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# Emergency Preparedness in Hospitals: Managing Chemical, Biological, and Radiological Hazards in Raipur, Chhattisgarh

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## Abstract

This paper investigates the preparedness of hospitals in Raipur, Chhattisgarh, for managing chemical, biological, and radiological (CBR) emergencies. These hazards pose significant risks to public health, and the ability of hospitals to handle such emergencies is vital. The research evaluates emergency response systems in AIIMS Raipur, MMI Narayana, and Balaji Hospital using a mixed-method approach—surveys, interviews, and observational analysis. Findings show significant gaps in training, infrastructure, coordination, and SOP implementation. The study recommends strategies to strengthen hospital resilience and establish city-wide preparedness networks.

## 1. Introduction

Hospitals are expected to respond swiftly to disasters, including chemical leaks, biological outbreaks, or radiological accidents. With increasing industrialization and biological risks like pandemics, the healthcare sector's preparedness has become critical. Raipur, Chhattisgarh's capital, has a growing healthcare infrastructure—yet its readiness for CBR threats remains untested and under-researched.

This study evaluates the preparedness of three key hospitals—AIIMS Raipur, MMI Narayana, and Balaji Hospital—across various dimensions such as training, infrastructure, SOPs, and inter-agency coordination.

## 2. Literature Review

Hospital preparedness includes the ability to anticipate, respond to, and recover from public health emergencies. According to the **World Health Organization (WHO)** and India's **National Disaster Management Authority (NDMA)**, hospital readiness includes infrastructure (isolation zones, PPE kits), planning (SOPs, emergency drills), and human resources (trained staff).

| Source | Key Insights |
|---|---|
| WHO, 2022 | Checklists for emergency response in hospitals |
| NDMA India (2007–09) | Separate guidelines for chemical, biological, and radiological emergencies |
| Kumar et al., 2019 (IJHM) | Highlighted lack of drills and SOP implementation in Indian hospitals |
| Bhopal Gas Tragedy (Case study) | Revealed major flaws in chemical disaster response planning |

 

| Source | Key Insights |
|---|---|
| Sendai Framework (UNDRR, 2015) | Promoted integration of health systems in national disaster risk reduction |

This review shows a gap between policy and practice, especially in tier-2 cities like Raipur, thus justifying the need for this research.

## 3. Research Methodology

### 3.1 Research Design

The study adopted a **mixed-method approach** involving:

- Structured surveys (quantitative)
- Semi-structured interviews (qualitative)
- Observational visits and document reviews

### 3.2 Study Area and Participants

Three hospitals were selected:

- **AIIMS Raipur** – Public tertiary-care hospital
- **MMI Narayana** – Corporate hospital with modern facilities
- **Balaji Hospital** – Medium-sized private hospital

### 3.3 Sample Size

Total Respondents: **75**

- Doctors: 25
- Nurses: 20
- Administrative staff: 10
- Housekeeping/security: 20

### 3.4 Data Collection Tools

- WHO preparedness checklist
- NDMA SOP compliance checklist
- Interview guide for heads of departments and emergency coordinators

## 4. Data Analysis

### 4.1 Training Exposure

| Hospital | General Training (%) | CBR-specific Training (%) |
|---|---|---|
| AIIMS Raipur | 82% | 52% |
| MMI Narayana | 64% | 18% |
| Balaji Hospital | 55% | 10% |

**Figure 1**: AIIMS Raipur had the highest percentage of trained staff. Balaji and MMI Narayana showed gaps, especially for non-clinical personnel.

### 4.2 Infrastructure Evaluation

| Preparedness Indicator | AIIMS Raipur | MMI Narayana | Balaji Hospital |
|---|---|---|---|
| Decontamination Zone | 4.2 / 5 | 2.5 / 5 | 1.8 / 5 |
| PPE Availability | 4.5 / 5 | 3.0 / 5 | 2.2 / 5 |
| Isolation Rooms | 4.8 / 5 | 3.4 / 5 | 2.7 / 5 |

**Table 1**: Infrastructure readiness scores based on WHO hospital safety index. AIIMS leads across all dimensions.

## 5. Interpretation

- **AIIMS Raipur** has dedicated units, updated SOPs, and ongoing training programs.
- **MMI Narayana** has general emergency protocols but lacks CBR-specific procedures.
- **Balaji Hospital** showed limited preparedness due to resource and training gaps.
- **Non-clinical staff** (e.g., security, housekeeping) lacked clarity on roles during emergencies.
- **Coordination with external agencies** (e.g., fire, police) was weakest in private hospitals.

## 6. Findings

1. SOPs for CBR hazards were absent or outdated in 2 out of 3 hospitals.
2. Simulation drills for radiological or chemical incidents had **never** been conducted in MMI or Balaji.
3. Majority of staff lacked awareness of inter-agency protocols.
4. Only AIIMS had documented risk assessments and decontamination procedures.
5. Support staff received **no** formal training in emergency handling.

## 7. Suggestions

- **Standardize SOPs** for chemical, biological, and radiological events in all hospitals.
- **Quarterly CBR drills** with full participation of support staff.
- **Create city-wide CBR coordination cell** linking hospitals with local disaster agencies.
- **Incorporate CBR preparedness in NABH accreditation** and hospital inspections.
- **Allocate 5–10% of hospital disaster funds** to CBR-specific infrastructure and training.
- **Conduct external third-party audits** annually to assess emergency readiness.

## 8. Conclusion

This study found that hospital preparedness in Raipur is uneven. AIIMS demonstrates acceptable readiness, but private institutions lag due to gaps in training, coordination, and investment. Non-clinical staff, critical in execution, are often ignored. Strengthening CBR preparedness requires policy reform, dedicated budgets, SOP enforcement, and cross-sectoral coordination.

The findings underscore the urgent need to institutionalize CBR readiness as part of India's hospital emergency framework, especially in growing urban centers like Raipur.

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