

**Unit 4: Applied Epidemiology and Public Health in One Health Research**  
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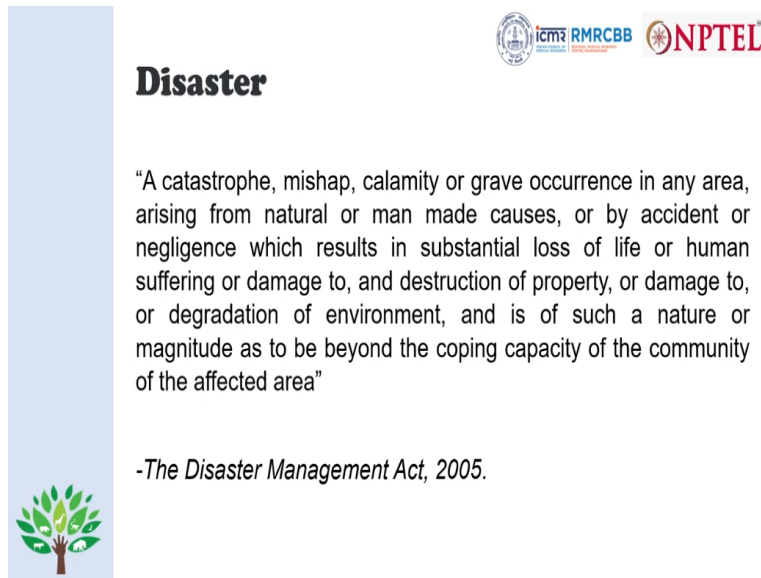
**Module - 9**  
**Lecture - 17**

**Rapid Response System, Disaster Management and Outbreak Investigation Plans**

Hello everyone. I am doctor Subrata Kumar Palo. I am working as Scientist at RMRC, Bhubaneswar. So, today we will be discussing on 3 different topics; one about disaster management, another about outbreak investigation and about rapid response system. So, today we will discuss these 3 topics with respect to from the perspective of One Health approach. So, about One Health you already know.

So, we will try to correlate how these 3 topics, they come under the purview of One Health approach, and the knowledge of these 3 topics, they can be utilised for One Health. So, let us start with the first topic that is disaster management.

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**Disaster**

"A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area"

*-The Disaster Management Act, 2005.*

So, first let me tell you what is a disaster. So, according to Disaster Management Act 2005 in India, they have defined disaster as a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes or by accident or negligence which result in substantial loss of life or human suffering or damage to and destruction of property or damage to

or degradation of environment and which is of such a nature or magnitude as to be beyond the coping capacity of the community of that affected area.

So, many of us know about different disasters like starting from the flood, cyclone and also like disease epidemics, disease and COVID-19 pandemic and the war, the recent war. We have witnessed such type of disasters. So, broadly these disasters, they are classified into 2 different categories; one is the natural disaster which like flood, cyclone, hurricane, earthquakes, these are the natural disasters; and another is the man-made disaster like war, like chemical exposure, like the Chernobyl tragedy, Bhopal gas tragedy; so, these are the man-made disasters.

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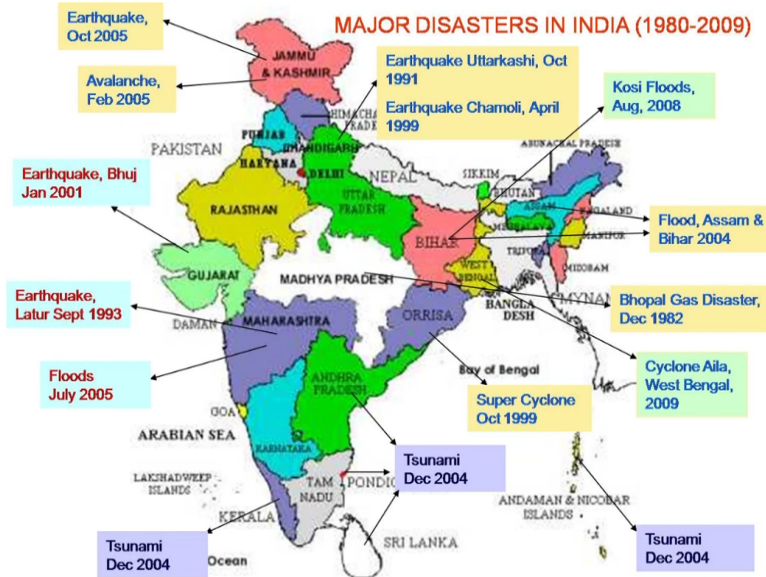
## Natural Disasters

- Geophysical (e.g. Earthquakes, Landslides, Tsunamis)
- Hydrological (e.g. Avalanches and Floods)
- Climatological (e.g. Extreme Temperatures, Drought and Wildfires)
- Meteorological (e.g. Cyclones and Storms/Wave Surges)
- Biological (e.g. Disease Epidemics and Insect/Animal Plagues)



So, natural disasters, they could be due to geophysical, that is like earthquakes, landslides, tsunamis; hydrological like avalanches, floods; climatological like due to extreme temperatures, extreme heat, the drought condition, the wildfires. It could be due to meteorological that is cyclone, storm, all these; and also biological that is in form of epidemic, in form of pandemic. Recently we have witnessed the pandemic due to COVID-19. These are the different types of natural disasters.

