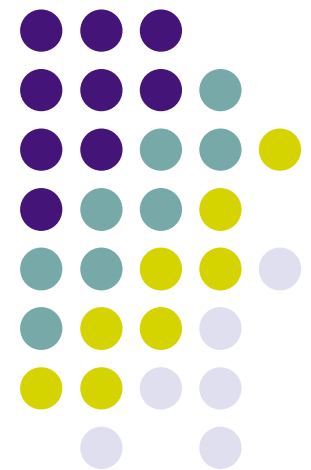


# Flexibility & Adaptability in Hospital Design & Construction

Investigating a design dilemma in  
the medical-surgical unit

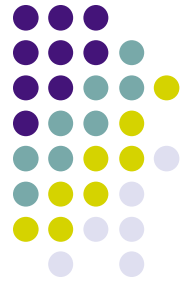


Lauren Thomas

8 November 2010

DEA 4530

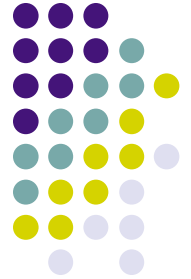
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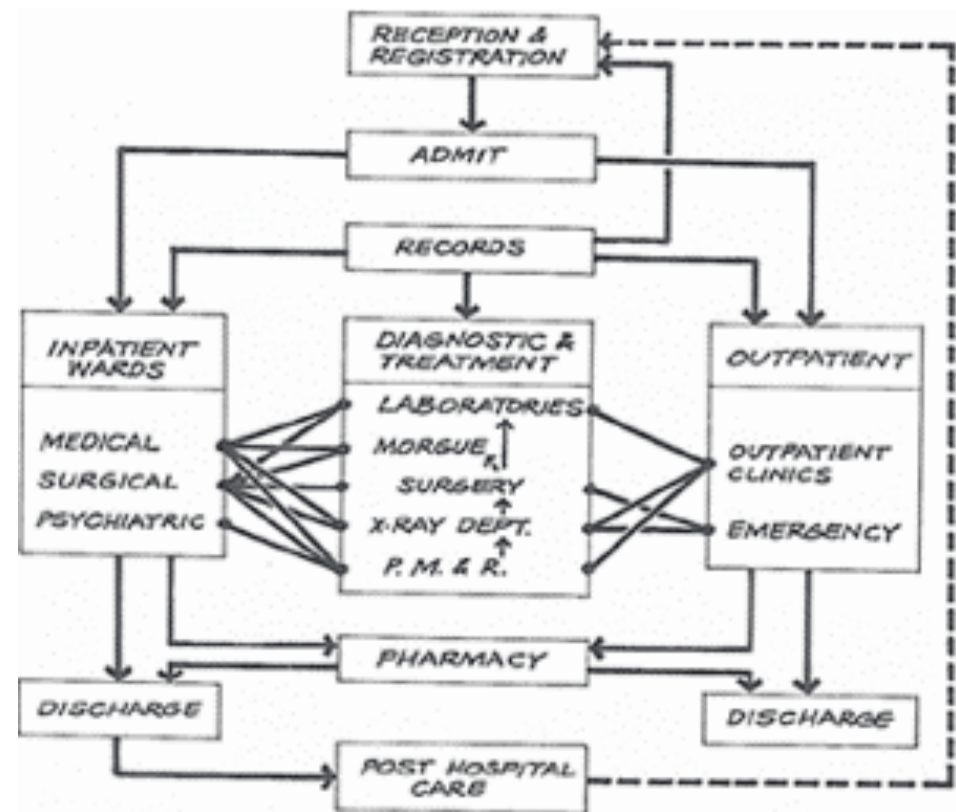
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# Executive Summary

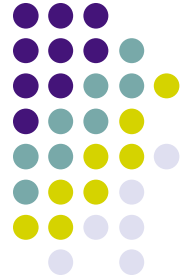


- Introduction

- Throughout the semester, the class has been introduced to the **complexity** of healthcare facilities and the systems and organizations that surround them, and the implications that this has for the planning and managing process. This has unfolded through a series of readings, lectures, presentations from visiting professionals of various backgrounds in healthcare, and a fieldtrip to SUNY Upstate Medical Center. With this knowledge and exposure as a starting point, students are now diving into some subsystem of healthcare in order to address a given design dilemma. **A design dilemma is a critical design decision for which there is no clear, obvious solution.**

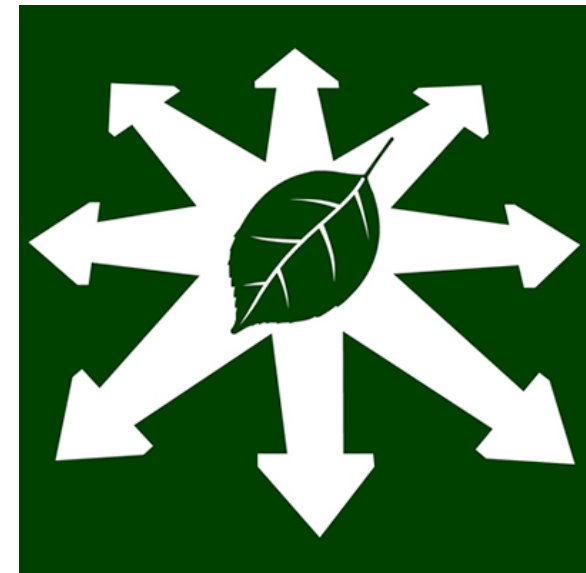


MAJOR CLINICAL RELATIONSHIPS

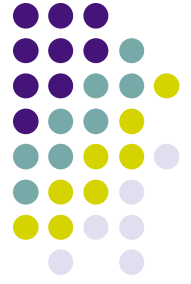


# Executive Summary

- Purpose
  - This report will examine issues related to **flexibility** in the hospital environment, including short-term and long-term flexibility to **adapt**, **convert**, and **expand**. It will address the problems and challenges that make flexibility increasingly more crucial to healthcare design and planning. The report will review conventional solutions proposed by previous literature, and the impact these solutions have made on hospitals as a complex system. Final recommendations and potential expansions of conventional ideas will be made.



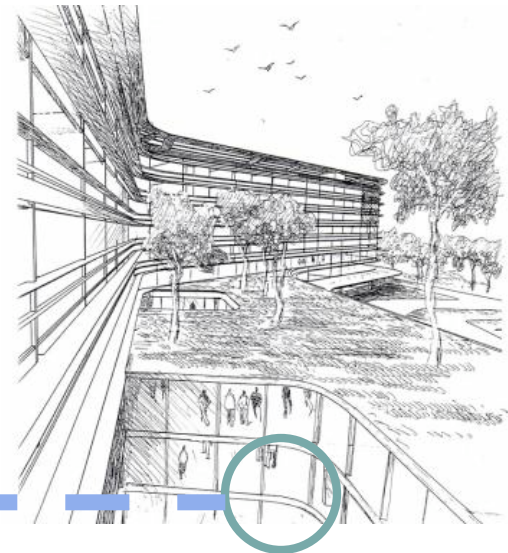
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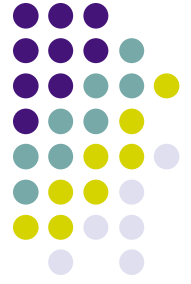


