

Assessment of Internal Hazards and Disaster Preparedness in a Tertiary Care Facility

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

By

Gurpreet Singh

Under the Supervision and Guidance of

Dr. S.P. Chattopadhyay

2021

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Assessment of Internal Hazards and Disaster Preparedness in a Tertiary Care Facility** is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.



(Signature)

Name of Student: Gurpreet Singh

Date: 28-06-2021

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Shri Mata Vaishno Devi Narayana
Superspecialty Hospital
Managed by Narayana Health

COMPLETION CERTIFICATE

This is to certify that Mr. Gurpreet Singh in partial fulfillment of the requirements for the award of the degree of MBA Hospital and Health Management from the IJHMR University, Jaipur has successfully completed his internship at Shri Mata Vaishno Devi Narayana Superspecialty Hospital during March 22, 2021 to June 19, 2021.

Place: _____
Date: _____

For Narayana Health Group Superspecialty Hospital Pvt. Ltd.
M M Mathuram (MD)
Preceptor/Head of the Original Certificate
Name of the organization

Shri Mata Vaishno Devi Narayana Superspecialty Hospital
Narayana Health Group Superspecialty Hospital Pvt. Ltd. | CIN No. U08130GJ2014PLC021824
Registered Office: 25/A, Bommasaandra Industrial Area, Arakal Taluk, Bangalore 560098
Hospital Address: Kalyani Village & Post, Katta Taluk, Ponnas District, Katta, Jammu and Kashmir 182020
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CERTIFICATE

This is to certify that dissertation titled **Assessment of Internal Hazards and Disaster Preparedness in a Tertiary Care Facility** is a record of the research work undertaken by Mr. Gurpreet Singh in partial fulfillment of the requirements for the award of the degree of MBA Hospital and Health Management from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.

Faculty Guide

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Date

Abstract:

- 1) *Background:* The healthcare facilities, especially hospitals, are the first responders towards any disaster/emergency/incident situation. Both internal and external disasters are not mutually exclusive i.e., can occur at same time but both are independent of each other. Similarly internal hazards are very common in healthcare facilities which when causes destruction changes into a disaster. But these can be controlled if effective supervision is done. The aim of this study is to identify the undesired event in a facility through Hazard identification and risk assessment (HIRA) too and to assess and compare the knowledge and readiness of clinical and non-clinical staff towards disasters and its preparedness using structured questionnaire tool.
- 2) *Methodology:* An Observational, Descriptive Cross sectional study was carried out between March 22nd, 2021 to June 19th, 2021. HIRA was used to check presence of internal hazards and 82 sample were collect via structured questionnaire to assess staff readiness towards internal and external disasters.
- 3) *Results:* A pareto analysis for top 30 observations of HIRA, showed top 20 percent reasons for 80 percent of the causes were from the Medical records department, chemotherapy department and Diagnostic laboratory. In order to assess knowledge and awareness among staff, a structured questionnaire was used. Majority of them remembered that an emergency code was raised 2-4 weeks back but less than half of them remembered the correct code which was red. Less than 60 percent of respondents were right and answered the question correctly that code red will be raised if ceiling falls whereas many responded code purple as an answer. Almost all the respondents had the knowledge of raising emergency code and were aware of the correct order of code announcement but the proportion of participants who think that they can activate code orange (assigned for external disaster) was very high. The staff awareness towards public announcement system phone numbers was very low where the majority of them did know the correct way to use a fire extinguisher. Correct site for evacuation of patients during an emergency situation was known by more non clinical staff than clinical staff and the majority of staff in both the categories knew the nearest fire exit from their respective departments. Less than 50 percent of staff answered that triage is done in the emergency department and red colour band is given to the patient requiring urgent treatment; the rest of them had given wrong answers to the questions. 80 percent of the staff of this tertiary care

facility was aware of their responsibilities if any emergency or disaster happens. More than 95 percent of respondents agreed that disaster management training should be conducted frequently. More than 90 percent clinical staff agreed that internal disasters are not natural and something can be done to stop these whereas 30 percent non clinical staff agreed that internal disasters are natural and nothing can be done to reduce the effect.

- 4) Conclusion: Knowing how prepared a medical facility is, may help them build and implement more effective disaster policies and procedures, which should lead to a better prepared, more resilient healthcare system in the future. Materials which can lead to internal hazards can be removed and some material should be made available due which internal hazard can be prevented. Staff should be given frequent training regarding their roles and responsibilities and other necessary topics which play a major role during an emergency/incident/disaster.
- 5) Keywords: Clinical, non-clinical, Hazard identification and risk assessment, preparedness, disaster, emergency.

Acknowledgements

The Dissertation opportunity that I had with Shri Mata Vaishno Devi Narayana Superspeciality Hospital was a great opportunity for me to learn and meet so many wonderful people and professionals who led me throughout.

I would like to express my gratitude to everyone who has helped me in completing my project. I would sincerely like to thank my industry mentor Mr. M Muthu Mathavan (Facility Director, SMVDNSH). Without his guidance it would not have been possible for me to complete this project successfully.

I express my deepest gratitude to the members of quality teams, Dr. Hiteshi Gandhi and Dr. Ishaan Kapoor, who helped me in understanding the basics of my project.

I am grateful to my university guide, Dr. S.P. Chattopadhyay for his continuous support and guidance throughout this study. It is due to his guidance that I am able to complete my project in a timely manner.

Lastly, I would like to thank my parents for guiding me throughout the process by providing me with adequate mental and emotional support all along.

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Abbreviations

- 1) HIRA: Hazard Identification and Risk Assessment
- 2) ICU: Intensive Care Unit
- 3) AVF: Arterial Venous Fistula
- 4) MRI: Magnetic Resonance Imaging
- 5) PET CT: Positron Emission Tomography and Computed Tomography
- 6) MRD: Medical Records Department
- 7) HIS: Hospital Information System
- 8) IPD: In-Patients Department
- 9) PASS: Pull the pin, Aim the base, Squeeze the trigger, Spray side to side
- 10) ETO: Ethylene Oxide
- 11) STP: Sewage Treatment Plant
- 12) OPD: Out-Patients Department
- 13) MSDS: Material Safety Data Sheet
- 14) F&B: Food and Beverages
- 15) ANP: Analytical network process
- 16) HAZID: Hazard identification

1. Introduction:

Disaster is an unpredicted event which causes massive disruption and damage. The healthcare facilities, especially hospitals, are the first responders towards any disaster/emergency/incident situation. It is expected that health facilities should be easily accessible and functional not only in pre and during the situation but also in post disaster situations as well. As per EM-DAT, in 2019, 290 natural disasters were recorded worldwide, with floods accounting for 49% (143), storms for 21% (61), and earthquakes accounting for 11% (30). Mortality that occurred due to disasters in affected areas was 11,694. Floods claimed the most people, with over 5,000 people killed, followed by high temperature events. Natural disasters affected 90.64 million people in 2019, with storms accounting for 35 percent (31.29 million). After storms, floods were the second most common natural disaster which affected 29.63 million people¹.

