

Multidisciplinary Operational Leadership and Proactive Risk Management for Safe Hospital Relocation During Operation Roaring Lion

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ABSTRACT **Background:** During Operation Roaring Lion, Carmel Medical Center, a 500-bed tertiary hospital, relocated nearly half of its inpatient activity to the fortified underground facility of Rambam Health Care Campus while maintaining independent clinical and managerial responsibility. Returning patients after hostilities subsided represented a complex organizational transition requiring preservation of patient safety and continuity of care. **Objectives:** To describe a multidisciplinary operational leadership model and evaluate the use of failure mode and effects analysis (FMEA) to support safe wartime hospital relocation. **Methods:** A prospective quality improvement study used multidisciplinary FMEA before patient relocation. The relocation pathway was divided into four phases, and potential failure modes were scored by severity, occurrence, and detectability to prioritize mitigation strategies. Interventions included centralized command, real-time patient tracking, structured clinical handoffs, standardized transfer checklists, medication reconciliation, risk stratification, and enhanced post-transfer monitoring. Outcomes included patient safety events, falls, resuscitation events, unplanned intensive care unit (ICU) admissions within 24 hours, multidrug-resistant organism (MDRO) cross-transmission, and departmental feedback. **Results:** During 55 days of wartime activity, 843 patients were hospitalized in the underground facility. In total, 84 medically complex patients were relocated in three operational waves. The highest-risk domains involved communication, documentation, operational coordination, staffing, and clinical monitoring. No predefined patient safety events, falls, resuscitation events, unplanned ICU admissions within 24 hours, or documented MDRO cross-transmission were identified. Department leaders reported high organizational preparedness and improved operational control. **Conclusions:** A multidisciplinary operational leadership model integrating proactive FMEA enabled coordinated management of clinical, informational, operational, and infection-related risks during complex wartime hospital relocation.

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KEY WORDS: emergency preparedness, failure mode and effects analysis (FMEA), hospital relocation, patient safety, quality improvement

Armed conflicts require hospitals to rapidly reconfigure healthcare delivery while maintaining safe and continuous inpatient care. Hospital relocation is a high-risk operation that may compromise patient safety through communication failures, medication discrepancies, transport-related deterioration, loss of clinical information, and operational disruption [1-3]. International guidance emphasizes proactive planning, structured command, patient tracking, standardized communication, and staff preparedness [4-9], while high reliability organization (HRO) principles and failure mode and effects analysis (FMEA) provide a framework for proactive risk management [10-16]. However, the integration of FMEA into operational command during a large-scale wartime hospital relocation has rarely been described.

During Operation Roaring Lion, Carmel Medical Center relocated approximately half of its inpatient activity to the underground protected hospital at Rambam Health Care Campus, where it continued to operate as an autonomous hospital with independent clinical and managerial responsibility.

Between 28 February and 23 April 2026, the underground facility operated continuously for 55 days, providing care for 843 patients, including mechanically ventilated and critically ill patients, and individuals requiring multidrug-resistant organism (MDRO) precautions. Returning these patients safely required preserving three interdependent dimensions of healthcare quality: clinical safety, information continuity, and infection prevention.

A distinctive feature of this operation was a multidisciplinary leadership model in which the Quality and Patient Safety Division coordinated proactive risk management together with nurse administration, the Infection Prevention Unit, departmental leadership, operational support services, and frontline teams. Using prospective FMEA, the leadership teams identified potential hazards before relocation and implemented targeted mitigation strategies.

In this study, we describe the implementation of this multidisciplinary operational model and discuss the contribution of proactive FMEA to safe patient relocation during wartime [Figure 1].

PATIENTS AND METHODS

STUDY DESIGN AND SETTING

We conducted a prospective quality improvement study using healthcare FMEA to support patient relocation following Operation Roaring Lion. In total, 84 patients were relocated from the underground facility to Carmel Medical Center.

OPERATIONAL LEADERSHIP MODEL

Operational leadership was delivered through a multidisciplinary command structure integrating the quality and patient safety division, nursing administration, the infection prevention unit, departmental medical and nursing leadership, operational support services, and hospital executive leadership [Table 1]. Responsibilities included operational coordination, patient flow, emergency preparedness, infection prevention, and safety oversight.

FAILURE MODE AND EFFECTS ANALYSIS

Before relocation, a multidisciplinary team conducted a prospective FMEA of the relocation pathway. The process was divided into four sequential phases: preparation, discharge from the underground facility, transportation, and admission to Carmel Medical Center. Potential failure modes were identified through process mapping and multidisciplinary discussion. The team prioritized failure modes using standard FMEA scoring based on severity, occurrence, and detectability [11,12].