# Executive Summary

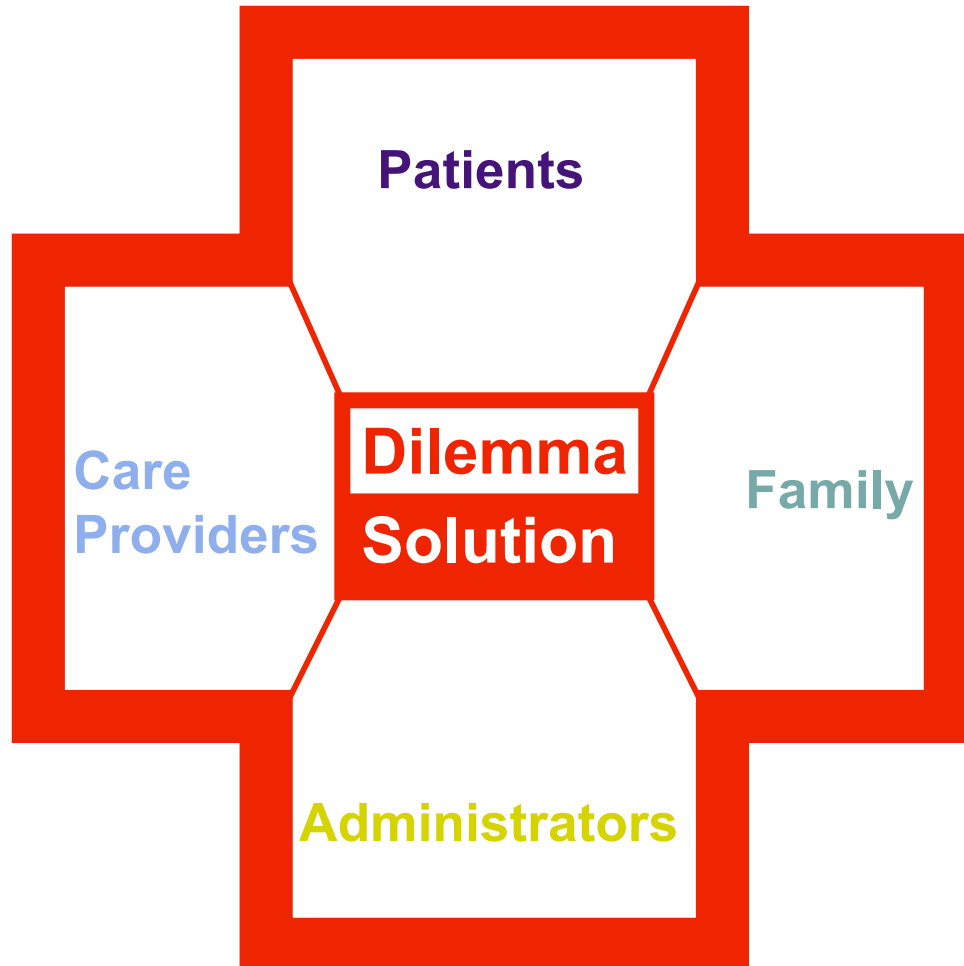
- Method

- For this report, I have done an extensive literature review to understand the definitions, implications, and solutions for flexibility and adaptability. I have examined **micro-level** flexibility in the medical surgical unit as well as **macro-level** expandability in the context of the entire hospital, with an emphasis on the former for the purposes of this assignment. Therefore, the design recommendations for a the medical surgical unit are based entirely out of a composite assessment of this research.

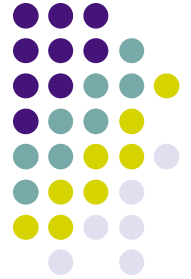




# Executive Summary

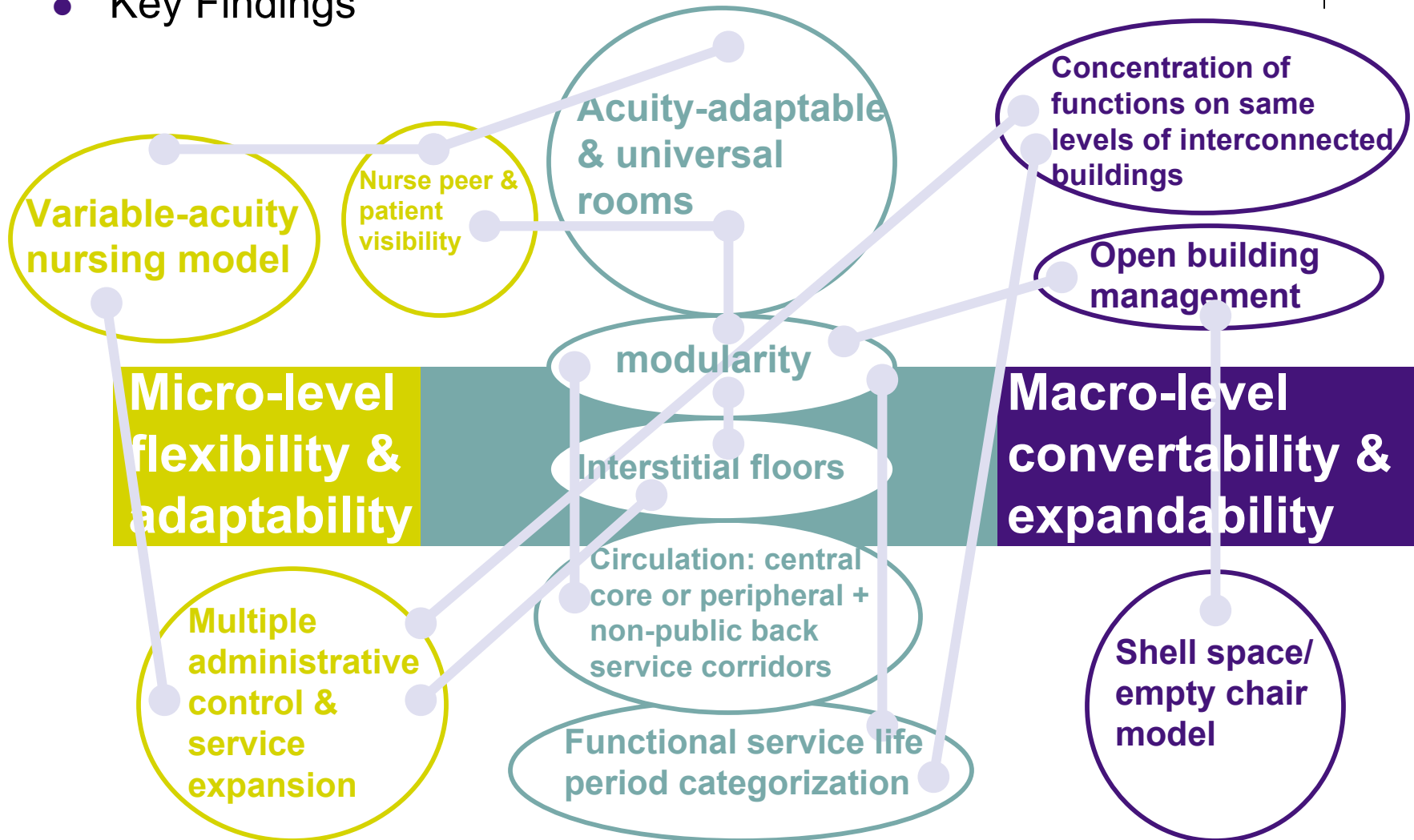


- **Method**
  - In interpreting research, it was necessary to keep in mind **four key stakeholders**
  - Theoretically, the interests of these individual stakeholders should not contradict one another, but this is a highly sensitive challenge to overcoming design dilemmas.
  - If the design is successful, stakeholder outcomes should, together, reflect the overall mission of the hospital.