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The instances of natural disasters in India from 1980 to 2009, as you can see in this picture, in the north side of the country, there are history of earthquakes, avalanches; from the eastern side like flood, cyclone; and in the southern side, tsunamis. These are the many disasters that have happened in India.

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## Effects of a Disaster

- Loss of Life (Human and Animal)
- Infrastructural Loss
- Loss of Economy
- Food insecurity
- Disease outbreaks/epidemics
- Displaced Population
- Increased Violence, armed conflicts
- Security risks

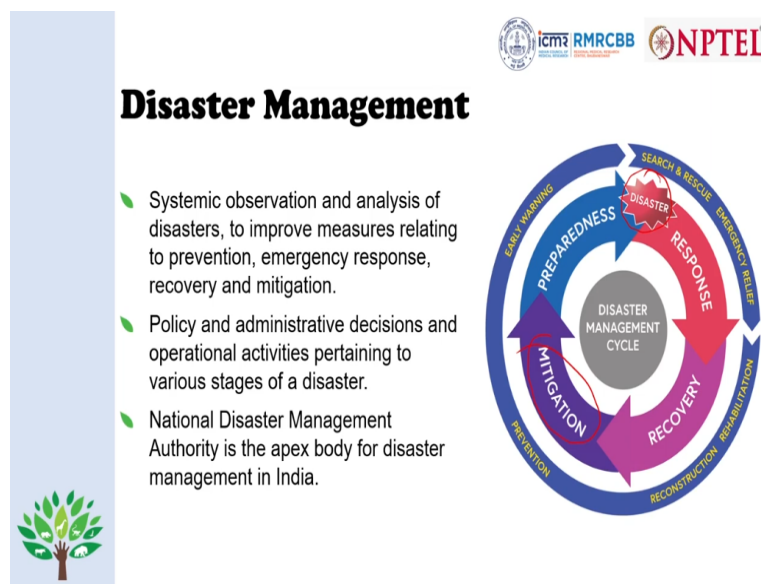


So, what are the effects of a disaster? So, we all know, because in a disaster there is loss of life, not only for human life but also animal life, so, this is important. As in One Health approach we have understood that it is a kind of integrated approach to restore the health and life of not only

human being but also animals and also the environment, plants, all these things in an integrated manner.

So, when disaster comes, all these life of human being, life of animals, life of plants, they get affected and even lives are lost. Infrastructure loss: Depending on the type of disaster, depending on the severity or the amount of disaster. Loss of economy, food insecurity, disease outbreaks, epidemics, displaced population, increased violence, armed conflicts and also there are issues related to security risks.

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Now let us understand how to manage this disaster. So, this disaster, broadly this can be managed in 4-5 phases. So, these are the the basic elements to manage a disaster. So, if you look at the inner circle, so, at 1 o'clock position, there you can find, it is a disaster. So, that is the onset of the disaster, point of onset of disaster. So, when the disaster happens, the impact of disaster, it starts; but when we are talking about the disaster management, we should be ready, we should be prepared prior to the onset of the disaster.

So, the first phase is the preparedness phase. So, in preparedness, first we will identify the early warnings, then how to prepare so that we can avoid, we can prevent to the disaster from its happening as much as possible. The second stage is the impact of the disaster. So, impact of the

disaster, it depends, it varies based on the type of disaster, based on its severity; and following this impact, there is how we respond to the disaster.

So, this is the next step, how we respond to the disaster. Then, after responding to the disaster, then the next phase comes, that is the phase of recovery. So, how we recover from a disaster; recover in terms of restoring our life, restoring our well-being, restoring our resources, economy, restoring our infrastructure, and following which the next or the last step is mitigation, developing mitigation strategy.

So, in mitigation, how we can reduce to the onset of a, or how we can be ready to prevent a disaster from its happening, so, that is mitigation. So, disaster management, it is a systemic observation and analysis of disasters to improve measures relating to prevention, emergency response, recovery and mitigation. Policy and administrative decisions and operational activities pertaining to various stages of a disaster. And in India, NDMA or National Disaster Management Authority, it is the apex body for disaster management in our country.

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So, this we have discussed. So, these are the phases of disaster management which I told, broadly there are 4 or 5 phases. So, it starts from disaster preparedness in which evaluation of risk, adoption to a protocol and regulation, public awareness, communication, resource mobilisation,

these are the various activities done under this phase, and this is done prior to the onset of the disaster.

So, once disaster happens, there is disaster impact and response. So, how to address that? How to respond to that? For that, the impact happens in terms of health, structural, ecology and economy. And how we respond? We need to search for the losses, not only for human but also for animal losses. We rescue, provide first aid, field care, triaging and tagging and identification of the dead.

Next step is about after the disaster is over; then the phase comes, the disaster recovery in which recovery in terms of community recovery, infrastructural recovery, economic recovery and environmental recovery are done. Next, following which we get prepared for disaster mitigation. In mitigation, we basically aim how to reduce the hazard and vulnerability and reducing the effects of a hazard.

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The slide features a light blue vertical bar on the left side containing a green tree icon at the bottom. At the top right, there are logos for ICMR, RMRCBB, and NPTEL. The main title is 'Disaster Preparedness' in bold black text. Below the title, the text reads 'Coordination of several sectors to carry out –' followed by a bulleted list of seven items, each preceded by a green leaf icon.

