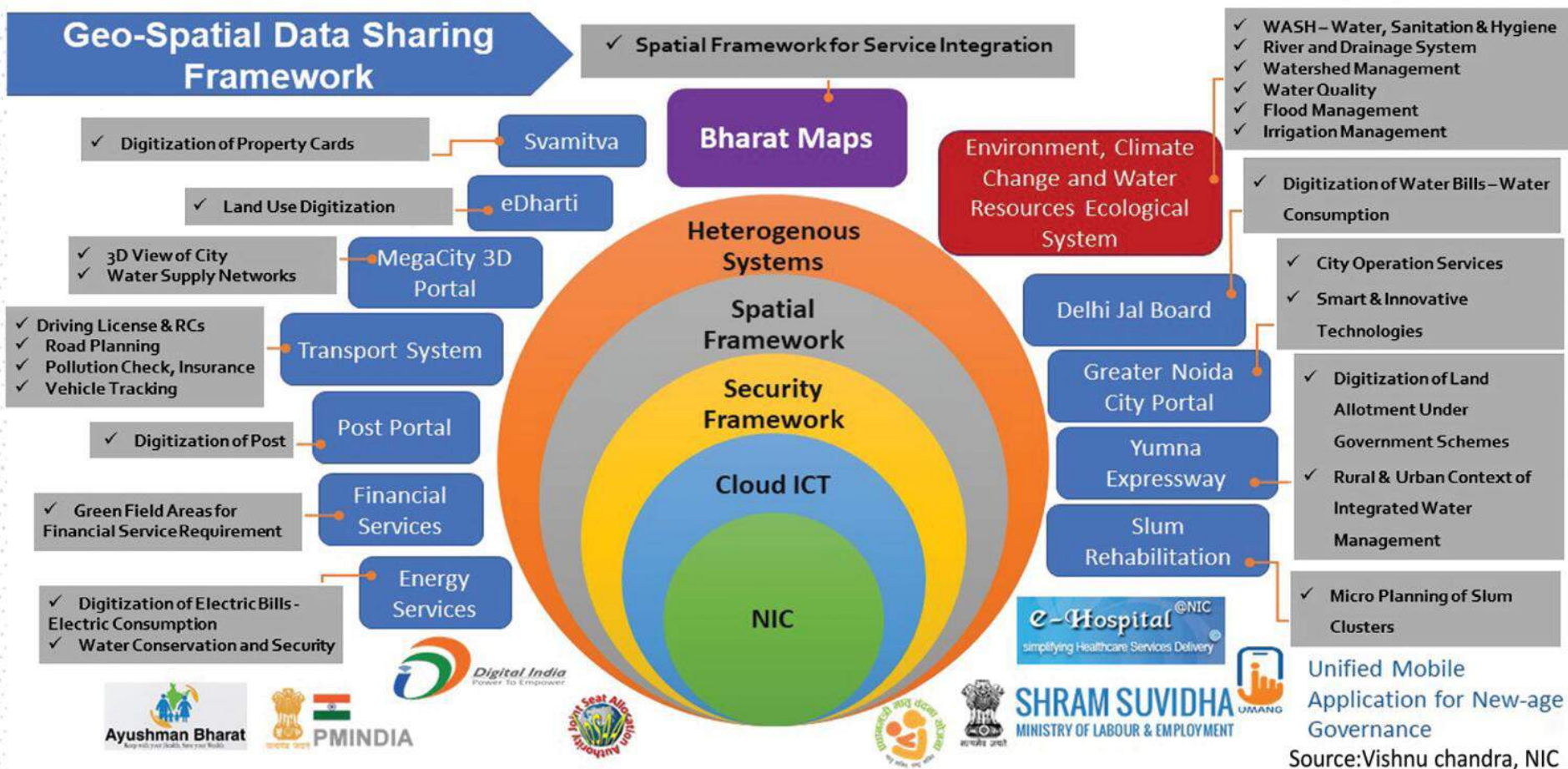
"LEVERAGING DIGITAL INNOVATIONS, DATA ANALYTICS AND TECHNOLOGY FOR BETTER WATER MANAGEMENT"

Effective remedial measures planning can be done through spatial mapping of different diseases (i.e. vector and water borne diseases), factors responsible for diseases, vulnerable population, pollution sources, etc. Based on the overlay and integrated analyses, critical and vulnerable zones can be identified in cases of health epidemics.

Innovative geospatial, artificial intelligence/ machine learning (AI/ML) applications in PH/WASH sector

Geospatial technologies are routinely being used in mapping of infrastructural facilities and preparing thematic maps of water quality, water availability, health parameters, etc. Planning for various water conservation measures such as rainwater harvesting, identification of suitable sites for groundwater recharge, and for decentralized wastewater treatment and reuse, identification of areas with high water consumption, can be easily and effectively done with the help of geospatial technologies.

Geo-Spatial Enabled Data Sharing Framework



Innovative geospatial, artificial intelligence/ machine learning (AI/ML) applications in PH/WASH sector

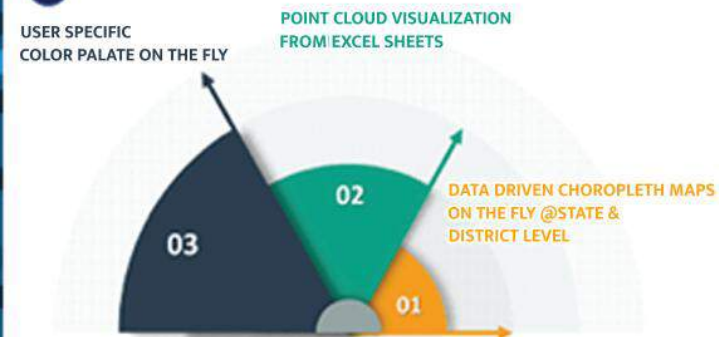
The application of digital technologies (including AI/ML) in healthcare has been enormous. AI/ML has been increasingly used in health and healthcare, particularly with the rise of high-performance and cloud computing capabilities. Health intelligence refers to the specific application of AI and data science methods and tools to provide accurate efficient, and productive insights into healthcare and medicine. Big data and AI have helped facilitate COVID-19 preparedness and the tracking of people, and so the spread of infection, in several countries. With the help of digital technologies, interactive dashboards are designed to provide the desired results and information to the public. With these data machine learning models develop forecasts of the regional transmission dynamics of pandemics like SARS-CoV-2. AI algorithms allow the effect of climate to be incorporated into the projections. Forecasting models developed by IIT Kanpur and IIT Kharagpur were made possible by the prowess of digital technologies.