Over the past years, whenever disasters have occurred around the world, whether internal or external, hospitals have been actively involved throughout. Both internal and external disasters are not mutually exclusive i.e., can occur at same time but both are independent of each other. Internal disasters are common in hospitals and occur more frequently but can be prevented. External disasters are not common but have a long-term effect on both community and hospital². The role of hospital staff is important in providing medical support to the disaster affected population. The affected population's life and health depends on the availability of medical professionals in terms of experience, expertise, and services³. Many public, private, federal, state, and local institutions have begun to establish some kind of preparedness and response plans in response to the growing threat of a naturally occurring or man-made global pandemic. The hospitals are among those on the front lines of preparedness to respond to the event of a disaster. The disaster management plan itself is a snapshot of the phase at a particular point in time, whereas planning is a never-ending jurisdictional process. Similarly, having a written plan does not guarantee that you will be prepared; preparedness is fluid and dependent on ongoing processes. A right method of educating hospital staff on emergency preparedness is a critical challenge. The disaster response group has prioritized the need for appropriate evidence-based disaster training of healthcare professionals at all levels, including the establishment of standards and recommendations for training in the multidisciplinary health response to major events⁴.

Jammu & Kashmir is a political and natural disaster prone area. It has an impact on the region's growth. The natural disasters such as earthquakes, floods, landslides, avalanches, high-velocity winds, and snowstorms, as well as man-made disasters such as road accidents and fires, occur in different parts of the multi-hazard prone state⁵. Despite the vital role of hospitals in saving disaster victims lives, there has been very little research on disaster preparedness in Indian hospitals. A popular tool referred to as hazard identification and risk assessment (HIRA) is used to identify the possible hazards that might be present in the workplace environment. The hazards are then identified in terms of their severity and the probability of occurrence. As hazard identification is the initial stage in Risk Management, hazards that are not recognized will not be subjected to the rigors of the Risk Management process, resulting in the non-identifying of preventive measures for execution and communication to prevent workplace injury. This study attempts to fill this gap by examining undesired events in a tertiary care hospital of Jammu & Kashmir using hazard identification and risk assessment (HIRA). The other objective is to know the knowledge and readiness of staff of various departments of this tertiary care facility towards disasters and its preparedness.

2. Review of literature:

Table-1: Summary of Literature Review

Year	Research question	Authors	Study location	Sample size	Sampling technique	Salient features
2016	To assess the level of disaster preparedness in a district hospital of Sri Lanka	-Nimali Lakmini Munasinghe -Kenichi Matsui	Sri Lanka	60	Simple Random Sampling	-Lack of human resources, less critical supplies, inefficient communication, safety and security system were some of the inadequacies observed. -It also highlighted some of the difficulties in dealing with many disaster victims. -Most respondents had no idea about disaster response plan. In addition, they had not taken part in any emergency exercises like disaster drills. All the doctors including nursing staff, on the other hand, expressed a desire to learn

						more about management of disaster and to help in potential disasters ⁶ .
2018	What is the readiness of hospital staff in case of disaster	-M. Georgiev -R. Kostadinov -E. Valkanova	Bulgaria	54	Simple Random Sampling	-Over 40% of participants believe their knowledge is inadequate about the topics for which the study is being done. -There were only two questions on which more than half of hospital workers were confident in their answers. -On the other hand, a statistically significant discrepancy existed between declared understanding of a hospital's disaster medical support plan and associated responsibilities and a lack of knowledge about self-protection, medical information flow, and disaster management capabilities³.
2018	To compare the perception of clinical and non-clinical staff of veterans affairs medical facility towards three types of disasters (epidemic/pandemic, natural and manmade).	-Aram Dobalian -Michelle D. Balut -Claudia Der-Martirosian	U.S. Department of Veterans Affairs	4026	Stratified simple random sampling	-In general, VA employees were less sure about the abilities of their medical facility towards tackling disaster. -Clinical workers were less sure about the abilities of their medical facility to towards tackling disaster than non-clinical staff. Clinicians, on the other hand, were times more likely than non-clinicians to believe their role in disaster response was significant and more likely to wish to receive extra training in order to be better prepared for different types of emergencies. The staff which was associated with VA for from longer times was non clinical and were more likely to have served

						in the United States Armed Forces ⁷ .
2015	To access the knowledge, attitudes, and practices of medical internship students regarding disaster preparedness	-Yogesh Kumar Singhal -Rekha Bhatnagar -Bhanwar Lal -Bharti Paliwal	Udaipur, Rajasthan, India	102	Simple random sampling	-A self-administered questionnaire was completed by 87 of the 102 internship students. The percentage of people who responded was 85.29 percent. -Medical interns demonstrate excellent basic knowledge of the hospital's emergency plan and preparedness. Their understanding of the disaster plan and preparedness, as well as their attitude toward it, were both extremely positive. -They lacked knowledge and attitude about their responsibilities during drill. The majority of disaster preparedness training and drills were negative, and more work needs to be done in this area. -Most students agreed that emergency readiness should be included in the internship program⁸.
2019	To assess knowledge and perception among healthcare workers of Bangladesh towards disaster management.	-Atoshi Rahman -Mainul Chaklader -Faisal Muhamad	Bangladesh	120	Multistage sampling technique	-In terms of gender, females had more knowledge than males and in terms of occupation, doctors had more knowledge than other employees. -It was observed that nearly nine-tenths of the respondents had positive perception about disaster management expertise, and the occupation of respondents was strongly related to their perception of disaster management knowledge⁹.
2018	To assess the	-Kayiranga Pascal	Rwanda	70	Simple random	-According to the results, 38.6% of respondents have