**Disaster Preparedness**

Coordination of several sectors to carry out –

- Evaluation of the risk
- Adopt protocol and regulation
- Maintain communication and response mechanism
- Ensure all resources to be easily mobilized
- Develop public awareness
- Share information with news media
- Disaster simulation exercises

So, these are like a disaster preparedness. So, in disaster preparedness, already we have discussed coordination of several sectors to carry out evaluation of the risk, adapt the protocol and regulation, maintain communication and response mechanism, ensure all resources to be easily mobilised, develop public awareness, share information with news and media, disaster simulation exercises; these are the things for disaster preparedness.

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## Medical preparedness

- Developing and capacity building of medical team for trauma & psycho social care, mass causality management and triage.
- Increase the casualty handling capacity of all hospital.
- Formulate appropriate treatment procedures.
- Involvement of corporate hospitals.
- Identify structural integrity and approach route.



In medical preparedness, we need to develop the capacity building of the medical team for managing the trauma and psychological care, mass casualty management and triage. Increase the casualty handling capacity of all the healthcare facilities, hospitals; formulate appropriate treatment procedures; involve the corporate hospitals and private hospitals; identify structural integrity and approach route.

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## Disaster Impact and Response

- Health-
  - Physical – Injuries, Disabilities, Death.
  - Psychological- Cognitive, Behavioral, Social.
- Structural damage- To variable extent.
- Ecological- Change in eco-system.
- Economical- Financial losses.



So, the impact and response because of a disaster: The health impact in terms of physical and psychological; physical like injuries, disability, death; psychological like cognitive, behavioural

and social health problems. Structural damage depending on the severity and depending on the type of the disaster. Ecological: Definitely, when there is a disaster, especially the natural or even the man-made disaster, there is change in the ecology.

So, it is not only the human beings, they are affected or the structural damage happens but also the forests, the trees, the surrounding environment, animals, all these change. So, this is important from the perspective of One Health. Economical: Like financial losses, they happen.

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## Disaster and Diseases

- Communicable diseases after Disaster due to change of ecology.
  1. Altered Ecology- Vector borne diseases (Malaria, Dengue, etc.)  
Water borne diseases (Typhoid, Cholera, etc.)
  2. Living Condition- Plague, Louse borne typhus and Relapsing fever.
  3. Street animal and wild animal displacement- Rabies.



And when there is a disaster, usually there happens to be a disease. So, the disease happens or it spreads leading to an outbreak or an epidemic which will discuss in the next topic. Because of the altered ecology, there are chances of vector borne diseases like malaria, dengue, chikungunya; water borne diseases like typhoid, cholera and other Hepatitis A, Hepatitis E; or all these gastroenteric diseases they have. Living conditions: plague, louse borne typhus, relapsing fever. Street animal and wild animal displacement leading to chances or probability of having rabies.

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## Public Health Response

- ✓ Food Safety and water safety
- ✓ Animal Control for prevention of zoonotic diseases
- ✓ Vector control for vector borne diseases
- ✓ Communicable disease control like Flu, Measles, Diarrheal diseases
- ✓ Waste Management like temporary latrines, Chemical Toileting, Sewage Disposal damage.



So, public health response in terms of food safety and water safety; animal control to prevent any zoonotic diseases; vector control for vector borne disease; communicable disease like flu, measles, diarrheal diseases; and waste management like temporary latrines, availability of chemical toilet, sewage disposal system. So, these are how we should respond to restore the life and well-being.

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## Disaster Recovery


- ✓ **Rehabilitation-**
  - Restoration of basic social functions.
  - Providing temporary shelters.
  - Economic Rehabilitation.
  - Psycho-social Rehabilitation.
  - Damage Assessment
- ✓ **Elements of recovery-**
  - Community Recovery (including psychological),
  - Infrastructure Recovery (Services & lifelines),
  - Economic Recovery (Financial & Political) and
  - Environment Recovery.



In disaster recovery, to rehabilitate restoration of basic social functions, providing temporary shelters, economic rehabilitation, psychosocial rehabilitation, damage assessment; and the


elements of recovery like community recovery including psychosocial; infrastructure recovery, services, lifelines; economic recovery, financial and political; and environmental recovery.

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## Disaster Mitigation

- Permanent reduction of risk of a disaster, to limit impact on human suffering and economic assets.
  - Primary mitigation-reducing hazard and vulnerability.
  - Secondary mitigation-reducing effects of hazard.
- Components-
  - Reducing hazard- Protection by removing the cause of threat.
  - Reducing vulnerability- Reducing the effect of threat.



So, how to mitigate a disaster? The permanent reduction of risk of a disaster to limit impact on human suffering and economic assets. Basically, broadly there are 2 different types of mitigation strategies; one is the primary mitigation which aims to reduce the hazard or the vulnerability, and secondary mitigation which reduces the effect after exposure of the hazard. Components like reducing hazard, to do that, protection by removing the cause of threat; reducing vulnerability by reducing the effect of the threat.


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## OUTBREAK INVESTIGATION


Now we will discuss the second topic that is about an outbreak or epidemic investigation.

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**Epidemic/Outbreak:**  
Sudden increase in the number of cases due to a disease (more than normally expected) in a population of an area.

**Epidemic/Outbreak Investigation:**  
A set of procedures used to identify the cause responsible for the disease, the people affected, the circumstances and mode of spread of the disease, and other relevant factors involved in propagating the epidemic, and to take effective actions to contain and prevent the spread of the disease.



