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MONSOON HEALTH PREPAREDNESS: A MANUAL FOR PREVENTING COMMUNICABLE DISEASES

DIRECTORATE OF PUBLIC HEALTH AND PREVENTIVE MEDICINE

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MONSOON HEALTH PREPAREDNESS: A MANUAL FOR PREVENTING COMMUNICABLE DISEASES

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PREFACE

Monsoons bring life-giving rains essential for agriculture and water resources, but they also carry the potential for widespread disruption and disaster. Flooding, landslides, and waterborne diseases can severely impact communities, infrastructure, and economies. The need for a comprehensive and systematic approach to preparedness is more pressing than ever, as climate change intensifies weather patterns, making monsoons increasingly unpredictable.

This Monsoon Preparedness Manual is designed to serve as a practical guide for communities, local authorities, emergency responders, and policy-makers. It provides key information on early warning systems, risk assessments, response strategies, and recovery plans to mitigate the adverse effects of the monsoon season. It emphasizes the importance of building resilient systems, enhancing awareness, and fostering coordination between various stakeholders.

The manual offers insights into best practices from regions frequently affected by monsoons and includes tools for developing localized action plans tailored to specific vulnerabilities. By proactively preparing, we can safeguard lives, reduce damage, and ensure a quicker recovery, allowing communities to continue thriving even in the face of natural challenges.

I hope that this manual serves as a valuable resource to all those involved in monsoon preparedness efforts, helping to create safer, more resilient environments for all.

Dr.T.S.Selvavinayagam

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CONTENT

1. Introduction

Natural disasters continue to strike unabated and without notice. Generally, floods are caused due to the concentrated spells of heavy rains in the upper mountain reaches during the monsoon months (June- September). Although disasters cannot be prevented fully, their impact can be reduced with better disaster management strategies including better public health preparedness and response.

2. Types of Floods

1.1. Flash Floods – Such floods that occur within six hours during heavy rainfall and are usually associated with towering cumulus clouds, severe thunderstorms, and tropical cyclones or during the passage of cold weather fronts. This type of flood requires rapid localized warning system and immediate response in favour of affected communities. Other causes of flash floods include dam failure or other river obstructions.

1.2. Coastal Floods – Some floods are associated with the cyclonic activities like Hurricanes, Tropical cyclones, etc. generating catastrophic flood from rainwater which often aggravate wind-induced storm and water surges along the coast. As in river floods, intense rain falling over a large geographic area produces extreme flood situation in coastal river basins.

3. Common Public Health Effects due to Flood

3.1. Immediate and Medium Public Health Risks

- The main public health threats in flooding crisis are related to communicable diseases, listed below. Basic preventive and curative health services are also disrupted, weakening access to appropriate health care.

- Interruption of safe water and sanitation supplies: The populations displaced by flooding are at immediate (days to weeks) and high risk of outbreaks of waterborne and food borne diseases, such as cholera.
- Population displacement with overcrowding: Populations in the affected areas have been displaced into schools, camps or with host families, and are at immediate and high risk for transmission of measles and meningitis and increased incidence of acute respiratory infections (ARI), especially pneumonia in children under 5 years.
- Vector breeding: Flooding can result in the proliferation of vector breeding sites, increasing the medium-term (weeks to months) risk of malaria.
- Poor access to health services is of immediate concern, as the health infrastructure has been destroyed or overwhelmed, drugs and supplies damaged and health-care workers also displaced.
- Malnutrition and transmission of communicable diseases. Malnutrition compromises natural immunity, leading to more frequent, severe and prolonged episodes of infections. Severe malnutrition often masks symptoms and signs of communicable diseases, making prompt clinical diagnosis and early treatment more difficult.

3.2 Post Flood Epidemic Prone Diseases

Floods can potentially increase the transmission of the following communicable diseases:

- Water-borne diseases, such as typhoid fever, cholera, leptospirosis and water borne hepatitis
- Vector-borne diseases, such as malaria, dengue and dengue haemorrhagic fever and Kalaazar, West Nile Fever.

Public Health Events following Floods can be categorized as:

Immediate health events (Days to Weeks)	Medium term Health events (Weeks to Months)	Long Term Health events (Months to Years)
Drowning	Water borne diseases	Post-traumatic Stress disorders
Injuries	Vector borne diseases	Other psychological ailments
Snake Bites	Leptospirosis	Nutritional problems
Animal or insect bites	Hepatitis A or E	
Water borne diseases	Skin infections	
	Eye infections	

4. Disease Surveillance During and After Flood Events

Surveillance is the systematic collection, analysis, interpretation and dissemination of information for public health. As floods significantly affect public health, robust surveillance is important during and after flooding to identify and control infectious disease outbreaks and other health issues rapidly to guide local and regional health service delivery; and to add information about possible associations between floods and ill health. Salient points on the need for surveillance during and after surveillance are listed to:

- Assess the needs of the affected population
- Match available resources to those needs
- Prevent exacerbation of adverse effects
- Protect the population from further health effects by implementing disease control strategies where appropriate and well defined
- Monitor and evaluate the effectiveness of emergency health plans and activities
- Improve contingency planning from the experience gained.

4.1. Disease Surveillance

During humanitarian emergencies, an early warning alert and response network (EWARN) is often set up to support broad public health surveillance systems that may be underperforming, disrupted or non-existent, particularly in the acute phase of an emergency, while the routine systems recover from the effects of the disaster.

Certain diseases must be considered priorities and monitored systematically.