# Executive Summary

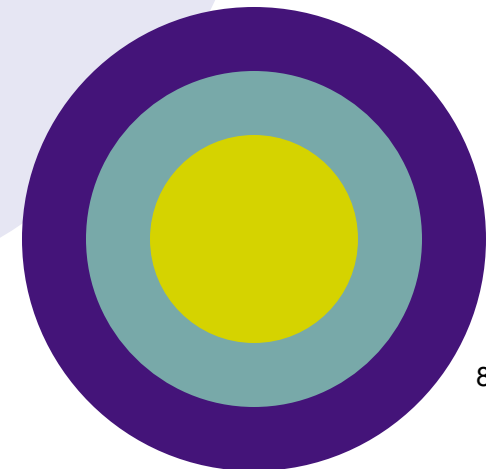
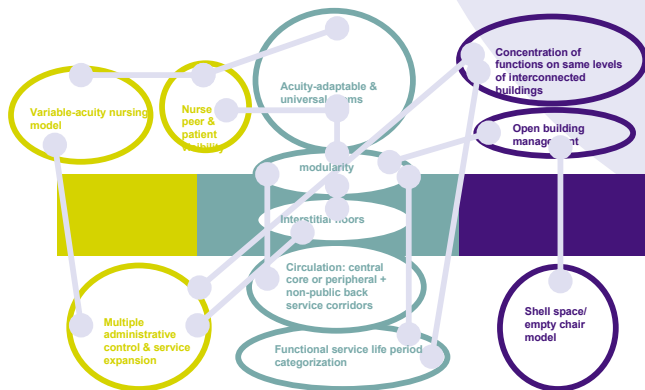
- Key Findings





# Executive Summary

- Implications for Innovative Design
  - In this case, most of the conventional solutions aim to **simplify and standardize** a highly complex system in a way that somehow does not limit healthcare's ability to care in the present as well as the uncertain future. Innovation is necessary in order to make this **synthesis** possible, and to make it impervious to obsolescence in the face of increasingly **rapid change** in healthcare.
  - How do we consolidate these solutions, at as many levels as possible, without compromising one system or another, without bringing stakeholders' interests into conflict? How do we achieve unity in the hospital environment while simultaneously calibrating individual units to be **acuity-ready**, and also geared for newly emerging specialized services and capacity demands? How do we then make this **specialization** possible within a **flexible framework**? It is a process of **optimization**.



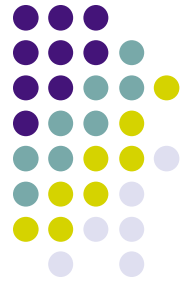




# Problems & Motivations

“Because the only  
certainty in healthcare is  
change”

Gressel & Hilands, 2008



# Problems & Motivations

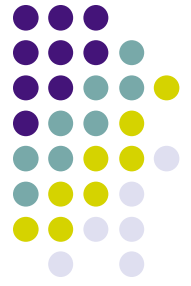
- Competition
  - A major reason for hospitals to invest in change is to make themselves **marketable**. They are not only competing with other hospitals, but with **physician groups**, “which are forming to build, own, and operate independent outpatient surgery or imaging centers [...] as alternatives to hospital-based services.” Competition is increasing “not only to attract patients, but also to recruit and retain physicians, nurses and other professional staff from a **shrinking pool of qualified health care professionals.**”

Gressel & Hilands, 2008



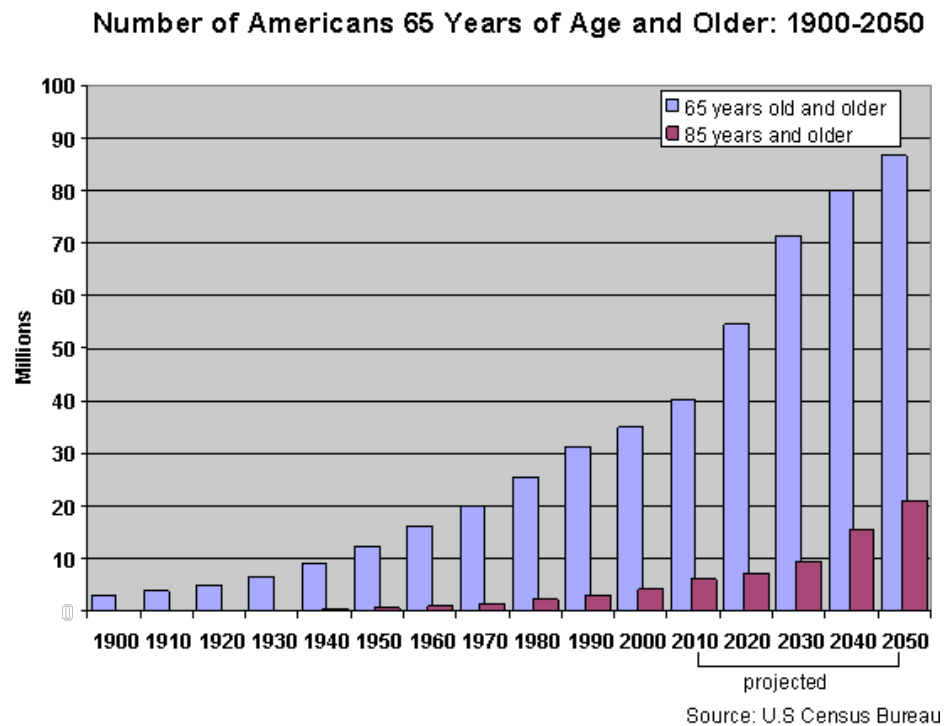
<http://www.reading.ac.uk/careers/postgrad/employerswant.asp>

# Problems & Motivations

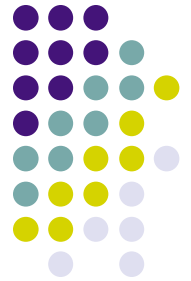


- Changing demographics
  - Especially influential is a large aging population
    - “Aging baby boomers [account] for two thirds of all dollars spent on healthcare. [W]ith differing expectations than generations past, baby boomers are demanding a holistic approach to care that focuses on psychosocial as well as medical needs.”

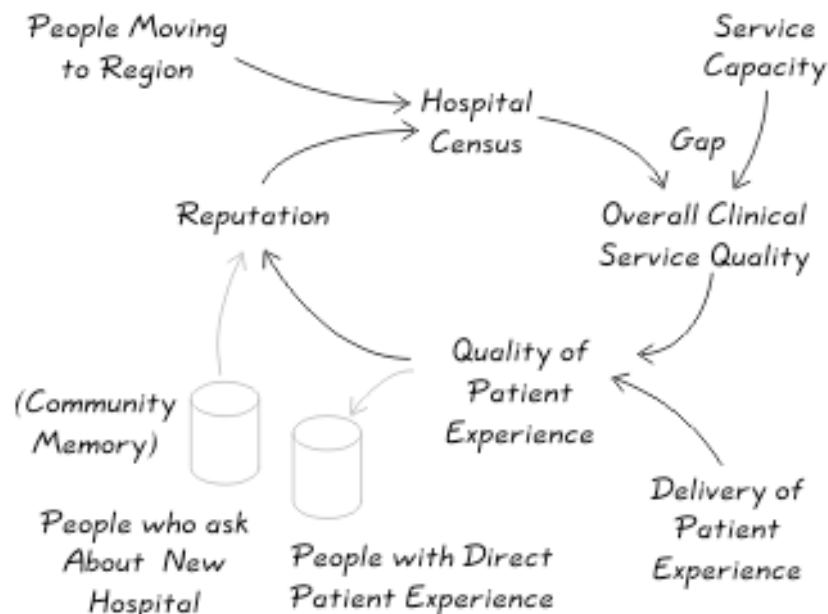
Brown & Gallant, 2006, p. 326



# Problems & Motivations



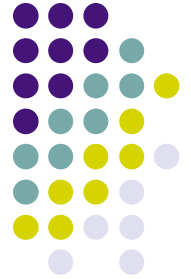
- **Shifts in demand:** quantity, quality, and type of care due to changing needs of clinicians, patients, and communities
  - Integration of healthcare treatment services related to specific types of disease, injury, or category of patient. Gressel & Hilands, 2008
  - **Specialized** facilities for:
    - Bariatrics
    - Heart disease
    - Orthopedics
    - Cancer
    - Women and children



“

Census estimates (total as well as in particular population groups) during hospital's planning and procurement changed considerably once the facilities were occupied. As a result, services experiencing larger demand are expanded in size, frequently spreading into adjoining units. [This leads to] unexpected pressure on available staff, [and] could affect the flexibility of unit management in optimizing staffing. ”

Pati et al, 2008, p. 222.