INTERVENTIONS

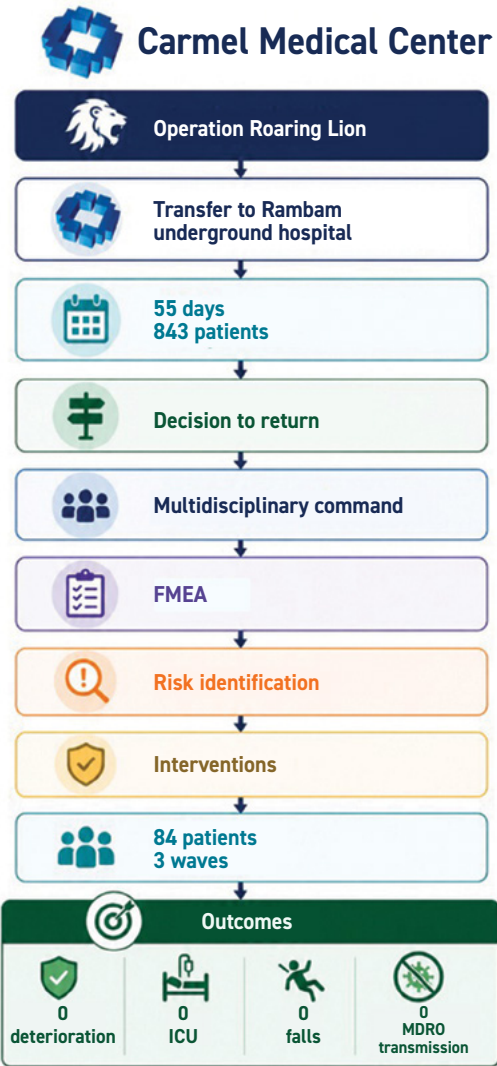
Based on FMEA findings, targeted interventions addressed three safety domains: clinical safety, information continuity, and infection prevention [Figure 2].

EVALUATION

Evaluation included departmental feedback and predefined patient safety outcomes assessed during transfer and the first 24 hours after admission to Carmel Medical Center, while MDRO cross-transmission was monitored throughout hospitalization.

Figure 1. Operational timeline of the relocation process from deployment to the underground hospital to patient return to Carmel Medical Center.

FMEA = failure mode and effects analysis, ICU = intensive care unit, MDRO = multidrug-resistant organism.



RESULTS

During the 55-day deployment, 843 patients were hospitalized in the underground facility across seven inpatient departments. A total of 84 patients were relocated back to Carmel Medical Center in three operational waves using approximately 30 ambulances performing multiple transfer cycles. The transferred cohort included six mechanically ventilated patients and ten patients infected by MDROs requiring transmission-based precautions.

Table 1. Multidisciplinary operational leadership model used during deployment in the underground hospital and patient relocation

Leadership level	Primary stakeholders	Core responsibilities	Role during relocation
Strategic leadership	Carmel executive leadership	Strategic oversight and executive decisions	Provided continuous oversight and strategic guidance throughout deployment and return
Operational command	Quality and patient safety division, nursing administration	Operational coordination, communication, risk management	Coordinated daily operations, patient transfers, emergency response, and safety monitoring
Clinical governance	Infection prevention unit	Infection prevention and MDRO control	Supervised infection control, isolation measures, and MDRO prevention
Departmental leadership	Department directors; head nurses	Unit implementation and clinical coordination	Led relocation activities and coordinated staff within each department
Operational support	Administration, logistics, transportation, technical services	Resource and logistics management	Ensured transportation, equipment availability, and operational continuity
Frontline teams	Physicians, nurses, allied health professionals	Direct patient care and protocol implementation	Delivered safe bedside care and executed relocation procedures

MDRO = multidrug-resistant organism

Figure 2. Three complementary safety domains addressed during patient relocation.

MDRO = multidrug-resistant organism, PPE = personal protective equipment

The three dimensions of safety in patient relocation

A holistic approach to ensure safe patient transfer through every step of the journey



FMEA FINDINGS

A multidisciplinary FMEA process was conducted through five structured workshops involving clinical, nursing, infection prevention, quality, logistics, and operational leadership. FMEA identified 36 potential failure modes, with communication and information transfer representing the highest-priority domain [Table 2]. Findings guided implementation of targeted mitigation strategies.

CLINICAL AND SAFETY OUTCOMES

Relocation was completed without transfer-related deterioration, resuscitation events, ICU admissions, falls, or MDRO transmission. Department leaders reported high organizational preparedness and preserved continuity of care.

DISCUSSION

In this study, we described a unique wartime model of multidisciplinary operational leadership in which the Quality and Patient Safety Division coordinated proactive risk management with the nursing administration, the infection prevention unit, operational support services, departmental leadership, and frontline multidisciplinary teams. Rather than functioning within separate organizational domains, these groups operated as an integrated command structure responsible for operational coordination, patient safety, infection prevention, and continuity of care during a complex hospital relocation.