Government and Data Sharing Platform

BharatMap Framework

Bharat Maps is a Multi-layered GIS platform/web service comprising of seamless country wide base maps, satellite images and hybrid maps aligned as per the global geospatial standards, It is an essential component of Digital India program to ensure easy governance, effective governance and economical governance.



Mobile Friendly Application

Source: VISHNU CHANDRA, NIC

Nature-based solutions for wastewater treatment at hospitals and HCF

Hospitals require large amounts of water for proper functioning of various healthcare facilities. Hospital wastewater (HWW) imposes a grave hazard to human health and the environment because of their capability to enter watersheds, pollute surface and groundwater, when inappropriately handled and disposed to nearby land areas. Sources of wastewater generation from the hospital are wards, laboratories, used disinfectants floorwashing, washing of patients' area, hand washing, laundry, discharge of accidental spillage firefighting, bathroom/toilet etc.

Various treatment facilities and equipment also require water. This consumption of water by the hospitals leads to the generation of large volumes of wastewater. The amount of wastewater generated from the hospital depends on the capacity or the number of beds available in the hospital, type and size of the healthcare facility, technical facilities available, services provided (laundry, kitchen, air-conditioning), in-house wastewater management facilities, etc. According to estimates, the wastewater generated by hospitals in developing countries varies from 200 to 400 L/capita/day, while in developed countries, it varies from 400 to 1200L/capita/day.

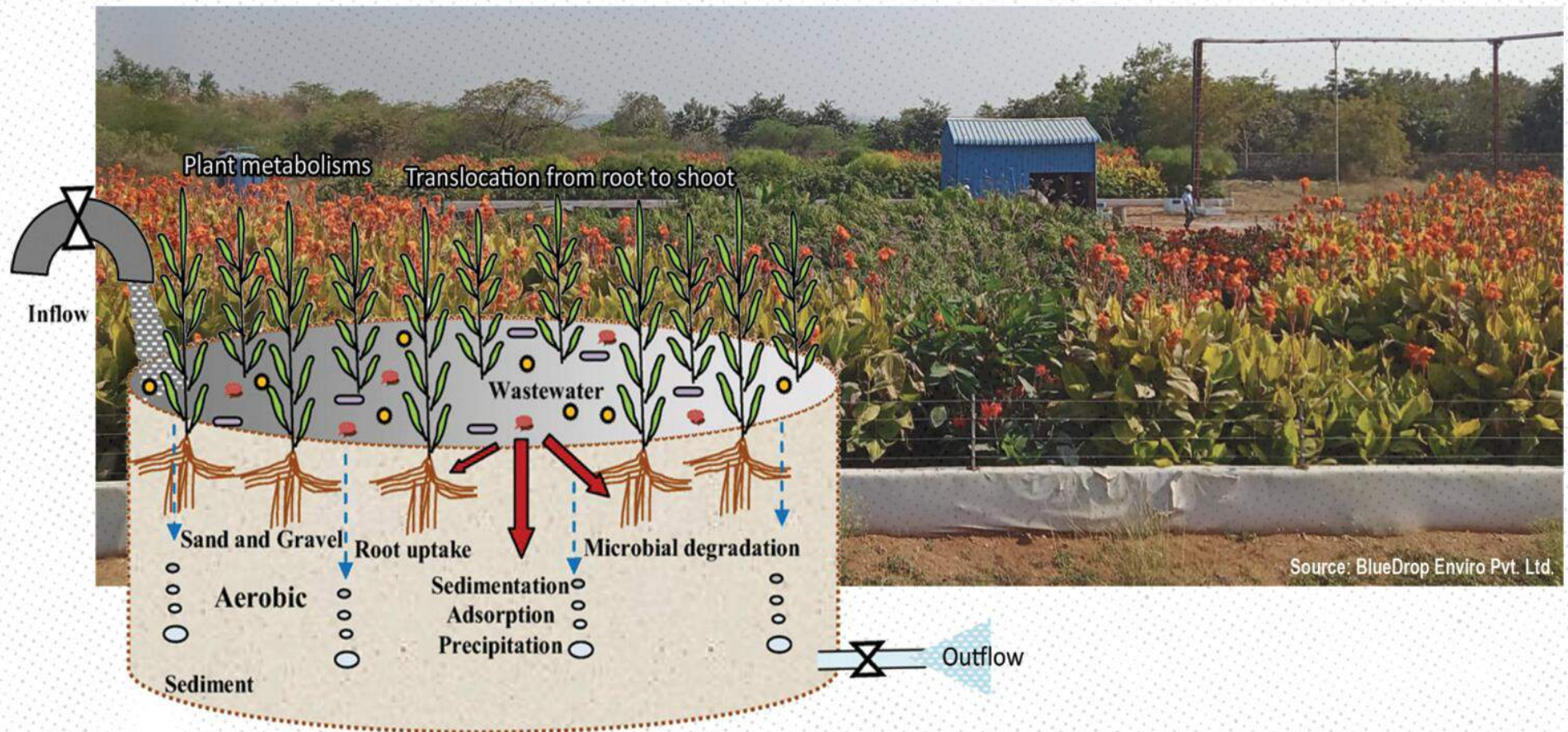


Constructed Wetland



Nature-based solutions for wastewater treatment at hospitals and HCF

HWW is characterized by the presence of various emerging contaminants such as pharmaceutically active compounds (PhACs), several microorganisms including antibiotic-resistant bacteria (ARB), antibiotic-resistant genes (ARG), persistent viruses, etc. Up to 90% of orally administered pharmaceuticals are excreted into wastewater as active substances in the faeces and urine of patients. Generally, HWW comprises high biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammonia, and nitrogen content, and their concentration is higher compared to the domestic wastewater. Treatment of HWW is not an easy feat, considering the vast quantities of wastewater generated having high COD, nitrogen, and PhAC content.



