INVESTIGATION OF EPIDEMIC

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- What is an Epidemic
- Types of Epidemics
- Investigation of Epidemic
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WHAT IS AN EPIDEMIC

- An **epidemic** is defined as the **occurrence of disease cases in a community or region clearly in excess of normal expectancy** for a given time period.

- Generally if **cases number are more than 2 standard deviations,** then it will be considered as an epidemic.

- Some times even one case can also be considered as epidemic Ex: Polio

1. COMMON SOURCE EPIDEMIC

- **Cause:** All cases are exposed to the same source of infection.
- **A. Point Source Epidemic:** Exposure happens at a single point in time. **Epidemic curve:** Sharp rise and fall in cases. **Example:** Food poisoning after a wedding dinner. **Incubation period:** Cases occur within one incubation period of the disease.
- **B. Continuous Common Source Epidemic:** Exposure occurs over a longer duration. **Epidemic curve:** Plateau or gradual rise and fall. **Example:** Cholera due to a contaminated water supply over days/weeks.

2. PROPAGATED EPIDEMIC

- **Cause:** Disease spreads person-to-person.
- **Epidemic curve:** Multiple waves; each wave reflects a generation of spread.
- **Examples:** Measles, COVID-19, Influenza.
- **Features:**
  - Slower rise.
  - Clusters of cases over time.
  - Depends on contact rate, susceptibility, and immunity in population.

3. MIXED EPIDEMIC

- **Cause:** Combination of common source and propagated spread.
- **Example:** A person gets infected from contaminated food (common source) and then transmits it to family members (propagation).
- **Epidemic curve:** Initial peak from common source, followed by secondary peaks due to person-to-person spread.

4. SLOW (OR MODERN) EPIDEMIC

- **Cause:** Non-communicable diseases (NCDs) or conditions with long latency periods.
- **Spread:** Develops slowly over time, often due to behavioral or environmental factors.
- **Examples:** Obesity, Type 2 Diabetes, Cardiovascular diseases, Tobacco use.
- **Features:** Long duration, gradual increase in prevalence.

TYPES OF EPIDEMIC

Type	Source of Infection	Pattern of Spread	Example
Point Source	Single exposure	Sharp rise and fall	Food poisoning at a feast
Continuous Common Source	Ongoing exposure	Plateau or gradual trend	Cholera from water supply
Propagated	Person-to-person	Multiple waves	Measles, COVID-19
Mixed	Both source and propagation	Combined curve	Hepatitis A from food + spread
Slow (Modern)	Lifestyle/Environment	Gradual, over years	Obesity, Diabetes

MONITORING EPIDEMICS

1. State Surveillance Unit (SSU), Andhra Pradesh

- Operates under the **Integrated Disease Surveillance Programme (IDSP)**.
- Located at **Directorate of Public Health and Family Welfare**, Vijayawada.
- **Functions:**
  - Collects and analyzes weekly disease surveillance data.
  - Investigates outbreaks.
  - Sends alerts to districts and central government.
  - Coordinates laboratory support and field epidemiology.

MONITORING EPIDEMICS

2. District Surveillance Units (DSU)

- Located in each of the **26 districts** of Andhra Pradesh.
- Supervised by **District Surveillance Officers (DSO)**—usually senior medical officers.
- **Tasks:**
  - Receive reports from Primary Health Centers (PHCs), Community Health Centers (CHCs), and hospitals.
  - Initiate outbreak investigation.
  - Coordinate field response teams.

CENTRAL-LEVEL SUPPORT

Integrated Disease Surveillance Programme (IDSP), MoHFW

- National-level program under **National Centre for Disease Control (NCDC), Delhi**.
- Andhra Pradesh reports all suspected outbreaks and weekly surveillance data to IDSP.

Indian Council of Medical Research (ICMR)

- Provides laboratory support and advanced epidemiological investigation via its network of virology labs (e.g., **VRDLs**).
- Supports Andhra Pradesh for diseases like COVID-19, Nipah, Zika, etc.

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

1. Health & Family Welfare Department

- **Lead agency for epidemic response.**
- Coordinates surveillance, testing, clinical care, vaccination, and health education.

2. Integrated Disease Surveillance Programme (IDSP)

- **Core surveillance unit** under MoHFW, operational at district and state level.
- Manages: Case reporting (S, P, L forms), Outbreak verification, Epidemiological investigation, Lab confirmation

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

- **3. Local Bodies (Municipalities / Panchayats)**
- Implement environmental sanitation measures.
- Oversee:
  - Waste disposal
  - Fogging/spraying in vector control
  - Clean-up drives around water sources
- Vital in controlling vector-borne and water-borne outbreaks.

