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Code Brown: A Review of Hospital-Acquired Malnutrition and Foodborne Outbreak Management in Emergency and Surgical Wards

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Abstract

Background: Within the high-stakes environment of acute care, two intersecting crises silently compromise patient safety and outcomes: hospital-acquired malnutrition (HAM) and healthcare-associated foodborne outbreaks. Patients in emergency and surgical wards are uniquely vulnerable, facing metabolic stress, increased nutritional demand, and exposure to pathogens via food and feeding practices. These dual threats are often managed in professional silos, leading to fragmented responses that fail to address their systemic interdependence.

Aim: This narrative review aims to synthesize evidence on the epidemiology, etiology, and interprofessional management of HAM and foodborne illness within emergency and surgical settings.

Methods: A comprehensive search of PubMed, CINAHL, Scopus, and Web of Science (2010-2024) was conducted.

Results: The review identifies a high prevalence of HAM upon admission and incidence during hospitalization, exacerbated by nil-by-mouth protocols, missed meals, and poor intake monitoring. Concurrently, outbreaks of pathogens like *Norovirus* and *Salmonella* are linked to hospital food systems. Key failures include disjointed communication between dietetic and infection control teams, inadequate nursing resources for feeding assistance, and management systems that prioritize cost and efficiency over nutritional safety and infection resilience.

Conclusion: HAM and foodborne outbreaks represent a "Code Brown" – a simultaneous metabolic and infectious emergency. Addressing them requires an integrated, hospital-wide strategy that repositions nutrition and food safety as inseparable components of clinical care, underpinned by interprofessional protocols, dedicated resources, and executive-level accountability.

Keywords: Hospital-Acquired Malnutrition, Foodborne Outbreaks, Clinical Nutrition, Healthcare Epidemiology, Interprofessional Management

Introduction

Hospitals are engineered for healing, yet within their walls, patients routinely face two pervasive, iatrogenic threats that undermine recovery: the insidious decline of nutritional status and the acute risk of infection from the very food meant to sustain them (Eglseer et al., 2020). These dual crises—hospital-acquired malnutrition (HAM) and healthcare-associated foodborne outbreaks—converge with particular ferocity in emergency departments (ED) and surgical wards. Here, patients present in catabolic states due to trauma, sepsis, or major surgery, their increased protein and energy needs colliding with systemic barriers to adequate intake: prolonged nil-by-mouth (NPO) orders, missed meals during procedures, and the logistical chaos of acute care (Bonetti et al., 2017). Simultaneously, the hospital food system, a complex logistical operation, can become a vector for pathogens like *Norovirus*, *Salmonella*, and *Listeria*, triggering outbreaks that disproportionately affect immunocompromised and surgically vulnerable patients (Galán-Relaño et al., 2023).

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Conceptualized as a "Code Brown"—a metaphor for a simultaneous metabolic and biological contamination emergency—this dual threat reveals critical fractures in healthcare systems. Nutrition and infection control are traditionally separate domains, governed by different departments (Food Services/Dietetics and Infection Prevention & Control), reported through different metrics, and addressed with isolated interventions (Barcus et al., 2021). This siloed approach is dangerously inadequate. Malnutrition suppresses immune function, increasing susceptibility to infection, while infectious gastroenteritis induces nausea, vomiting, and diarrhea, accelerating nutritional depletion and wound dehiscence (Bretscher et al., 2022). In surgical patients, this synergy can lead to devastating outcomes: increased postoperative complications, longer lengths of stay, higher readmission rates, and greater mortality (Weimann et al., 2021).

Therefore, a paradigm shift is urgently needed. The management of nutritional risk and foodborne infection risk must be integrated into a unified framework of patient safety, recognizing that safe food is not merely pathogen-free but also nutritionally adequate, palatable, and delivered in a manner that supports intake. This narrative review synthesizes the literature from 2010 to 2024 to investigate this dual crisis in emergency and surgical contexts. It will explore the epidemiology of HAM and foodborne outbreaks, dissect the contributory roles of food science, nursing practice, clinical medicine, and hospital management, and propose integrative strategies for prevention, surveillance, and response. By framing these issues as interconnected components of operational resilience, this review argues for their elevation to a core priority in hospital safety and quality agendas.