	knowledge, attitude and practice of disaster preparedness among Rwanda Red Cross employees				sampling	worked with the Red Cross for more than ten years, 58.6% of respondents have no experience with disaster preparedness, 58.6% of respondents have no expertise in disaster management, 54.3 percent of respondents need to know about disaster plans, and 57.1 percent of respondents do not know how many drills are held. -In the event of a tragedy, 100 percent of respondents are able to provide first aid¹⁰.
2013	To identify hospital workplace at risk of violence using hazard risk matrix	-Judith E. Arnetz -Lydia Hamblin -Joel Ager -Deanna Aranyos	USA	1159 units of 7 hospitals	Systematic sampling	-41 hospital units were assigned a severity and probability rating of medium or high, and were given top priority for future treatments. In psychiatric care units, the probability and severity were highest ¹¹ .
2017	To identify health, safety, and environmental hazards during usage of steam boiler by implementing HAZID method and ANP.	- MoahamMadd Baratchi -Nabiollah Mansour -Aida ahmadi	Tehran city, Iran	Boiler room of farabi hospital	Convenience sampling	-Total 58 hazards were identified in four categories, with the super decisions software weighting 6 of them. The greatest and least important hazards identified were Job stress and cooling system wastewater respectively ¹² .
2019	What is the disaster preparedness level in trauma centers of Canada	-Jordan Nantais -Belinda Gabbe -Avery Nathens -David Gomez	Canada	24 Canadian trauma centers	Convenience sampling	-Comparison to prior data indicated an increasing prevalence of committees dedicated to preparedness of disaster and disaster exercises but poorer external stakeholder representation and weak capacity to offer a protracted response to disasters. The data suggest that MCI preparation is a

						rising emphasis of trauma centers of Canada, but that there are gaps that remain unresolved. These flaws should be focused on in order to make a better and reliable disaster response in future ¹³ .
2014	How much is the flood disaster preparedness among hospitals in the central region of Thailand	-Kanittha Rattanakanlaya -Achara Sukonthasarn -Suparat Wangsrikhun - Chawapornpan Chanprasit	Thailand	27 hospitals	Convenience sampling	-None of the twenty-four participating hospitals met the requirements in every aspect of flood disaster preparedness. -While supplies and equipment were determined to be available, staffing preparations at all participating hospitals were determined to be insufficient. In all the hospitals that responded, staff who were given disaster response training was reported to be present. -None of the hospitals that encountered minor interruptions in their health services previously conducted any disaster preparation evaluations or improvements ¹⁴ .

In general the findings from literature review were, Unavailability of essential supplies and equipment, lesser number of participation in disaster drills. Knowledge and attitude of staff towards disaster and its preparedness was less in majority of the reviewed researches. Respondents were not aware about the disaster response plan of their facility. Role and responsibilities which are to be performed at the time of disaster were not known by staff of various facilities. Clinical staff was more aware about procedures to be carried out during mass casualty. Staff associated with facilities for longer durations were more aware about different procedures and situations. All the doctors including nursing staff, expressed a desire to learn more about management of disaster.

3. Study Methodology:

The research questions developed based on the review of disaster management & objectives there off along the study areas with research design followed to answer the questions are mentioned below:

a) **Research questions:**

- What are the elements leading to flaws in disaster preparedness?
- How much is the staff knowledge and readiness towards internal and external disasters?

b) **Research objectives:**

- To identify the undesired event in a facility through Hazard identification and risk assessment (HIRA) tool.
- To assess and compare the knowledge and readiness of clinical and non-clinical staff towards disasters and its preparedness using structured questionnaire tool.

c) **Research design:** Descriptive Cross-sectional study.

d) **Study setting:** Shri Mata Vaishno Devi Narayana super speciality Hospital, Katra, Jammu and Kashmir.

e) **Study population:**

- **Inclusion criteria-** HIRA for non-COVID departments & Staff from all other departments are considered for assessment of readiness, willingness to participate in the study.
- **Exclusion criteria-** Staff working in COVID ward, staff who are ill from COVID, staff exposed to any education program related to disaster management recently, non-cooperative participants, ICU and COVID ward staff.

f) **Research procedure/approaches:** Quantitative assessment.

g) **Study approach:**

-**Study duration:** March 22nd, 2021, to June 19th, 2021

-**Sampling technique:** Stratified Sampling

-**Sample size:** 82 (41 clinical and 41 nonclinical staff)

-Study instrument: HIRA to check disaster preparedness of facility and a structured questionnaire to assess staff readiness towards internal and external disasters. The questionnaire included questions on socio demographic characteristics, past experiences of staff, knowledge on emergency codes and triage, staff attitude.

-Data Management: Data cleaning and Data analysis on Microsoft excel.

h) **Operational definitions:**

-Disaster: Disaster is an unpredicted event which causes massive disruption and damage. It can be internal as well as external.

-Emergency: A situation where an affected individual requires immediate attention or treatment.

-Incident: An occurrence of an event that might or might not be harmful.

-Hazards: An event or a substance that can cause potential harm.

-Hazard identification: Identification of an event, substance or circumstances that can cause harm.

-Risk assessment: Identification of hazards or risks that have the potential of causing harm.

-Hospital emergency Codes: These are the coded messages for emergencies and incidents, which are often delivered to the hospital staff in the form of announcements

-Triage: Triage is categorising patients based on needs of treatment and severity of conditions.

4. Study Findings:

4.1: Hazard identification and risk assessment:

Hazard identification and risk assessment is done to identify failure modes for different departments to check facility preparedness. The below tables represents findings from HIRA assessment. A total of twenty-seven (n=27) departments were assessed and one thirty (n=130) observations were recorded. After calculating severity (consequences) and probability (likelihood of occurrence) for these observations the risk rating for each observation was done by multiplying both severity and probability. The risk rating was further divided into three categories (often referred to as priority of action) i.e., high, medium, and low. Observations for which the risk rating was between 1-9 was

categorised as low, the observation for which the risk rating was between 10-15 was categorised as medium and the risk rating ranging from 16-25 was categorised as high.