Ideally, diseases or syndromes should be prioritized in the emergency outbreak surveillance, ranked by:

- Epidemic potential
- Ability to cause severe morbidity or death
- International surveillance requirements (International Health Regulations/public health emergency of international concern);
- Availability of prevention and control measures
- Availability of reliable and meaningful case definitions and simple laboratory tests, where appropriate

Daily Reporting Format 1 - Field Based Surveillance

Table -1 Reporting Unit Details

Details of Health :

Facility (SC/PHC/CHC) :

Name of the field worker/Medical officer :

Name of reporting unit	**Type of reporting unit**	**Location details**	**IDSP reporting week**
	Village Sub-centre	State_____ District _____ Town/city _____ Village_	**Date of reporting Name and contact details of the reporting officer**

Table -2 List of Conditions for Syndromic Surveillance

Details of Health Facility :

Name of the field worker/Medical officer:

S. No.	Syndrome	Cases		Deaths	
		<5 y	>5 y	<5 y	>5 y
1	Loose watery stool				
2	Loose stool with visible blood				
3	Fever				
4	Fever with bleeding				
5	Fever with rash				
6	Fever with cough				
7	Fever with semi-consciousness/confusion				
8	Fever with neck stiffness				
9	Difficulty in breathing and wheezing				
10	Jaundice (< 4 weeks)				
11	Isolated redness of eyes with or without discharge				
12	Open wounds and bruises				
13	Fracture				
14	Burns				
15	Animal Bites				
16	Drowning				
17	Other (to be specified depending on the unusual syndrome/event)				

Table - 3 Water Chlorination Level

Details of Health Facility (SC/PHC/CHC/DH) :

Name of the field worker/Medical officer :

S. No.	Source of water	Chlorination adequate/ Inadequate	Marks

Table - 4 Daily Faecal Coliform Test

Details of Health Facility (SC/PHC/CHC/DH) :

Name of the field worker/Medical officer :

S. No.	Source of water	Faecal Coliform Present/ Absent	Remarks

Table - 5 List of Conditions for Presumptive Surveillance

Details of Health Facility (PHC/CHC/DH) :

Name of the Medical officer :

S. No.	Syndrome	Cases		Deaths	
		<5 y	>5 y	<5 y	>5 y
1	Acute diarrheal disease				
2	Cholera				
3	Dysentery				
4	Malaria				
5	Dengue				
6	Chikungunya				
7	Acute Haemorrhagic Fever				
8	Measles				
9	Chickenpox				
10	ARI				
11	Acute Asthma				
12	Meningitis				
13	Acute Encephalitis Syndrome				
14	Acute Hepatitis				
15	Leptospirosis				
16	Conjunctivitis				
17	Open wounds and bruises				
18	Fracture				
19	Burns				
20	Dog bite				
21	Snake bite				
22	Drowning				
23	Hypertension				
24	Diabetes Mellitus				
25	Other (to be specified depending on the unusual syndrome/event)				

*Use IDSP Case definition

Daily Reporting Format 2

Table - 6 Line Listing of Deaths in Post-Disaster Situations

Details of Health Facility (PHC/CHC/DH) :
Name of the field worker/Medical officer :

S.No.	Name	Father's name	age	Sex	Address	Date of reporting	Diagnosis	Suspect/ probable	Co- morbidities, if any	ate of death	Place of death	Remarks

5. Water and Food Borne Diseases

- The populations affected by the flooding are at immediate risk from outbreaks of waterborne and foodborne diseases, particularly cholera, typhoid, Shigella dysenteriae type 1, and hepatitis A and E. Population displacement, crowding, poor access to safe water, inadequate hygiene and toilet facilities, and unsafe food preparation and handling practices are associated with transmission.
- Usual water sources can become unsafe for drinking for several reasons: the incursion of flood waters; faecal contamination caused by overflow of latrines and inadequate sanitation; contamination by dead animals; and upstream contamination if water sources are interconnected. Since the onset of the rains, cases of diarrhoea and dysentery, including deaths, have been reported from the flood-affected areas, and the immediate risk of further cases will remain extremely high.

5.1 Cholera

- Cholera is an acute enteric infection caused by the ingestion of bacterium Vibrio cholerae present in fecal contaminated water or food. Primarily linked to insufficient access to safe water and proper

sanitation, its impact can be even more dramatic in areas where basic environmental infrastructures are disrupted or have been destroyed. Cholera is characterized in its most severe form by a sudden onset of acute watery diarrhea that can lead to death by severe dehydration. The extremely short incubation period - two hours to five days - enhances the potentially explosive pattern of outbreaks, as the number of cases can rise very quickly. About 75% of people infected with cholera do not develop any symptoms. However, the pathogens stay in their feces for 7 to 14 days and are shed back into the environment, possibly infecting other individuals. Cholera is an extremely virulent disease that affects both children and adults. Unlike other diarrheal diseases, it can kill healthy adults within hours. Individuals with lower immunity, such as malnourished children or people living with HIV, are at greater risk of death if infected by cholera.

Key Messages

- Cholera is transmitted through contaminated water or food.
- Water should be chlorinated during and after floods to prevent cholera.
- Prevention and preparedness of cholera require a coordinated multidisciplinary approach.
- Cholera can rapidly lead to severe dehydration and death if left untreated.
- ORS can successfully treat 80% of cholera cases.
- Appropriate antibiotics can reduce the duration of purging.

Case Management

- Efficient treatment resides in prompt rehydration through the administration of oral rehydration salts (ORS) or intravenous fluids, depending of the severity of cases.
- Up to 80% of patients can be treated adequately through the administration of ORS (WHO/UNICEF ORS standard sachet).

- Very severely dehydrated patients are treated through the administration of intravenous fluids, preferably Ringer lactate.
- Appropriate antibiotics can be given to severe cases to diminish the duration of diarrhoea, reduce the volume of rehydration fluids needed and shorten the duration of V. cholerae excretion.
- For children up to five years, supplementary administration of zinc has a proven effective in reducing duration of diarrhoea as well as reduction in successive diarrhoea episodes.
- In order to ensure timely access to treatment, cholera treatment centres should be set up among the affected populations whenever feasible.
- For children below 6 months of age, add zinc 10mg daily for 2 weeks. For children from 6 months to 12 years, add zinc 20mg daily for 2 weeks.