Methodology

A systematic search strategy was employed to identify relevant English-language literature published between January 2010 and December 2024. Electronic databases included PubMed, CINAHL, Scopus, and Web of Science. The search strategy combined terms from four key conceptual areas using Boolean operators: (1) Patient Condition & Context: ("hospital-acquired malnutrition" OR "disease-related malnutrition" OR "postoperative complications" OR "emergency service, hospital" OR "surgical wards"); (2) Infection Risk: ("foodborne diseases" OR "disease outbreaks" OR "cross infection" OR "norovirus" OR "infection control"); (3) Interventions & Systems: ("food service, hospital" OR "enteral nutrition" OR "nutritional support" OR "epidemiological monitoring" OR "quality indicators, health care"); (4) Professional Domains: ("nursing" OR "dietetics" OR "epidemiology" OR "hospital administration" OR "food science").

Inclusion criteria encompassed peer-reviewed original research, systematic and narrative reviews, outbreak reports, and clinical guidelines focusing on adult patients in acute care settings. Studies were required to address either nutritional care/inadequacy or foodborne infection within hospitals, with preference given to those exploring the intersection or systemic causes. Exclusion criteria comprised studies solely in community or long-term care settings, pediatric-only populations, and articles not available in full text.

Epidemiology of HAM and Foodborne Outbreaks in Acute Care

The prevalence of both HAM and healthcare-associated foodborne illness is substantial, representing a significant yet often under-recognized burden on healthcare systems and patient outcomes.

Hospital-Acquired Malnutrition (HAM)

Malnutrition is not merely a condition patients present with; it is frequently acquired or exacerbated during hospitalization. Epidemiological studies indicate that 20-50% of patients are malnourished upon admission, and a significant proportion of those who are well-nourished will experience nutritional decline during their stay, particularly in surgical and critical care areas (Kang et al., 2018). This decline is driven by a combination of increased metabolic demands (due to injury, infection, or surgery) and inadequate nutritional intake. In surgical pathways, prolonged preoperative fasting, despite modern guidelines recommending shorter periods, remains commonplace, depleting glycogen stores and inducing a catabolic state before the first incision (Morrell et al., 2021). Postoperatively, nausea, ileus, and pain further suppress intake. In the ED, extended wait times without nutritional provision, coupled with the acute catabolism of trauma or sepsis, can initiate a rapid downward spiral (Rinninella et al., 2018). The consequences are well-documented: malnourished surgical patients have at least a 2-3-fold increased risk of major complications, including surgical site infections (SSIs), pneumonia, and wound dehiscence (Weimann et al., 2021).

Healthcare-Associated Foodborne Outbreaks

Hospitals are high-risk settings for foodborne outbreaks due to the concentration of immunocompromised individuals and the scale of food production. Pathogens such as *Norovirus* (highly contagious and environmentally stable), *Salmonella*, and *Listeria monocytogenes* pose the greatest threats (Carrasco et al., 2012). Outbreaks often originate from contaminated food ingredients, inadequate temperature control, or infected food handlers. However, once introduced, transmission can be amplified via contaminated surfaces, shared utensils, and person-to-person contact among patients and staff. Surgical and emergency wards are particularly vulnerable during outbreaks. Surgical patients with SSIs or open wounds are at heightened risk for systemic infection, while EDs can become points of entry, introducing the pathogen into the hospital system (Levy et al., 2022). The impact extends beyond immediate morbidity, leading to ward closures,

cancelled surgeries, substantial financial costs, and reputational damage to the institution (Zenbaba et al., 2022).

The convergence of these epidemics is not coincidental but synergistic. A malnourished patient in the ED or on a surgical ward has impaired mucosal immunity and cellular defense mechanisms, making them more susceptible to gastrointestinal pathogens (Schuetz et al., 2021). Conversely, a patient struck by norovirus on postoperative day three will experience vomiting, diarrhea, and anorexia, nullifying any nutritional therapy and directly threatening anastomotic integrity and wound healing (Gressies et al., 2022). This creates a vicious cycle of deterioration that the current siloed systems are ill-equipped to break (Table 1).

Table 1: Synergistic Risks and Impacts of HAM and Foodborne Outbreaks in Emergency and Surgical Patients

Risk Factor / Outcome	Impact Related to HAM	Impact Related to Foodborne Outbreak	Combined/Synergistic Effect
Immune Function	Depressed cell-mediated immunity, impaired phagocytosis.	Direct pathogen challenge to gastrointestinal and systemic immunity.	Severely compounded risk of sepsis and opportunistic infection.
Wound Healing	Reduced collagen synthesis, impaired angiogenesis, and increased wound dehiscence risk.	N/A (Direct effect less clear).	Systemic stress and catabolism from infection further impair healing.
Postoperative Recovery	Increased fatigue, delayed mobilization, and longer length of stay.	Procedure cancellations, ward closures, isolation protocols limiting rehab.	Protracted recovery, functional decline, heightened risk of hospital-associated disability.
Clinical Management	Requires complex nutritional support (e.g., enteral/parenteral).	Requires infection control measures, antimicrobials, and fluid/electrolyte management.	Competes for nursing time and clinical resources; complex polypharmacy.
System Burden	Higher readmission rates and increased cost of care.	Outbreak investigation costs, lost revenue from closed beds, and reputational harm.	Major strain on hospital operational and financial resilience.

