SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

This study sought to identify design strategies related to flexibility and adaptability from international examples that would assist Health Infrastructure New South Whales (NSW), a major Australian state health department, in the design and development of healthcare infrastructure that is cost-effective and can accommodate future change ("future-proofing").

Flexibility: Beyond the Buzzword-Practical Findings from a Systematic Literature Review

Carthey, J., Chow, V., Jung, Y-M., Mills, S.
2011 | Health Environments Research & Design Journal
Volume 4, Issue 4, Pages 89-108

Key Concepts/Context

While many healthcare facilities claim to have incorporated flexibility and adaptability into their new design, few have documented the outcomes of such claims. In reality, many healthcare facilities are outdated before they are built and fully occupied. These facilities then require extensive renovation and replacement during their life cycle to respond to changing demands of demographics, technology, and care delivery models.

Methods

This study was conducted utilizing a systematic literature review. A three-part strategy covering (1) environment, (2) intervention, and (3) outcome was used to frame a comprehensive search of existing literature featuring international case studies that used different approaches to designing flexible and adaptable healthcare facilities. First, a range of electronic databases was searched for scholarly data. The databases included: MEDLINE, ICONDA, Avery Index, Architectural Periodicals, Royal Institute of British Architects [RIBA] Library, Scopus, Web of Science, and others. Next, books were searched within the topic areas of architecture, engineering, health, business, and science disciplines. The search was then expanded through Google and Google Scholar to include "grey literature" and cover a broader range of literature, such as trade magazines, conference papers, and technical reports from various sources. Following this initial search, a manual search was conducted of journals, books, trade magazines, conference proceedings, and reference lists. Finally, unstructured conversations via email and telephone were conducted with Australian and international research professionals familiar with these principles. Exclusion criteria were as follows: a non-healthcare focus, discussions without design implications, editorial and

DESIGN IMPLICATIONS

While this study found 11 possible strategies for increasing flexibility and adaptability within hospitals, it is important to note that local conditions can impact the success of each of these design strategies for any given project. Each new healthcare building project possesses a unique opportunity to approach the issue of flexibility and adaptability from a uniquely innovative perspective by utilizing these strategies alone or in combination to address specific organizational needs and requirements.

advertising pamphlets, non-English writings, publish date prior to 1990, and non-similar cultures and practices to Australia. Other filters included: nationality, facility type, context, and research method. A total of 49 articles from 357 potential sources were identified. From those, 19 distinct case studies were further analyzed. Of those distinct cases, 48 percent of the cases represented U.S. hospitals, 18 percent referenced facilities in the United Kingdom, and seven percent were conducted in Norway.

Analysis of the literature review began with the identification, definition, and use of the terms "flexibility" and "adaptability" within each study. These definitions were summarized, and the literature was then analyzed to assess how well each case study addressed flexibility within the scope of the individual project requirements. Finally, each project was assessed on its projected ability to respond to change over time in relation to the scope of the implemented design-related strategies surrounding flexibility. A list of practical strategies for future-proofing new healthcare facilities was then developed.

Findings

Study findings revealed varied and, at times, conflicting definitions. This showed the abstract nature of flexibility and adaptability and its intangible impact on proposed designs. The research revealed that flexibility and adaptability were more easily defined within the context of actual design and options for future use of healthcare buildings. The literature also pointed to the decreased time it takes for a facility to become obsolete due to rapid changes in the rate of knowledge and information development. Discussions regarding scenario planning, life cycle cost analysis, and the categorization of different building components in terms of functional service life periods were found as topics that would assist in developing design strategies to improve long-term flexibility.

From the 19 cases identified in the literature, 11 strategies demonstrating possible approaches to achieving flexibility and adaptability within different project phases were identified. Acuity-adaptable, or universal, rooms represent one strategy for achieving flexibility within the patient room. Within each of these rooms, the equipment and medication needed to treat the majority of treatments and procedures are placed. These rooms are generally larger than typical rooms and easier to construct due to the identical nature of the rooms within the scheme of the whole facility. They have also shown reductions in medication errors and patient falls. However, they have resulted in greater distances for nurses to travel.

Another design strategy for increased flexibility is the provision of surplus capacity. In the areas of technology, electrical, and support services, planning ahead for growth during the design and construction phase can save on costly renovation and retrofit expenses as a building grows in capacity and services.

Modular layouts are another strategy that can assist in allowing space to change to accommodate new services and activities. Modular layouts use a uniform grid and a system of core distribution that can be incrementally divided on an "as needed" basis.

Interstitial floors are a design strategy that increases access to mechanical and electrical services by inserting a mechanical floor between two primary floors. This increases flexibility by reducing disruption during necessary service upgrades and increasing flexibility of floor plans.

Operational flexibility can be achieved through zoning and decentralization. A zone approach utilizes each floor or level to accommodate a specific function; circulation, such as stairs, elevators, and other service amenities, is centralized on each floor. This allows specialty departments to easily adjust to growth needs by relocating or expanding within the same floor. Decentralization of nursing stations can also increase flexibility in operational and staffing needs.

A design strategy to increase flexibility for future growth is open-ended corridors. Open-ended corridors allow for potential expansion of the facility with minimal disruption to the existing facility. In some cases, they can also increase sunlight in corridors and expanded views.

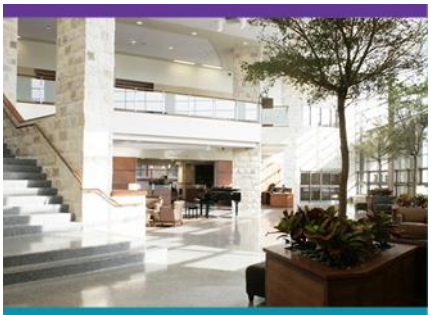
Discrete building systems, offer a "plug and play" approach to the design of healthcare facilities. By separating the building structure into distinct systems, the individual systems can be treated with parameters such as expected lifespan, potential use, and expansion needs that will not interfere with other systems.

Another design strategy increases flexibility through the use of soft spaces and hot spots. Hot spots, which house core programs that are difficult to relocate, are placed next to multiple soft spaces that can change as necessary.

Site master planning can increase flexibility by purposely leaving an area open within the building site for future needs. As the medical facility ages and needs updating, construction of a new area can take place with minimal disruption to the existing facility. Once the new addition is constructed, the other areas of the medical facility can be updated or retrofitted to serve other purposes.

Site conversion happens when a hospital reaches end of life. If mechanical and electrical systems have been adequately placed within the initial design, converting the hospital into commercial office space or apartments can become a very cost-effective strategy for repurposing an outdated medical facility.

Increased flexibility can also come through land purchase options that allow for organizations to take more of a "hospital on demand" approach. This approach allows a hospital to build a smaller main hospital and then add ancillary buildings around the main hospital as needed, making the initial investment more approachable.



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Limitations

Although this study was able to identify design-related strategies for increased flexibility and adaptability that have been used in the construction of new hospitals, one of the study limitations is that the efficacy of these strategies cannot be tested at the current time. To evaluate these strategies, the buildings represented in this study will need to be in operation for at least a decade or longer. Another limitation to this study was the lack of research published outside the United States and the United Kingdom. This limits the generalizability of the findings cross culturally.