5.2 Foodborne Diseases

Following natural disasters such as floods, food in affected areas may become contaminated and consequently be at risk for outbreaks of foodborne disease due to bacteria, viruses and chemicals. Threats posed by contaminated water and food are interrelated and cannot be separated. Therefore, water should be treated as a contaminated food and should be boiled or otherwise made safe before it is consumed or used as an ingredient in food.

For food safety across the food supply chain, it is important to ensure that hazard of microbial contamination should be reduced from food and agricultural produce sourced from the affected areas reinforcing food safety messages to food handlers. Possibility of chemical contamination of agricultural produce harvested from flood affected areas should be ruled out before consumption.

Health System Preparedness for Prevention of foodborne illness

- Heighten surveillance for food and water borne diseases
- Heighten surveillance of perishable food products

- Give Public Health Authorities and the community information on five keys to food safety
- Identification and prompt response to foodborne outbreaks

Five Keys to Food Safety

- Household level
- Wash hands before cooking and eating food
- Wash vegetables, fruits and raw material prior to cooking with safe water
- Keep food preparation area clean
- Cook food thoroughly
- Store food at safe temperature
- Food handlers
- Report illness/sickness and do not handle food in case of fever & loose motion/ cold & cough/skin infections
- Use protective gear while cooking

5.3 Viral Hepatitis A and E

Viral hepatitis A and E are food- and water-borne infections that can result in acute outbreaks in communities with unsafe water and poor sanitation. They do not result in chronic infection or chronic liver disease and there is no specific treatment. Prevention is through improved sanitation, food safety and vaccination.

Management

- Hepatitis A and hepatitis E are generally a self-limiting illness, and most patients improve in a few weeks. No specific treatment is indicated for uncomplicated disease.
- Patients with marked vomiting, fever or headache may benefit from symptomatic treatment.

- Pregnant women with hepatitis E are at a greater risk than others of developing liver failure and adverse outcomes. They may need to be carefully observed so that complications can be detected and treated early. It may thus be preferable to refer such women to a first referral unit for delivery
- Management is available free of cost at designated district hospitals under National Viral Hepatitis Control Program

Control measures to outbreak specific for hepatitis A and hepatitis E

- During a waterborne hepatitis outbreak, the concentration of free chlorine should be increased to more than 0.5 mg/L throughout the system as a minimum immediate response.
- Consumption of only boiled water. (Water should be boiled for at least 1 minute, cooled and then consumed)
- Generating awareness regarding water, sanitation and hygiene interventions to disrupt transmission of hepatitis A and E. Individuals should be encouraged to always wash their hands with soap after defecation and/or disposing of feces.Hand hygiene practices should be followed after using the toilet / latrines, after cleaning a soiled baby, Before eating or before feeding a child.
- Ensure safe disposal of excreta and prevent open defecation.
- Since the incubation period of hepatitis A is 2-6 weeks and for hepatitis E is 2–10 weeks, cases may continue to occurfor up to 6 weeks for hepatitis A and for 10 weeks for hepatitis E (the maximum incubation period) after steps have been instituted to ensuresafe drinking water, sanitation and improved hygiene. Therefore, longer-term monitoring after institution of these prevention measures is needed.

6. Water, Sanitation and Personal Hygiene

6.1. Safe Drinking Water

- Minimum drinking water requirement per person per day is 5 litres. Daily activities like cooking, toilet use, hand washing etc. require a minimum of 20 litres of water. Water sources are likely to get contaminated after floods and microbial drinking-water quality is the first concern. Consult with local authorities on whether tap water is safe to use. Agree to a procedure to receive warnings and an emergency water supply if the tap water becomes unfit for human consumption.
- Encourage women to breastfeed their babies, especially when the water quality is uncertain or insufficient. Ensure that water that is below drinking-water quality is used only for cleaning, laundry and sanitation, and that it is labelled as such. Water below drinking-water quality should be used for cleaning and laundry only in combination with detergent.
- For drinking water, point of use treatments like boiling of water; use of bleach, alum, etc should be used as measures for disinfection. The treatment should be cost effective and fast.

Boiling of Water

- Water can be made safe by bringing it to a rolling boil (for example, in a kettle or pot on a cooker). After boiling, the water should be allowed to cool down on its own without the addition of ice. If water cannot be boiled for all, give priority to boiling drinking water for formula-fed infants, immunocompromised and other vulnerable patients. Protect it from post- treatment contamination during storage.

Using Sodium Hypochlorite (Bleach)

- If it is not possible to boil water, chemical disinfection of clear, non-turbid water is effective for killing bacteria and most viruses, but not for protozoa like Cryptosporidium. Options for chemical disinfection include chlorine compounds or iodine.

- Bleach (Sodium Hypochlorite) is cheap and easily available domestic cleaner which is widely used for disinfection of drinking water and personal hygiene during floods.

Some tips for using Bleach:

- Never mix Bleach with any other domestic cleaning agent (especially one containing ammonia). Wear rubber boots, rubber gloves, and eye protection while working with bleach. Try not to breathe bleach fumes.
- To treat clear drinking water: Use about 1/8 teaspoons bleach (approximately 0.75 ml treat clear drinking water for 1 gallon (nearly 4 litres of water let the water stand for 30 minutes before using it.
- In case of cloudy drinking water, add ¼ teaspoon bleach per I gallon (approximately 4 litres) and let it stand for 30 minutes before using.

Using Chlorine Tablets

- For typical room temperature and water temperature of 25 °C, minimum contact time should be 30 minutes; increase contact time for colder water (e.g. double time for each 10 °C less than 25 °C). Prepare according to package instructions. Add to clear water or after settling or
- Clarification to be most effective. This solution should be added to water to leave a free residual chlorine concentration of 0.4 to 0.5 mg/l after 30 minutes, which can be determined using a special test kit. If this is not available, a slight smell of chlorine is a crude indicator.