So, first let us understand what is an epidemic or an outbreak. So, when there is sudden increase in the number of cases due to a disease which is more than what normally is expected in a population in an area, then we call it as an outbreak or as an epidemic. So, though the definition is same for both the things, but there is some difference; whereas the epidemic, it happens in a larger area, in a larger boundary area; the outbreak usually it is limited to a smaller area or to a particular zone or a smaller area with a particular boundary. Whereas epidemic, it goes to a broader area, it spreads to like districts, even state, it gets affected due to epidemic. Otherwise,

the terminology, as the terminology says, it is the sudden rise in number of cases because of a disease which is normally more than what is usually expected. What is an epidemic or outbreak investigation?

So, epidemic or outbreak investigation is a set of procedures used to identify the cause responsible for disease, the people affected, the circumstances and mode of spread of the disease and other relevant factors involved in propagating the disease and to take effective actions to contain and prevent the spread of the disease. As per the definition, so there are 4 different objectives of doing or pursuing an outbreak or epidemic investigation.

One is to identify the cause responsible. What is the causative agent? To identify that, number 1. And the circumstance, mode of spread of the disease: To identify the circumstances and mode of the spread of the disease, that is number 2; how the disease got spread and what is its mode. Third point is, and other relevant factors involved in propagating the epidemic.


What are the relevant factors for propagating disease and what are the preventive measures to be taken to prevent; so, the preventive measures to be taken. So, these are the 4 basic objectives why we should carry out an epidemic or outbreak investigation. To identify the source of infection or the causative agent to find out what is the mode of the spread of the disease and to find out what are the factors that are involved in spreading the disease and last but not the least, to come up with preventive solutions, how we can prevent the spread of the disease.

So, these are the 4 major objectives why we should carry out an outbreak or epidemic investigations. So, first we should remember that, we should have a kind of a, after getting the information, how we get an information that in a particular area the outbreak or epidemic has happened. It could be like, it could be information from the people or healthcare provider of that locality or it could be from the hospitals, from the even maybe government or private hospitals or from the clinicians or it could be from the newspapers or it could be even from the community people.

So, these are the many such sources, back from which we can get informed about the occurrence of an outbreak or epidemic. So, when that is done, when we come to know about an epidemic or outbreak, then we proceed to do an investigation; but before that, or doing an outbreak or an epidemic investigation, we should have a kind of a team what we call as the responders or the rapid response team.


So, they are basically the responders who go and do an investigation. So, the team basically includes like clinicians, epidemiologists, a law personal and if it is related to vector borne, then entomologists. So, these are like constant official constant experts. They form that rapid response team; they move to that, they go to that place and do the, start the investigation.

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**Preparation before going for Investigation**

- ✓ Money
- ✓ Travel order
- ✓ SIM card
- ✓ Sampling material
- ✓ Supervisor's home and cell number
- ✓ Laptop



Before going there, we should be prepared, we should carry with us money, travel order, sim card, sampling material; so, the home and cell number for contacting, laptop; all these necessary daily use items we should carry with us.

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## Steps of an outbreak investigation

1. Determine the existence of an outbreak
2. Confirm the diagnosis
3. Define a case and population at Risk
4. Rapid search for cases
5. Analyze the collected Data
6. Generate hypotheses using descriptive findings
7. Test hypotheses based upon an analytical study
8. Evaluate the Ecological factors
9. Compare the hypothesis with established facts
10. Prepare report (Findings along with prevention measures)



And when we start an epidemic or outbreak investigation, so, these are the 10 steps I have highlighted like 10 different steps to proceed for an outbreak investigation, but it is not mandatory that each step should, it is not like that it is sequential. So, we can do any step depending on the situation, depending on where we are and practically in the field, at what stage we are and what are the things that are happening; based on that, we can do the investigation, but it is just to guide you to tell you how to carry out an outbreak or epidemic investigation effectively.

So, these are the guiding steps. So, there are 10 steps for an outbreak or epidemic investigation. Number 1 is to determine the existence of an outbreak; then confirm the diagnosis; then define a case or define the population at risk; then do a rapid search for all the cases; then analyse the collected data; then generate an hypothesis using the descriptive findings; then test the hypothesis based on an analytical study; then evaluate the ecological factors; then compare the hypothesis with established or available facts; then finally, prepare a report based on the findings and based on your suggestions to prevent.

So, all these 10 steps, they should be included or they, when we do or when we follow these steps, we do the activity related to these things that completes an epidemic or outbreak investigation.

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## 1. Determine the existence of an outbreak

- ✔ Observe the frequency of the disease.
- ✔ Compare it with data for the same period in previous years.
- ✔ Most often the existence of an outbreak is obvious.
- ✔ For common diseases, an arbitrary limit of 2 SDs than the endemic level is considered.






So, first step, to determine the existence of our outbreak. So, first we need to determine that yes, there is an outbreak. To ensure that the outbreak has really happened, for that we need to have the data, the number of cases, the frequency of cases. Then we need to look at what our experiences from the previous years; whether the, as I told in the definition, epidemic or outbreak means there is a sudden increase in number of cases compared to the normal occurrence.

So, we should see that during past years or previous years, the number of cases were not that much, but this year, it has suddenly it has happened that, suddenly there is more number of cases, more number of patients suffering from a particular disease; they have come to, they have attended to hospital or even from the reports, you can see that the number of cases reported, it has increased.