Vertical subsurface flow constructed wetland and associated removal mechanisms of PhCs and TPs

SOURCE: Researchgate, HUMA LLYAS, ERIC hullebusch

Nature-based solutions for wastewater treatment at hospitals and HCF



Effluent Treatment Plant (ETP) should be provided in every HCF to treat the wastewater generated from the hospital in order to comply with the effluent standards prescribed under the Bio-Medical Waste Management Rules-2016, notified by the MoEF&CC (GoI).

Liquid waste generated due to use of chemicals or discarded disinfectants, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, house-keeping and disinfecting activities should be collected separately and pre-treated prior to mixing with rest of the wastewater from HCF. The combined wastewater should be treated in the ETP having three levels of treatment- primary, secondary and tertiary.

According to CPCB Guidelines (2018), the effluent treated from the premises of HCF before discharge into the sewer should conform to the following limits:

<u>Parameter</u>	<u>Permissible Limit</u>
pH	6.5-9.0
Suspended solids	100 mg/l
Oil and grease	10 mg/l
BOD	30 mg/l
COD	250 mg/l

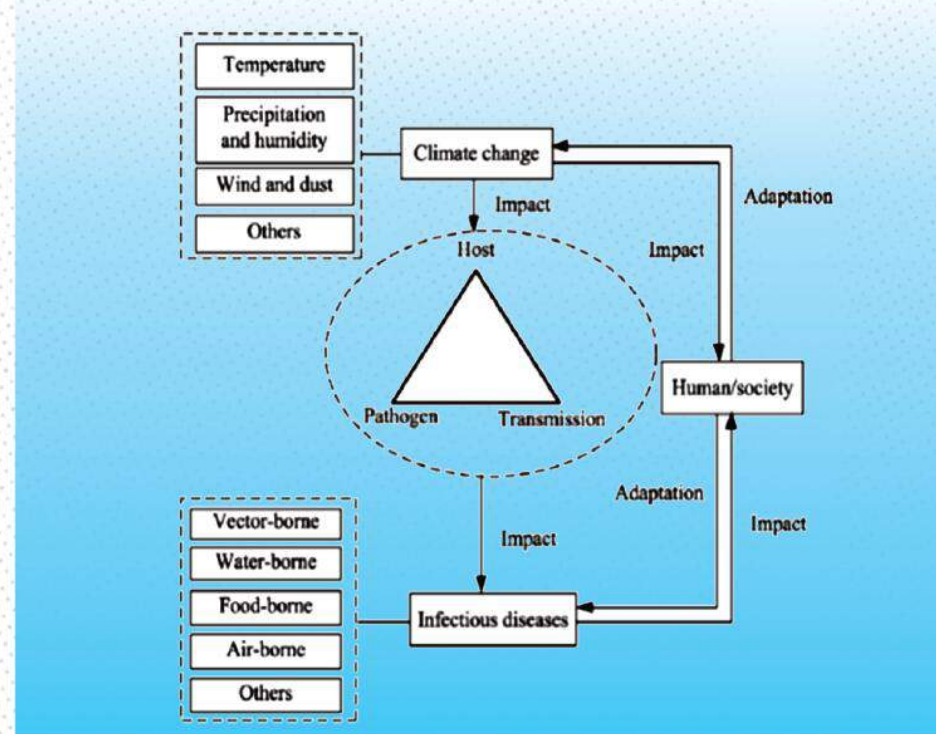
Various treatment technologies, including the biological methods, such as activated sludge process (ASP), membrane bioreactor (MBR), moving bed bioreactor (MBBR), constructed wetlands (CWs), the advanced oxidation processes, such as photo-catalysis, Fenton process, etc. have been utilized to treat HWW. Constructed wetlands, which is a part of Nature-Based Solutions, can be effectively utilized for secondary and tertiary treatment of hospital wastewater in a decentralized mode.

Climate change and health implications



Climate change is a significant and emerging threat to public health. The COVID-19 pandemic has shown that a global health crisis can bring entire countries to a standstill and without urgent action, climate change too can cause similar damage to lives and livelihoods.

Predicted impacts on human health due to climate change include increases in temperature (heat) related illnesses, vector borne diseases, water-borne diseases, health impacts related to extreme weather events (e.g. floods and droughts), and health effects due to food insecurity. These changes will require more emphasis to be placed on planning for health facilities, as well as increased capacity of the medical community to cope with these changes.



Climate change and health implications

The Ministry of Health and Family Welfare (MoH&FW) approved National Action Plan on Climate Change and Human Health (NAPCCHH) under National Health Mission (NHM) in February 2019. The specific objectives of NAPCCHH are:-

(i) to create awareness among general population (vulnerable community), health care providers and Policy makers regarding impacts of climate change on human health.

(ii) to strengthen capacity of healthcare system to reduce illnesses/ diseases due to variability in climate.

