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Surge Capacity and Capability: Flexible Frameworks for Expanding Care Beyond the Hospital Walls

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Abstract

Background: Traditional hospital-centric surge capacity models are increasingly inadequate for modern mass-casualty events, pandemics, and infrastructure failures. These crises demand the rapid creation of clinical care capacity beyond fixed facilities, requiring a fundamental reimagining of healthcare delivery. **Aim:** This narrative review synthesizes evidence from 2010-2024 on innovative frameworks for expanding clinical care into alternative settings during surges, analyzing the integration of emergency management systems, paramedic scope expansion, and nursing leadership in non-traditional environments. **Methods:** A comprehensive search of PubMed, Scopus, CINAHL, and disaster medicine databases was conducted. Thematic analysis integrated literature from public health, emergency medical services, nursing science, and health policy. **Results:** Evidence identifies three key models: (1) Alternative Care Sites (ACS), including field hospitals and repurposed community venues; (2) Pre-hospital treat-in-place and community paramedicine to decompress emergency departments; and (3) Virtual care surge through telehealth. Successful implementation hinges on pre-event planning, legal/regulatory flexibilities, adaptable clinical protocols, and crucially, the defined roles of paramedics and nurses operating beyond their traditional settings. **Conclusion:** Effective surge response requires a paradigm shift from "beds inside hospitals" to "care anywhere." This demands integrated systems where emergency management provides the structure, nursing provides the clinical leadership, and paramedicine provides the mobile extension of care. Future resilience depends on investing in these flexible frameworks, standardized training, and policy reforms that enable healthcare to dynamically scale beyond institutional walls.

Keywords: surge capacity, alternative care sites, disaster nursing, community paramedicine, emergency management

Introduction

The concept of healthcare surge capacity—a system's ability to expand beyond normal operations to meet increased demand—has traditionally been constrained by a fundamental architectural limitation: the physical hospital (Migliore et al., 2022). For decades, planning focused on internal elasticity: canceling elective surgeries, decompressing wards, erecting temporary walls in emergency departments, and hoping the crisis would subside before resources were exhausted (Steinlage et al., 2023). The COVID-19 pandemic served as a brutal, global stress test that exposed the catastrophic failure of this inward-looking model. Hospitals in Lombardy, Madrid, New York City, and beyond became overwhelmed, not merely by patient volume, but by the inability to separate highly infectious from non-infected patients, by shortages of personal protective equipment (PPE), and by the collapse of staff health (Carenzo et al., 2020; Ranney et al., 2020). Concurrently, emergency medical services (EMS) systems were paralyzed, with ambulances queuing for hours to offload patients, rendering them unavailable for community emergencies (Mell et al., 2017).

This experience underscored a critical truth: during large-scale or prolonged incidents, the hospital itself can become a casualty or a vector of disease.

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Surge capacity, therefore, must be redefined not as the maximum occupancy of a building, but as the system's capability to relocate and reconfigure care delivery across a geographic and operational spectrum. This demands flexible frameworks that move care outward—into parking lots, convention centers, hotels, schools, and patients' homes. This narrative review synthesizes the evolving evidence (2010-2024) on the models, implementation, and integration of care delivery systems designed to operate beyond traditional hospital walls during crises.

Moving beyond theoretical surge concepts, it analyzes the practical integration of three critical pillars: Emergency Management (providing the command structure, logistical backbone, and legal authority), Paramedicine (extending acute assessment and treat-in-place capabilities into the community), and Nursing (providing the clinical leadership and core patient care in unfamiliar environments). The central thesis is that resilience in modern health crises depends on pre-planned, interoperable systems that decouple clinical capability from fixed infrastructure, requiring unprecedented role adaptation and cross-disciplinary collaboration.