Safe Water Storage

- Store water safely in order to prevent it from becoming (re-) contaminated or a breeding place for mosquitoes. Use of narrow mouthed containers, or covered containers should be encouraged.
- Containers for transportation and storage of drinking-water should be cleaned and preferably disinfected before they are put into operation.

Disinfection of Water Containers and Cans to Store Water

- Mix soap and clean water in container
- Shake or stir to clean inside of container
- Rinse container
- Mix 1 teaspoon (4.9 ml) bleach per 1 cup (240 ml) water and pour it in the container
- Cover the container and shake so the solution touches all inside surfaces
- Cover and let stand for 30 minutes
- Rinse with clean water
- It is advised that the containers should be cleaned and disinfected every alternate day.

Disinfection of Wells

- WHO endorses the disinfection of well in emergency situation. There are various ways of doing this but the most common is chlorination as it leaves a residual disinfectant in the water after chlorination.
- Chlorine has the advantage of being widely available, simple to measure and use, and it dissolves easily in water. Its disadvantages are that it is a hazardous substance (to be stored and handled with care) and that at commonly applied concentrations it is not effective against all pathogens (some cysts and viruses require higher chlorine concentrations).
- The chlorine compound most commonly used is high strength calcium hypochlorite (HSCH) in powder or granular form which contains 60-80% chlorine. Also used is sodium hypochlorite in liquid bleach or bleaching powder form which contains 35% chlorine or laundry bleach with 5- 8% chlorine. Each chlorine compound has a different amount of usable chlorine depending on the quantity of time the product has been stored

or exposed to the atmosphere and the way it is made. Table 10 and 11 outlines methods for calculating appropriate chlorine doses for bleaching powder, HSCH granule chlorine and liquid bleach. Stir the water in the well thoroughly with a long pole and then allow the water to stand for at least 30 minutes.

Dewater the Well

- Following the contact period, remove all water in the well using a pump or bucket. When the well has refilled, wait a further 30 minutes and measure the chlorine concentration. If the residual chlorine concentration is less than 0.5mg/l the well is safe to use. If the concentration is greater than 0.5mg/l, remove all the water from the well again and repeat the process.

Two issues need extra care when dewatering the wells:

1. water with high concentration of chlorine should not flow into streams or wetlands;
2. when dewatering on coastal areas salt water intrusion should be avoided.
3. Do not allow anyone to use the well during the cleaning process. The water will have a strong concentration of chlorine that will give it a bad taste and smell.

7. Water Supply Needs Assessment in Health Care Facilities During and Aftr Flood Event

- With the help of the relevant authority, establish mechanisms to monitor water quality at the health care facility.
- Should the tap water be unsafe, assess needs using the following recommended minimum quantities of water per person in each setting type:
- Outpatients: 5 litres/consultation
- Inpatients: 40-60 litres/patient/day

- Operating theatre or maternity unit: 100 litres/intervention
- Viral haemorrhagic fever isolation centre 300–400 litres/patient/day.
- Emergency water supplies can consist of packaged water, tanker water, direct use of alternative water sources or on-site production of drinking-water. If circumstances allow, separate emergency supplies (including both materials and human resources) are encouraged for health care facilities. Prevent access of unauthorized people to the emergency water supply and storage system.

Table-10 Methods for Calculating Appropriate Chlorine Doses

Water (m3)	Bleaching powder (25-35%) (g)	High strength calcium hypochlorite (70%) (g)	Liquid bleach (5% sodium hypochlorite) (ml)
0.1	10	4.3	60
0.12	12	5.2	72
0.15	15	6.5	90
0.2	20	8.6	120
0.25	25	11	150
0.3	30	13	180
0.4	40	17	240
0.5	50	22	300
0.6	60	26	360
0.7	70	30	420
0.8	80	34	480
1	100	43	600
1.2	120	52	720
1.5	150	65	900
2	200	86	1 200
2.5	250	110	1 500
3	300	130	1 800
4	400	170	2 400
5	500	220	3 500
6	600	260	3 600
7	700	300	4 200
8	800	340	4 800
10	1 000	430	6 000
12	1 200	520	7 200
15	1 500	650	9 000
20	2 000	860	12 000
30	3 000	1 300	18 000
40	4 000	1 700	24 000
50	5 000	2 200	30 000
60	6 000	2 600	
70	7 000	3 000	
80	8 000	3 400	
100	10 000	4 300	
120	12 000	5 200	
150	15 000	6 500	
200	20 000	8 600	
250	25 000	11 000	
300	30 000	13 000	
400	40 000	17 000	
500	50 000	22 000	

** This produces a chlorine concentration of approximately 30 mg/l (ppm). This water should not be drunk by people or animals.

Table-11 Methods for Calculating Appropriate Chlorine Doses

Water (m3)	Bleaching powder (25-35%) (g)	High strength calcium hypochlorite (70%) (g)	Liquid bleach (5% sodium hypochlorite) (ml)
0.1	2.3	1	14
1.2	3	1.2	17
1.5	3.5	1.5	21
2	5	2	28
2.5	6	2.5	35
3	7	3	42
4	9	4	56
5	12	5	70
6	14	6	84
7	16	7	98
8	19	8	110
10	23	10	140
12	28	12	170
15	35	15	210
20	50	20	280
30	70	30	420
40	90	40	560
50	120	50	700
60	140	60	840
70	160	70	980
80	190	80	1 100
100	230	100	1 400
120	280	120	1 700
150	350	150	2 100
200	470	200	2 800
250	580	250	3 500
300	700	300	4 200
400	940	400	5 600
500	1 170	500	7 000

* Approximate doge 0.7 mg of applied chlorine per litre of water.