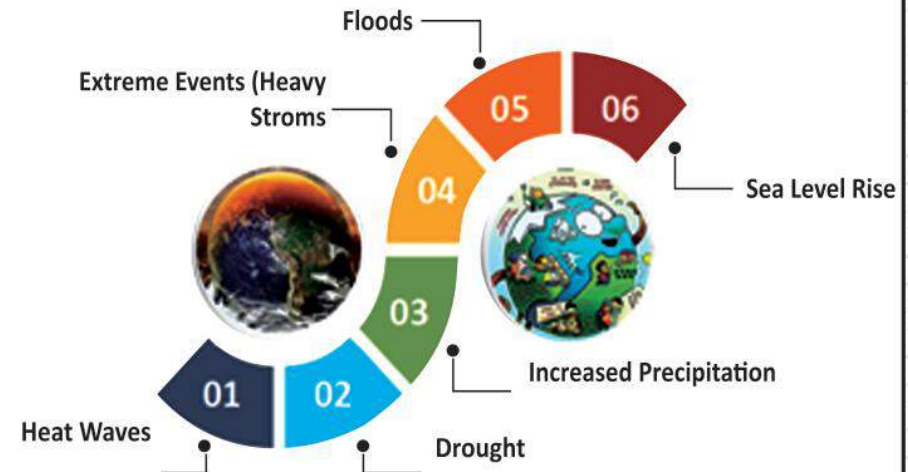
(iii) to strengthen health preparedness and response by performing situational analysis at National/ state/ district/ below district levels.

(iv) to develop partnerships and create synchrony/ synergy with other missions and ensure that health is adequately represented in the climate change agenda in the country.

(v) to strengthen research capacity to fill the evidence gap on climate change impact on human health.

National Centre for Disease Control (NCDC) under MoH&FW is incorporating both the green and climate resilient healthcare principles in revising Indian Public Health Service (IPHS) Guidelines which deal on Sub- Centre, PHCs, CHCs, SDHs and District Hospitals and is considering to work in near future to other healthcare facilities. Since India is a diverse country with variety of geo-climatic conditions, each State is desired to develop its own State Action Plan for Climate Change and Human health (SAPCCHH).

Challenge - Global Warming



Source: Dr. Rameshwar sorikhaibam, NCDC. MoH&FW



Image Credit: PTI

Water security and safety plan for HCF

Water has many more uses in a hospital that must be considered when planning for a shortage, including hand washing and hygiene, food service, laundry, central services, cleaning and infection prevention, and decontamination and hazardous materials response as well as patient care needs like bathing and flushing toilets. Infrastructure and medical equipment dependent on water include radiology, fire-protection sprinkler systems, water-cooled medical gas and suction compressors and HVAC systems, among others. Extra temporary backup water supplies also may be needed for rinsing contaminated devices, dialysis, labor and delivery, emergency departments (EDs), critical care units and for eye-washing functions.

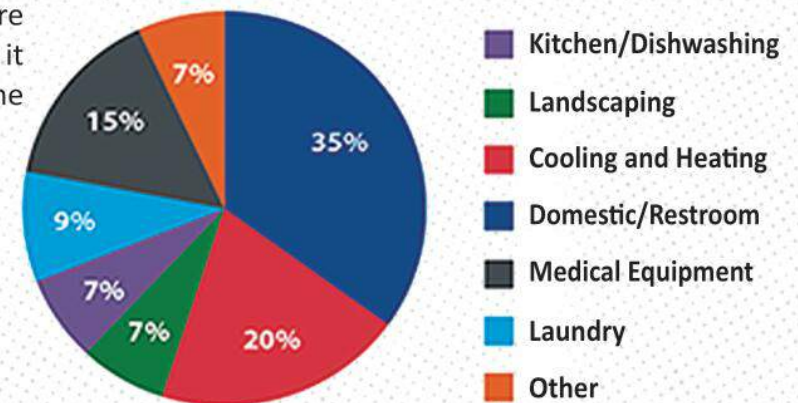
It is known that the direct and indirect impact of weather-related disasters can significantly disrupt access to health services and the sector's ability to provide healthcare. However, today it also is becoming increasingly clear that the healthcare sector itself is one of many contributors to the impact of climate change, making it imperative to step up efforts to reduce the environmental footprint and increase the resiliency of its healthcare facilities.

As per BIS, water requirement in hospital

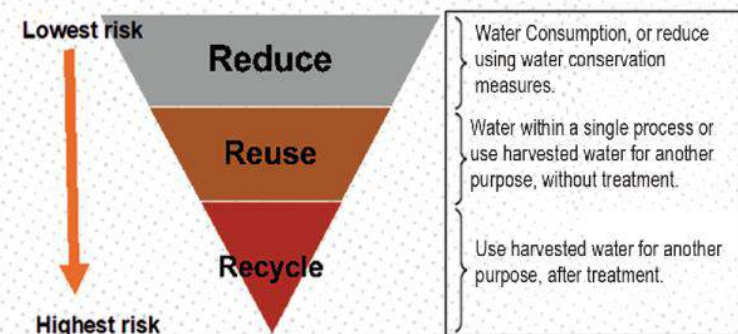
Type of Facility	Water Requirement
Bed Strength: Not exceeding 100	340 lt/bed/day
Bed Strength: Exceeding 100	400 lt/bed/day

WHO/UNICEF Guidelines for Health Care Facilities	
Topic	Guideline definition
Water quality	Water for drinking, cooking, personal hygiene, medical activities, cleaning and laundry is safe for the purpose intended
Water quantity	Sufficient water is available at all times for drinking, food preparation, personal hygiene, medical activities, cleaning and laundry
Water facilities and access to water	Sufficient water-collection points and water use facilities are available in the health-care setting to allow convenient access to, and use of, water for medical activities, drinking, personal hygiene, food preparation laundry and cleaning

End Uses of Water in Hospitals



United States Environment Protection Agency (2012) Water sense at work, best management practices for commercial and institutional facilities: onsite non-potable water sources (chapter 8). U.S EPA, Washington DC