The Strategic Imperative to Move Beyond the Hospital

The drivers for extra-institutional surge are multifaceted and compounding. Pandemics create a dual demand: a surge of infectious patients requiring isolation and a simultaneous need to maintain care for non-infected chronic and acute patients to prevent collateral mortality (Emanuel et al., 2020). Mass casualty incidents (MCIs) from terrorism or natural disasters can produce casualty numbers that instantly overwhelm local emergency department capacity, necessitating immediate forward triage and holding areas (Arnold et al., 2023). Infrastructure failures, such as grid blackouts, cyberattacks on hospital systems, or water supply contamination, can render a hospital non-functional, requiring the rapid establishment of alternate sites (Saulnier et al., 2022). Furthermore, the crisis itself often restricts *access* to hospitals due to flooding, debris, security perimeters, or public fear (Effa & Otu, 2023).

The consequences of failing to expand externally are severe. They include increased morbidity and mortality from delayed care, healthcare worker burnout and infection, ethical crises in resource allocation, and the total collapse of community emergency response systems as ambulances are trapped in hospital queues (Polsky et al., 2017). Therefore, developing external surge capability is not an optional adjunct but a core component of health system resilience and a moral imperative for equitable crisis response (Li et al., 2023).

The Architecture of Expansion – Emergency Management and Alternative Care Sites (ACS)

Emergency management provides the essential scaffolding for extra-institutional care. An Alternative Care Site (ACS) is any location temporarily converted to provide healthcare services during a surge. The strategic activation and operation of ACSs represent the most tangible manifestation of external surge capacity.

Types and Tiers of ACS

ACS models exist on a spectrum of capability and complexity (see Table 1). Tier 1: Overrun Sites include hospital-adjacent facilities like parking lot tents or converted auditoriums, designed to handle low-acuity overflow (e.g., waiting patients, minor procedures). Tier 2: Community-Based ACS repurpose large, open spaces such as convention centers, sports arenas, or schools into field hospitals capable of providing intermediate care (e.g., oxygen therapy, monitoring, basic inpatient care for stable patients). The Javits Center in New York and the NHS Nightingale hospitals in the UK are prime examples (Jarrett et al., 2022). Tier 3: Non-Traditional Housing Sites, such as hotels or dormitories, are used for isolation, quarantine, or sub-acute recovery (monitoring patients discharged early from hospitals). Tier 4: Home-Based Care represents the most distributed model, leveraging telehealth and community paramedicine to manage patients in their residences (Cai et al., 2021; Honda et al., 2023).

The Emergency Management Role from Site Selection to Sustainment

The emergency manager’s role is systemic. It begins with pre-incident planning: identifying and pre-negotiating agreements for potential ACS venues, assessing utilities (power, water, oxygen, waste), and ensuring interoperable communications (Christensen et al., 2023). During activation, they establish Incident Command System (ICS) structure at the ACS, integrating it with the regional healthcare coalition. They manage logistics: sourcing beds, PPE, medical gases, pharmaceuticals, and food service. Crucially, they navigate the legal and regulatory morass, obtaining waivers for facility licensing, clinical scope of practice, and liability protection—often through state and federal emergency declarations (Newland et al., 2021). This administrative and logistical foundation is what allows clinical care to occur in a non-clinical space. Figure 1 illustrates the distributed healthcare surge ecosystem in which care is dynamically expanded beyond the hospital.

Table 1: Typology of Alternative Care Sites (ACS) for Surge Capacity

ACS Tier	Example Venues	Intended Patient Acuity & Function	Key Clinical Staffing Model	Primary Enabling Role of Emergency Management
Tier 1: Hospital-Adjacent Overflow	Parking lot tents, converted hospital cafeterias, nearby medical office buildings.	Low-acuity ED overflow; waiting areas; screening/triage; minor procedure space.	ED nurses, paramedics, technicians.	Rapid deployment of infrastructure (tents, utilities); traffic & security control.
Tier 2: Community-Based Field Hospital	Convention centers, sports arenas, school gymnasiums.	Intermediate-acuity inpatient care (e.g., stable COVID-19 pts on O2); step-down care; monitored recovery.	Mixed teams: inpatient nurses, respiratory therapists, paramedics, volunteer clinicians.	Complex site procurement & build-out; major logistics (O2 systems, pharmacy); integration into regional patient distribution system.
Tier 3: Non-Traditional Housing	Hotels, university dormitories.	Isolation/quarantine; sub-acute convalescence; post-hospital discharge monitoring.	Public health nurses, community paramedics, non-clinical support staff.	Contracting with private entities; establishing security & support services; managing isolation protocols.
Tier 4: Home-Based Care	Patient residences.	Management of stable acute illness (e.g., COVID-19); chronic disease monitoring; palliative care.	Telehealth providers, community paramedics, home health nurses.	Establishing telemedicine infrastructure; coordinating with EMS for home visits; addressing digital equity barriers.