Ground water contamination

Ground water contamination is one of the serious issues which is often neglected. Flooding has potential to pollute ground water and is unsafe for human use. It contains salts and heavy metal concentration and certain micro-organisms which can cause serious illness.

Sanitation

Concentration of a large number of people at limited sites, compromises sanitation and water supply situation, are ideal conditions for rapid spread of water borne diseases like diarrhoea, cholera and typhoid. These diseases are responsible for high mortality and morbidity rate in developing countries and are all spread through faeco-oral or skin penetration.

Children under five years of age are most at risk from communicable diseases since their immune systems have not developed. Relief workers and affected population in the camps must wash their hands with soap before meals and after using the toilet.

Shallow trench latrines should be dug out in areas where the usage will be less than 5 days. In areas, where the toilets will be in use for more than 5 days, deep trench latrines (minimum depth 6 feet, width: 1 ½ feet, length: 3 feet) should be dug. The trenches should be covered with fresh earth after every use and the toilets should be disinfected with disinfectant powders

like gamma hexane, twice daily. The toilets should be minimum 100 feet away from the relief camps.

Sanitation and Hygiene in Health Care Facilities During and After Flood Event

- For non-emergency circumstances, WHO recommends one toilet per 20 users for inpatient settings (including patients who use bedpans instead of toilets) and at least four toilets for small outpatient settings (one for staff; one for females and one that is appropriate for use by children for patients). The number should be increased for larger outpatient settings.

Waste Handling and Disposal

- In the absence of functioning sewers and routine waste collection/treatment services, collection mechanism for both human and medical waste will experience additional strain. Staff involved with handling human waste from emergency sanitation must be

provided with personal protective equipment. For staff handling medical waste, personal protective equipment includes aprons, masks, boots and gloves.

- Waste collection zones need to be protected to prevent access by the general public, disease vectors and the dispersion of hazardous materials by floods and storms. Local authorities can advise siting of additional disposal areas for human waste (such as deep trench latrines for emptying bucket latrines). Provide a possibility of hand washing or hand disinfection in the waste collection zones.

Toilets and Hygiene

- Remind patients and staff of the importance of hand washing with soap after every toilet use. If hand-washing facilities have become dysfunctional, provide temporary alternatives (such as a basin, soap and a jug of water and/or hand rub). In an emergency situation, it is particularly important to clean toilets regularly, preferably with detergent and/or disinfectant. Provide gloves for cleaners.

- Prevent toilets from becoming a breeding place for disease-transmitting organisms (such as mosquitoes, flies and rats) – no puddles or other habitats for mosquitoes and other animals should be present in toilet rooms.

- Provide emergency lighting to ensure the safe use of toilets during power outages.

Dysfunctional or Insufficient Numbers of Toilets

- Where toilets in health care facilities are dysfunctional or insufficient in number, open defecation in the surroundings of hospitals and health care centres must be avoided. In order to prevent open defecation, the following measures can be taken.

In Urban Settings

- If the sewers or water pipes are broken or unusable but the toilet bowls are still functional, cover them with sealable plastic bags. After each use, add disinfectant or garden mould to decrease infectivity and odour. Store full bags in tight containers until a waste collection system has been re-established.
- Where the toilet bowls have become unusable, provide chemical toilets if financially and logistically viable (including transport and regular emptying/replacement). The least preferred alternative is the use of (camping-)bucket toilets, but this can be encouraged to prevent open defecation.

In Rural Settings

- Construct (additional) latrines in the surroundings of the health care facility, but at least 30 metres away from any water source and 10 metres away from any water storage tank or treatment facility. If latrines cannot be built, defecation fields provide an alternative.
- Where toilets are functional but insufficient in numbers and additional sanitation facilities are provided outside the health care facility, patients with restricted mobility (including pregnant women, people with physical disabilities and elderly people) should be given priority access to the functioning indoor toilets.
- Where additional or alternative sanitation facilities are built or used, the same considerations regarding functioning toilets for patients with restricted mobility apply.

8. Vector Borne Diseases: Emergency Vector Control Response Plan

- Floods due to heavy rains or natural disaster needs preparedness for emergency vector control response in the given area. The understanding of duration of floods and area affected is essential to plan emergency vector control response during and after floods. Rapid and appropriate precautionary vector-control measures applied in a post-floods settings can prevent and mitigate vector borne diseases.

1. Heavy rains and flood wash away aquatic (larval) stages of vectors.
2. The adult vector population from the peripheral areas or any mother foci, if existing may help in building vector population again in those areas
3. After floods, water stagnations in the low lying areas may become prolific breeding sites for vector breeding after 15 days to 1 month for anopheline and culicine breeding
4. However, mother foci for dengue vector (larval) may exist indoors in the dengue endemic areas
5. Sand fly population may increase after the water receded and lot of moisture in the soil is available with organic matter.

8.1. Emergency Preparedness for Vector Control Response

A. Risk Factors following floods:

1. Re-habilitation Camps
2. Possibilities of circulating vector-borne viruses.
3. Close proximity of large population
4. Optimal Climatic Factors
5. Presence of open water containers
6. Possibility of adult population of vectors for Malaria / Dengue
7. Creation of large breeding places

B. Immediate Vector Surveillance and Control:

1. IEC for minimizing exposure to existing adult vectors
2. Space spray with 2% pyrethrum extract for adult vector control, if any
3. Adult vector surveillance in rehabilitation centres / shelter homes
4. Mapping of potential breeding sites

C. Short Term Vector Control Response (After Floods):

- Heavy rains in dengue prone areas usually flushes Aedes larvae from outdoor breeding sites. However, many indoor receptacles may retain Aedes eggs and larvae. This may increase in adult Aedes population within 7–10 days. There is a probability that vector may transmit the disease, if virus is in circulation.
- Stagnated flood waters may also result in breeding sites for Anopheles vector. Mosquito population build up from these sites may take 2–4 weeks. In case parasitic reservoir is available, malaria case may be reported after 4–6 weeks.
- In case of JE and Kala-azar, vector population build up and presence of pathogen reservoir is essential to determine the onset of new clinical cases. Regular vector surveillance and control is required in the affected areas.

