

Risk assessment in a teaching hospital in Western India from 2017 to 2021

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Abstract

Objective: The primary objective was to compare changes in risk assessment during five years (2017-21) in a teaching hospital. **Materials and Methods:** The study was an analysis of documented data. The authors conducted the study in a teaching hospital in Western India. A team consisting of hospital administrators and heads of various committees (who are faculties from multiple departments) carried out risk assessment thrice a year. We considered human-related, financial, technological, clinical, and other domains and 48 events/elements for assessment. We assigned the observations of the last round to the specific year. The probability of occurrence of an event and its impact was scaled into four grades unanimously after discussion and in concordance with acknowledged documents. The assessment process included a review of reported incidents and an unanimously agreed score if there were no incidents. We carried out the study for five years. The first two years' assessment reflects the situation before National Accreditation Board for Hospitals and Healthcare Providers (NABH) accreditation and the last three years' situation after NABH accreditation. **Results:** The first and last year's comparison revealed that out of 50 events/elements, 40 improved, six had descent, and four did not change. Out of six descents, three originated due to constructional activities. In this period, the management constructed a new super-specialty building and renovated some parts of the existing building. One descent was related to licensing delays due to the COVID-19 pandemic. **Conclusions:** Most of the events/elements showed decreased risk.

Keywords: Risk assessment, Impact of event, Probability of event, Risk matrix, NABH, India

Introduction

Quality care includes patients' safety and is a vital concern of all accreditation systems worldwide. Risk assessment implies making hospitals safe for patients' stay. Usually, the risk assessment revolves around patients' safety. Risk assessment is never an academic exercise; the ultimate objective is preparedness. It is a continuous process of identifying the hazards, evaluating the associated risks, controlling them, and re-evaluating them. Identifying, quantifying, mitigating, and monitoring risk are key themes under patient safety and quality improvement. Most of the standards included in facility management are related to risk management⁽¹⁾. In India, despite many acts like Medical Termination of Pregnancy (safeguarding women from unauthorized and unequipped institutions), Medicare Service Persons, and Medicare Service Institutions (Prevention of Violence and Damage or Loss to Property) for minimizing the risk, the actual situation is not considered satisfactory. Most articles pertain to grading or coding events/situations, clinical risks like pressure ulcers, or information security^(2,3). Comprehensive risk assessment might be done in some hospitals but is usually not documented. Serial assessment is

rare. The present study aimed to estimate the risks in various domains and the changes that occurred in five years follow-up period in a teaching hospital in Western India. The initial assessment of two years pertains to the period before National Accreditation Board for Hospitals and Healthcare Providers (NABH) accreditation.

Materials and Methods

We carried out this study in a teaching hospital having 831 beds in Pune Municipal Corporation, India. There are four medical college hospitals (two Government, two, and two private) in the Pune Municipal Corporation area. As per the last census (2011), the population of Pune Corporation is 3.2 million⁽⁴⁾. It is the second-largest city by population in Maharashtra State and ninth in India. The medical college has almost all the primary specialties and super-specialties. The medical college is a constituent of a Deemed to be University with A+ grade from the National Assessment and Accreditation Council of India. The NABH has accredited the hospital. The International Society for Quality in Health Care (ISQua) has accredited the standards adopted by NABH. The regular risk assessment was a collaborative and consultative process among the authors, Principal, Vice

Principals, Medical Director, Deputy Medical Directors, Matron, and Chairpersons of various committees like the Hospital Infection Control Committee, Safety Committee, Drugs, and Therapeutics Committee, etc. Almost all these persons were faculty from various teaching departments. While interacting with the members described above, the author team referred to the incident reporting mechanism for risk assessment. The author's team also discussed the reasons for worsening or no change. The hospital management carried out the risk assessment from 2017 to 2021, and the authors are presenting it here. The frequency of the

evaluation and scoring was thrice a year. We assigned the last (third) scoring to that calendar year. Assessment of the initial two years reflects the status before receiving NABH accreditation.