Table-2: Findings from HIRA Assessment Framework

S No.	Observation	Department	Consequence of harm	Likelihood of harm being caused	Risk rating	Priority of action
1	Dustbin in front of electrical panel room	Emergency	1	1	1	Low
2	Crash cart in procedure room not covered		3	1	3	Low
3	Fire due to equipment's		2	1	2	Low
4	Exposure of blood/body fluid		2	3	6	Low
5	Hazardous Material Storage and Spillage		2	2	4	Low
6	Medication Errors		3	2	6	Low
7	Equipment Breakdown		3	2	6	Low
8	Fire due to equipment's	Wards/Semi Private/Private	2	1	2	Low
9	Hospital Acquired Infections		3	1	3	Low
10	Patient Falls		2	1	2	Low
11	Medication Errors		4	1	4	Low
12	Needle stick injuries		3	2	6	Low
13	Electrical equipment's - shocks		3	1	3	Low
14	High density gloves not being used for chemo preparation	Chemo	4	4	16	High
15	Lid of plastic container was open and overflow was there (AVF needles)	Dialysis	4	3	12	Medium
16	Bed sheets and blankets were kept in open space near counter		4	2	8	Low
17	Set up box of television was temporarily attached with the almirah with the help of doctor tape		1	1	1	Low
18	One fire exit was blocked and in front of other the cans of haemodialysis solution		5	2	10	Medium

	was lying					
19	Extension board is being used	Endo/Bronch o	3	2	6	Low
20	Boxes on the top of the almirah		2	1	2	Low
21	Portable eyewash stations not available in the department.		2	2	4	Low
22	Hypochlorite bottle in spill kit was labelled with pen		4	1	4	Low
23	Rusted tong found in spill kit		3	1	3	Low
24	Dustbin overflow in consultation room	Physiotherap y	1	2	2	Low
25	Inspection date on fire extinguisher was not mentioned		3	2	6	Low
26	Calibration sheet was not present on X-ray film machine	Radiology	4	2	8	Low
27	Carton box lying on top of the almirah		2	1	2	Low
28	No code number for x-ray register		3	1	3	Low
29	MRI door switch not working plus the switch was not attached to the wall instead it was hanging		2	2	4	Low
30	CT Contrast present in spill kit		3	1	3	Low
31	Gauze swab present in spill kit was expired		4	1	4	Low
32	Fire due to equipment's		3	2	6	Low
33	Hazardous Material Storage and Spillage		2	1	2	Low
34	Equipment Breakdown		4	2	8	Low
35	Reporting Error		3	1	3	Low
36	Exposure to radiation		4	1	4	Low
37	No dustbin in patient waiting area	PET-CT/Nuclear Medicine	1	1	1	Low
38	Black bin bag with garbage found lying in back side of nuclear medicine department		2	2	4	Low
39	Carton box lying on top of the almirah of store	Cath lab	2	1	2	Low

40	Fire due to equipment's		3	1	3	Low
41	Hazardous Material Storage and Spillage		2	1	2	Low
42	Equipment Breakdown		4	2	8	Low
43	Exposure to radiation		4	1	4	Low
44	Patient Falls		2	1	2	Low
45	Medication Errors		5	1	5	Low
46	Dirty lab coats were kept in open space	Lab/Phlebotomy	2	2	4	Low
47	Chemical spill kit not available		4	4	16	High
48	Geyser was without any supporting rods		3	1	3	Low
49	Bottle of hypochlorite solution was without cap		2	1	2	Low
50	Fire due to machines		3	1	3	Low
51	Exposure of blood/body fluid		3	2	6	Low
52	Hazardous Material Storage and Spillage		3	2	6	Low
53	Equipment Breakdown		4	3	12	Medium
54	Reporting Error		2	1	2	Low
55	Blood collection vial holder used for support of table		3	1	3	Low
56	Vacutainer disposable container was uncovered		3	1	3	Low
57	Blood group testing plates were left unwashed	Blood Bank	1	1	1	Low
58	Blood bag was lying outside at the corner of the table.		4	3	12	Medium
59	Stabilizers of refrigerator, platelet incubator and deep freezer were lying over them at the corner		3	1	3	Low
60	Breakdown of refrigerator		3	1	3	Low
61	Improper handling of equipment's		2	1	2	Low
62	Stocking of files in MRD not Proper (Chances of Fire)	MRD	4	1	4	Low

63	Other gate of MRD which opens in back side of nuclear medicine department was closed with help of a wooden stick and no proper lock was there		4	4	16	High
64	Fire exit is blocked		4	3	12	Medium
65	Rodent		3	2	6	Low
66	Loss of files		2	1	2	Low
67	Fire due to heavy electrical wiring	IT	3	1	3	Low
68	Server Failure		2	1	2	Low
69	Computer Virus/Cyber Attack		3	1	3	Low
70	Telecommunications Failure		2	1	2	Low
71	Sitting for long hours	Front office/registration counter/admission counter	2	1	2	Low
72	Disruption in HIS system		2	1	2	Low
73	Safety		2	1	2	Low
74	Calibration not done of fridge kept in IP pharmacy	IP Pharmacy	2	1	2	Low
75	Dispensing of wrong medication		3	1	3	Low
76	Theft		2	1	2	Low
77	Gas leakage	Maintenance	3	2	6	Low
78	Fire		3	2	6	Low
79	Black bin is being used for normal waste that too is blocked	Housekeeping department	1	1	1	Low
80	Cleaning chemicals		1	1	1	Low
81	Hazardous Material Storage and Spillage		2	1	2	Low
82	MSDS list is there but hazardous material labels are hand written plus are detaching from wall	Laundry and Linen	4	2	8	Low
83	Fire extinguisher not audited		4	3	12	Medium
84	Gas leakage		2	2	4	Low
85	Fire due to machines		3	2	6	Low
86	Fall of machines		2	2	4	Low
87	Alarm not installed in cold storage	Kitchen	2	1	2	Low

88	Calibration of weighing scale not done		2	1	2	Low
89	Annual health check-up for kitchen staff is pending.		4	1	4	Low
90	Boxes on the top of rack		2	1	2	Low
91	Wire hanging from ceiling		1	1	1	Low
92	Fire due to machines and equipment's		2	3	6	Low
93	Safety		2	1	2	Low
94	Food contamination		3	1	3	Low
95	Breakdown of Machine	CSSD	2	1	2	Low
96	ETO gas leakage		2	1	2	Low
97	Burn while handling heat generating equipment's		3	2	6	Low
98	Sharp injury		2	1	2	Low
99	Gauze swab present in spill kit was expired		4	1	4	Low
100	Fire due to electrical faults	STP Plant	2	1	2	Low
101	Electrical short circuit		4	1	4	Low
102	Infection from infectious waste	Incinerator Room	2	2	4	Low
103	Fire due to electrical faults		1	1	1	Low
104	Electrical short circuit		1	1	1	Low
105	Sprinkler not available.	Main Store Pharmacy	4	3	12	Medium
106	Dispensing of wrong medication		2	1	2	Low
107	Theft		1	1	1	Low
108	Adrenaline bitartrate was near to expire drug found in crash cart	Radiation oncology	4	3	12	Medium
109	Vecuronium bromide injection was near to expire drug found in crash cart		4	3	12	Medium
110	No label on hand rub in spill kit		3	1	3	Low
111	Fire due to machines and equipment's		1	1	1	Low
112	Hazardous Material Storage and Spillage		1	1	1	Low
113	Equipment Breakdown		2	1	2	Low