The following actions are required:

- Intensify vector surveillance (both larval & adult) in high risk areas
- Larval control in localized area near human rehabilitation sites/camps
- Ensure sustainable vector control to prevent transmission in peripheral areas surrounding flood areas, in case known endemic areas for any vector borne disease
- Community awareness to cover water storage containers with lids to prevent vector breeding

- Use of Indoor residual spray (IRS) should be based on disease incidence in last 3-5 years
- Use of Space spray in areas reporting confirmed malaria / dengue cases.

9. Rodent-Borne Diseases

- There is some concern about diseases transmitted by rodents, which could increase during or after heavy rainfall and flooding as a result of altered patterns of contact. Leptospirosis is an example of such diseases.
- The following advice should be given to people during floods and when returning home:
- Keep food in sealed cupboards and/or containers out of the reach of rodents
- Dispose waste in rubbish bins with covers/lids
- Ensure that all entrances and windows are suitably sealed to prevent entry of rodents into the property.

9.1. Snakebites

- There is an increased risk of snakebite as venomous snakes will be washed from their normal habitats and carried in flood waters into new areas. Since both people and snakes will seek drier ground there is a greater chance of contact.
- Snake bites during floods are common. Bites by venomous snakes can cause severe consequences.

Victims of Snake Bites May Suffer Any or all of the Following:

- Local envenoming, confined to the part of the body that has been bitten – these effects may be debilitating, sometimes permanently;

- Systemic envenoming, involving organs and tissues away from the part of the body that has been bitten – these effects may be life-threatening and debilitating, sometimes permanently;
- Effects of anxiety prompted by the frightening experience of being bitten and by exaggerated beliefs about the potency and speed of action of snake venoms – these symptoms can be misleading for medical personnel;
- Effects of first aid and other pre-hospital treatments that may cause misleading clinical features these may be debilitating and, rarely, even life-threatening

Stages in Management of Snake Bites

- Apply first aid
- reassure the victim, who may be very anxious;
- Immobilize the whole of the patient's body by lying him/her down in a comfortable and safe position and, especially, immobilize the bitten limb with a splint or sling – any movement or muscular contraction increases absorption of venom into the bloodstream and lymphatics;
- Consider pressure immobilization or a pressure pad if the necessary equipment and skills are available, unless an elapid bite can be excluded;
- Avoid any interference with the bite wound (incisions, rubbing, vigorous cleaning, massage or application of herbs or chemicals) as this may introduce infection, increase absorption of the venom and increase local bleeding;
- Release tight bands, bandages and ligatures – ideally, these should not be released until the patient is under medical care in hospital, resuscitation facilities are available and antivenom treatment has been started
- Transport the patient to hospital

- Undertake rapid clinical assessment and resuscitation
- Perform detailed clinical assessment and species diagnosis
- Perform investigations and laboratory tests
- Administer antivenom treatment
- Observe the response to antivenom
- Decide whether further dose(s) of antivenom are needed
- Administer supportive/ancillary treatment
- Treat the bitten part of the body
- Begin rehabilitation
- Treat chronic complications
- A knowledge of which species of venomous snakes present the greatest risks to human populations in any particular region or country is essential to addressing snake bite problems. Snake antivenoms are the only effective treatment to prevent or reverse most of the venomous effects of snake bites.

9.2. Leptospirosis

- Leptospirosis is a bacterial disease that can cause serious illnesses such as kidney or liver failure, meningitis, difficulty breathing, and bleeding. Cases of leptospirosis can increase after floods when people may have to wade through contaminated water or use it for drinking or bathing.
- Leptospirosis is essentially animal infection by several serotypes of Leptospira (spirochaetes) and transmitted to man under certain environmental conditions. It can cause a wide range of symptoms and can be mistaken for some other diseases. Leptospirosis is an infection in rodents and other wild and domesticated animals, it can be transmitted directly or indirectly from animals to humans, and in a very rare case it can be transmitted from human to human.

Mode of Transmission

1) Direct contact

2) Indirect contact

- Direct contact- Leptospira can enter body through skin abrasions or through intact mucosa (eyes, nose, mouth), by direct contact with urine or tissue of infected animal.
- Indirect contact- infection can enter through the contact of the broken skin with soil, water or vegetation contaminated with urine of infected animals or through ingestion of food or water contaminated with Leptospira.
- It can also spread through droplet infection which may occur through inhalation as while milking infected cows or goats.

People at Risk

- Risk of infection depends on exposure such as on the basis of occupation, living environment and lifestyle. The main occupational group at risk are farm and agricultural workers, pet shop workers, veterinarians, sewer workers, slaughterhouse workers and military personnel. Other groups at high risk of contracting leptospirosis include survivors of natural disasters (e.g. flooding) and people wading in contaminated water sources.

Prevention

- Creating awareness among people who are at risk of exposure.
- Wearing protective clothing (boots, gloves, spectacles, aprons, masks).
- Covering skin lesions with waterproof dressings.
- Preventing access to, or giving adequate warning about water bodies known or suspected to be contaminated (pools, ponds, rivers). Try to avoid wading or swimming in potentially contaminated water.