# Problems & Motivations

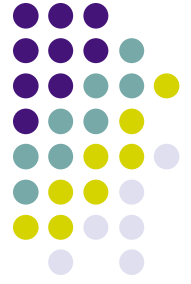
- **Shifts in demand:**
  - **Flux** from mostly inpatient to outpatient
    - Introduction of outpatient surgery and other support facilities previously only provided with inpatient care
  - Changes in healthcare delivery strategies, including diagnostic and treatment modalities Gressel & Hilands, 2008
  - Expectations for the provision of **healing environments**, not just basic medical care
  - Sustainability as a drive for efficient, flexible, and adaptable design



[http://www.e-architect.co.uk/england/james\\_cook\\_university\\_hospital.htm](http://www.e-architect.co.uk/england/james_cook_university_hospital.htm)



Nch.org

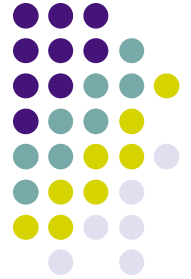


# Problems & Motivations

- Economic patterns
  - Cost of healthcare
  - Public & private sector health budgets
  - Different funding models
- Rapid introduction of increasingly sophisticated technologies
  - Increase in quality, cost, and demand of equipment
- Current and projected shortage in workforce capacity and capability

## The key challenge:

Future-proofing hospitals is complex because they are becoming functionally obsolete faster and faster.



# Definitions

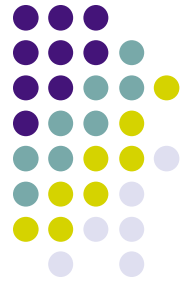
- Flexibility and adaptability are intertwined and interrelated in many ways, with many subcategories to consider in their implementation.
- Overall:

The provision of options for the future use of healthcare buildings, without the obligation to necessarily exercise those options. To design for flexibility and adaptability is to plan and implement an organized system whereby a health facility can fulfill its long term potential by being able to respond to the necessity of future changes of purpose or use.

Carthey et al., 2010, p. 108

”

“ The flexible facility accommodates changes of use of function, which result in the need to alter the building and its services physically or organizationally. Worthington, 2008



# Definitions

- **Convertibility + Expandability:** other potential criteria for a flexible & adaptable system

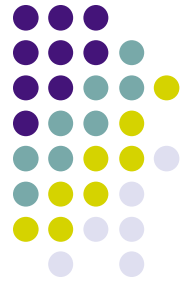
- This pertains to the long-term, macro level of flexibility or adaptability: flexibility to expand and convert
  - Requires site master planning that allows for future expansion with minimal construction (future-proofed construction of walls, ceilings, building services capacity)
  - The major challenge: uncertainty of conclusions with cost/benefit analysis when constructing space for future needs.

- **Efficiency** is required for flexible & adaptable design to be successful

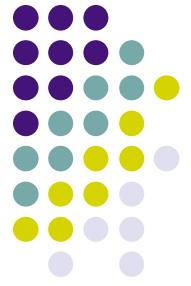
- At the same time, flexibility should not necessarily be limitless or open-ended. The planning process requires some forecast of demand and lifecycle cost analysis, even though this design dilemma is a response to uncertainty. What is “extra” at this stage should be what is ultimately necessary at another.



# Focus



- This report's focus is primarily on the smaller scale concept of flexibility to adapt within a medical-surgical inpatient unit rather than hospital facility-wide flexibility to expand or convert. Key components of this criteria are acuity adaptable care and universal patient rooms. However, it is important to understand the micro-level and macro-level implications for designing the flexible hospital, as the dilemma encompasses a complex network of goals and ideas that span all layers from furniture to structural shell. Just as the hospital is a system of services and stakeholders, the criteria for successfully implementing flexibility within the hospital environment is also a system. There is simply no single, isolated solution.

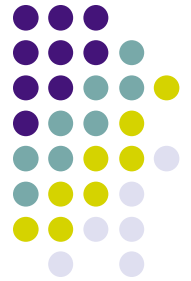


# Focus

## ● Why?

- “Study of this specific hospital component is important as it currently constitutes the vast majority of hospital expansion programs. Furthermore, adult medical-surgical units are the **most common inpatient units** across all hospital types—rural, suburban, and urban hospitals as well as in general hospitals and centers of excellence.” Pati et al., 2008, p. 209
- According to Pati’s study (2008), the assessment of the priorities and concerns of hospital stakeholders in terms of flexibility, most viewed it in purely operational terms. In general, most responses focus on being able to provide optimum service to the patients, or to the direct caregivers. p. 213
- Therefore, **securing micro-level flexibility is the most salient step in meeting the goals of various stakeholders. This is the level of flexibility that is of immediate concern.**

# Conventional Solutions: Micro level flexibility



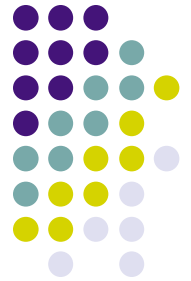
- Multifunctional facility design | flexibility to adapt
  - Universal & acuity adaptable patient rooms



Hendrich et al., 2004

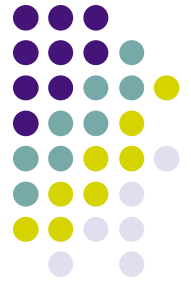
- Universal patient rooms accommodate a variety of patient types and an increasingly higher acuity mix of patients over its extended life, but does not specifically alter the current care practice and transfer of patients; Acuity adaptable patient rooms are intended to eliminate patient transfers by providing a comprehensive care combined staffing model where the flexibility is utilized real time, patient-to-patient. Brown & Gallant, 2006, p. 328.

# Conventional Solutions: Micro level flexibility

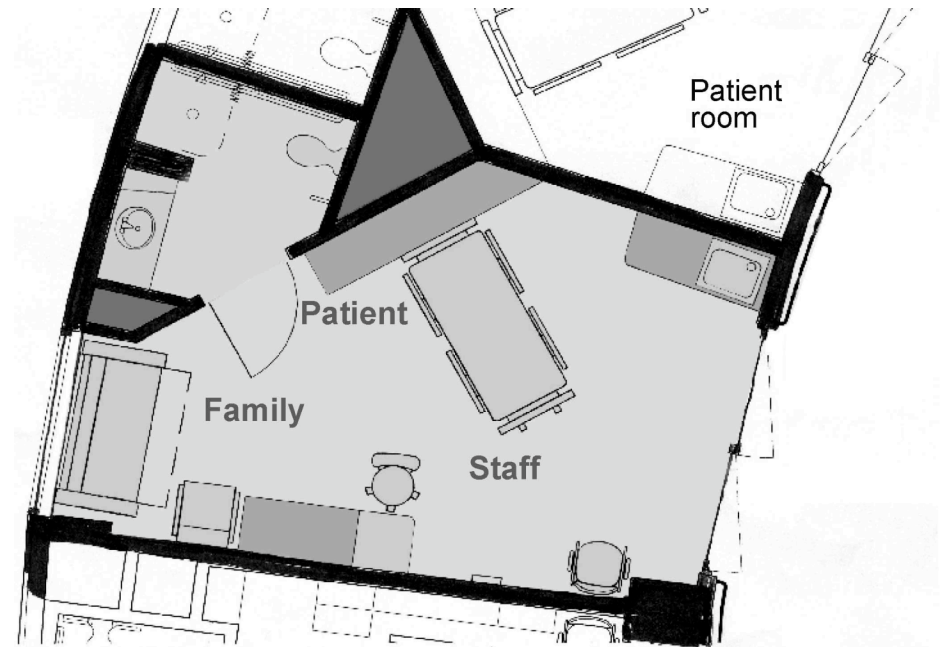


- Universal patient rooms
  - Modular furniture arrangements & storage capacity
    - “The size, shape and quantity of consumable goods, reprocessible items and portable medical equipment to be centrally held on a bed unit change on a regular basis. As a result, **support core space demands frequent modifications**”  
Pati et al., 2008, p. 226
    - Instead of built-in cabinetry, improve flexibility with **moveable compartments** or cart systems in utility rooms, equipment holding rooms, material holding areas of medication and nutrition. This also permits partition relocation by minimizing walls containing mechanical, electrical, and plumbing elements.  
Pati et al., 2008, p. 226