We considered the probability of an event or patient outcome into the following four grades; highly likely, likely, possible, and unlikely, as given in Table 1. The detailed explanation of possibilities was as per accepted norms. Similarly, we graded the impact into four categories; catastrophic, critical, serious, and marginal. They were given scores as follows; 11-12, 8-10, 5-7, and 1-4 respectively.

Table 1: Risk rating matrix in a teaching hospital, India

Rating		Probability			
		A	B	C	D
		High likely	Likely	Possible	Unlikely
Impact rating	11 to 12: Catastrophic	A11-A12	B11-B12	C11-C12	D11-D12
	8 to 10: Critical	A8-A10	B8-B10	C8-C10	D8-D10
	5 to 7: Serious	A5-A7	B5-B7	C5-C7	D5-D7
	4: Marginal	A1-A4	B1-B4	C1-C4	D1-D4
Risk rating		High risk	Moderate risk	Low risk	Very low risk

Note: Details of probability rating: A: Nearly 100% probability in next year, B: 10-100% probability in next year, or at least one event in next 10 years, C: 1-10% probability in next year, or at least one event in next 100 years, D: Less than 1% probability in next 100 years

Risk management includes eight conventional domains, including patient safety and medical liability⁽⁵⁾. We performed the risk assessment and rating in the following five domains and identified events/elements in each domain. The domains and events/elements therein were decided through a consultative process. We selected a total of 50 events/elements. The details, including numbers in each domain, are given below:

1. Human-related events (seven identified)
2. Financial event (three identified)
3. Technological events (17)
4. Clinical and (19)
5. Others related to hazardous materials (4)

The risk rating was considered a combination of the probability of occurrence of the hazard/incident and the impact/severity of harm score. The possibility was color-coded, and the impact was as a score. The matrix of risk rating and color codes adopted in this study are given in Table 1.

The source of data for risk assessment was the reported number of incidents or measurement of an identified quality indicator. The team unanimously decided on the extent of risk after discussion in the absence of reported incidents or quality indicators.

All the actions required for hospital accreditation, like regular training, meetings of various committees, incident reporting, safety rounds, root cause analysis, etc. were executed.

Results

The tables compare the change in the first year and last year's data. During five-year, the information about human-related hazards from Table 2 reveals that six of seven elements improved, and there was no change in one. A view of these five-years changes in financial risk assessment reveals that there was no change in two elements and one improved (Table 2).

Table 2: Changes in risk assessment of human related hazards and financial risk in a teaching hospital, India

Event	Risk rating					Source: (Quality Indicator/Incident)	Comparison of first and last year's data		
	2017	2018	2019	2020	2021		2017	2021	Change
Human related hazards risk									
Strike	B7	B4	B4	B4	C4	Incident	0	0	+
Non-availability of staff	B7	B4	B4	B10	B6	% of absentees	1.40%	0.82%	+
Employee illness	C3	D4	D4	C7	C7	% Annual Health check-up	100%	100%	No
Harassment	C3	C4	C4	C4	D5	No. of harassment incident reported	2	0	+
Infant abduction	C3	C3	C3	C3	D5	No. of Incident	0	0	+
Violence	C6	C6	C6	C10	C5	No. of Incident	1	0	+
Patient absconding	B4	B4	B4	B4	D10	No. of Incident	1	1	+
Financial risk									
Theft and pilferages	C6	C5	C5	C5	C4	No. of Incident	7	1	+
Cash loss in transit	C5	C5	C5	C5	C5	No. of Incident	0	0	No
Fraud and forgery	C4	C4	C4	C4	C4	No. of Incident	0	0	No

+ Indicates betterment

Technological risk assessment showed that out of 17 elements, 12 showed betterment, and five showed descents (Table 3). Table 3 also provides a clinical risk assessment. Out of 19 clinical indicators, all showed betterment in risk assessment except one no change and one descent. Table 3

presents other four elements which improved. Overall betterment in various indicators was 80% and ranged from 33 to 100%. The general descent was only 12% (0 to 29.41%). The situation did not change in 8% of events/elements and ranged from 0 to 66.66%.