- Washing or showering after exposure to urine splashes or contaminated soil or water.
- Washing and cleaning wounds.
- Avoiding or preventing urine splashes and aerosols, avoiding touching ill or dead animals
- Strictly maintaining hygienic measures during care or handling all animals
- Where feasible, disinfecting contaminated areas (scrubbing floors in stables, butcheries, abattoirs, etc.)
- Consuming chlorinated drinking-water

Prophylaxis

- Antibiotic prophylaxis of exposed persons is used to prevent the transmission and spread of the disease as per programme guidelines.
- Antibiotic prophylaxis with Doxycycline weekly has been used in high risk areas during Kerala floods (2018) and Maharashtra floods (2018).

10. Vaccination during Flooding

- In an acute emergency such as a flood event, the objective of vaccination is reduction of risk from a disease in order to protect a population during a relatively short period of extreme vulnerability. In no circumstances should an acute emergency be seen as an opportunity for rapid achievement of the goals of a routine vaccination programme. On the contrary, those goals should be set aside in order to use vaccines for one clear and present objective: to limit the number of excess preventable deaths for which the emergency might be responsible for or these reasons, certain strategies (e.g. mass vaccination campaigns, expanded target age groups, reduced courses for certain vaccines) warrant greater consideration in acute emergencies than they might in other circumstances, whether or not routine vaccination services remain functional.

- The SAGE framework covers only that period of time between the onset of emergency and re- establishment of routine vaccination programmes. Any additions to routine vaccination should only be considered for vulnerable population groups under certain specific circumstances.

10.1. Tetanus

- Tetanus is not transmitted from person to person, but is caused by a toxin released by the anaerobic tetanus bacillus Clostridium tetani. Contaminated wounds, particularly in populations where routine vaccination coverage levels are low, are associated with morbidity and mortality from tetanus.

10.2. Measles

- Measles and the risk of transmission in the disaster-affected population is dependent on the baseline vaccination coverage rates among the affected population, and in particular among children aged <15 years. Crowded living conditions, as is common among people displaced by natural disasters, facilitate transmission and higher immunization coverage is required to prevent outbreaks.

10.3. Vaccination for Rescuers and Relief Workers

- Hepatitis A vaccination is recommended for selected high-risk individuals such as public utility workers (e.g. those involved in cleaning operations, sewage, waste or drinking-water management). Tetanus toxoid with or without tetanus immunoglobulin, as appropriate, is recommended for those whose vaccinations are not up to date, and should accompany wound treatment.

11. Safe Disposal of Dead Bodies

General Principles:

- The dead and the bereaved should be respected at all times.
- The priority for affected families is to know the fate of their missing loved ones.
- Honest and accurate information should be provided at all times and at every stage of the recovery and identification process.
- A sympathetic and caring approach is owed to the families throughout the process.
- Psychosocial support for families and relatives should be considered.
- Cultural and religious needs should be respected.
- A family liaison focal point should be established to support relatives.
- Identification should be conducted as speedily as possible. Mistaken identification should be avoided.
- Bodies should be released as swiftly as possible to the relatives.
- Advice and assistance from religious and community leaders should be sought to improve understanding and acceptance of the recovery, management, and identification of the dead bodies.
- Undignified handling and disposal of dead bodies may further traumatize relatives and should be avoided at all times. Careful and ethical management of dead bodies, ncluding disposal, should be ensured, including respect for religious and cultural sensitivities.

For Workers that Routinely Handle Corpses

- Teams handling dead bodies should wear protective equipment (heavy-duty gloves and boots) and wash their hands with soap and water after handling dead bodies.

- Graveyards should be at least 30m from groundwater sources used for drinking water
- The bottom of any grave must be at least 1.5m above the water table with a 0.7m unsaturated zone. Surface water from graveyards must not enter inhabited areas.
- Ensure universal precautions for blood and body fluids
- Ensure use and correct disposal of gloves (no re-use)
- Ensure use of body bags
- Ensure disinfection of vehicles and equipment
- Bodies do not need to be disinfected before disposal (except in case of death due to highly infectious aetiology)

Steps

1. Body Recovery

- Body recovery is the first step in managing dead bodies and is usually chaotic and disorganized. Body recovery is often done spontaneously by a large number of individuals, including: Surviving community members, Volunteers, Search and rescue teams, Military, police or civil defence personnel:

a) Bodies should be placed in body bags. If these are unavailable, use plastic sheets, bed sheets, or other locally available material.

b) Body parts (e.g., limbs) should be treated as individual bodies. Recovery teams should not attempt to match the body parts at the disaster scene.

c) Body recovery teams work most effectively in two groups: one to take bodies to a nearby collection point and a second to take them to identification or storage areas.

d) Noting the place and date where the body was found helps identification.

e) Personal belongings, jewellery, and documents should not be separated from the corresponding remains during recovery, but only during the identification phase.

f) Stretchers, body bags, and flatbed trucks or tractor-trailers can be used to transport bodies. Ambulances should not be used for this purpose as they are best used to help the living.

2. Storage/ Mortuary Services:

a) Whichever storage option is used, each body or body part should be kept in a body bag or wrapped in a sheet before storage.

b) Waterproof labels (e.g., paper in sealed plastic) with a unique identification number should be used.

c) Do not write identification numbers on bodies or body bags/sheets as they are erased easily during storage.

d) Refrigeration between 2°C and 4°C is the best option. Refrigerated transport containers used by commercial shipping companies can be used to store up to 50 bodies. Enough containers are seldom available at the disaster site and alternative storage options should be used until refrigeration becomes available.

e) Temporary burial provides a good option for immediate storage where no other method is available, or where long term temporary storage is needed. Temporary burial sites should be constructed in the following way to help ensure future location and recovery of bodies:

f) Use individual burials for a small number of bodies and trench burial for larger numbers.

- Burial should be 1.5m deep and at least 200m from drinking water sources
- Leave 0.4m between bodies.
- Lay bodies in one layer only (not on top of each other).
- Clearly mark each body and mark their positions at ground level.