So, that gives us a confirmation or that gives us an idea that yes, there could be an epidemic or an outbreak in a particular area. So, observe the frequency of the disease; compare it with the data for the same period in previous years; and for common reasons like influenza, like malaria, for all these, for the common diseases, what we usually take is, we collect the record from the previous years, then we see what is the frequency in the previous years; if it is more than 2 standard deviation compared to the previous years, then yes, there is possibility that it could be an epidemic or outbreak.

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## 2. Confirm the diagnosis

- Based on clinical information
  - Information from clinicians, specialists
  - Make a list of probable diagnoses
- Based on laboratory confirmation
  - Laboratory investigation result
  - Test for probable diagnoses




Next step is to confirm the diagnosis. For that, it is done based on the clinical information; that means we need to consult the clinicians, the specialists, the doctors of that particular locality; we need to find out whether the clinical sign symptoms, they are suggestive of the disease or not. Then I make list of probable diagnosis and based on that, we collect the sample, we send it to the laboratory and seek their investigation report. If the investigation report or the test result says that yes, it is positive, then that confirms the diagnosis.

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## 3. Define case and population at Risk

- Defining a case based on a standard case definition:
  - Possible cases
  - Probable cases
  - Confirmed cases
- Identifying the population at Risk:
  - Map of the affected area
  - Counting the population of the area

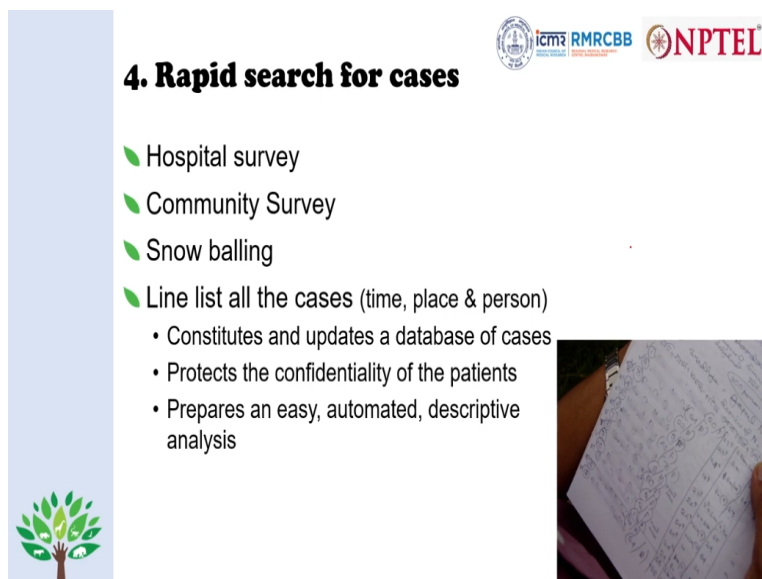




So, step 3 is to define a case and define the population at risk. For that, to define a case, usually we need to use a standard case definition for that. So, the standard case definition for different diseases, they are already available, may be led by WHO or maybe IDSP. All these, from that we can get the standard case definition and based on that, these case definitions, they are basically, they are meant for either a possible cases based on the sign symptoms and probable case based on the sign symptoms and also based on the clinical examination data, and a confirmed case based on the laboratory reports.

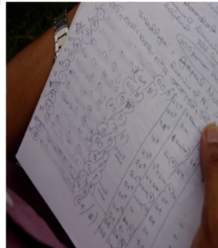
So, these case definitions, when we follow that, then we can identify, we can define a case; then, accordingly we proceed to identify the cases. Next is to identify the population at risk. So, for that, we need to have a kind of a geographical map of that area. So, we need to have that boundary of that map, how many people they are residing in that area. So, that is based on the census data or based on the counting of the total people of that area.

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**4. Rapid search for cases**

- ✓ Hospital survey
- ✓ Community Survey
- ✓ Snow balling
- ✓ Line list all the cases (time, place & person)
  - Constitutes and updates a database of cases
  - Protects the confidentiality of the patients
  - Prepares an easy, automated, descriptive analysis






The slide features a light blue vertical bar on the left with a green tree icon at the bottom. At the top right, there are logos for ICMR, RMRCCB, and NPTEL. The main content is a bulleted list of rapid search methods, with the 'Line list' method having three sub-bullets. A photograph on the right shows a person's hand pointing to a line list, which is a table with columns for time, place, and person, used for recording cases.

Next step is for rapid search of cases. So, for rapid search, either we can do active surveillance or passive surveillance. From the hospital survey, we can by asking for the data from the hospitals because the patient having the disease, they often go to the hospital for their care. So, by asking the data from the hospital, we can get to know about the number of cases; who are the cases, who have reached to hospital for seeking a particular care; that can be done.

Or, from the community survey, going from door to door also we can find out the cases. Or snow balling, that means when we know a case or disease person or patient, then we ask him or her that who are the other such cases; maybe their relatives, maybe their neighbours, maybe someone from their own village or own place. So, from that, getting that information, then again we find out the cases.

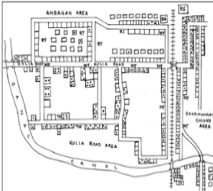
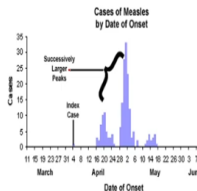
So, these are the different methods that we adopt for searching new cases. Then, after having the list of all the cases, then we do a line listing of cases. Line listing, from where we found out all these cases, based on the time, place and that person. So, the constitutes and updates a database for the cases, it protects the confidentiality of the patients and prepares an easy automated and descriptive analysis.