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

- **4. Public Health Engineering Department / Rural Water Supply**
- Ensures **safe drinking water** supply.
- Responds to outbreaks like cholera or typhoid by:
  - Chlorinating water (≥0.5 mg/L residual chlorine)
  - Repairing pipelines
  - Providing alternate water sources (e.g., tankers)

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

- **5. Food Safety Department**
- Investigates **food-borne disease outbreaks** (e.g., food poisoning).
- Collects food samples for lab testing.
- Conducts inspections of:
  - Eateries, messes, hostels
  - Food vendors and caterers

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

- **6. Animal Husbandry Department**
- Involved in **zoonotic disease** outbreaks like:
  - Brucellosis
  - Anthrax
  - Rabies
- Conducts:
  - Animal testing
  - Vaccination of livestock
  - Culling (if required)

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

- **7. Education Department**
- Disseminates IEC (Information, Education, Communication) materials in schools. Coordinates school-based screenings, closures, and vaccinations.
- **8. Disaster Management Authority**
- Activated during **major epidemics or pandemics**.
- Coordinates logistics, resource mobilization, and inter-departmental coordination.
- Works closely with: Police, Revenue Department, Transport Department (for isolation and referral)

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

- **9. Police Department**
- Enforces quarantine/isolation orders.
- Assists in **crowd control, perimeter sealing**, and compliance checks.
- Ensures law and order during mass panic or lockdowns.

KEY DEPARTMENTS IN EPIDEMIC MANAGEMENT

- **10. Information & Public Relations Department**
- Leads **risk communication** and **awareness campaigns**.
- Prevents misinformation.
- Broadcasts alerts through:
  - TV
  - Radio
  - Newspapers
  - Social media

INTERSECTORAL COORDINATION IN EPIDEMICS

Department	Role in Epidemic Control
Health & Family Welfare	Case detection, treatment, vaccination
IDSP	Surveillance, investigation, outbreak alerts
Municipal/Panchayat	Sanitation, waste disposal, vector control
Water Supply & PHED	Safe water provision, pipeline repair, chlorination
Food Safety	Food inspection, sample testing
Animal Husbandry	Zoonotic disease control, animal vaccination
Education	School health coordination, IEC
Disaster Management Authority	Resource mobilization, intersectoral coordination
Police	Quarantine enforcement, lockdown compliance
I&PR	Risk communication and public awareness

INVESTIGATION OF EPIDEMIC - OBJECTIVES

1. To define the magnitude of the epidemic outbreak or involvement in terms of time, place and person
2. To determine the particular conditions and factors responsible for the occurrence of the epidemic
3. To identify the cause, sources of infection, and modes of transmission to determine measures necessary to control the epidemic
4. To make recommendations to prevent recurrence

INVESTIGATION OF EPIDEMIC

- Generally starts after peak of epidemic reached
- In such cases, investigation is mainly retrospective
- No Cook Book approach/ Step by Step approach suitable for all situations
- However it is desired to follow orderly procedure

INVESTIGATION OF EPIDEMIC

1. Verification of Diagnosis
2. Confirmation of the existence of Epidemic
3. Defining the population at Risk
4. Rapid search for all cases and their characteristics
5. Data analysis
6. Formulation of Hypothesis
7. Testing of Hypothesis
8. Evaluation of Ecological factors
9. Further investigation of population at risk
10. Writing the report

1. VERIFICATION OF DIAGNOSIS

- Sometimes news of epidemic may be spurious and arise from misinterpretation of signs and symptoms by public
- It is not necessary to examine all cases
- **Collect clinical samples** for lab confirmation.
- Rule out false positives or misdiagnosis.

SPURIOUS EPIDEMIC DUE TO MISINTERPRETATION – "MASS HYSTERIA IN SCHOOL CHILDREN"

- In a government high school in rural Andhra Pradesh, over **30 students** from classes 6 to 9 complained of: Abdominal pain, Nausea, Dizziness, Fainting
- All symptoms appeared **within 2 hours** of eating their midday meal.