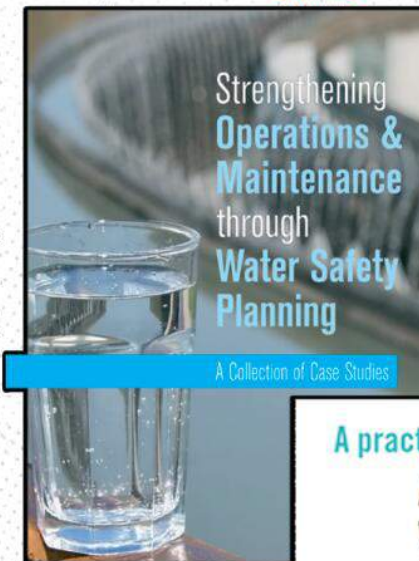
Water security and safety plan for HCF

Many HCF are located in disaster risk areas, people in these areas lose precious healthcare periods due to the damage directly related to disasters. Extreme weather events such as storms, floods, drought, create emergency situations that damage infrastructure, compromising access to critical resources (e.g., food and water) and the safety of patients, visitors and staff. The effects of climate change can increase the risk of some infectious diseases (vector-, water- and food-borne, new and emerging) and worsen air quality. The vulnerability of healthcare facilities in disaster situations cannot be underestimated.

Disruption in water supply and/or water usage may be for the following reasons:

- Damage/break in main supply line
- Cyclone/hurricane/flooding/cloud burst
- Contamination of water supply
- Adverse impacts of climate change
- Vandalism

To deal with such interruptions, HCF should have plan ready to identify alternative mean of providing (i) water needed for consumption and essential care activities, and (ii) water needed for equipment and sanitary purposes. Even during normal operations, HCF need a water management program to reduce the risk of bacteria growth and spread within their water system and devices.



Water Conservation Opportunities

Water reuse		Process equipment	
Sprinklers	Radiation therapy linear accelerator	Steam Traps	Steam Condensator on Sterilizers
FUSHOMETER toilets/urinals	Flow reduces aerators	Film processors	Refrigeration equipment
Water supply			
Reverse osmosis (RO) plants	Boilers	Cooling towers	Pressure-reducing valves

Outreach and engagement approaches at hospitals and HCF

To ensure judicious water use at hospitals and HCF, it is important that both the healthcare personnel and water professionals are aware of the appropriate use of water and of the measures for water conservation at their sites. Strong and effective outreach approaches are required at the hospital and HCF premises, and also for the administrators and managers dealing with such units. Guiding documents, protocols, SOPs, incentives, penalties, etc. are required to achieve the appropriate water use, water conservation, and sustainability targets at hospitals and HCF.

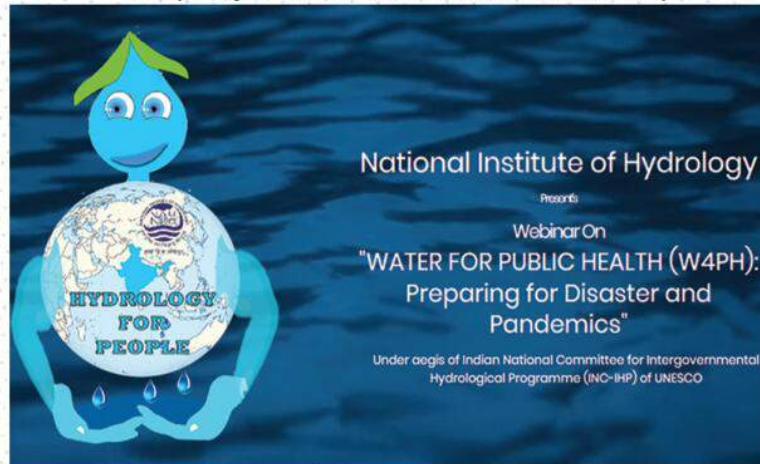


Photo Credit: SPH, AIIMS, JODHPUR

Outreach and engagement approaches at hospitals and HCF



<https://jalchitran1.wixsite.com/websitew4ph>



NIH recently conducted a webinar on the theme of Water for Public Health, which brought together doctors and other medical professionals, water researchers and specialists, policy planners, communication and outreach professionals, technology providers, with an aim to sensitize the people about judicious water utilization and efficient water conservation and management at HCF.

Some of the awareness and outreach activities required to address the specific stakeholders are as follows:

