

SHIKHA KUMARI

MBA-HM27

1607

SYNOPSIS

Title:

Enhancing Emergency Department Safety: A Comprehensive FMEA Approach

Introduction:

Emergency departments (EDs) play a pivotal role in providing urgent medical care, yet they are susceptible to errors and adverse events that can compromise patient safety. To address these challenges, a Comprehensive Failure Mode and Effects Analysis (FMEA) approach offers a systematic method for identifying, prioritizing, and mitigating risks within ED settings. This synopsis explores the application of FMEA methodologies in enhancing safety protocols and optimizing patient outcomes in ED environments.

Research Question:

Can Failure Mode and Effects Analysis (FMEA) be employed to systematically identify and prioritize potential sources of delays within the emergency department (ED), ultimately leading to the development of interventions that can effectively reduce these delays and enhance patient care?

Objectives:

1. To employ an FMEA to systematically recognize potential failure modes that contribute to delays within the emergency department.

2. To assess the severity, frequency, and detectability of each identified failure mode relevant to wait times in the ED.
3. To calculate a Risk Priority Number (RPN) to rank failure modes according to their potential impact on patient wait times in the ED.
4. To formulate interventions and mitigation strategies to address high-risk failure modes that contribute to extended wait times in the ED.

S. No.	Authors	Study Location	Sample Size	Sampling Technique	Salient Features
1.	Shahrami A Rahmati F Kariman H	Imam Hossein Hospital, Tehran, Iran	100	The study employed a prospective cohort design. Sampling entailed focused and frequent conversations with staff working in different subsystems, producing defect reports, meetings with staff from the next subsystem to identify concerns based on studied documents.	The study's goal was to look into FMEA as a tool for identifying & solving problems that cause ED revenue loss. Conducted for about 24 months (Oct 2007 to Nov 2009). The department was organized into one major system and six classified subsystems. The study was divided into two phases: First Phase: Identified defects in the subsystems and prioritized them based on Risk Priority Number (RPN). This phase lasted for the first six months.

					Second Phase: Solutions to the defects were implemented based on priority. Key results included a significant increase in ED revenue (from 73.1 thousand US dollars per month to 320 thousand US dollars per month by the end of the study, a 337.75% increase The study found that FMEA is an effective strategy for identifying and resolving financial system faults in the medical setting, resulting in enhanced profitability.
2.	Sheikhbards iri H. Fateme Rezaei Yasamin Molavi Taleghani	Imam Hossein Hospital, Tehran, Iran	The hospital averages about 4,500 visits per month. However, the exact number of records reviewed or the sample size is not explicitly mentioned	Data were acquired using three basic methods: Meetings with personnel from each subsystem are held on a regular and concentrated basis, and defect reports are compiled.	The study employed Failure Mode and Effect Analysis (FMEA) to uncover issues causing revenue loss in the ED. Key concerns highlighted were the nursing unit's failure to document services and a lack of particular identifying codes for patients' files when they moved from the ED to other departments.

				Regular meetings with the team of the next subsystem to identify problems in the previous subgroup using studied files. The researchers randomly selected and analyzed files in the presence of connected people.	The study attempted to provide answers to these issues in order to ensure dependability and validity in raising income in the emergency department. The study indicated that FMEA might be regarded an effective approach for enhancing ED revenue by addressing identified difficulties.
3.	Ehsan Ullah Mirza Mansoor Baig Hamid GholamHos seini Jun Lu	Taranaki Base Hospital, New Plymouth, New Zealand	The study utilized the knowledge of 6 frequent users of the Rapid Response System (RRS)	The study employed a purposive sampling technique by recruiting 6 frequent users of the RRS as subject matter experts (SMEs) to participate on a	Objective: The study's goal was to use Failure Mode and Effect Analysis (FMEA) to locate and fix possible problems with a hospital's Rapid Response System (RRS). Methodology: Using the Risk Priority Number (RPN) technique, 6 common users of the RRS, including

				voluntary basis. These experts were selected based on their hands-on knowledge and experience with the RRS process	doctors and nurses, assessed potential failures and identified 35 failure modes and 101 failure mode effects over 13 process phases. Afferent vs. Efferent Limb: The afferent limb of the RRS (the part responsible for detecting and responding to patient deterioration) was found to be more susceptible to failures compared to the efferent limb (the part involved in the subsequent management of the patient). Causes of Failures: Human mistake, staff workload, staffing numbers, the drawbacks of paper-based charts, and organizational problems were among the main causes of the failures. Electronic System Benefits: Research has indicated that an electronic system has the capacity to eliminate or reduce 70.2% of failures that are recognized; the remaining problems require focused corrective actions, such as education,
--	--	--	--	---	---