- **Initial Public Perception:**
- Parents and local media **suspected food poisoning**.
- Rumors spread rapidly through WhatsApp and local TV channels.
- Headlines claimed: "*Mass food poisoning—government negligence?*"

SPURIOUS EPIDEMIC DUE TO MISINTERPRETATION – "MASS HYSTERIA IN SCHOOL CHILDREN"

- **Public Health Response:** District Surveillance Unit (DSU) initiated outbreak investigation. Medical team examined all affected students. **Food samples were collected** and sent to the state food lab. Detailed history was taken—**no common food item** or water source implicated.
- **Findings:** **No pathogens** found in food samples. **No new cases** occurred after media coverage stopped. The symptoms were **mild**, resolved spontaneously within a few hours. All students had **normal vital signs and test results**.

SPURIOUS EPIDEMIC DUE TO MISINTERPRETATION – "MASS HYSTERIA IN SCHOOL CHILDREN"

- **<u>Conclusion:</u> Diagnosis: Mass Psychogenic Illness (Mass Hysteria)**
- Trigger: A few students reported nausea after seeing a lizard near the kitchen. Others, witnessing their reactions, developed similar symptoms through **psychological suggestion**.
  - **No true epidemic or infection.**
- This case highlights how **spurious epidemics** can arise from: Misinterpretation of symptoms, Psychological factors like fear or rumor, **Lack of accurate information.**

2. CONFIRMATION OF THE EXISTENCE OF EPIDEMIC

- This is done by comparing the disease frequencies during the same period of previous years
- An epidemic is said to exist when number of cases in excess of expected frequency by atleast two standard errors
- Some times it also causes misleading
- **Example:** Clinically Diagnosed cases of Dengue fever cases are more than 2 SE. It looks like epidemic. However lab confirmation revealed that half of the cases are not Dengue fever cases.

3. DEFINING POPULATION AT RISK

- **Obtaining a map of area** which had information of land marks, roads, location of dwelling units, isolated areas etc.
- **Counting the population** living in that area. It is used to calculate the attack rates

EXAMPLE

- A suspected **cholera outbreak** was reported in **Madhavaram village**, Andhra Pradesh, population approximately **3,200**.
- The **ANM and surveillance team** obtained a **hand-drawn village map** from the Panchayat Office.
- Map included:
  - All **roads and lanes, Public landmarks** (temple, school, PHC sub-centre, water tank)
  - Location of all **households/dwelling units, Isolated hamlets** at the periphery,
  - Location of all **public water sources** (hand pumps, overhead tanks)

EXAMPLE

- **2. Population Counting (Denominator):**
- Using **household survey and existing family folders**, they estimated:
  - **Ward 1:** 600 people
  - **Ward 2:** 850 people
  - **Ward 3:** 750 people
  - **Peripheral tribal hamlet:** 1,000 people
  - **Total Population = 3,200**

- **3. Case Line Listing (Numerator):**
- In 3 days, they recorded **80 cholera cases**, distributed as:
  - Ward 1: 5 cases
  - Ward 2: 10 cases
  - Ward 3: 15 cases
  - Tribal Hamlet: 50 cases

EXAMPLE

Calculation of Attack Rates:

$$\text{Attack Rate} = \frac{\text{Number of new cases}}{\text{Population at risk}} \times 100$$

- The **highest attack rate was in the Tribal Hamlet**.
- The map helped identify that the **only drinking water source** in the hamlet was a **contaminated open well**.
- Immediate measures were taken:
- Distribution of **chlorine tablets,** Emergency water tankers supplied by the **Public Health Engineering Department,** IEC activities on **safe water storage**