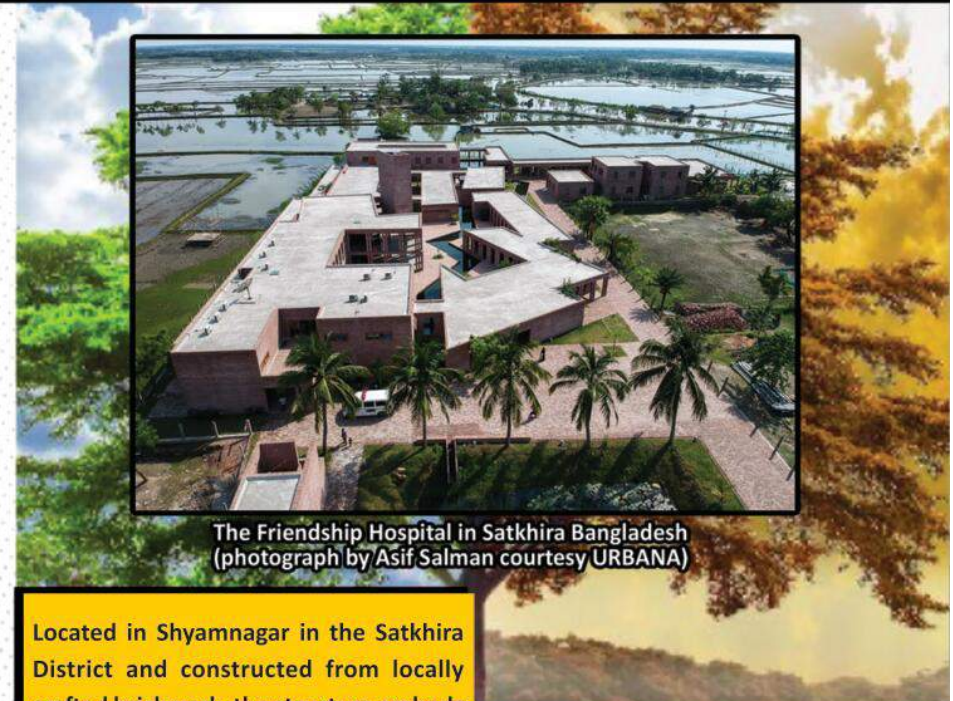


Green and climate-resilient healthcare facilities

Healthcare facilities are highly intensive resource consuming areas contributing significantly to carbon footprint globally. In India, health sector roughly corresponds to about 5% of the national carbon footprint. At the same time, the already burdened health care facilities in the country are facing added challenges to the increasing health impacts due to climate change. In the last few decades, there have been reports of changes in frequency and intensity of climate and weather related events hugely affecting functioning of healthcare facilities and even collapsing during the most critical juncture.

A well-prepared and responsive healthcare facility is crucial for preventing and minimizing the health risks posed due to climate change. A green healthcare facility will help to optimally minimize the carbon footprint from the healthcare facilities. At the same time, climate resilient health facilities will help to deal with the adverse health impacts due to extreme weather events like cyclones, floods, heat etc and will continue to give some critical services

despite the extreme events impacting the healthcare facilities. The core principles to develop the healthcare facilities include health system models of care based on appropriate technology, building design and construction based on low carbon approaches, investment programs in renewable energy and energy efficiency, waste minimization and sustainable health system waste management, sustainable transport and water consumption policies etc. Also important is improving the surveillance, monitoring, and integration of meteorological, environmental, geospatial, and health data while working in parallel to implement the adaptation strategies.



The Friendship Hospital in Satkhira Bangladesh
(photograph by Asif Salman courtesy URBANA)

Located in Shyamnagar in the Satkhira District and constructed from locally crafted brickwork, the structure embeds a number of courtyards that can be enjoyed as spaces of quiet and reflection and endow wards with natural light and views of the surrounding environment. Other areas of the hospital requiring privacy and darkness are shielded with corridors and double layered arches. The brick used was selected with endurance, climate-resilience, and cost in mind. Together with the small canal, it provides cooling properties, allowing temperatures to remain low even during notoriously hot summers in the region.



The water channel integrates the hospital
into the natural and agricultural landscape

International guidance on water for public health

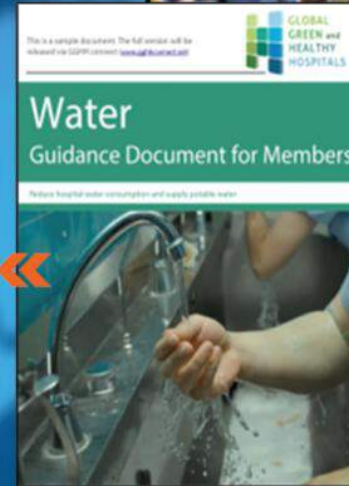


Informs Nurses of the public health challenges presented by water quality and safety, and guides them with tools to take action to support healthier water in their communities.

» Gives guidance on healthcare specific elements of standards, policies and established best practice.



» Lists out the design requirements for new construction and major renovation projects.



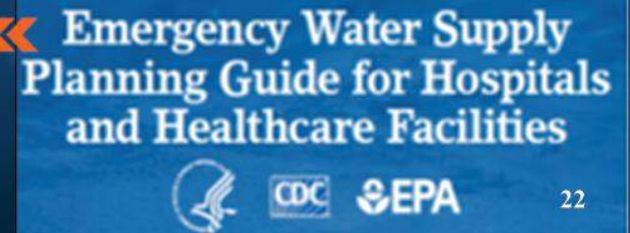
Helps healthcare facilities make the changes needed to reduce their water consumption, responsibly treat wastewater and minimize the environmental impacts.



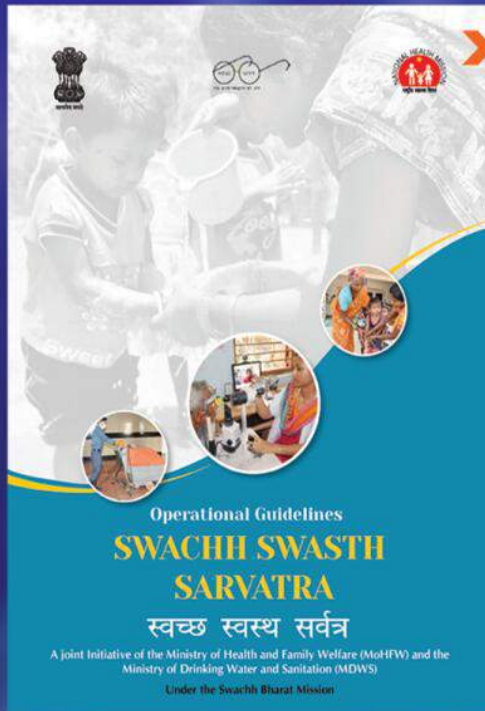
» Gives status of global targets set by WHO/UNICEF under Joint Monitoring Programme for WASH in HCF, Also outlines eight practical steps to improve WASH services in HCF.



Provides guidance for healthcare facilities to prepare for, respond, and recover from water supply interruption during emergencies such as disasters and pandemic situations.