Table 3: Changes in technological risk assessment, Clinical risk assessment and other risk assessment in a teaching hospital, in western India

Event	Risk rating					Source: (Quality Indicator/Incident)	Comparison of first and last year's data		
	2017	2018	2019	2020	2021		2017	2021	Change
Technological risk assessment									
Electrical failure	A3	B4	B4	B4	D4	% of electrical breakdown	25 mins.	20 mins.	+
Diesel generator (DG) failure	C9	C7	C7	C7	C4	% of DG breakdown	0	0	+
Fuel shortage	C9	C5	C5	C5	C7	No. of Incident	0	0	+
Water supply shortage	D5	D4	D4	D4	D4	No. of Incident	0	0	+
Sewer failure	B4	D7	D7	B4	C7	No. of incident	0	0	-
Fire	B12	B7	B7	B7	B7	No. of Incident	5	0	+
Fire alarm failure	C3	C3	C3	C3	D5	No. of Incident	0	0	+
Medical gas failure	C3	D7	D7	D7	D4	No. of Incident	0	0	+
Heating Ventilation and Air Conditioning (HVAC) failure	C4	D7	D7	D7	D7	No. of Incident	0	0	+

Cont... Table 3: Changes in technological risk assessment, Clinical risk assessment and other risk assessment in a teaching hospital, in western India

Event	Risk rating					Source: (Quality Indicator/Incident)	Comparison of first and last year's data		
	2017	2018	2019	2020	2021		2017	2021	Change
Communication and Internet Failure	D3	D3	D3	D3	C4	No. of Incident	0	0	-
Improper maintenance / tampering of medical records	C3	C3	C3	C3	D4	No. of Incident	0	0	+
Structural damage	C4	C5	C5	C5	C5	No. of Incident	0	3	-
Bio medical (BM) critical equipment failure	D3	D4	D4	D4	D4	% of BM equipment breakdown (annual average)	611 minutes/month	423 minutes/month	+
Legal licenses non-compliances	D3	D3	D3	D3	D4	No. of license pending	0	1	-
Disaster	A12	A8	A8	A8	A7	No. of Incident	0	0	+
Sterilization failure [Central Sterile Service Department (CSSD)]	D3	D4	D4	D4	D4	No. of Incident	0	0	-
Falls in hospital premises	B4	C7	C7	C7	C4	No. of Incident/QI	3	3	+
Clinical risk assessment									
Medication management [Medication Errors (ME)] (allergies)	C5	C4	C4	C4	D5	% of ME due to allergies	47	41	+
Equipment risk (fire / injury)	C7	C7	C7	C7	C4	Incident if any	0	0	+
Medication error (omission, overdose, wrong route, wrong medication)	B6	B4	B4	B4	C7	% Operational Review (OR) Incident	480 (3.97%)	256 (0.90%)	+
Nosocomial infection	C5	C4	C4	C4	C4	Annual average of Catheter Associated Urinary Tract Infection (CAUTI) %	2.82	0.54	+
						Annual average of Central Line Associated Blood Stream Infection (CLABSI) %	5.19	2.87	+
						Annual average of Ventilator Associated Pneumonia (VAP) %	12.64	2.7	+
						Annual average of Surgical Site Infection (SSI) %	3.29	1.11	+
Adverse events	C5	C5	C5	C5	C5	Adverse Event	0	0	+

Cont... Table 3: Changes in technological risk assessment, Clinical risk assessment and other risk assessment in a teaching hospital, in western India