# Conventional Solutions: Micro level flexibility

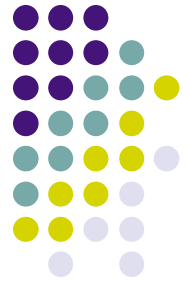


- Universal patient rooms
  - Standardized, same-handed rooms
    - **Standardization** of physical execution of tasks and location of materials
    - Constant entry point
    - “A standardized unit—where patient rooms as well as the support core are standardized—is a necessity before the physical design can significantly enhance the flexibility to move or relocate.” Pati et al., 2008, p. 221
    - “Standardization of patient care environments and equipment greatly decreases the cognitive load on the nurses, making routine tasks less likely to cause slips and lapses.” Carayon et al., 2003, p. 36
  - Large, standard rooms size
    - So that size & configuration serve all purposes from medical-surgical to labor & delivery to intensive care



Brown & Gallant, 2006

# Conventional Solutions: Micro level flexibility



- Variable-acuity nursing model and acuity adaptable rooms



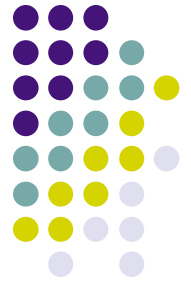
In an average hospitalization, a patient can be transferred **3 to 6** times to receive the level of care their acuity requires

Brown & Gallant, 2006, p. 337

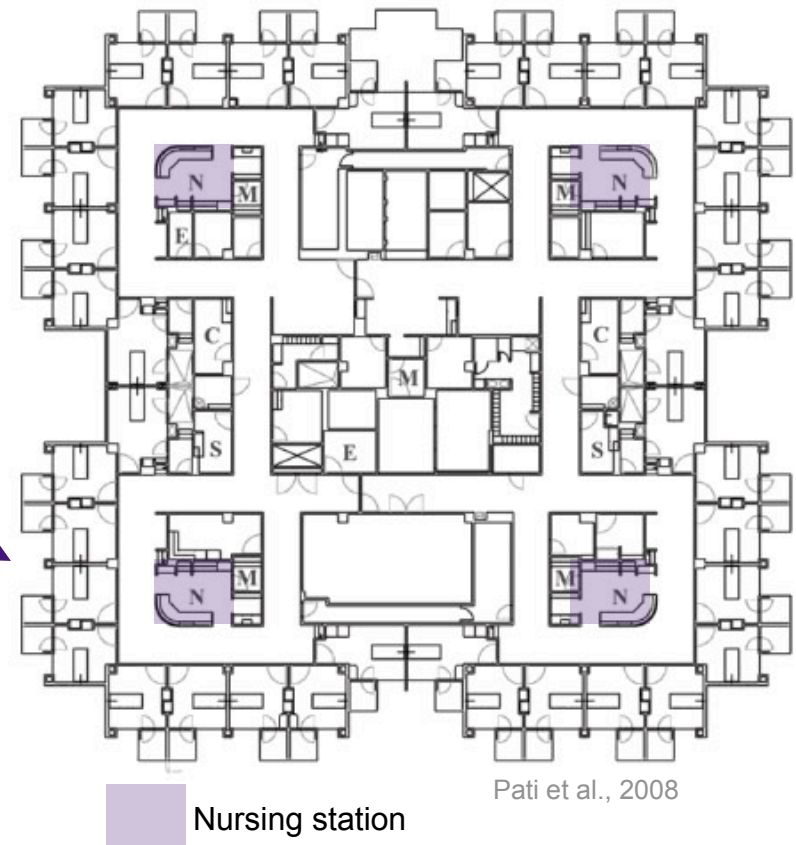
In a non-acuity adaptable unit, **40% to 70%** of patients are transferred or discharged daily.

Hendrich et al., 2004, p. 36

# Conventional Solutions: Micro level flexibility



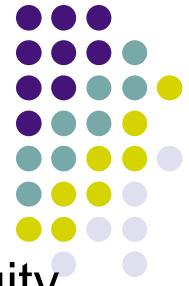
- Variable-acuity nursing model and acuity adaptable rooms
  - This is “nursing model of care designed to serve a patient population at all levels of acuity, from acute care to step-down to intensive care.” Pati et al., 2008, p. 206
  - “Utilizing this model of care delivery requires combining critical care staff with progressive or medical-surgical nursing staff to **eliminate hand-offs** and provide more **seamless comprehensive care practice**.” Brown & Gallant, 2006, p. 327
  - Generally implies a decentralized or **satellite** nursing station design
  - Requires **staff skill level mix** within each unit
    - Some hospitals recruit both ICU and telemetry nurses with the goal of cross-training all staff.
      - Pros: cost-effective; alleviates some of the issues caused by the shortage of trained ICU nurses and allows the hospital to hire from a larger pool of recruits. Brown & Gallant, 2006, p. 335
      - Cons: some telemetry nurses may not be comfortable in provided an intense level of care; extra attention must be paid to the proportion of ICU nurses vs. telemetry-trained nurses on a shift-by-shift basis. Brown & Gallant, 2006, p. 335



Pati et al., 2008



# Conventional Solutions: Micro level flexibility



(a)



(a) progressive and (b) critical care mode  
Brown & Gallant, 2006

- Variable-acuity nursing model and acuity adaptable rooms
- **Technology requirements:** 3 approaches to providing headwall solutions for acuity adaptable rooms that are critical care ready with redundant multigases, monitors, and dialysis equipment
  1. **Fully loaded ICU capacity:** the headwall is equipped with an ICU level complement of medical gases, electrical outlets, and communication and data ports. In addition, a wall-mounted patient monitor and other patient devices are incorporated into the headwall.
  2. **Flexible capacity, “plug-n-play”:** the headwall is equipped with a moderate complement of gas outlets, but can be increased through the use of flexible hose outlets that can be installed at another time. The patient monitor may be rolled in on a computer on wheels, and other medical devices can be added to accessory tracks.
  3. **Conceal and reveal:** similar to the concept used in labor, delivery, recovery, postpartum, the headwall is designed to conceal the outlets and devices behind sliding panels or bifold doors. When the patient requires advanced monitoring and intensive care services, the panels may remain open until the use of these services is discontinued.