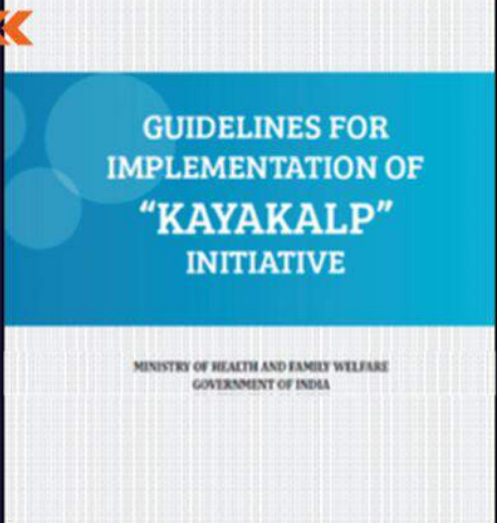
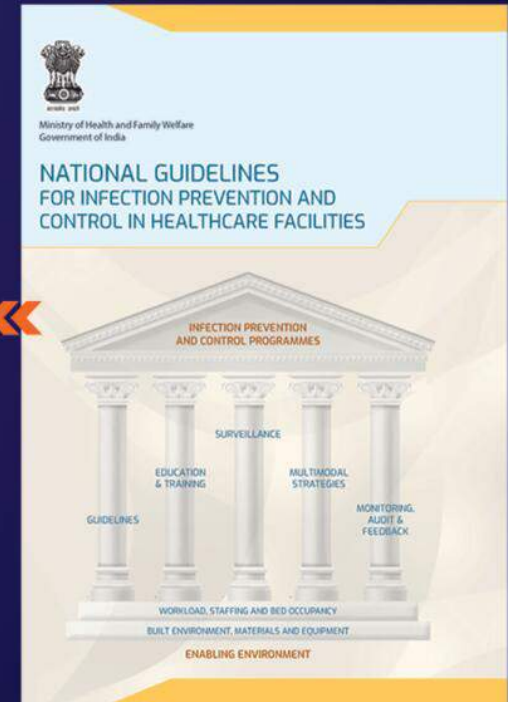


National guidance on water for public health



Provides guidance on strengthening HCF in open defecation-free (ODF) blocks in India. The initiative is a part of Swachh Bharat Mission under National Health Mission, and aims to strengthen Community Health Centres in 708 ODF blocks across India.

To support hospitals and other HCF to establish their IPC protocols so as to provide safer healthcare services to the community. This document was developed by National Centre for Disease Control (NCDC), MoH&FW (GoI) in collaboration with WHO-India, and has a section on safe water and food.

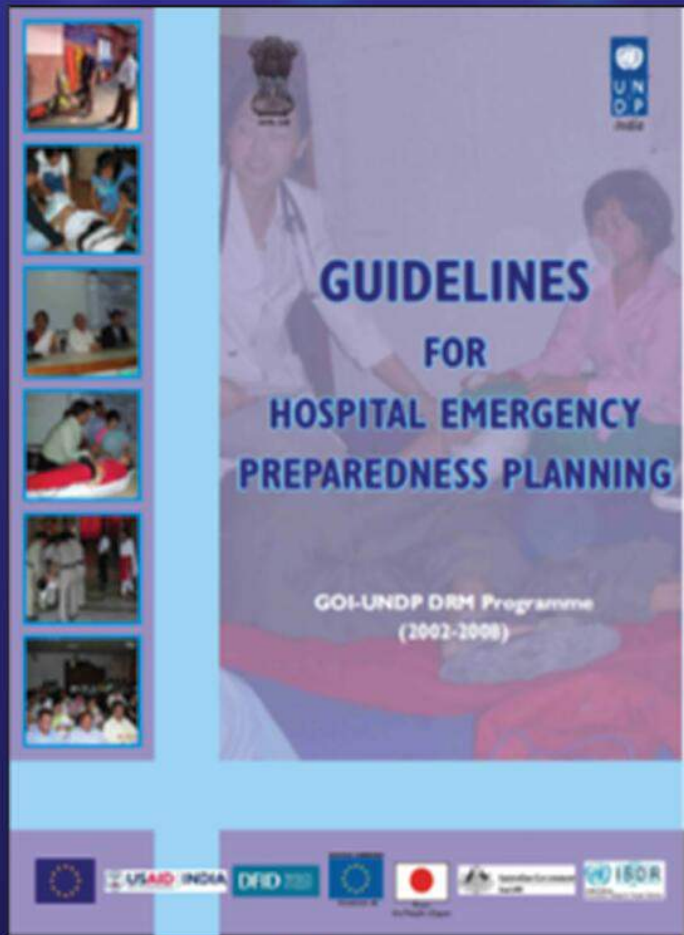


Deals with Hospital Support Services, which has section on 'Water Sanitation'. It mentions water requirement storage of water, including cleaning of storage tanks disinfection of water tanks and ways to test and ensure quality of water.