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### 5. Analyze the collected Data

- Time (Epi Curve)
  - Time of onset of Index/First case
  - Occurrence of cases over time
- Place (Spot Map)
  - Plot cases (spot) on a rough map in field
  - Does not account for population density
- Person
  - Incidence by age, sex, etc.



The fifth step is to analyse the collected data. So, whatever data or the thing that we have observed, we need to analyse that. That analysis usually is done based on the time, place and person. Based on the time, we need to identify where was the first case or the index case it happened. Index case and first case, there is a difference; though it is used interchangeably, that means often changed, but there is difference between index case.

Index case means it is the first case which got into the notice of the system, which is noticed by the system, but it usually happens that the first case in case of an outbreak or epidemic, it is not

noticed even. So, whosoever is really the first case, that is the first case; he may or may not be noticed; but index case is the first case which is noticed by the system or by the investigating team; that is the index case.

So, when that index case first happened or first appeared, that time, then how the other cases, they, that means the, from the primary case, the secondary cases that happened and what is the, with the time, how the number of cases, whether it went up or down, how it happened. So, by plotting this number of cases with duration or day or time, we can come up with an epi curve or epidemic curve.

That will give us an information about what is the magnitude or the severity of the disease, how the disease spread has happened, whether it is kind of a propagated epidemic or which type of epidemic it is, that also we can get to know from that. So, based on time, we can find out, we can get an epi curve. It has 2 components, time of onset of index or first case as I told, and another is occurrence of other cases over the time.

Next is about place. So, for place, from where we detected a case? For that, we need to plot a spot map. So, for that, we need to have a clear understanding about the geographical mapping, the important landmarks of that place and the boundary of that village or a locality; everything we need to have. We can just in a drawing, we can draw that; then we can see from which place or which state or which locality the cases, they have been identified or detected.

And besides that, what are the other sources for transmission or contamination are available? Next is person. Based on person, we need to find out what is the incidence according to their age, according to their gender; all these things we can find out.

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## 6. Generate hypotheses using descriptive findings

- ✔ Formulate hypothesis based on:
  - Time, Place and Person distribution.
  - Agent, Host and Environment interaction.
- ✔ What is the possible source of infection?
- ✔ What is the causative agent?
- ✔ Possible mode of transmission?
- ✔ The enabling environmental factors ?



So, these are the findings when we analyse the descriptive data. So, based on those findings, we can generate or we can postulate a hypothesis, hypothesis about the time, place and person distribution of the epidemic or outbreak; the agent, host and environment interaction of an epidemic or outbreak. What is the possible source of infection? So, from where the infection usually it got spread.

What is the causative agent? What are the possible mode of transmission? The enabling environmental factors or ecological factors which helped in transmission of the disease. So, all these reasons, we can postulate or we can think of.

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## 7. Test hypotheses based upon an analytical study

- ✔ Analytical study to test the hypotheses:
  - Association between exposure to suspected source and disease
- ✔ Conduct a Cohort or case control study, as appropriate
- ✔ Was the suspected exposure associated with the disease?
  - Strength of association? , Statistically significant?
- ✔ Temporality of association?, dose response relation?
- ✔ Which type of exposure?
  - Single source or Multiple? Single exposure or multiple?



Then, after formulating those or after generating those hypothesis, it is time to establish the with evidence with facts. For that, we need to test that hypothesis. For that, we need to carry out some analytical studies; maybe it could be a kind of a case control study or it could be a cohort study, depending on the nature, depending on the objectives and feasibility also. In analytical studies, basically we can look at the association between the exposure and the disease or the outcome, so, whether the association is present or not; if it is present, then what is the strength of association; whether the association is statistically significant or not.

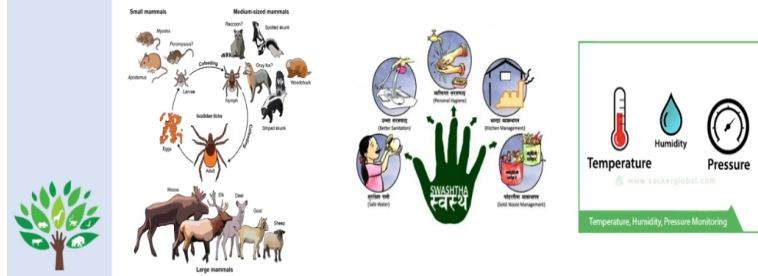
Then, what is the temporality of association? That means, which one happened first, whether the exposure or the disease, which one has happened first; and also dose response, relationship whether it is there or not. That means, as the exposure or the quantity of exposure increases, whether the effect also increases or not. Then, which type of exposure, whether it is a single source, a multiple source; whether it is a single exposure, one-time exposure or a multiple exposure; all these things we can find out by doing an analytical study, and this will support or refute to the hypothesis that we had made earlier.

So, if the findings suggest you that yes, there is strong association between exposure and the disease or the outcome, then our hypothesis that we made, that is successful, that is correct.

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## 8. Evaluate the Ecological Factors

- Find out the ecological factors responsible for the disease spread  
 Ex: Sanitation, Water supply, human movement, temperature, humidity, air pollution, insect and animal reservoirs etc.