Event	Risk rating					Source: (Quality Indicator/Incident)	Comparison of first and last year's data		
	2017	2018	2019	2020	2021		2017	2021	Change
Clinical process problem (wrong diagnosis, inappropriate treatment, poor care)	D6	D5	D5	D5	D5	Event	0	0	+
Error related to blood/body fluid testing	D4	D4	D4	D4	D6	Incident	0	0.02	-
Wrong side surgery	D6	D4	D4	D4	D4	% of World Health Organization (WHO) surgical safety checklist	0	0	+
Error in surgical planning	D6	D4	D4	D4	D4	Incident	0	0	+
Bed sore / pressure ulcer	C5	B7	B7	B7	C4	% Bed Sore	44	15	+
Wrong identification of patient	C5					% Error in patient identification	3	2	+
Transfusion of wrong blood group component	C5	D6	D6	D6	D5	Incident	0.40%	0.30%	+
Cautery burn	C5	D7	C4	C4	C4	Incident	1	0	+
Physical assault	B7	B7	B7	B7	D12	Incident	0	0	+
Documentation problem (inadequate, incorrect, unclear)	C5	C5	C5	C5	C4	Quality indicator monitoring	6.50%	0.13%	+
Infusion problem (omission, wrong rate)	C5	C4	C4	C4	C4	Incident	0	0	+
Assessment of other risks									
Rodent nuisance	B5	B4	B4	B4	B4	No. of Incident	0	0	+
Radiation hazard						No. of Incident	0	0	+
Chemical hazard	C4	D7	D7	D7	D7	No. of Incident	0	0	+
Spillages in hospital	C5	C4	C4	C4	C4	No. of Incident	10	Blood:4 Chemical:1	+

+ Indicates betterment; - Indicates descent

Discussion

During the five years, 80% of elements improved no change in 8% and a decent in 12%. Out of six descents, three resulted due to constructional activities. During this period,

management renovated some parts of the existing building and constructed a new super-specialty building. One decline was related to licensing delays due to the COVID-19 pandemic. Human resource availability suddenly decreased

in 2020 due to the COVID-19 pandemic. The non-availability is mainly due to staff nurses returning home for fear of contracting the infection. We also attempted an assessment of the proportion of sickness. However, we realized that almost all personnel availed the sick leave, and the data was unreliable.

The risk matrix may be a three-by-three, four-by-four, or five-by-five table^(5,6). Three by three may not give a complete picture, and five by five may become too complex. Hence, we chose four by four matrix. National Health Service (NHS) uses five by five matrix⁽⁷⁾. The fifth edition of NABH standards has 10 chapters and 605 objective elements⁽⁴⁾, and many are related to risk assessment. Actions taken require a relatively long time to detect the effects or change the perceptions. Although identifying the hazards, evaluating the associated risks, controlling the risks, and evaluating is a cyclical process, in the current paper, we have only deliberated on the first stages of the cycle. Extensive

literature is available on industrial risk assessment and its management. Some hazards are inherent in any hospital activity and may be actual or potential. The identification and risk assessment varies from ward-to-ward, Intensive Care Unit, Maternity ward, orthopedic ward, etc. We have considered the hospital a total unit. We have grouped the probability and impact into four groups. None of the members who participated in the process had undergone formal training but had experience. We graded the likelihood and impact in three to five groups. Accordingly, the matrix changed⁽⁸⁾. Many hospitals have one separate domain as 'naturally occurring events' in their assessment. The risk assessment may be calculated separately for a specific domain like 'information', 'security' but more than information and security fire risk was rated higher⁽⁹⁾. The rating we followed is commonly used. In United Kingdom (UK) the likelihood categories are grouped into six as in Table 4⁽⁹⁾.

Table 4: Likelihood categories in United Kingdom

Likelihood Category	Definition
Frequent	Likely to be continually experienced
Probable	Likely to occur regularly
Occasional	Likely to occur several times
Remote	Likely to occur sometimes
Improbable	Unlikely, but may exceptionally occur
Incredible	Extremely unlikely that the event will occur at all

Even five categories, (Rare, Unlikely, Possible, Very Likely, Certain to Occur) are also frequently followed particularly in Australia⁽¹⁰⁾.