114	Patient Falls		2	1	2	Low
115	Exposure to radiation		3	2	6	Low
116	Fire due to machines		2	1	2	Low
117	Wrong site, wrong patient, wrong surgery		5	1	5	Low
118	Exposure of blood/body fluid		2	1	2	Low
119	Adverse Anaesthesia event		2	2	4	Low
120	Hospital Acquired Infections	OT	1	1	1	Low
121	Hazardous Material Storage and Spillage		1	1	1	Low
122	Patient Falls		2	1	2	Low
123	Medication Errors		2	1	2	Low
124	Bed Sores		2	1	2	Low
125	Equipment Breakdown		1	1	1	Low
126	Unwanted rusted material in department	Biomedical engineering	1	1	1	Low
127	No proper ceiling		4	1	4	Low
128	Calibration of fridge not done		4	2	8	Low
129	Pharmacy license expired		4	3	12	Medium
130	Labels for same medicine with different strengths should be mentioned separately	OP pharmacy	3	2	6	Low

Table-3: Observation & Ratings

Total departments	Total Observations	Risk rating (Consequence x Likelihood)		
		High	Medium	Low
27	130	3	10	117

Further, a pareto analysis was done for top 30 observations for which the risk rating was higher than other observations. Pareto analysis demonstrates that 80 percent of the problems are due to 20 percent of the reasons. Here three departments constituted 20 percent of the reasons which includes unavailability of chemical spill kit in laboratory, unavailability of high-density gloves in the chemo department and unlocked medical records department gate.

Graph-1 : Hazard Identification & Risk Assessment

Apart from this, the departments for which the risk rating was observed to be more and there is a need of focus were radiation oncology where near expiry drugs were found, pharmacy where the license was expired, main store pharmacy where the sprinklers need to be installed.

4.2: Participant's characteristics:

The sociodemographic characteristics of participants on which the data was collected consisted of gender, age, level of education, profession, and professional experience. Participants were divided into two categories i.e., clinical, and non-clinical staff and total of 82 responses were recorded (41 from clinical and 41 from non-clinical). Participation was more from the side of male respondents (clinical Vs non-clinical) (n=22; 53.7% ,n=35; 85.4%) for both the categories as compared to females (n=19; 46.3% ,n=6; 14.6%). Average age of clinical staff was observed to be 29 years whereas for non-clinical staff it was 28 years. In clinical staff 80.5 percent (n=33) participants completed their college education and were graduate and among the other remaining 17.1 percent (n=7) completed post-graduation. In non-clinical staff the percentage of graduates and postgraduates were almost the same (graduates: n=15; 36.6%, post-graduates: n=14; 34.1%). Four (9.8%) respondents were there who completed school education and school dropouts were 19.5% (n=8) of the total non-clinical staff. 48.8 percent (n=20) of clinical staff had overall experience more than 5 years and in non-clinical 43.9 percent (n=18) were there who had experience of more than 5 years. Percentage of staff employed in this facility was more among clinical as compared to non-clinical (n=29; 70.7% Vs n=23; 56.1%).

Table-4: Participants Characteristics

Characteristics	Clinical		Non-Clinical	
	Frequency	Percent	Frequency	Percent
Gender				
Female	19	46.3	6	14.6
Male	22	53.7	35	85.4
Total	41	100.0	41	100.0
Age (in completed years)				
21-26 years	14	34.1	14	34.1
27-32 years	17	41.5	18	43.9
33-38 years	9	22.0	6	14.6
39-44 years	1	2.4	2	4.9
45 years and above	0	0.0	1	2.4

Total	41	100.0	41	100.0
Level of education				
Attended school, did not finish.	0	0.0	8	19.5
Finished school	1	2.4	4	9.8
Finished college, graduate	33	80.5	15	36.6
Post-graduate or higher	7	17.1	14	34.1
Total	41	100.0	41	100.0
Total years of experience				
Less than 1 year	3	7.3	6	14.6
1-2 years	5	12.2	6	14.6
2-3 years	7	17.1	5	12.2
3-4 years	3	7.3	3	7.3
4-5 years	3	7.3	3	7.3
More than 5 years	20	48.8	18	43.9
Total	41	100.0	41	100.0
Total years of experience in Shri Mata Vaishno Devi Superspeciality Hospital				
Less than 1 year	4	9.8	7	17.1
1-2 years	8	19.5	11	26.8
More than 2 years	29	70.7	23	56.1
Total	41	100.0	41	100.0

Non-clinical staff		
Profession	Frequency	Percent
Management	26	63.4
Housekeeping	8	19.5
F&B	2	4.9
Fire and safety officer	1	2.4
Security	4	9.8
Total	41	100.0

Clinical staff		
Profession	Frequency	Percent
Doctor	5	12.2
Consultant	2	4.9
Technician	10	24.4
Nursing	16	39.0
Pharmacy	4	9.8
Medical Physicist	2	4.9
Dietician	2	4.9
Total	41	100.0

Majority of respondents in non-clinical staff were from Management (n=26; 63.4%). In clinical 39 percent (n=16) was nursing staff whereas 24.4 percent (n=10) were technicians.

Table-5: Experience of Staffs

	Clinical		Non-Clinical	
Characteristics	Frequency	Percent	Frequency	Percent
Have you heard the term disaster/emergency/incident				
Yes	41	100.0	38	92.7
No	0	0.0	3	7.3
Total	41	100.0	41	100.0
When was the last time an emergency disaster happened in the facility				
2-4 Weeks back	31	75.6	31	75.6
6 months back	2	4.9	3	7.3
More than 1 year back	6	14.6	3	7.3
More than 2 years back	2	4.9	4	9.8
Total	41	100.0	41	100.0
Which code was raised at that time				
Code pink	8	19.5	2	4.9
Code purple	3	7.3	4	9.8
Code orange	1	2.4	6	14.6
Code red	14	34.1	19	46.3
Code blue	15	36.6	10	24.4
Total	41	100.0	41	100.0

All the clinical staff was aware of the term disaster/emergency/incident whereas 92.7 percent (n=38) non clinical staff heard these terms. Equal number of respondents (n=31; 75.6% Vs n=31; 75.6%) among both the categories of staff were aware that some emergency/incident/disaster happened 2-4 weeks back but only 14 (34.1%) clinical and 19 (46.3%) non-clinical staff knew the correct code which was raised at that time.