					scenario-based training, and changed calling criteria.
4.	Ronald E. Warnick, MD, Amy R. Lusk, MSN, John J. Thaman, MS, Elizabeth H. Levick, MD, Andrew D. Seitz, BSN	Cincinnati, OH, USA	The study describes the analysis and implementation of FMEA based on the treatment of 1,400 patients using the Gamma Knife Perfexion® system	The study does not explicitly mention a sampling technique. It focuses on the entire process of Gamma Knife radiosurgery and the identification of potential failure modes within that process.	Objective: The goal of the study was to use Failure Mode and Effects Analysis (FMEA) to improve the safety and effectiveness of Gamma Knife radiosurgery. Process: The Gamma Knife process tree was thoroughly mapped by the FMEA team, who also identified possible failure modes and assigned a Risk Priority Number (RPN). Process Tree: included 177 steps and 14 subprocesses that together identified 31 possible failure modes. Of these, 7 had a high score (RPN ≥ 150), and 3 other modes were chosen by physicians as mitigation techniques. Mitigation Strategies: Designed to address high-risk failure modes; the efficacy of these tactics was reevaluated after a period of 18 months.

					Outcome: The impact of the FMEA mitigation techniques was confirmed by the significant reduction in RPN scores that was seen. For both newly opened and already-operating Gamma Knife institutions seeking to improve their quality management systems, the report offers a road map. Documentation: There are five quality control documents available that any Gamma Knife clinic can alter.
5.	- Andy Yuanguang Xu - Jagdish Bhatnagar - Greg Bednarz - John Flickinger - Yoshio Arai - Jonet Vacsulka - Wenzheng Feng	- University of Pittsburgh Cancer Institute, Pittsburgh, PA, USA - University of Pittsburgh Medical Center, Pittsburgh, PA, USA - New York Presbyterian Hospital/Columbia University	The study does not specify the exact number of cases analyzed, but mentions that over 600 patients receive single-fraction Gamma Knife	The study does not specify a sampling technique. It focuses on the process and failure modes of Gamma Knife radiosurgery as performed at their institution.	Objective: To formulate a risk-based quality management program utilizing the FMEA tool, which is suggested by AAPM Task Group 100, for Gamma Knife radiosurgery. Process Tree: A process tree with 53 steps total, 10 subprocesses, including stages for the frame-based aspect of Gamma Knife radiosurgery, including steps for frame installation.

	- Edward Monaco - Ajay Niranjan - L. Dade Lunsford - M. Saiful Huq	Medical Center, New York, NY, USA	radiosurgery treatments annually at their institution.		Failure Modes Identification: Detected 86 failure modes, 40 of which were unique to Gamma Knife radiosurgery and may have resulted from improper use of the Gamma Plan treatment planning system's features, imaging fiducial boxes, Gamma Knife helmets, plugs, and other items. Risk Priority Number (RPN): Each failure mode was scored based on the probability of occurrence, severity, and probability of no detection. The overall RPN for each failure mode was calculated. Hazard Scores: The machine mechanical failure that went unnoticed throughout the morning QA process, improperly attached frame adaptors, defective fiducial box assembly, loose plugs or inserts, and neglected target regions were the failure
--	---	--	---	--	--

					types that had the greatest risk ratings. Outcome: Professionals were able to gain a deeper grasp of the Gamma Knife radiosurgery procedure and potential limitations were identified by the study. It offers a foundation for creating a risk-based focussed system on quality management program for radiosurgery using gamma knives.
6.	- Alix J.E. Carter, MD, MPH - James B. Gould, BSc - Peter Vanberkel, PEng, PhD - Jan L. Jensen, ACP, MAHSR - Jolene Cook, MD - Steven Carrigan, MPA	- Emergency Health Services, Dartmouth, Nova Scotia - Dalhousie University, Halifax, Nova Scotia - IWK Health Centre, Halifax, Nova Scotia	- The study identified 78 failure modes (FM) in the offload zone process.	The study used Health Care Failure Mode and Effect Analysis (HFMEA) to identify failure modes, determine their probability and severity, calculate hazard scores, and propose mitigations for high-risk scores.	Objective: In order to assess the unloading zone's (OZ) efficiency and safety, the study intends to create a process map of EDs and carry out a hazard analysis. Process Mapping: The OZ procedure consists of six main steps: patient study in OZ, patient care in OZ, patient in-transfer out of OZ, patient out-transfer via ambulance, and arrival to the ED. Hazard Analysis: After conducting a Health Care