Although the authors have considered four categories of severity of impact, the severity of categories may be more. The Victoria Government defines six categories as in Table 5⁽¹¹⁾.

Table 5: categories of severity of impact as defined by Victoria Government

Category	Definition
Catastrophic	The clinical Hazard results in permanent harm and/or death to a patient. This category will also apply to a Clinical Hazard that causes many occurrences of Major Severity.
Major	The Clinical Hazard creates a situation that is inherently and immediately threatening to a patient's life. Harm is unlikely to be prevented by a clinician. This category will also apply to a Clinical Hazard that causes many occurrences of Moderate Severity.
Moderate	The Clinical Hazard presents a serious and imminent Clinical Safety risk to a patient by allowing a life-threatening situation to develop. Harm may be prevented by the clinician. This category will also apply to a Clinical Hazard that causes any occurrences of Minor Severity.
Minor	The Clinical Hazard presents a significant risk to a patient, though not one that is immediately or necessarily life-threatening. Harm is likely to be prevented by the clinician. This category will also apply to a Clinical Hazard that causes many occurrences of Minimal Severity.
Minimal	The Clinical Hazard presents a latent risk, which may impact the quality of the patient care if ignored.
Benign	The Clinical Hazard has no foreseeable impact on patient care.

As a result, the matrix also differs. However, the risks considered by Victoria Government are essentially clinical.

The data sources of risk assessment may be long-term incident reporting and data analysis. Action-taking is an obligatory fallout of risk assessment. Safety and risk management is a continuous process. The acknowledged list of actions that are taken to reduce is almost similar to our efforts⁽¹²⁾.

The risks are identified by analyzing firstly incident reporting, particularly their volume and severity. Secondly, they can be identified by past claims analysis. If records of a long time are available, one can study the trend also. Although a sound system, Prospective Hazard Analysis is usually not practiced in health care institutions⁽¹³⁾.

Three approaches to the management of risk have been described; 'ultra-adaptive', 'high reliability', and 'ultra-safe'. 'Ultra-adaptive' simply means that this approach relies heavily on the judgment, adaptability, and resilience of individuals; 'high reliability' is mainly meant to indicate a flexible but prepared response of teams in the management of risk; 'ultra-safe' refers to the absolute priority has been given to safety in the organizations and to the means of achieving such safety⁽¹⁴⁾. In recent years, the UK-NHS has put substantial effort into building up its risk analysis and risk management systems; the reporting involves 22 items, including fire safety and infection control⁽¹⁵⁾. No such mandatory reporting exists in India except notification of certain infectious diseases.

The present study is unique because it presents data from five years of a large hospital. Our 4 by 4 matrix is not too large or too small. We did not encounter rare events; hence we finalized the score after discussion. That led to the inability to conduct statistical analysis.

Conclusions

The actions taken by the authors and the hospital management while implementing the NABH standards in the hospital resulted in betterment in most of the studied events/elements (about 80%). Although we did not analyze all the events/elements and mandatory and elective quality indicators of NABH standards, there must be similar improvement across all the events/elements and indicators. The descent in some events/elements was structure related and inevitable.

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Authors' Contribution

PD: Conceptualization, Designing, writing initial draft of manuscript, finalization of manuscript; SK: Data collection

and data analysis, finalization of manuscript; AV: Data collection and monitoring, finalization of manuscript.

Ethical consideration


The authors obtained approval from Bharati Vidyapeeth (Deemed to be University) Medical College, Institutional Ethics Committee (DCGI Reg. No. ECR 518/Inst/MH/2014/RR-17) vide letter, REF: BVDUMC/IEC/73, Date-19/01/2022.

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