Figure 1. Distributed Surge Care Ecosystem Beyond Hospital Walls

The Mobile Extension – Paramedicine and Treat-in-Place Models

Paramedicine represents the most agile component of the external surge system (Martin & O'Meara, 2020). By expanding the role of paramedics beyond emergency transport to the hospital, systems can create virtual capacity by preventing unnecessary ED visits and providing care in the community.

Community Paramedicine (CP) and Mobile Integrated Health (MIH)

These established models, where paramedics perform scheduled home visits for chronic disease management, post-discharge follow-up, and minor illness, become critical surge tools (Jensen et al., 2016). During the pandemic, CP programs were rapidly adapted to assess and monitor COVID-19 patients at home, checking oxygen saturation and symptoms, thereby preventing thousands of low-acuity ED visits (Gillespie et al., 2019). This "horizontal surge" decompresses the ED and preserves inpatient beds for the critically ill.

Treat-in-Place and Triage-to-Alternative-Destination

In disaster settings, paramedics can be empowered to provide definitive care on scene or transport patients directly to an ACS instead of an overwhelmed ED (Zhao et al., 2023). This requires protocolized clinical decision-making and robust online medical direction. For example, during an MCI, paramedics can categorize "walking wounded" and direct them to a designated ACS via bus or other means, reserving ambulances for critical patients (Cone & Koenig, 2005). During a pandemic, they can assess patients at home, initiate treatment, and leave them in place with a monitoring plan (Mackie et al., 2022).

Staffing the ACS

Paramedics also play a vital role *within* ACSs. Their skills in assessment, intravenous access, medication administration, and managing acute decompensation are invaluable in field hospital settings. They can work under the supervision of nurses or physicians, effectively extending the reach of a limited number of higher-level providers (Venkatraman et al., 2021). This role flexibility is a key force multiplier.

The Clinical Core – Nursing Leadership in Unconventional Care Environments

Nursing is the constant, the professional cohort that provides the continuous, hands-on care that defines an ACS as a healthcare facility rather than a shelter. Nursing leadership and adaptation are the single greatest determinants of ACS clinical quality and safety.

Nurses working in an ACS must operate under crisis standards of care (CSC), which are formally declared adjustments to healthcare practices made during catastrophic events due to scarce resources (Hick et al., 2020). This may involve altered nurse-to-patient ratios, simplified documentation, task-shifting (e.g., paramedics or nursing assistants performing roles typically reserved for RNs), and using unfamiliar equipment. Successful adaptation requires clear, pre-defined protocols, just-in-time training, and strong clinical leadership (Langan et al., 2017).

ACSs are often staffed by a heterogeneous mix of regular hospital staff, volunteers from other specialties (e.g., dentists, veterinarians), retired clinicians, and medical students. The experienced nurse becomes the essential team leader, educator, and standard-bearer (Bell et al., 2022). They are responsible for orienting volunteers to the unique environment, ensuring basic safety protocols are followed, and creating a culture of teamwork under extreme stress (Chiu et al., 2023).

Nurses in ACSs manage everything from medication administration without a fully integrated electronic health record to infection control in a cavernous space, to family communication without normal privacy (Scanlon et al., 2023). They are responsible for recognizing patient deterioration and activating transfer protocols to a higher level of care. Their clinical judgment, honed in traditional settings, must now be applied in an environment lacking the usual support systems, making their role exponentially more challenging and critical (Glette et al., 2023).

Integrating the Pillars into a Coherent System

The effectiveness of external surge frameworks depends entirely on the seamless integration of these three pillars before a crisis. Failures are often integration failures: paramedics arriving at an ACS with patients, only to find it unstaffed; nurses deployed without the medications or equipment they need; emergency managers procuring a site that clinicians deem unusable (see Table 2).