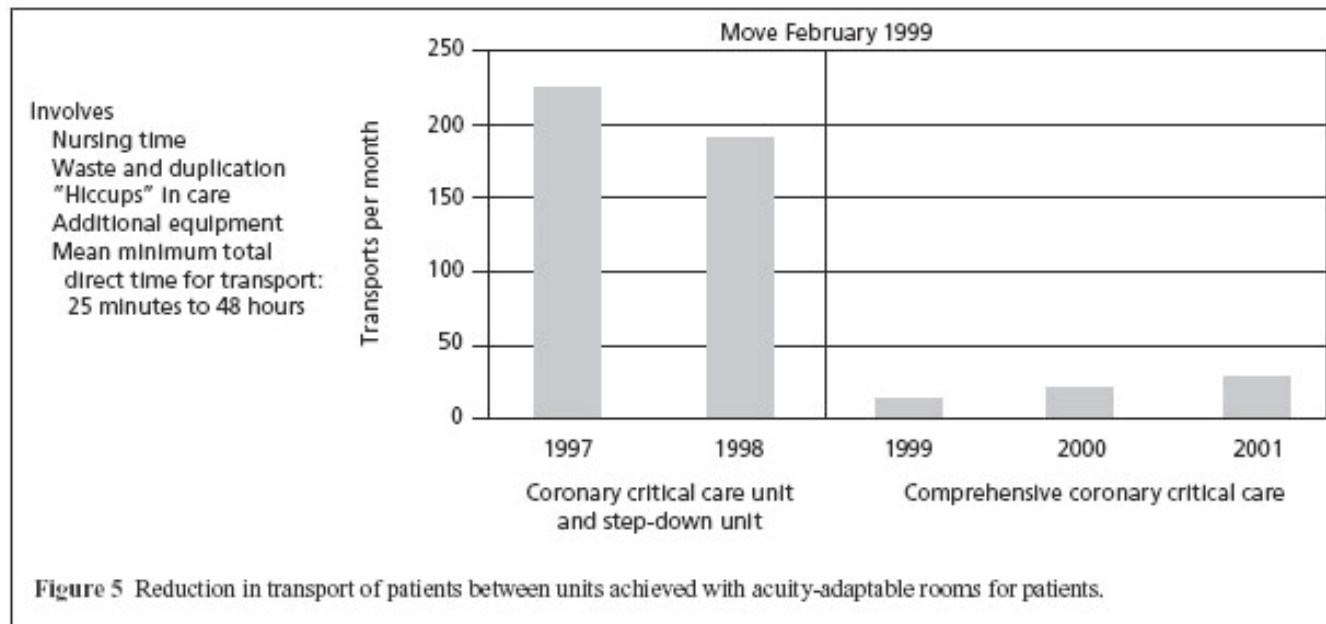
# Conventional Solutions: Micro level flexibility



- Variable-acuity nursing model and acuity adaptable rooms:  
**stakeholder outcomes**
  - Increase in **operational efficiency** and decreases in **cost**
    - “The transfer process adds cost to the patient’s hospitalization, considering the staff time involved as well as the duplication of certain amenities and missing medications (not to include the cost of lost patient articles and potential for staff injury)” Brown & Gallant, 2006, p. 335
    - Transfers cost between \$200 to \$300 in labor and equipment. Runy, 2004, p. 38

Graph illustrating a decrease in patient transfers due to integration of acuity adaptable rooms

Hendrich et al., 2004



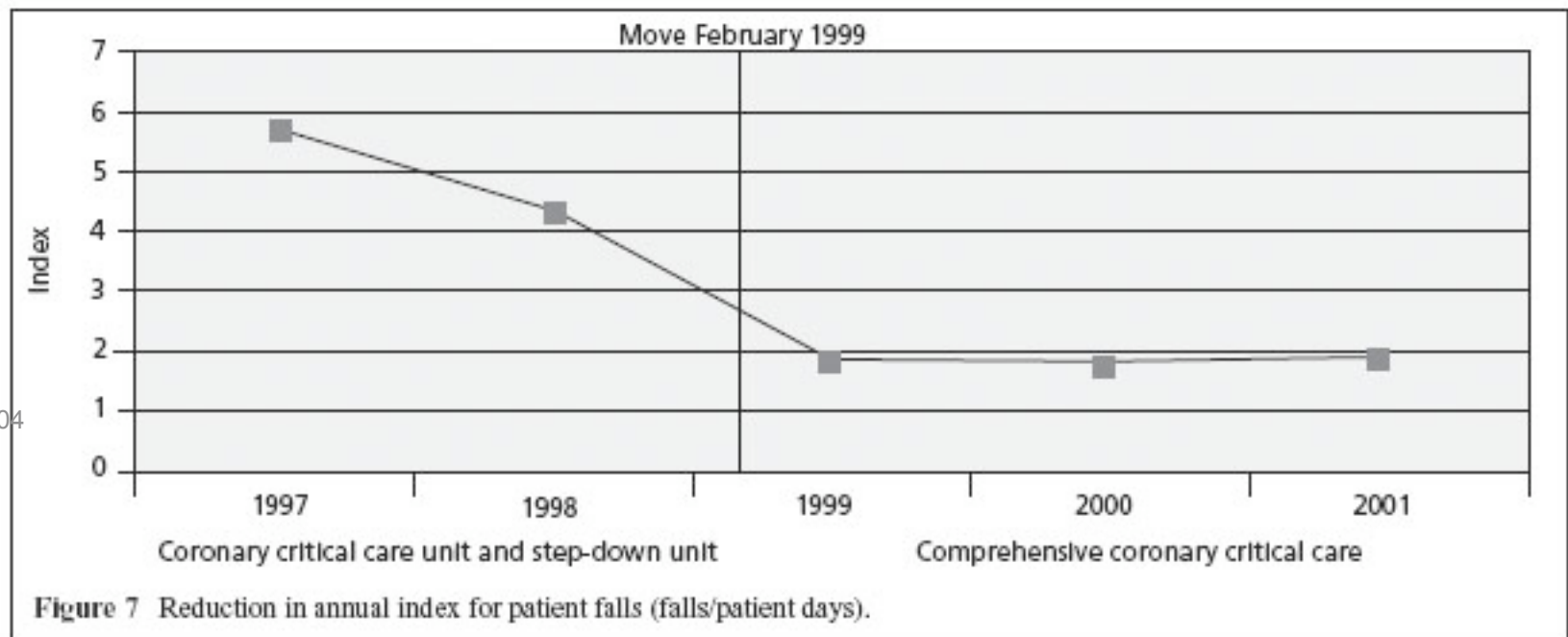
# Conventional Solutions: Micro level flexibility



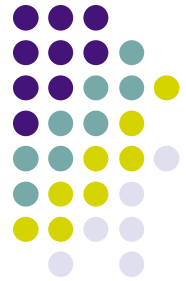
- Variable-acuity nursing model and acuity adaptable rooms: **stakeholder outcomes**
  - Decrease in transfers means a decrease in **patient falls** and **nosocomial infections**. Brown & Gallant, 2006, p. 337

Graph illustrating a decrease in patient falls due to integration of acuity adaptable rooms

Hendrich et al., 2004



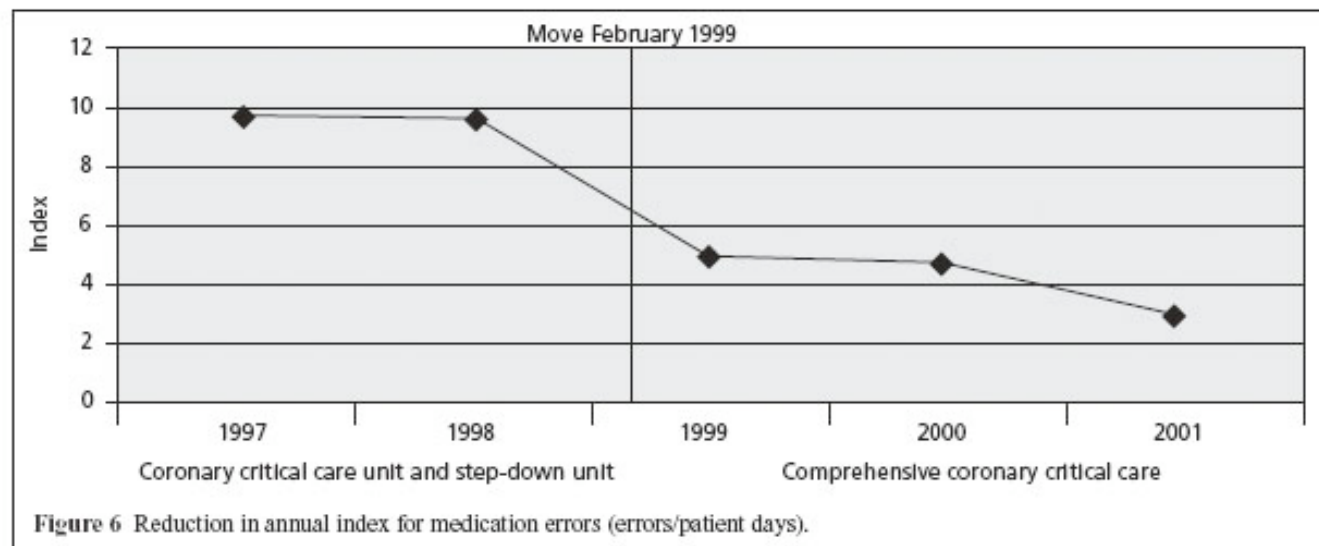
# Conventional Solutions: Micro level flexibility