Table-6: Knowledge of staff

	Clinical		Non clinical	
Characteristics	Frequency	Percent	Frequency	Percent
Which code will be raised if the ceiling falls				
Code black	2	4.9	1	2.4
Code purple	8	19.5	10	24.4
Code red	21	51.2	23	56.1
Code pink	6	14.6	2	4.9
Code blue	1	2.4	2	4.9
Code orange	3	7.3	3	7.3
Total	41	100.0	41	100.0
What is the correct order for code announcement				
code-location-area x 3	36	87.8	35	85.4
area-location-code x 2	2	4.9	3	7.3

location-code-area x 3	3	7.3	2	4.9
code-location- area x 4	41	100.0	1	2.4
Total			41	100.0
Can you activate code orange				
Yes	16	39.0	20	48.8
No	25	61.0	21	51.2
Total	41	100.0	41	100.0

Almost half of the clinical staff was not aware of the correct code which will be raised if the ceiling falls whereas the awareness was somewhat higher in case of non-clinical staff. Most of the clinical and non-clinical staff had the knowledge of correct order of code announcement (n=36; 87.8% Vs n=35; 85.4%) and 60 percent (n=25) clinical and 51.2 percent (n=21) non-clinical staff answered the question correctly and selected no as an option when asked that whether they can activate code orange or not.

Table-7: Awareness of Staff on Correct control room contact

Characteristics	Clinical		Non clinical	
	Frequency	Percent	Frequency	Percent
Are you aware of the mobile no. to contact control room in case of emergency				
9070999600	1	2.4	1	2.4
9070999550	18	43.9	13	31.7
9070796666	9	22.0	6	14.6
9070999500	13	31.7	21	51.2
Total	41	100.0	41	100.0

Graph-2: Awareness on Mobile No. in case of Emergency

Less than one third (n=13; 31.7%) of the clinical staff was aware of the correct mobile number to contact the control room in case of emergency. Awareness among non-clinical was more (n=21; 51.2%).

Table-8: Awareness of PASS

Characteristics	Clinical		Non clinical	
	Frequency	Percent	Frequency	Percent
What is the full form of PASS				
Pull the pin, aim the base, squeeze the trigger, spray side to side	34	82.9	35	85.4
Pack the pin. aim the base, squeeze the trigger, stop the spray	2	4.9	4	9.8
Press the pin, aim the base, squeeze the trigger, spray top	5	12.2	2	4.9

to down				
Total	41	100.0	41	100.0

Graph-3: Awareness of PASS

More than 80 percent of staff in both the categories had the knowledge of correct procedure for using the fire extinguisher in case of fire situation.

Table-9: Awareness of Fire Situation

Characteristics	Frequency	Percent	Frequency	Percent
In case of fire what should be the direction of evacuation of patients from their respective areas				
By lift	1	2.4	1	2.4
Through main entrance	4	9.8	0	0.0
From fire exit	28	68.3	36	87.8
Through evacuation area	8	19.5	4	9.8
Total	41	100.0	41	100.0
Do you know the nearest fire exit on your floor				
Yes	33	80.5	38	92.7
No	8	19.5	3	7.3
Total	41	100.0	41	100.0

Graph 4: Awareness of Fire

Clinical staff was observed to have less knowledge about patient evacuation during fire incidents as compared to non-clinical staff (n=28; 68.3%, n=36; 87.8%). The nearest fire exit was known by more than 80 percent (n=33) of clinical staff but for respondents from non-clinical category, the number was higher (n=38; 92.7%).

Table-10: Knowledge about Triage

Characteristics	Frequency	Percent	Frequency	Percent
where is triage done				

IPD	19	46.3	20	48.8
OPD	0	0.0	4	9.8
Emergency	20	48.8	16	39.0
Dialysis area	2	4.9	1	2.4
Total	41	100.0	41	100.0
What is triage colour code for patient requiring immediate attention				
Black	7	17.1	9	22.0
Red	20	48.8	16	39.0
Green	7	17.1	6	14.6
Orange	7	17.1	10	24.4
Total	41	100.0	41	100.0

Graph 5: Knowledge about Triage

Two questions were asked about the knowledge and triage system and it was observed that very less participants has the knowledge regarding the same. Less than 50 percent (n=20) clinical staff and less than 40 percent (n=16) non-clinical staff was aware of triage system and the colour codes used.

Table-11 : Attitude towards disaster/emergency/incident

	Clinical		Non clinical	
Characteristics	Frequency	Percent	Frequency	Percent
Are you aware of your responsibility during disaster				
Strongly agree	22	53.7	17	41.5
Agree	14	34.1	19	46.3
Disagree	1	2.4	0	0.0
Strongly disagree	4	9.8	5	12.2
Total	41	100.0	41	100.0
Do you think that disaster management training should be conducted frequently				
Strongly agree	39	95.1	33	80.5
Agree	2	4.9	8	19.5
Disagree	0	0.0	0	0.0
Strongly disagree	0	0.0	0	0.0
Total	41	100.0	41	100.0
Do you think trainings and mock drills can help in better management at the time disaster or emergency				
Strongly agree	39	95.1	37	90.2
Agree	2	4.9	3	7.3
Disagree	0	0.0	1	2.4

Strongly disagree	0	0.0	0	0.0
Total	41	100.0	41	100.0
Internal disasters are natural and nothing can be done to reduce the effect				
Strongly agree	1	2.4	5	12.2
Agree	2	4.9	7	17.1
Disagree	6	14.6	8	19.5
Strongly disagree	32	78.0	21	51.2
Total	41	100.0	41	100.0

Graph-6: Attitude of Staff towards incident

This section contained four questions related to the attitude and sense of responsibility of the staff towards any kind of internal or external incident. Out of total participants in clinical staff category 53.4 percent (n=22) strongly agreed and 34.1 percent (n=14) agreed that being an employee of their respective departments they know their responsibility if any emergency or disaster happens. On the other hand in non-clinical 41.5 percent (n=17) strongly agreed and 46.3 percent (n=19) agreed that they know their responsibility. All the staff in both the categories agree that disaster management training should be conducted frequently and these training and mock drills will help in better management at the time of an emergency or disaster situation. More than one fourth (n=12; 29.2%) of the non-clinical staff believe that internal disasters are natural and nothing can be done to reduce their effect whereas this number was quite low in case of clinical staff (n=3; 7.3%).