4 RAPID SEARCH OF ALL CASES AND THEIR CHARACTERISTICS

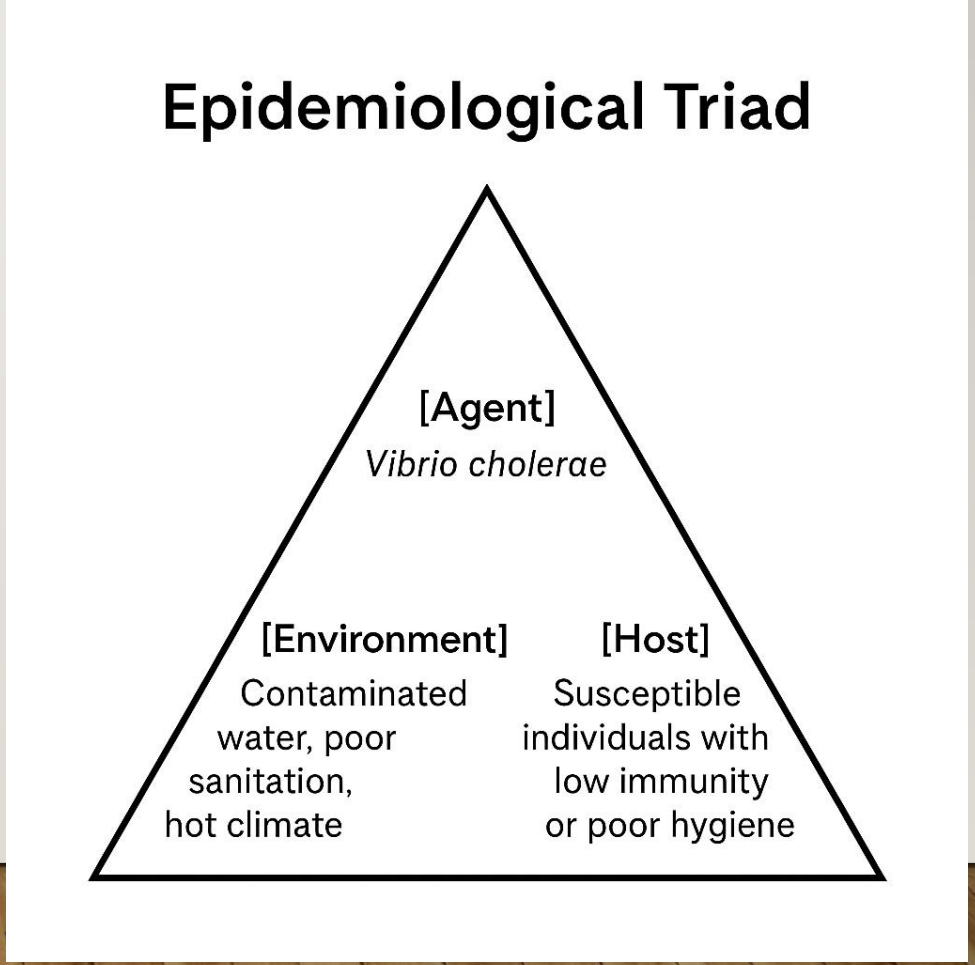
- Medical Survey should be conducted
- Health workers should be trained to collect information using Epidemiological case sheet or Case interview form
- It should include socio-demographic variables, Presence of Signs and Symptoms, History of Exposure and relevant risk factors of disease.
- If the outbreak is large, random sample should be examined and data should be collected from them

4 RAPID SEARCH OF ALL CASES AND THEIR CHARACTERISTICS

- Searching of new cases: Patient may be asked if he knew of other cases in the home, family, neighbourhood, school or work place
- Searching of new cases should be done every day till the area declared free of epidemic
- This period is usually taken as twice the incubation period of disease since the occurrence of last case