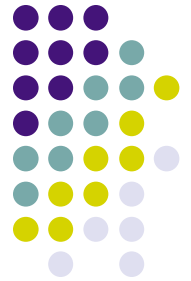
- Variable-acuity nursing model and acuity adaptable rooms: **stakeholder outcomes**
  - Less **delays**, **errors**, and **miscommunications**, especially related to transcription omissions and misinterpretations, since hand-offs between nurses are minimized. Brown & Gallant, 2006, p. 334 & 337
  - After implementing the acuity adaptable unit at Clarian Health System's Methodist Hospital, monthly transfers were reduced by 90% with a resultant 70% reduction in medical errors. Hendrich et al, 2004, p. 41

Graph illustrating a decrease in medical errors due to integration of acuity adaptable rooms

Hendrich et al., 2004



# Conventional Solutions: Micro level flexibility

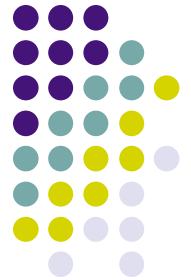


- Variable-acuity nursing model and acuity adaptable rooms: **stakeholder outcomes**
  - Reduction in **average lengths of stay** and **nursing hours** per patient day
  - Reduces the need for precautionary investments in lifting and moving aids, since there are less patient transfers
  - Decrease in **burnout rates** generally seen in ICUs with nurses always caring for extremely ill patients. Brown & Gallant, 2006, p. 334
  - Nurses develop a **collaborative relationship** and **team approach** to patient-centered care through unification of goals. Brown & Gallant, 2006, p. 334
  - Continuity of care allows patients to build **trusting relationships** with a consistent staff leading to an increased patient confidence in nursing skills, and leads patients to view the nurses and physicians as a cohesive team. Brown & Gallant, 2006, p. 334
  - Because the nurse “cares for the patient over a longer period of time, [he or she] has a more in-depth understanding of the clinical issues pertinent to each patient. The intermingling of critical care knowledge on the unit leads to a more rapid assessment and proactive management of complications, leading to a faster resolution of potentially life-threatening situations.” Brown & Gallant, 2006, p. 336



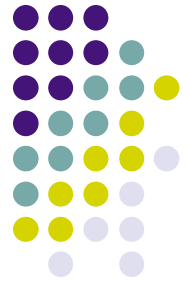
<http://goodlifezen.com>

# Conventional Solutions: Micro level flexibility



- Variable-acuity nursing model and acuity adaptable rooms: **stakeholder outcomes**
  - Offer “latitude in patient allocation [and] assignment of nursing staff to patients in a particular care delivery model.” Pati et al., 2008, p. 207
  - Long-term adaptability to changes in patient population, acuity, and census. Pati et al, 2008, p. 207
  - Acuity adaptable beds minimize bottlenecks and delays in the patient flow. Brown & Gallant, 2006, p. 327

# Conventional Solutions: Micro level flexibility



- Variable-acuity nursing model and acuity adaptable rooms: **stakeholder outcomes**

- **Negatives**



<http://www.navigatenursing.org>

- The culture of the critical care nurse merging with the medical nurse can be a barrier that takes time and energy to refocus. Hendrich et al, 2004, p. 43
- Some nurses feel that decentralized nursing units typical of acuity-adaptable facilities hindered interaction with colleagues and created a sense of isolation
- Skepticism from upper level management and physicians about nurse skill levels and interchangeability: “The acuity-adaptable room assumes a nurse is a nurse is a nurse” Runy, 2004, p. 38
  - “Recent studies show that implementing the acuity-adaptable nursing model posed significant cultural challenges, and were discarded in many hospitals after brief experimentation, while the architectural concept was still in vogue.” (<http://www.hkssmarthealthcare.com/?p=337>)
- Therefore, “protocols must be developed to increase nurse autonomy in progressing the patient along the continuum of care.” Brown & Gallant, 2006, p. 339

# Conventional Solutions: Micro level flexibility



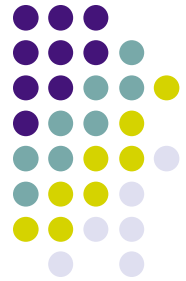
<http://www.pronurse.co.uk/education>

- Facilitating peer and patient visibility | Ease of patient access
  - Multiple caregiver work centers proximal to patient rooms; **unobstructed line of sight** from work zones to patient room door; stairwells or support spaces located either at the periphery or within the support core
  - Simply shaped, possibly symmetric unit configurations; **back-stage corridors** linking caregiver stations that may be designed within the core space. Pati et al., 2008, p. 216
  - **Stress levels** increase and **perceptions of flexibility** decrease when nurses feel they are operating alone. Pati et al., 2008, p. 216

“Higher acuity in medical-surgical units is necessitating direct sensory links to patient rooms—a factor with considerable impact on one’s flexibility to multitask” Pati et al., 2008



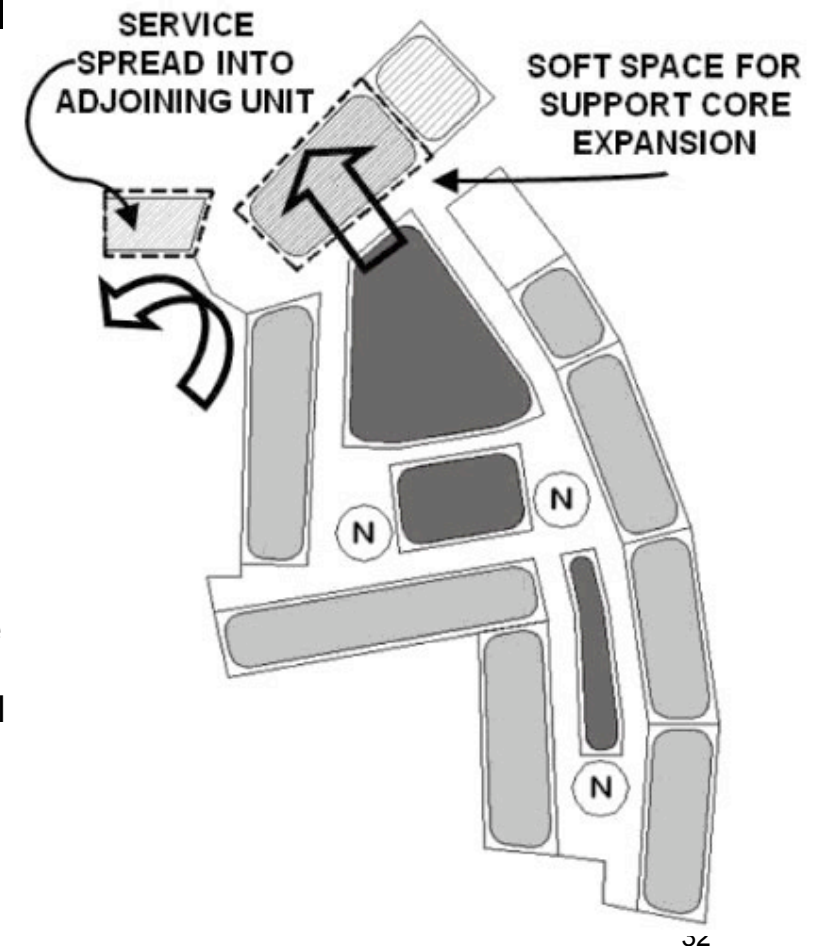
# Conventional Solutions: Micro level flexibility



