

Site Selection of Field Hospitals During Emergencies

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Executive Summary

Field Hospitals have been used successfully during different civilian scenarios including response to natural hazards (e.g., earthquakes, typhoons), man-made disasters, infectious disease outbreaks, war/conflict zones and in support of health and medical needs of developing nations.

The experience of field hospitals during the COVID-19 pandemic demonstrates the value of early deployment of field hospitals during disaster management. However, while emergency preparedness is receiving more attention in urban planning studies, there is no urban planning framework for determining the criteria for locating field hospitals. Thus, this study provides a framework for defining site selection criteria and urban planning considerations for field hospitals during emergencies.

This study investigates site selection criteria through a descriptive systematic review. Initially, relevant papers were collected from three electronic databases (Scopus, Science Direct, and Google Scholar). The search string was designed broadly to cover a wide range of research topics that exist in both medical and urban planning studies. The first step involved identifying 32 studies. Articles that were published in peer-reviewed journals which provided site selection criteria for field hospitals were included. A brief evaluation of the title and abstract of each article revealed that four articles had no relevance to the study's objectives. They were primarily involved with the design principles, construction management and human resources management of field hospitals as well as the site selection of permanent hospitals. Next, in the full-text assessment stage, the author excluded four non-English articles and those that focused exclusively on fixed hospitals or specialized medical topics (five nonrelated papers). Finally, this process left 16 eligible articles for a comprehensive review in the EndNote database.

In the analysis phase, the material was extracted from the full texts of the included articles. This data included the authors' names, the year of publication, the geographical scope and site selection criteria. To create a comprehensive category for all the identified field hospital site selection criteria, the author applied "the urban system resilience to disasters framework". In the case of disasters, the urban system should be divided into four fundamental components that have a major impact on its resilience: buildings, open space, infrastructure, and community. Buildings are the physical skeleton of the urban system, which is united by open space and supported by infrastructure. Finally, the soul of the system, community (i.e., people and organizations) is key for urban resilience in preventing extreme events or disasters.

As a result, this research explains how each component of an urban system contributes to the success of the site selection and deployment of field hospitals during emergencies and consequently shapes the field hospital framework.

The field hospital framework consists of:

Infrastructure

- Transportation infrastructure (road availability, traffic congestion and traffic convenience)
- Technical infrastructure (access to water, power supplies and telecommunications, waste management and sewage, fire safety facilities and ventilation)

Building

- Key important facilities (proximity to existing permanent hospitals and medical universities)
 - Other buildings (converting public venues into field hospitals)

Open space

- Green/Open Space (large-scale central parks and large parking lots) • Undeveloped surface (site preparation requirements)

Community

- People (population density)
- Organization (contribution of stakeholders)

The systematic review of the field hospital site selection criteria with a focus on urban system resilience has resulted in five recommendations. Due to the scope and scale of this research paper, these recommendations are preliminary.

1. The process of field hospital site selection and deployment requires collaboration from all stakeholders such as municipalities, local governments, military, and health care organizations for decision-making, logistical and medical resource support, as well as the provision of infrastructure, material, physical space, and security.
2. Having a set of design and deployment principles prepared in advance for each scale/type of field hospital can be very valuable during the golden hours after an emergency. For example, municipalities can propose various standards concerning site selection of field hospitals for different emergency scenarios.
3. The use of field hospitals is not limited to emergency situations; they can also be beneficial during peacetime. Field hospitals are recommended as appropriate locations for mass gatherings, prevention programs (screening activities), as well as training and research activities in emergency and disaster preparedness (Rossodivita & Losapio, 2013).
4. During the site selection process, it is advisable to use geospatial information systems in order to reduce the time and errors associated with on-site assessments.
5. The experience of COVID-19 taught us the public buildings should not only be designed for their normal purposes but also meet the demands of emergencies. Therefore, with respect to converting public venues into field hospitals, future urban planning and emergency preparedness plans should include:
 - a. a digital inventory of existing public venues that are suitable for converting into field hospitals in case of emergency
 - b. details explaining requirements and procedures for renovation of those public venues
 - c. guidelines for architectural design and construction plans to consider the possibility of converting large public venues from the very initial stage of development process.

It is recommended that the criteria outlined in this paper be used as a checklist by owners and designers of new public venues to ensure that they may serve as field hospitals, if necessary, either immediately or after a limited upgrade.

Several future research directions are identified based on the present research. First, further studies should focus on hazard-specific scenarios, such as floods, earthquakes, and terrorism, to offer specific criteria for the site selection of field hospitals according to different scenarios in order to improve emergency response efficiency.

Second, future studies should focus more on vulnerable populations and neighbourhoods with limited resources in the process of field hospital site selection during emergencies to ensure equity-oriented health care.

Finally, as a practical approach, the next phase of this research can utilize Multi-Criteria Decision Analysis (MCDA) and Geographical Information Systems (GIS) together to determine the optimum sites for field hospitals in specific urban areas. Finding the optimal location will depend

on the criteria outlined in this study. The GIS-based MCDA method will translate all these qualitatively determined criteria into a quantitative analysis, which will make the results more tangible. Data from both spatial and non spatial sources are combined to produce visualized information (maps) that decision makers can understand and use to arrive at very accurate solutions. However, GIS-based MCDA decisions should be made using reliable data since any inaccurate information can affect the outcome.