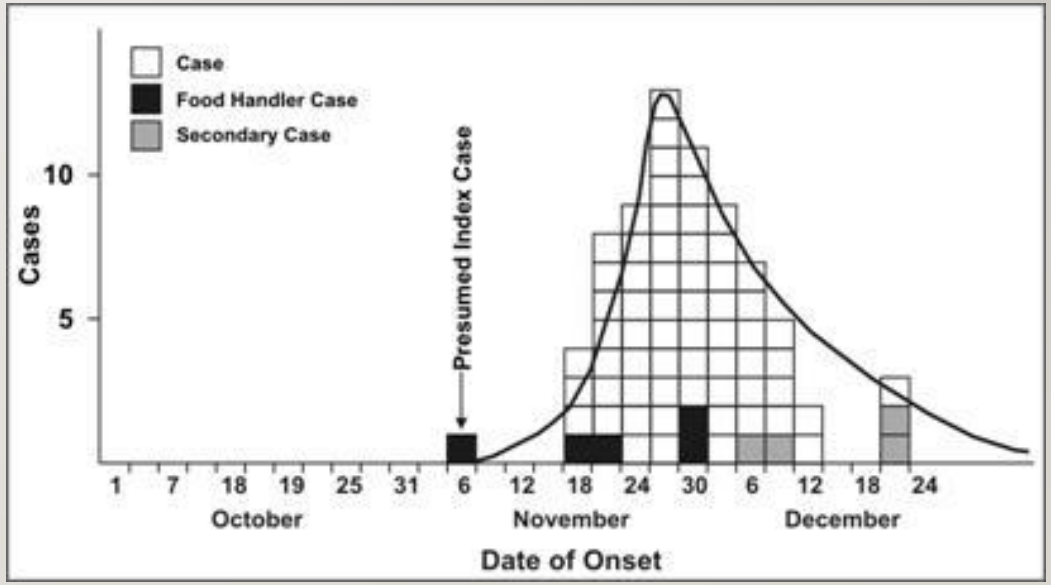
5. DATA ANALYSIS

- Data analysis should be **ongoing process** using the parameters **time, place and person**
- If the disease agent is known, the characteristics of time, place and person may be rearranged into Epidemiological triad model **Agent- Host- Environment model.**



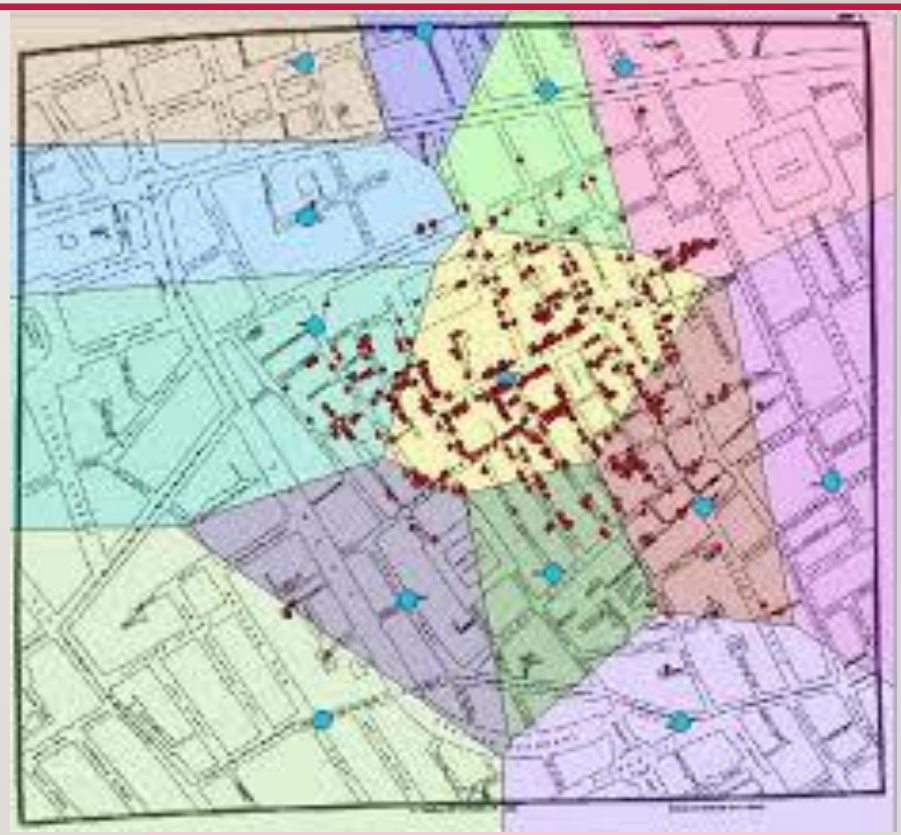
DATA ANALYSIS - TIME

- Arrange the cases in chronological order and prepare **Epidemic Curve**
- It may suggest
- A) **Time relationship** with exposure to a suspected source
- B) Whether it is **Common source or propagated** Epidemic
- C) Whether it is **seasonal or cyclical pattern**



DATA ANALYSIS - PLACE

- Prepare a **spot map** of cases, their relation to possible sources of infection like water supply, air pollution, foods eaten hotel, industries etc..
- **Analysis of geographical information** may provide evidence of source of disease



Distribution of Cholera cases

DATA ANALYSIS - PERSON

- Analyse the data by age, sex, occupation and other possible risk factors
- It is useful to identify the high risk population

6. FORMULATION OF HYPOTHESIS

Hypothesis should include

a) Possible source of infection

b) Causative agent

c) Possible modes of spread

d) Environmental factors which enabled it

"This outbreak of acute diarrheal illness is likely caused by *Vibrio cholerae* (**causative agent**), transmitted through ingestion of **contaminated drinking water from the community well** (**possible source of infection**). The disease appears to be **spread primarily via the fecal-oral route** (**mode of spread**), facilitated by **poor sanitation practices, lack of chlorination in water supply, and high ambient temperatures** (**environmental factors**) that enhance bacterial survival and proliferation."