Interprofessional Roles and Systemic Vulnerabilities

The prevention and management of "Code Brown" scenarios depend on a tightly coordinated interprofessional system. Breakdowns in any link of this chain can precipitate or exacerbate a crisis.

Food Science and Food Service Management

This domain is the first line of defense and a potential point of failure. Responsibilities span food safety (HACCP protocols, temperature monitoring, handler hygiene) and the provision of therapeutic nutrition (texture-modified diets, fortified meals, allergen-free options) (Al-Akash et al., 2022; Rowell et al., 2013). Vulnerabilities include the use of outsourced catering with variable standards, inadequate training of staff on texture-modified diet safety (aspiration risk of thickened fluids), and menu cycles that fail to consider palatability for anorexic patients (Barker et al., 2011). During an outbreak, the failure to quickly trace ingredients, recall suspect batches, and switch to disposable service ware can amplify the spread.

Nursing

Nurses are the pivotal professionals for nutritional care and early outbreak detection. They are responsible for nutritional screening (with validated tools like the Malnutrition Screening Tool), assisting with feeding, monitoring intake, and managing enteral feeding systems (Tappenden et al., 2013). They are also the first to observe clusters of gastrointestinal symptoms. However, systemic understaffing and competing acute care priorities often relegate feeding assistance and detailed intake monitoring to the bottom of the task list (Lærum-Onsager et al., 2021). Without dedicated resources and protected time, nutritional care becomes an unreliably performed "extra," and early signs of an outbreak may be missed or attributed to individual patient conditions (Yinusa et al., 2021).

Emergency Medicine and Surgery

Physicians in these specialties control critical decisions: ordering diagnostic tests, prescribing diets (NPO, clear liquids, etc.), and initiating nutritional support (enteral/parenteral nutrition). Prolonged, unnecessary NPO orders for diagnostic tests or due to outdated traditions remain a major driver of HAM (Nelson & Ljungqvist, 2022). Furthermore, a lack of familiarity with the specifics of hospital food service (what a "soft diet" entails) can lead to orders that do not meet patient needs. During an outbreak, surgeons and emergency physicians must balance the need for urgent operative intervention with the risk of exposing other patients and staff, a complex challenge in infection control.

Epidemiology and Infection Prevention & Control (IPC)

Hospital epidemiologists and IPC teams are responsible for surveillance, detecting outbreaks, and conducting investigations. They analyze trends in laboratory reports of enteric pathogens and clusters of symptoms (White et al., 2022). A key vulnerability is the disconnect between IPC and clinical nutrition departments. An outbreak may be detected through lab reports, but its impact on the nutritional status of a whole ward may not be assessed, nor is nutritional support typically integrated into the outbreak response plan.

Hospital Management

Senior administrators and operations managers hold ultimate responsibility for creating a culture of safety and allocating resources (Silva et al., 2016). They negotiate food service contracts, set staffing levels, approve budgets for nutritional supplements and IPC measures, and establish organizational key performance indicators (KPIs) (Park et al., 2020). When financial pressures lead to cuts in food quality, dietary staff, or nursing positions, the risk for both HAM and outbreaks increase. Conversely, management can drive integration by making "reduction in HAM prevalence" and "zero foodborne outbreaks" explicit, funded, and measured strategic goals (Chawla et al., 2022).

Table 2: Integrated Strategies for Preventing and Managing "Code Brown" Scenarios

Strategic Domain	Prevention Focus	Outbreak Response & Mitigation Focus	Key Responsible Parties
System Protocols & Pathways	Implement mandatory nutritional screening within 24h of admission (ED & surgical); enforce Enhanced Recovery After Surgery (ERAS) protocols to minimize fasting.	Activate predefined outbreak response team with reps from IPC, Nursing, Food Service, Dietetics, and Communications.	Hospital Management, Clinical Leads (Surgery/ED), IPC.
Technology & Infrastructure	Use electronic health record (EHR) alerts for patients at high nutritional risk or on prolonged NPO; implement automated intake monitoring systems.	Use EHR for rapid symptom surveillance; employ electronic meal tracking for ingredient recall.	IT, Hospital Management, Food Service.
Education & Training	Interprofessional training on importance of nutrition, feeding assistance, and food safety. Training for food handlers on therapeutic diets.	Just-in-time training for staff on outbreak-specific isolation, hygiene, and communication protocols.	Nursing Education, Dietetics, IPC.
Service Delivery Model	Establish protected "mealtime assistance" roles (e.g., Nutrition Assistants). Implement room service/"food on demand" models to reduce waste and improve intake.	Switch to pre-packaged, disposable meals for affected wards. Institute dedicated staff cohorts for affected patients.	Hospital Management, Nursing, Food Service.
Quality Assurance & Metrics	Track and publicly report rates of HAM, meal intake adequacy, and compliance with screening.	Conduct root cause analyses of outbreaks that include nutritional impact assessment. Track time to outbreak control.	Quality & Safety Dept., Executive Leadership.