3. Identification

a) Identification of the dead body should be ensured by giving each body a unique reference number.

b) Any separate body part, which proves that a person is dead, can aid in the identification and should therefore be managed as though it is a whole body (i.e. using a unique reference number).

c) Bodies that cannot be recognized by visual means, should be properly stored until forensic specialists can investigate.

d) Care should be taken before releasing bodies that are not whole, as this may complicate subsequent management of body parts.

4. Release of Body to the Relatives

a) A dead body should only be released when identification is certain.

b) Visual recognition should be confirmed by other information such as identification of clothing or personal effects.

c) Information collected about missing people can be used to cross-check visual recognition.

d) A body should only be released by the responsible authority, which must also provide documentation of the release (a letter or death certificate).

e) Record the name and contact details of the person or relatives who claimed the body together with the body's unique reference number.

5. Information for the Public

a) The population should be promptly and clearly informed about the response and procedures adopted for:

- Search for the missing.
- Recovery and identification of dead bodies.

- Collection and release of information.
- Support for concerned families and communities.

b) Information can be provided through the local or regional centres.

c) A wide range of communication channels can be used: The Internet, Notice boards, Newspapers, television, radio, etc.

d) Information centres should be established at regional and/or local levels.

e) Local centres act as focal points for collection and consolidation of information on the dead and for attending to the public. They are particularly necessary for receiving tracing requests, leaving photographs and information about the missing, and for the release of information on persons found or identified.

f) A system for management and coordination of information should centralize all information on the dead and missing during disaster event.

6. Safe Disposal of Dead Animals or Birds

Dead animals or birds if noticed should be brought to the notice of the Municipality /Panchayat officials, and disposed off by deep burial and spreading of bleaching powder.

12. Health Advisory for the Public/ Relief Camp Officials During Flood and Post Flood Period

12.1. Medical Care

- Public should get health advice in the health facilities / medical camps / mobile medical and public health units visiting the affected areas.
- For injured persons, one dose of Tetanus Toxoid Injection should be administered in all the health facilities including camps.
- In addition to the medical care, bleaching powder for decontamination of
- water tanks should be made available in the medical camps / mobile medical and public health units.
- Further, all Government Health facilities have all necessary emergency facilities and drugs.

12.2 Infectious Diseases Prevention and Control

- Health service should take all efforts to prevent the occurrence of water borne diseases like Diarrhoea, Hepatitis, air borne diseases like Acute respiratory tract infections, viral fevers, vector borne diseases like Dengue Fever, Malaria and also Leptospirosis.

The public are advised to follow the following precautions:

- Only safe drinking water to be used.
- Boiled water is most preferable for drinking.
- Frequent hand washing with soap and water is a must to prevent infections.
- Food materials soaked in flood water should not be used.
- If anyone develops fever or diarrhoea, they should seek health care in Government health facilities including medical camps. Self-treatment

is not advisable. If any clustering of cases is noticed, nearby health facility may be informed

12.3 Protected and Safe Drinking Water

- If boiled or quality bottled water is not available, water which has been super-chlorinated should be used for drinking.
- Methods of super-chlorination for water tanks, storage containers 5gms (1 teaspoon) of commercial bleaching powder for 1000 liters of water (Take bleaching powder in a bucket and make a paste by adding small amount of water, then add water up to 3/4th of the bucket slowly and mixing thoroughly. Wait for 10 to 15 minutes to sediment, transfer the supernatant chlorine water to another bucket and mix the chlorine water in the overhead tank. One hour after the above process of Super Chlorination, the water may be used.

12.4 Procedure for Cleaning of Tanks / Overhead Tanks After Flood

Submerged bore-wells, open wells should be used for collecting drinking water only after thorough cleaning.

The Step by Step Procedure is Given Below:

a) The water already in the tanks / overhead tanks should be drained out completely.

b) Scrub and wash the tanks / overhead tank thoroughly.

c) After thorough scrubbing, the tanks / overhead tank can be filled with water.

d) 36The water should be super-chlorinated as described above.

e) Allow the water to flow for at least five minutes in all taps to flush out the impurities and to sanitize the system.

f) Wells and water from bore-wells also should be super-chlorinated in the same manner.

12.5 Hygiene Measures in Temporary Shelters

- People staying in temporary shelters should drink only boiled /bottled water provided in the camp.
- People should use toilet facilities. If not available for any reason, they may request the camp in-charge to provide the temporary safe toilet facilities.
- Disinfection of temporary shelter areas with bleaching powder and lime mixture frequently (Method of preparation-- 250gms of bleaching powder + I Kg lime powder).

12.6 Fly Control Activities

· Flies multiply in garbage and decaying materials. Therefore, garbage and decaying materials should be removed at the earliest with the involvement of the Local Bodies.

- These areas should be disinfected with bleaching powder and lime mixture

12.7 Mosquito Control

- Regular mosquito breeding preventive measures should be followed as far as possible
- General use of mosquito repellent creams and measures like mosquito coils are also advisable

12.8 Safe Disposal of Dead Animals or Birds

Dead animals or birds if noticed should be brought to the notice of the municipality/Panchayat officials, and disposed of by deep burial and spreading of bleaching powder.

CONCLUSION

Effective monsoon preparedness requires a comprehensive, multi-faceted approach that addresses both immediate and long-term challenges. Key components include early warning systems, infrastructure maintenance, community awareness and coordinated efforts among Government, Non-Government and Local Organizations. Ensuring that Emergency response teams are well-trained, Stockpiling essential supplies, and Educating Communities on safety measures can significantly mitigate the risks associated with heavy rainfall, floods, and landslides. Continuous monitoring and adaptive strategies will help build resilience against future monsoon impacts, safeguarding lives, property, and livelihoods.

NOTES

DIRECTORATE OF PUBLIC HEALTH AND PREVENTIVE MEDICINE

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