	- Mark R. Wheatley, ACP - Andrew H. Travers, MSc, MD				Failure Mode and Effect Analysis (HFMEA), 78 failure/factors modes (FM) were found, of which 28 were deemed to be high priority. Failure Modes: The high-priority failure or delay modes were classified into impacts on patient safety (25%), process efficiency (35.7%), and both (39.3%). Mitigations: Seventeen mitigations was recommended for the identified high-risk failure modes to improve safety and efficiency. Offload Delay: The study addresses offload delay, a significant issue where ambulances experience prolonged waiting times to transfer patient care due to ED crowding, impacting patient outcomes and EMS availability. Policy Implications: The findings are intended to
--	--	--	--	--	---

					inform current policies and practices, aiming to reduce offload delays and improve overall ED and EMS efficiency.
--	--	--	--	--	---

Hypothesis:

Implementing an FMEA approach will lead to the identification and prioritization of key drivers of delays in the ED. This will enable the development of targeted interventions that will significantly reduce patient wait times and improve overall ED efficiency.

Materials and Methods:

This study will utilize a mixed-methods approach, combining qualitative and quantitative analyses to assess ED safety protocols and interventions. Data collection methods will include interviews with ED staff, observations of workflow processes, and review of incident reports and patient records. A time motion study and questionnaire survey will be conducted on the samples to gather data. The FMEA process will be applied to identify failure modes, assign severity, occurrence, and detection ratings, and prioritize interventions. Implementation of FMEA-derived action plans will be monitored, and outcomes such as adverse events, patient safety incidents, and staff perceptions will be evaluated.

Research Design

The research design outlines the overall methodological approach employed and the specific course of action adopted to achieve the study's objectives and investigate the research question.

Study Setting

The study was conducted in the Gurgaon region at Artemis Hospital- a multi-speciality hospital with nearly 550 beds. It houses a team of over 400 highly skilled and experienced doctors across a staggering 40 specialties. The research study was conducted under the supervision of the General Manager - Security & Operation, taking place between March and June 2024.

Research Approaches

This prospective cohort study investigated the reasons for the patient delay, throughout a 3-month period, from March 2024 to June 2024, in the emergency department. The delay factors were used to perform & calculate FMEA analysis. A time motion study and questionnaire survey were used during the study. Patients who visited the emergency departments in advanced cardiac care, Level 1 trauma care, mother and childcare, and a dedicated stroke centre during the study period made up the participants. To choose individuals who met the inclusion requirements, a practical sampling technique will be used. Based on practicality and time availability during the time period, the sample size was chosen.

Data Analysis Plan:

Qualitative data from interviews and observations will be analyzed using thematic analysis to identify common themes and patterns related to ED safety. Quantitative data, including severity, occurrence, and detection ratings, will be analyzed using descriptive statistics. The effectiveness of FMEA-derived interventions will be assessed through comparisons of pre- and post-intervention data, including rates of adverse events and patient safety incidents.

Overall, this research aims to demonstrate the efficacy of a Comprehensive FMEA Approach in enhancing emergency department safety and quality of care, ultimately contributing to improved patient outcomes and healthcare delivery.

Data Collection Methods

- a) Time Motion Analysis: TMA was used to calculate the total time taken by patient visiting the ED. The time was observed from the entry of the patient in the department till final settlement of bill and exit of patient. The duration of patient in ED was observed and recorded by trained researcher using a stopwatch. The TMA data of 105 patients was observed as a sample size for the study. The TMA data contained the details for patients like the reason for visit, door-in time, doctor visit time and door-out time.
- b) Questionnaire Survey: The patients who were observed in the time motion analysis, were surveyed. Patients were given a structured questionnaire to complete to gather information about their satisfaction and experiences. A variety of factors, including reason for delay, admission services experience, the billing experience, and overall experience in the

emergency department, was evaluated using the questionnaire. A total of 105 patients' responses were observed as a sample. Using both online and offline modes, the responses were collected in person.