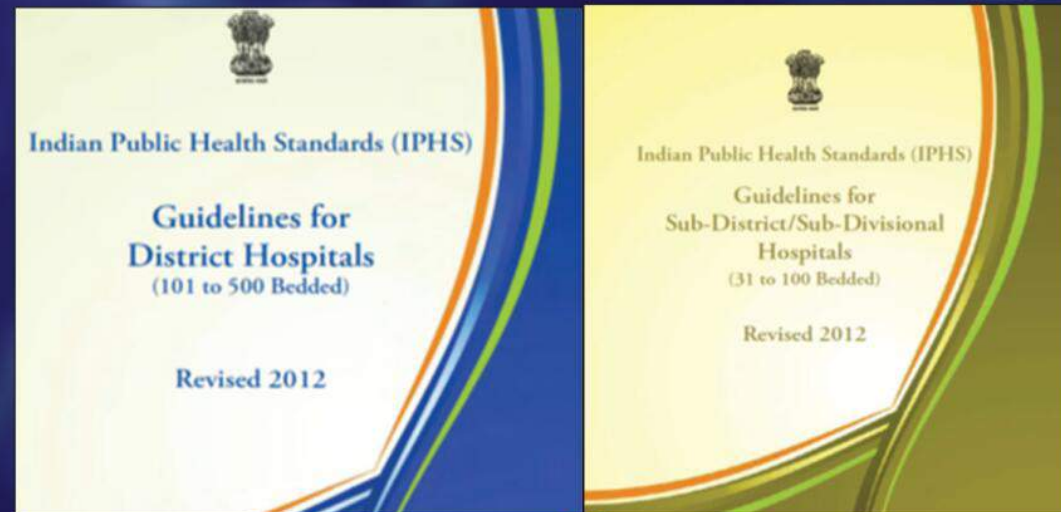
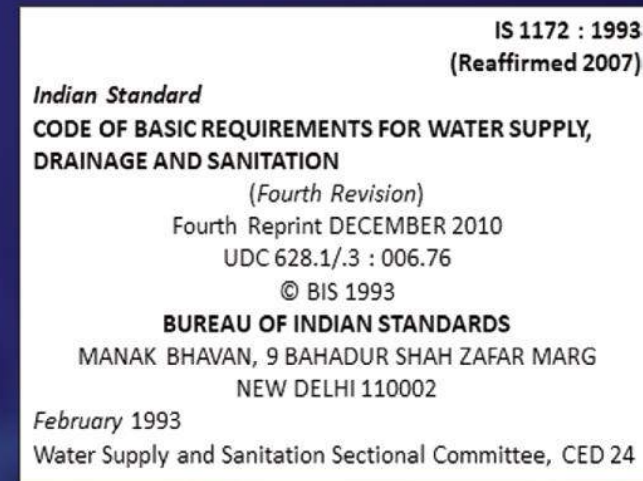


Aims to strengthen health preparedness and capacity of healthcare system to reduce illness/ diseases due to variability in climate. Also promotes development of IEC material to create awareness among community, healthcare providers and policy makers.

National guidance on water for public health



Encourages hospitals to formulate their own emergency plans that will meet demands of medical care effectively during disasters /emergencies.



Provides Guidelines for Services that a District/Sub-District or Sub-Divisional Hospital is expected to provide.



"I HOPE THE SAP WILL MEET ALL ITS GOALS AND BE A DRIVING FORCE IN OUR PURSUIT FOR A CLEAN INDIA." -NARENDRA MODI

SWACHHATA ACTION PLANS



Takeaway points

- Water is essential part of treatment at HCF, and appropriate water use is critical for public health.
- Medical and water professionals should work in tandem.
- COVID-19 pandemic has revealed the necessity to re-think our preparations for future challenges, such as impacts of climate change as well as other potential outbreaks.
- Ensuring water quality and safety requires active participation of all stakeholders.
- Wastewater surveillance is required at HCF for early detection of potential risks.
- AI/ML techniques and geospatial technology is helpful in increasing resilience of HCF.
- Water audit is desirable for appropriate use at HCF (for potable and non-potable uses).
- Aspire for 'net-zero water use' within a hospital system (Circular Economy).
- All HCF should prepare Water Security Plan, which includes emergency water supply plan.
- Healthcare professionals require training in appropriate water use and water conservation.
- Strong communication- IEC material is essential for behavioral change.
- India needs Guidelines on Water Conservation & Management in Healthcare Facilities.
- Hydrologists can play effective role in planning the water conservation and security for HCF.



Authors

Dr V C Goyal

Scientist G and Head, RMO Division, National Institute of Hydrology,
Roorkee, Uttarakhand 247 667. Phone- (+91) 1332-249226, Email: vcg.nihr@gov.in

Dr. Jyoti P Patil

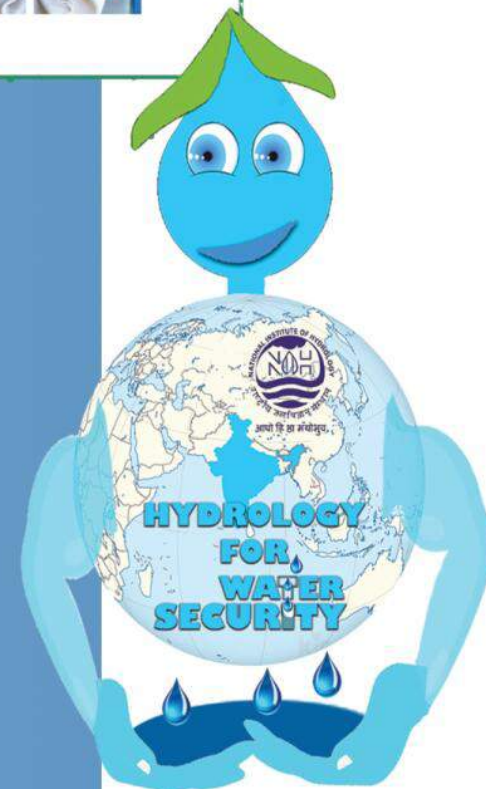
Scientist- D, RMO Division-LCU, National Institute of Hydrology,
New Delhi- 110003, Phone- (+91) 11-24653812 (O), Email: jyoti.nihr@gov.in

Varun Goyal

Resource Person (Sr.), RMO Division, National Institute of Hydrology,
Roorkee, Uttarakhand 247 667. Email: hydrology4people@gmail.com

WATER IS LIFE AND CLEAN WATER MEANS HEALTH.

- Audrey Hepburn



राष्ट्रीय जल विज्ञान संस्थान, रुड़की, भारत
National Institute of Hydrology, Roorkee, India
ISO 9001:2015
Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation

Visit Us @ <http://nihroorkee.gov.in>



@nihroorkee.gov.in @NIH_Hydrology nih_hydrology