4.3: Discussion:

This study was aimed at identifying the undesired events in this facility and the knowledge and readiness of staff towards disaster and its preparedness. Hazard identification and risk assessment (HIRA) is a tool that answers what can go wrong, how likely an event can occur and how much effect it can have. To manage risk, hazards must first be identified, followed by an assessment of the risks and a determination of whether they are bearable or not. In this study, HIRA was done for 27 departments and 130 observations were recorded. A Pareto analysis for top 30 observations showed top 20 percent reasons for 80 percent of the causes were from the medical records department, chemotherapy department and Diagnostic laboratory While recording the observations the reasons were also revealed by staff of various departments. For the chemotherapy department and laboratory, the staff said that incident

has been issued since a year but the chemical spill kit in the laboratory and high-density gloves in chemo departments has not been provided yet.

For MRD, no proper reason was given for not locking the other gate and for other observations like improper stocking of files and blockage of fire exit due to it was seen because the space is very insufficient. Also the racks for stocking up files are very less in number. Shredder which is used to discard old files is also not working.

Hospitals are the first point of contact for the patients whenever a mass casualty occurs. Being situated at the high altitude in the region of Jammu and Kashmir where the mountains covers most of the area, this tertiary care facility has tackled many situations with their robust workforce. Nevertheless, when staff was asked about past encounters with any kind of incident whether external or internal, the majority of them remembered that an emergency code was raised 2-4 weeks back but less than half of them remembered the correct code which was red. Further questions on codes were also asked. When asked about emergency code if the ceiling falls, less than 60 percent of respondents in both the categories were right and answered the question correctly that code red will be raised whereas many also answered code purple as an answer. The ones who were wrong were not aware that code red is also assigned for internal disaster and not just for the fire incident. Almost all the respondents had the knowledge of raising emergency code and were aware of the correct order of code announcement but the proportion of participants who think that they can activate code orange (assigned for external disaster) was very high. Though the colour codes are different for different countries, confusion and lack of awareness is also seen in other regions of the world. A study of Korea also shows that staff was more aware about the codes which are generally raised i.e., code pink, blue and code red. Whereas lack of training sessions was given as the reason behind insufficient knowledge, also the staff had not gone through the code of conduct¹⁵.

It is important to be well versed not just about the emergency codes but also the correct contact number where calls should be made to raise the code. The contact number was changed 8-9 months back and all the departments received the information on this. Also the concerned persons visited the departments and mentioned the number on the writing board, still half of the clinical staff was not aware of the correct number. Whereas the awareness in other categories was also low (51.3%) but was somewhat higher than clinical staff. Majority of the respondents had knowledge about the correct procedure

for using a fire extinguisher (PASS: Pull the pin, Aim at the base of the fire, Squeeze the trigger, Spray side by side).

Evacuation of patients is the first thing that is needed to be done in case of any emergency situation and two questions were asked so as to check the knowledge regarding this. Though more than 50 percent of staff in both the categories had knowledge on this but non-clinical staff was more aware and answered both the questions correctly. They understood the question and answered that the patient will be evacuated through nearest fire exit and were also aware of the nearest fire exit from their respective department (92%) whereas clinical staff got confused and some answered that patient will be evacuated through evacuation point but in question the term immobile patient or the patient which cannot move was not mentioned anywhere. Moreover only 80 percent knew the nearest fire exit. Work which was done prior also suggests that more than 50 percent of employees had the knowledge regarding entry and exit routes and security and registration officers were more aware¹⁶.

Whenever a mass casualty occurs, it is important to identify the patients who need immediate attention. Triage is the name given to a system done while identifying the patient with immediate treatment needs. Hospital staff should be well aware of this so as to give a prompt response in case of an emergency or an incident. In this survey less than 50 percent of staff answered that triage is done in the emergency department and red colour band is given to the patient requiring urgent treatment; the rest of them had given wrong answers to the questions. Previously conducted research also showed that at the time of code orange almost half of the staff could not identify the triage system used in emergency and also were not aware of whom to contact during this situation¹⁷.

Having knowledge towards disaster preparedness and procedures to be used is important but what behaviour or attitude do the hospital staff have towards these conditions is much more important. A thorough awareness should be there about the responsibility and the role which a person will play. In this study it was identified that more than 60 percent of the clinical staff and less than 50 percent of non-clinical staff of this tertiary care facility was aware of their responsibilities in case any emergency or disaster happens. In the past a study was conducted in Italy that showed the on-duty staff had poor knowledge of the functions and responsibilities which are necessary during disaster when the hospital emergency plan is activated which was also supported by a study conducted in UK in which out of total participants which were interviewed,

less than 5 percent of the physicians were aware of their responsibilities during such conditions^{18,19}.

More than 95 percent respondents in both the categories agreed that disaster management training should be conducted frequently because this helps in better management at the time of disaster. A study was conducted in Sri Lanka in which almost all of the doctors and nurses expressed a desire to learn more about management of disaster in order to help at the time of potential disasters⁶. Also a study done in Saudi Arabia showed that only a few respondents disagreed when asked whether there is a need for disaster simulation activity or not. Rest of them agreed that conducting drills and training in the emergency department will increase the knowledge which in turn will help in better management at the time of disaster²⁰. More than 90 percent of clinical staff agreed that internal disasters are not natural and something can be done to stop these whereas 30 percent non clinical staff agreed that internal disasters are natural and nothing can be done to reduce the effect. An open-ended question was also asked for suggestions and comments on how the preparedness can be improved or increased. Majority of the staff in both the categories suggested that training and mock drills can be conducted, awareness material like booklets can be distributed, shift wise training should be done, training on triage system and training regarding signs and emergency codes can be given.

4.4: Conclusion:

In this study HIRA tool was used to identify events that could lead to hazard which can further change into disaster if not controlled on time. This risk analysis tool helps hospital managers prioritize which units to focus on for hazard prevention. The major observations which were recorded using this tool was the lack of security and arrangement in the medical records department which was due to insufficient space. It can be overcome by making necessary arrangements for stocking up files and locking the gate of MRD. The other two observations were regarding the unavailability of high density gloves in the chemotherapy department and chemical spill kit in the diagnostic laboratory since an year. These can be overcome by making these materials available.