The cornerstone of integration is joint planning and exercises. Tabletop and functional exercises must involve all three disciplines, testing ACS activation protocols, patient flow from EMS to the ACS, and clinical management scenarios (Barbera & Macintyre, 2002). These exercises reveal gaps in communication, credentialing of volunteers, and supply chain interfaces.

Sustainable frameworks require policy action. This includes granting liability protections for clinicians working outside their normal settings under CSC; establishing uniform cross-state licensing recognition for volunteer health professionals (e.g., through the Nurse Licensure Compact and EMS compacts); and creating reimbursement mechanisms for care provided in ACSs and via treat-in-place models, which are often unfunded mandates in a crisis (Jester et al., 2018).

Integration requires interoperable communications (radios that work between EMS, ACS, and hospitals) and basic health information exchange. Even simple, offline-capable patient tracking and documentation systems are vital for maintaining continuity and facilitating eventual data transfer (Sundararaman et al., 2021). Figure 2 depicts the integrated three-pillar model for surge capacity expansion: Emergency Management (command, logistics, and regulatory authority), Nursing Leadership (clinical governance and continuous patient care), and Paramedicine (mobile assessment, treat-in-place, and alternative destination transport).

Table 2: Critical Challenges and Enablers for Beyond-the-Hospital Surge Systems

Domain	Critical Challenges	Essential Enablers & Solutions
Clinical Operations & Integration	Unfamiliar teams, lack of shared protocols, role confusion, inadequate patient transfer pathways to definitive care.	Pre-defined ACS clinical protocols; integrated training exercises; embedded ICS clinical leads; clear transfer agreements with hospitals.
Logistics & Supply Chain	Lack of medical gases (O2) at ACS, inadequate pharmaceutical supply, PPE shortages, equipment incompatibility.	Pre-positioned ACS "kits" or vendor-managed inventory contracts; state/national stockpile integration; standardized equipment lists.
Human Resources & Staffing	Burnout of core staff, credentialing and privileging of volunteers, lack of mental health support, liability fears.	Tiered volunteer registry systems (e.g., ESAR-VHP); just-in-time training packages; legislated liability protection

		under emergency declarations; mandatory behavioral health support.
Legal & Regulatory	Licensing barriers for out-of-state volunteers, scope-of-practice restrictions, ACS facility licensing, reimbursement denial.	Emergency waivers pre-authorized by governors; adoption of interstate licensure compacts; CMS waiver authority for reimbursement; model state legislation.
Communication & Data	Incompatible radio systems between agencies, lack of EHR access at ACS, poor situational awareness for command.	Interoperable communications plans (e.g., COWs); offline-capable patient tracking systems; designated liaison officers between ACS and EOC.

Figure 2. Three-Pillar Framework for Flexible Surge Capacity

Conclusion

The COVID-19 pandemic was not an anomaly but a prologue. Future crises—whether another pandemic, a climate-driven catastrophe, or a deliberate attack—will again test the limits of fixed healthcare infrastructure. Relying solely on hospitals to absorb surge is a strategic vulnerability. This review demonstrates that a resilient health system is a distributed one, capable of dynamically relocating and reconfiguring care along a continuum from the home to the field hospital.

This capability is not built spontaneously. It requires intentional investment in the three-pillar framework: empowering emergency management with the authority and resources to stand up ACSs; formally integrating community paramedicine and treat-in-place authority into EMS systems' disaster plans; and preparing the nursing workforce through education and exercises to lead clinical care in austere environments. It demands policy reform to break down the legal and financial barriers that hamper rapid adaptation.

Ultimately, expanding care beyond the hospital walls is about more than managing patient volume; it is about preserving the core mission of healthcare during times of system-wide failure. It is about maintaining access, equity, and dignity when traditional structures are compromised. By building these flexible, integrated frameworks, we move from a paradigm of brittle capacity to one of resilient capability—ensuring that care can find the patient, wherever they are.

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