Next is how to evaluate the ecological factors. So, ecological factors, basically they are the surrounding factors which have a role in disease or health or the transmission of various diseases or affect the health conditions like the hygiene sanitary practices, water supply, human movement, temperature, humidity, air pollution, insect, animal reservoirs, etcetera. So, while investigating for an outbreak, we need to look at the surroundings, how the surroundings are there.

What are the environmental factors? What is the humidity? What is the rainfall? Whether it is a forest area? What is the chances of the wild animals? All these things we need to look into.

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### 9. Compare the hypothesis with established facts

- ✔ Literature review
- ✔ Internet search
- ✔ Consult subject experts
- ✔ Laboratory studies



Then, comparing the hypothesis with established fact. For that, we need to search, we need to do a search, we need to search through internet, do a literature search to find out whether already these facts, they have been established or not. We need to consider some experts; we need to take their opinion, their experience and also we need to look at some laboratory studies. So, that will compare the hypothesis with already established facts.

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### 10. Prepare report (Findings and preventive measures)

- ✔ The report needs to be short, factual and preliminary.
- ✔ Short, medium and long term recommendations to be provided
- ✔ Recommendations need to be Evidence based, Specific, Feasible, Cost effective, Acceptable and Ethical.



And last but not the least but most important step is to prepare a report. So, this report is basically prepared based on the study findings and based on the preventive measures that we are going to suggest for this particular outbreak or epidemic. So, the report needs to be short, factual

and preliminary; it should have short term, midterm and long term recommendations proposed; and recommendations need to be basically evidence-based, specific, feasible, cost effective, acceptable and ethical.

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## RAPID RESPONSE SYSTEM

So, this is the last topic we are going to discuss today. So, this is about the rapid response system. So, first let us understand what is a rapid response system.

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What is a RRS?

- Rapid Response System (RRS) aim to improve the safety of hospital ward patients whose condition is deteriorating.
- It is the overarching structure that coordinates all teams involved in a rapid response call.
- It has 4 components:
  1. Identification of deteriorating patients and communicating - **Activator**
  2. Team attending the patient- **Responder**
  3. Ensuring implementation and supporting resources- **Administration**
  4. Team reviewing the RRS and supporting for improvement- **Quality Improvement**



So, while discussing on an outbreak investigation, I told that first we will formulate or first we make a rapid response team. So, it consists of like clinicians, other investigators like the



laboratory scientists, our laboratory technicians, laboratory persons, epidemiologists, entomologists, all these things; but here, the term is rapid response system. Usually, this rapid response system, it is applicable in a kind of a, to a hospital setup where we provide medical care.

So, here, to manage the critical cases or a very sick or critical patient, so, the hospital should have a kind of a dedicated team called as a rapid response team similar to the outbreak investigation. So, the rapid response team, they look after, they carry out so that we can save the life of that critical patient. So, basically, that is the objective of this rapid response; but here, rapid response system is something kind of an overarching system under which this rapid response team is one of the components.

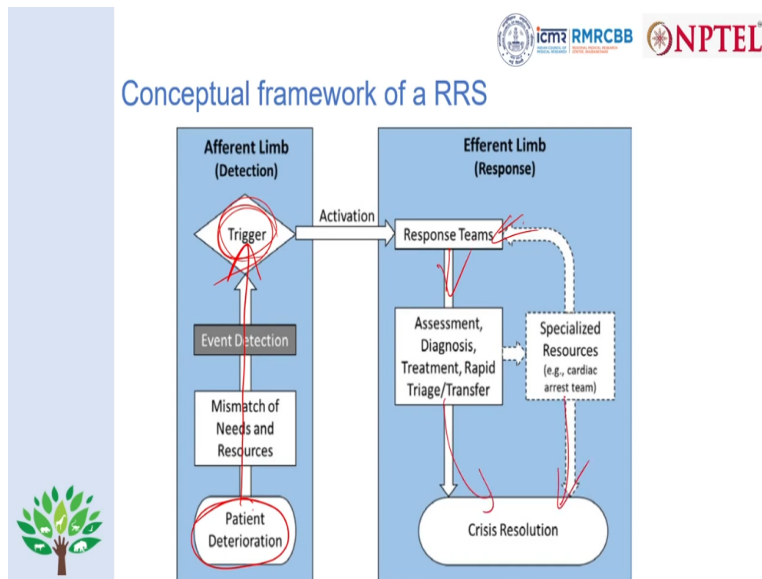
Rapid response system, it aims to improve the safety of hospital ward patients whose condition is deteriorated. It is the overarching structure that coordinates all teams involved in a rapid response call. Basically, this rapid response system, it has 4 components. So, two are the primary components or most essential components; one is the activators, they are the persons who usually identify that the patient is deteriorating and they immediately communicate that to the hospital system or to the responders.

Then, the second essential element is the responders, that is as I told, the RRT or rapid response team. They are basically, they are the responders. They are the kind of interventionists like anesthetist, like maybe cardiologists or the even the pulmonologists. So, they basically, they immediately rush to the bed of the patient, they immediately try to revive or make the patient survive.

So, they are the 2 pillars, main pillars I would say of a rapid response system; but to support them, the third element is the administration that is from the hospital side, who provides all necessary resources, support for functioning of this rapid response team or the responders; and also the administration, it ensures that this rapid response system is well functional in the hospital or the setup.