Towards an Integrated Management Framework

To effectively defuse the "Code Brown" threat, hospitals must adopt an integrated management framework that bridges the nutrition-infection divide. This requires action at cultural, procedural, and structural levels. First, culturally, nutrition and food safety must be reframed as inseparable, non-negotiable components of medical treatment, not hotel services. Executive leadership must champion this mindset, embedding it in institutional safety slogans and performance dashboards (Calderwood et al., 2023). Mortality and morbidity rounds should routinely examine cases for contributions from nutritional decline or iatrogenic infection.

Second, procedurally, integrated protocols are essential. Nutritional screening should be as routine as vital signs, with automatic dietitian referral for at-risk patients. ERAS protocols, which integrate preoperative carbohydrate loading and early postoperative feeding, should be standard for all elective surgeries (Ljungqvist et al., 2017). Concurrently, infection control protocols must explicitly address food service, mandating joint inspections by IPC and dietetics. Outbreak response plans must include a "nutritional continuity" clause, detailing how patients in isolation will receive adequate, safe nutritional support—whether through adjusted meal delivery, increased supplement provision, or expedited parenteral nutrition consultation (Yeung et al., 2021).

Third, structurally, investments must be made in human resources and technology. Protected roles for mealtime assistance, whether through dedicated aides or volunteer programs with proper

training, can ensure patients receive the help they need to eat (Bruno et al., 2021). Technologically, the EHR must be leveraged to connect data streams: linking diet orders to nursing flow sheets for intake monitoring, and integrating microbiology reports with patient location data for real-time outbreak mapping (Dewey-Mattia, 2018).

Finally, performance measurement must evolve. Hospitals should be accountable for tracking and reducing HAM rates (using tools like the Global Leadership Initiative on Malnutrition criteria) just as they are for SSI rates or hand hygiene compliance (Cederholm et al., 2019). Similarly, the frequency and severity of foodborne outbreaks should be a publicly reported quality indicator, driving continuous improvement in food safety systems (Barazzoni et al., 2022). Figure 1 illustrates the synergistic relationship between hospital-acquired malnutrition (HAM) and healthcare-associated foodborne outbreaks in emergency and surgical wards.

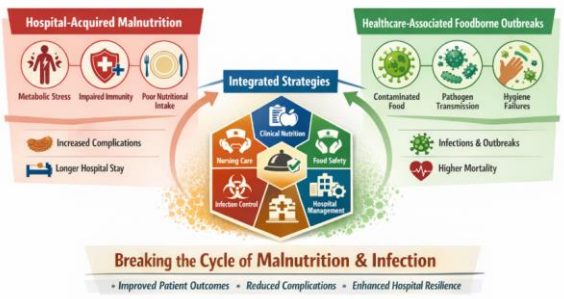

Figure 1. The "Code Brown" Integrated Framework for Patient Safety in Acute Care

Conclusion

The concurrent crises of hospital-acquired malnutrition and healthcare-associated foodborne outbreaks represent a critical failure in the fundamental duty of hospitals to "not harm." In the metabolically vulnerable populations of emergency and surgical wards, these are not separate issues but two sides of the same coin: a breakdown in the safe, effective delivery of fundamental sustenance. The "Code Brown" metaphor underscores the urgency of moving from siloed, reactive approaches to an integrated, proactive safety model.

This review has demonstrated that vulnerabilities in food science, nursing practice, clinical decision-making, and management oversight create a perfect storm for patient harm. The solution lies in deliberate integration—of goals, protocols, data, and accountability. By recognizing that nutritional care is infection prevention and that safe food is a medical intervention, hospitals can begin to build truly resilient systems. The path forward requires leadership, investment, and a collective commitment to ensuring that the hospital environment supports healing in its most holistic sense, protecting patients from both the silent epidemic of starvation and the acute threat of the contaminated plate. The cost of inaction is measured in prolonged suffering, compromised outcomes, and systemic inefficiency—a price that no healthcare system can afford to pay.

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