When a disaster strikes, healthcare personnel, in all the categories, play a key part in responding to that situation. Knowing how prepared a medical facility is, may help them to build and effectively implement policies and procedures for management of disaster, which in turn will lead to a better prepared healthcare system for the future. In this study

the response of non-clinical staff was more positive as compared to clinical staff. Response was positive by clinical staff for questions related to triaging or which requires direct involvement of them. Nevertheless, all the staff expressed a readiness to learn more about management of disaster and to serve in future.

4.5: Recommendations:

- Supply chain department should coordinate with departments where the essential items are not available.
- More racks can be provided in MRD and also doors should be locked properly.
- Training on emergency codes can be conducted.
- Training on emergency codes for staff which are permanently on evening and night duties can be conducted.
- Training on Triaging can be given to staff of Emergency, Registration, Diagnostic, Radiology, ICU,OT and Housekeeping department.
- Mock drills of code orange can be performed in a time bound manner.
- Most of the staff are not aware of the public announcement system phone number, so they can be informed about the same.
- Staff can be informed about their roles and responsibilities during an emergency.

4.6: Limitations:

- Sample size was less due to pandemic situation as most of the staff was busy with covid duty.
- All the departments were not covered while performing hazard identification and risk assessment because way to some departments were blocked as they came under the areas which were assigned for treatment of only covid patients.

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Annexures

Informed consent

The screenshot shows a Google Forms interface. The title of the form is "Readiness towards disaster management among clinical and non clinical". The form is in the "Questions" tab, showing 83 responses. The content of the form is as follows:

Dear Friends,
I am a student of MBA Hospital and Health management at IIHMR University, Jaipur-Rajasthan. Presently I am working on my dissertation project under the guidance of my university mentor, Dr S.P. Chattopadhyay, Professor, IIHMR University and industry mentor Mr. M Muthu Mathavan, Facility director, Shri Mata Vaishno Devi Super speciality hospital. As you all are aware that the hospitals all over the world have been involved in disasters, both internal and external. Internal disasters are isolated to the hospital, occur more frequently than external disasters. External disasters affect the community as well as the hospital. The hospital staff role is essential for disaster medical support. With the growing threat of a naturally occurring or man-made global pandemic, many public, private, federal, state and local institution have begun to develop some form of preparedness and response plans. Despite the critical role of hospitals in saving lives of disaster victims, very limited research has assessed disaster preparedness at hospitals in India. This study attempts to fill this gap by examining disaster preparedness at Shri Mata Vaishno Devi Super speciality hospital, Jammu and Kashmir and also to know the readiness of staff of various departments of this tertiary care facility towards this preparation. We request your 10-15 minutes time to participate in this survey. We assure you that all your responses will be kept confidential and anonymous. Only the aggregated findings will be presented. At the point of time you feel not to provide the information, you may quit the survey.
Thank you for your participation.

1. Please read the below statement carefully. Providing consent is a mandatory requirement for Enrollment in the study. *

Informed consent: I hereby give my consent for participation in this survey that is aimed at knowing the staff readiness towards internal and external disasters in healthcare facility. I understand that my responses are likely to be used for generation of data and its analysis and possible publication. I understand that I will be guaranteed anonymity, and that any personal information that I provide will be kept confidential. I also understand that I can refuse to answer any or all questions at any time, and that I have the option to choose to exit the survey at any time of my choosing.

☐ Yes

☐ No

Study tool

S No.	Questions
Socio-demographic characteristics	
2	Please mention your full name
3	How old are you, in completed years of age?
	21-26 years
	27-32 years
	33-38 years
	39-44 years
	45 years and above
4	What is the gender assigned to you at birth?
	Female
	Male
	Prefer not to say
5	What is the highest level of education that you have had?

	Attended school, did not finish.
	Finished school
	Attended college, did not finish.
	Finished college, graduate
	Post-graduate or higher
	Prefer not to say
	Other:
6	What is your profession?
	Management
	Doctor
	Consultant
	Technician
	Nursing
	House keeping
	If other, then please mention.
7	How many years of experience do you have?
	Less than 1 year
	1-2 years
	2-3 years
	3-4 years
	4-5 years
	More than 5 years
8	From how long are you working in Shri Mata Vaishno Devi Super speciality hospital?
	Less than 1 year
	1-2 years
	More than 2 years
Past experiences of staff:	
9	Have you heard the term disaster/Emergency incident
	Yes
	No
10	When was the last time an emergency/disaster happened in the facility?
	2-4 Weeks back
	6 months back
	More than 1 year back
	More than 2 years back
11	Which code was raised at that time
	Code pink
	Code purple
	Code orange
	Code red
	Code blue
Staff knowledge and readiness	
12	Are you aware the mobile no. to contact control room in case of emergency?
	9070999600
	9070999550
	9070796666
	9070999500

13	What is the full form of PASS?
	Pull the pin, aim the base, squeeze the trigger, spray side to side
	Pack the pin. aim the base, squeeze the trigger, stop the spray
	Press the pin, aim the base, squeeze the trigger, spray top to down
14	Which code will be raised if the ceiling falls?
	Code black
	Code purple
	Code red
	Code pink
	Code blue
	Code orange
15	What is the correct order for code announcement?
	code-location-area x 3
	area-location-code x 2
	location-code-area x 3
	code-location- area x 4
16	In case of fire what should be the direction of evacuation of patients from their respective areas?
	By lift
	Through main entrance
	From fire exit
	Through evacuation point
17	Do you know the nearest fire exit on your floor?
	Yes
	No
18	Can you activate code orange
	Yes
	No
19	where is triage done?
	IPD
	OPD
	Emergency
	Dialysis area
20	What is triage colour code for patient requiring immediate attention?
	Black
	Red
	Green
	Orange
Staff attitude:	
21	Are you aware of your responsibility during disaster?
	Strongly agree
	Agree
	Disagree
	Strongly disagree
22	Do you think that disaster management training should be conducted frequently?
	Strongly agree
	Agree
	Disagree

	Strongly disagree
23	Do you think trainings and mock drills can help in better management at the time of disaster?
	Strongly agree
	Agree
	Disagree
	Strongly disagree
24	Disasters are natural and nothing can be done to reduce the effects?
	Strongly agree
	Agree
	Disagree
	Strongly disagree
Your valuable Suggestion & Comments	
25	Your suggestions/comments to make the emergency/ disaster management more effective in your hospital.

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