7. TESTING OF HYPOTHESIS

- Testing Hypothesis can be done using analytical studies
- Use **case-control** or **cohort studies**.
- Calculate **attack rates, relative risk (RR), odds ratio (OR)**.
- Calculate the **association and correlation factors** to confirm **statistically significant** the association between risk factors and disease

8. EVALUATION OF ECOLOGICAL FACTORS

- Ecological factors which have made epidemic possible should be investigated
- Example: Sanitary status of eating establishments, Water and milk supply, breakdown in the water supply system, movements of the human population, atmospheric changes such as temperature, humidity and air pollution, population dynamics of insects and animal reservoirs

9. FURTHER INVESTIGATION OF POPULATION AT RISK

This may include

- Medical examination
- Screening tests
- Examination of suspected food, faeces or blood samples
- Biochemical studies
- Assessment of immunity status etc..

10. WRITING THE REPORT

- It Includes Five headings

1. Back Ground
2. Historical data
3. Methodology of Investigations
4. Analysis of data
5. Control measures

11. COMMUNICATE WITH PUBLIC

- Issue **accurate, timely, and transparent** information.
- Use **IEC (Information, Education, Communication)** campaigns.
- Address **misinformation and panic**.

- **HEALTH EDUCATION PLAYS KEY ROLE IN CONTROLLING EPIDEMICS**

12. MONITOR AND EVALUATE

- Ongoing **surveillance**: new cases, effectiveness of interventions.
- Adjust strategies based on **real-time data**.
    - IDSP Department will play key Role in this stage

13. PREPARE FOR FUTURE

- Analyze and document the outbreak.
- Strengthen surveillance systems.
- Recommend long-term preventive measures (e.g., safe water supply, routine immunization).
- It depends upon the epidemic disease.

14. OPERATIONAL RESEARCH

- **Operational research (OR)** in epidemic control refers to the **application of scientific methods and practical field investigations** to improve the **planning, implementation, and evaluation** of epidemic prevention and response strategies.
- It answers **real-time, actionable questions** like:
- "What works, for whom, under what conditions, and how can we make it more effective?"

OPERATIONAL RESEARCH - OBJECTIVES

- Identify **bottlenecks** in response systems
- Improve **resource allocation**
- Test **field-level innovations**
- Optimize **surveillance, containment, and treatment protocols**
- Bridge the gap between **research and public health practice**

KEY FEATURES OF GOOD OPERATIONAL RESEARCH

Feature	Description
Problem-oriented	Focused on a specific operational issue in epidemic control
Field-based	Data collected in real-world epidemic settings
Actionable results	Findings should guide immediate improvements
Participatory	Local staff and community are involved
Time-sensitive	Results available during or shortly after outbreak

EXAMPLE 1

Improving Case Detection

- **Research Question:**
- Can daily SMS-based reporting from sub-centres increase timeliness of cholera case detection?
- **Method:**
- Pilot use of SMS alerts from 10 PHCs vs. traditional weekly IDSP reports.
- **Findings:**
- SMS system reduced detection-to-reporting time from 4.5 days to 1 day.

EXAMPLE 2

Assessing ORS Usage Compliance

- **Research Question:**
- Does pictorial instruction leaflet increase correct ORS preparation during cholera outbreak?
- **Design:**
- Randomized households into two groups: standard instructions vs. pictorial leaflet.
- **Result:**
- Correct ORS preparation increased from 68% to 92% in the pictorial group.

EXAMPLE 3

Vaccine Coverage in Emergency Cholera Response

- **Research Question:**
- What are the barriers to oral cholera vaccine uptake in an urban slum?
- **Findings from survey:**
- 40% feared side effects
- 25% unaware of campaign
- 20% missed due to work
- **Recommendation:**
- Add evening sessions, use mobile loudspeaker campaigns.

COMMON CHALLENGES IN EPIDEMIC MANAGEMENT

- Delayed reporting
- Misdiagnosis
- Community misinformation
- Lack of lab infrastructure
- Lack of Epidemiologists

CONCLUSION

- Epidemic investigation is a cornerstone of public health response.
- **A multi-disciplinary, intersectoral approach** involving surveillance, scientific methods, community engagement, and operational research ensures effective control and future preparedness.
- **Structured investigation backed by real-time data analysis** helps not only to contain current outbreaks but also to build resilient health systems.

THANK YOU