References

1. Sorrentino, P. (2016). Use of Failure Mode and Effects Analysis to Improve Emergency Department Handoff Processes. *Clinical Nurse Specialist*, 30(1), 28–37. <https://doi.org/10.1097/nur.0000000000000169>
2. Teklewold, B., Anteneh, D., Kebede, D., & Gezahegn, W. (2021). Use of Failure Mode and Effect Analysis to Reduce Admission of Asymptomatic COVID-19 Patients to the Adult Emergency Department: An Institutional Experience. *Risk Management and Healthcare Policy*, Volume 14, 273–282. <https://doi.org/10.2147/rmhp.s284835>
3. Shahrami, A., Rahmati, F., Kariman, H., Hashemi, B., Rahmati, M., Baratloo, A., Forouzanfar, M. M., & Safari, S. (2013, January 1). *Utilization of Failure Mode and Effects Analysis (FMEA) Method in Increasing the Revenue of Emergency Department; a Prospective Cohort Study*. PubMed Central (PMC). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4614557/>
4. Gur-Arieh, S., Mendlovic, S., Rozenblum, R., & Magnezi, R. (2023). Using Failure Mode and Effect Analysis to Identify Potential Failures in a Psychiatric Hospital Emergency Department. *Journal of Patient Safety*, 19(6), 362–368. <https://doi.org/10.1097/pts.0000000000001127>
5. *Human Verification*. (n.d.). <https://www.semanticscholar.org/paper/Utilization-of-Failure-Mode-and-Effects-Analysis-in-Shahrami-Rahmati/5e76d287d22cf205eac691b9bf5bd31c77b57b0b>
6. Chanamool, N., & Naenna, T. (2016). Fuzzy FMEA application to improve decision-making process in an emergency department. *Applied Soft Computing*, 43, 441–453. <https://doi.org/10.1016/j.asoc.2016.01.007>

Patient Satisfaction Assessment

Dear All,

We are conducting a small survey regarding your visit at Artemis Hospital Emergency Department. In order to be able to serve our patients better, we would like to hear from the patients and attendants about their experience.

प्रिय साथियो,

हम आर्टेमिस अस्पताल के आपातकालीन विभाग में आपकी यात्रा के संबंध में एक छोटा सर्वेक्षण कर रहे हैं। अपने मरीजों को बेहतर सेवा देने में सक्षम होने के लिए, हम मरीजों और परिचारकों से उनके अनुभव सुनना चाहेंगे।

kumari.shikha436@gmail.com [Switch account](#)



Not shared

Name of Patient/ मरीज का नाम

Your answer

Contact Number/ संपर्क संख्या

Your answer

Gender of patient/ लिंग

Your answer

Reason for visiting emergency department/ आपातकालीन विभाग में जाने का कारण

Your answer

Please rate your experience at admission process on a scale of 1 to 5/ कृपया प्रवेश प्रक्रिया में अपने अनुभव को 1 से 5 के पैमाने पर रेटिंग दें

1 2 3 4 5

Poor Experience/खराब अनुभव ☐ ☐ ☐ ☐ ☐ Excellent Experience/ उत्कृष्ट अनुभव

Please rate your experience at consultation process on a scale of 1 to 5/ कृपया परामर्श प्रक्रिया में अपने अनुभव को 1 से 5 के पैमाने पर रेटिंग दें

1 2 3 4 5

Poor Experience/खराब अनुभव ☐ ☐ ☐ ☐ ☐ Excellent Experience/ उत्कृष्ट अनुभव

Please rate your experience at discharge process on a scale of 1 to 5/ कृपया डिस्चार्ज प्रक्रिया में अपने अनुभव को 1 से 5 के पैमाने पर रेटिंग दें

1 2 3 4 5

Poor Experience/खराब अनुभव ☐ ☐ ☐ ☐ ☐ Excellent Experience/ उत्कृष्ट अनुभव

Please rate your overall experience at emergency department on a scale of 1 to 5/ कृपया आपातकालीन विभाग में अपने समग्र अनुभव को 1 से 5 के पैमाने पर रेटिंग दें

1 2 3 4 5

Poor Experience/खराब अनुभव ☐ ☐ ☐ ☐ ☐ Excellent Experience/ उत्कृष्ट अनुभव