Although FMEA has been widely applied to improve individual clinical processes, its use as a real-time operational management tool during large-scale wartime hospital relo-

Table 2. High-priority failure modes identified through the FMEA process, along with corresponding mitigation strategies for patient relocation from the underground facility to Carmel Medical Center

Process step	Subprocess	Potential failure mode	Existing controls	S	O	D	RPN	Recommended actions
1. Preparation for transfer	Workforce	Insufficient staffing for unit preparation and relocation day (need for parallel teams)	Routine staffing model	9	6	6	324	Develop a dedicated relocation staffing plan; reinforce nursing, medical, and support staff; implement parallel shifts; separate preparation and receiving teams; appoint an incident manager
	Prioritization	Inadequate patient prioritization according to clinical risk	Staff experience	9	6	6	324	Prioritize patients into transfer waves based on clinical risk (high, medium, low), unit readiness, and hospital operational needs
2. Patient discharge from underground facility	Medical Record	Incomplete or unsigned electronic medical record unavailable to receiving teams	Structured EMR report	9	6	7	378	Require physician digital signature before transfer; prepare pre-transfer checklist including record completion; administrative verification; electronic alerts for unsigned records; train staff
	Medications	Omission of critical medications	Partial discharge summary	9	6	7	378	Perform structured medication reconciliation before transfer
	Clinical Status	Unclear resuscitation status	Local practice	10	5	7	350	Require mandatory documentation of resuscitation status and define escort level according to patient risk
3. Transportation	Communication	No direct clinical handoff between teams	Written documentation only	8	7	8	448	Standardize risk-based handoff levels; require verbal handoff with read-back confirmation
	Real-time Monitoring	Lack of real-time tracking of transfer status	Partial telephone updates	8	6	7	336	Establish a command center with a real-time dashboard (departed/in transit/arrived); mandatory reporting checkpoints; dedicated transfer coordinator; structured digital communication tools
4. Admission at Carmel	Clinical Handoff	No direct nurse-to-nurse and physician-to-physician handoff	Written documentation only	8	7	8	448	Standardize risk-based handoff levels; require verbal handoff with read-back confirmation
	Medication Continuity	Medication discrepancies (e.g., interruption of antibiotic therapy)	Discharge summary	9	6	7	378	Complete medication reconciliation within 1 hour of admission
	Patient Monitoring	Monitoring not aligned with patient risk level	Routine monitoring	10	5	6	300	Define monitoring level on admission; implement a high-risk patient protocol; increase monitoring frequency; communicate risk level using a standardized format

S = severity, O = occurrence, D = detectability, EMR = electronic medical records, FMEA = failure mode and effects analysis, RPN = risk priority number

cation has rarely been described [11-16]. In our experience, FMEA enabled prospective identification of critical vulnerabilities before patient movement, with communication and information transfer emerging as the highest-priority risks. Structured handoffs, transfer checklists, and mandatory completion of electronic documentation created multiple safeguards that minimized information loss during transitions between two independently functioning hospitals.

International guidance emphasizes centralized command, patient tracking, multidisciplinary collaboration, and staff preparedness as key elements of safe hospital

relocation [4-9]. Our findings extend these recommendations by demonstrating how proactive FMEA can be integrated into operational command within a multidisciplinary leadership model consistent with the HRO principle of deference to expertise [10]. Successful implementation ultimately depended on the engagement and resilience of departmental leadership, frontline teams, and operational support personnel.

Continuous involvement of infection prevention specialists was another key strength of the model, ensuring that infection prevention remained fully integrated in the

overall patient safety strategy and contributing to the absence of documented MDRO transmission.

The three complementary safety domains identified in this study, including clinical safety, information continuity, and infection prevention, were addressed through targeted interventions that preserved clinical stability as well as maintaining continuity of care and preventing MDRO transmission throughout relocation.

Our model may also support hospital relocations during disasters, infrastructure failures, and other complex health-care emergencies. Our findings suggest that successful relocation was achieved not through FMEA alone, but through the integration of proactive risk assessment, multidisciplinary operational leadership, standardized communication, and strong frontline engagement.

LIMITATIONS

In this report, we described the experience of a single medical center during a single wartime event, which limits generalizability. As a single-center quality improvement study without a comparison group, this report cannot determine the relative contribution of individual interventions within the multidisciplinary operational model to the observed outcomes. Objective clinical outcome measures were restricted to a short post-transfer window, and medication error data were unavailable. Safety events may have been underreported, and departmental feedback reflected perceptions rather than patient-reported outcomes or externally validated measures.

Nevertheless, the prospective application of FMEA and successful implementation of system-wide interventions under high-risk conditions provide valuable insights for future emergency preparedness and hospital relocation planning.

CONCLUSIONS

Integration of proactive FMEA into a multidisciplinary operational leadership model enabled safe relocation of a highly complex patient population during prolonged wartime conditions. This approach may provide a practical framework for managing clinical, informational, operational, and infection-related risks during future hospital relocations and other complex healthcare emergencies.

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