And the fourth supportive element is, that is the quality improvement. Basically, they are kind of a senior experts who are placed in that facility, who usually review the performance of those responders and basically the functioning of the system and they suggest to provide their input and they appreciate the work and they try to improve or make the rapid response system better functional in the hospital.

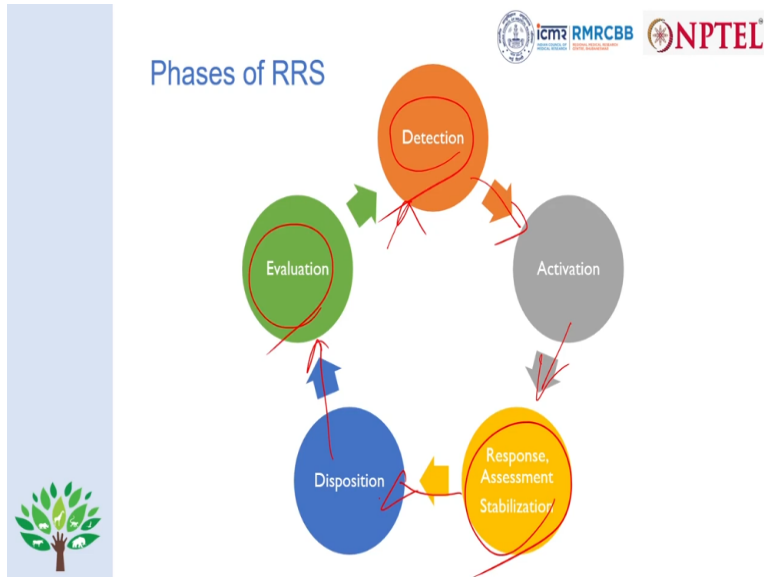
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So, this is the conceptual framework of a rapid response system. It has 2 limbs; one is the afferent limb, that means from the detection; it starts with; suppose a patient is deteriorating here, then someone watches, someone observes that, that patient is deteriorating, then immediately he or she informs to the team so that after the team or from the hospital, they are informed.

Then they immediately call to the responsive team, the rapid response team or the responders. And the responders immediately rush to the patient; they do the intervention; they take action so that they resolve the crisis, the patient gets stabilised and the adverse outcome, that is, that gets prevented.

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So, basically, they are the 5 different phases of a response team. One is the phase of detection; it is the first; patient is deteriorating. So, that is, that gets detected. So, who usually identifies that? Maybe some of the hospital staff, maybe a kind of a doctor, it could be nurse, it could be like the cluster employee, the sweeper or even the relative of the patient or the patient attendant, he or she could also find that.

So, all these, they act like an activator. The first detects that patient is deteriorating. Immediately, they inform, they communicate. Then, after that, that gets activated. Then they communicate to the responder; then the responder comes; then the third step is, the response assessment and stabilisation. They take necessary action to stabilise the patient, either if the condition is deteriorating, they may either shift the patient to the ICU or do some interventions, maybe they change the treatment protocol.

They do all necessary steps to revive to make the patient survive. Then disposition; then by a senior team, they evaluate the job of RRT. So, these are the 5 different phases of rapid response system.

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## Activator(s) ✓

### Activators can be:

- ✓ Floor staff
- ✓ A technician
- ✓ The patient
- ✓ A family member
- ✓ Specialists
- ✓ Anyone sensing the acute deterioration



So, as I told, the activators could be like anyone; maybe floor staff, technician, patient, family member, specialist. So, whosoever first detects that patient is having problem is deteriorating, then he or she is an activator. First, he or she does a whistle blow, informs to the system, then this system calls to the rapid response team or the responder to take action.

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## Responder(s) ✓

### ✓ Responders come to bedside and assess patient's situation

### ✓ Responders determine patient disposition:

- ✓ Transferring the patient to another critical care unit (e.g., ICU or CCU)
- A handoff back to the primary nurse/primary physician
- Revising the treatment plan

### ✓ Who are the Responders?

- ICU Physician, ICU Charge Nurse
- Nurse Practitioner (if available)
- RRS coordinator
- Transportation service



Then responders, who are the responders? He or she could be an ICU physician, ICU staff nurse, nurse practitioner, rapid response system coordinator or transportation service or anyone, so, who participates in reviving or surviving the patient. Those responders, they rush to the bedside, assess patient situation. So, they do, they determine patient disposition; that means, either to

whether they transfer the patient to ICU or to handoff back to the primary nurse or to revise the treatment protocol.

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### Administration

- The Administration Team of the RRS brings organizational resources, support, and leadership to the entire RRS and ensures that changes in processes are implemented if necessary



Administration: As I told, they are the supporting bodies, either they provide on all necessary or required resources, assistance to the responders so that this RRS system is well functional in that setup or the facility or hospital.

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### Quality Improvement

- The Quality Improvement (QI) Team supports Activators and Responders by reviewing RRS events and evaluating data for the purpose of improving RRS processes



Quality improvement: Quality improvement team provides activators and responders by reviewing the RRS events and evaluating the data for the purpose of improving the rapid

response system. So, basically, for that we need to have a kind of a protocol. Basically, a protocol should be there in a hospital setup or health facility, how a rapid response system works.

Then, based on that, the activator, responder, the administrator and also the quality improvement team, jointly they can improve this rapid response system in a hospital, and this will help to revive not only to revive but also this minimises the hospital stay, this reduces the cost of treatment. So, this is why this RRS, rapid response system is important. So, thank you.