- Multiple administrative control & service expansion

- Subdivision of the medical surgical unit floors into zones of care rather than mixing of services, which contributes to confusion and patient alignment challenges. Pati et al., 2008, p. 222
  - Contributes to flexibility from a patient care management and administration perspective
  - Meets demands resulting from short and long-term **fluctuations in census**
  - Especially effective if paired with overall expansion of the bed unit and designing similar unit plans in an adjacent position on the same floor connected by a non-public corridor. Such an arrangement “can allow an occasional swing of patient load between the units and better support a longer term growth in census within a specific service.” Pati et al., 2008, p. 223

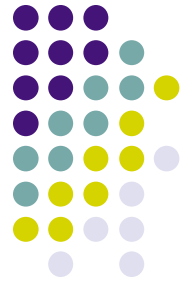
McKay-Dee Hospital Center in Ogden, Utah



Pati et al., 2008

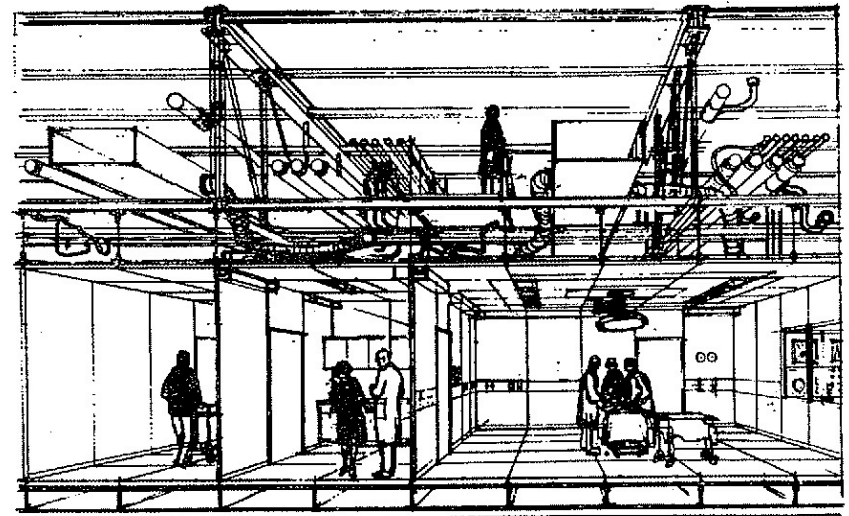


# Conventional Solutions: Micro level flexibility



**Dynamic infrastructure:** interstitial floors (to provide acuity-adaptable medical services and technology)

- When dealing with frequent and potentially disruptive changes, it is important to keep in mind that healthcare facilities are open year-round, 24 hours a day.
- “Changes made to ventilation systems, often mandated by evolving regulations, are most common in areas that deal with infectious diseases.” Battisto, 2002, p. 3
- The ease and speed of the installation of mechanical and electrical mains balances the initial cost of interstitial floor construction. Beck & Frank, 1974, p. 19



Beck & Frank, 1974

- Moveable, demountable walls that can be rapidly erected or moved.
  - Solves the problem of major, **costly alterations**, which often equal the cost of new construction. Beck & Frank, 1974, p. 20

# Conventional Solutions: Micro level flexibility

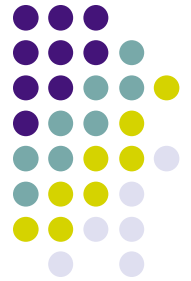


- Circulation patterns: flexible both in terms of **efficient nurse-patient access** on a daily basis and in terms of **long-term building expansion** and **conversion**. Flexible circulation routes in the form of a vertical core are also a component of **modular design**.
  - Central stair linking floors of a bed tower
  - Proximal location of vertical circulation core
  - Back-corridor links between units. Pati et al, 2008, p. 222



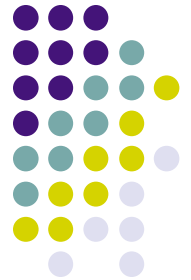
<http://www.findingspace.org/healthcare.html>

# Conventional Solutions: Micro level flexibility



- Pod facility design
  - Consists of a small number of procedure rooms clustered around a **central core area**, which allows for sterile distribution of supplies. Each surgical suite might contain three, four, or five pods, and the suite is accessed by a peripheral corridor surrounding the entire suite. The design provides for isolation and is highly flexible in terms of future expansion. Miller & Swensson, 2002, p. 163
  - “The pod design **decreases fatigue** among nurses and keeps nurses closer to their patients. [It also] facilitates **visibility**, which is critical to the care of high-acuity patients.” Chadhury et al., 2009, p. 775

# Conventional Solutions: Micro level flexibility

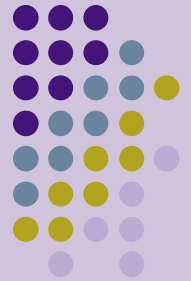


- Multiuser, multiuse clinical workstations
  - Simple, touch-down, collaborative work spaces available for use by all clinicians in order to perform med/surg unit-related tasks and deskwork throughout day such as accessing patient records, reference information, or population data. This requires sufficient desk space to support working efficiently with multiple reference materials simultaneously (digital and hardcopy), as well as a design that accommodates both **collaboration** and **privacy** should either be needed by various users performing various tasks.
  - Remove administrative offices from medical-surgical unit to replace with functional space directly related to activities in that unit
  - If offices are located in unit: same-size offices with spatial capacity to adapt to other functions, such as storage, as the building organization changes
    - Program for “modular furniture, adjustable height tables, and movable furniture are recommended so workstations can be removed or reconfigured as technological processes change.”

Battisto, 2002, p. 5



# Conventional Solutions: Macro level adaptability

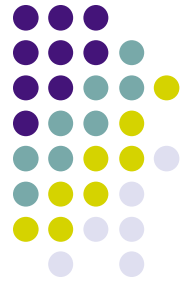


- Systems integration
  - “Building systems and subsystems and their interrelationships are defined and examined as integrated or coordinated components of the building as a whole from the very beginning of the design process. The primary objectives for systems integration are cost control, improved performance, adaptability, time (schedule) reduction, and the provision of a basis for the long-term development and modification of the hospital building.”

VA Hospital Building Development Study Supplement, 2006



# Conventional Solutions: Macro level adaptability



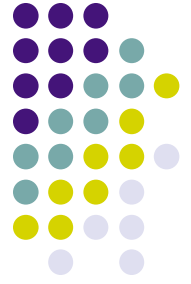
- Modularity

- “Suitably sized uniform building grid is applied in conjunction with a core distribution system for various building services that allows subdivision and reconfiguration in response to emerging and changing purpose and needs. This results initially in spaces that are ‘fit for purpose’ for one or more specific functions whilst also allowing these to morph through movement of walls, building expansion, etc, but with minimal overall structural impact, to suit different activities and service conditions in the future” Carthey, Chow, Jung, and Mills 2010, p. 110
- The conventional design process tends to concentrate on spatial and functional relationships with minimal consideration for structure and mechanical and electrical systems during preliminary and schematic design. This approach tends to result in specialized and unique designs for the service systems in each part of the building. The results are increased complexity in detailing and construction, and compromises in maintenance, future adaptability, and expansion. VA Hospital Building Development Study Supplement, 2006
- The building block concept can offer advantages in design, construction, operation and maintenance. Once established, the service module provides a means of manipulating overall building configuration with the assurance of subsystem capability and integrity. VA Hospital Building Development Study Supplement, 2006

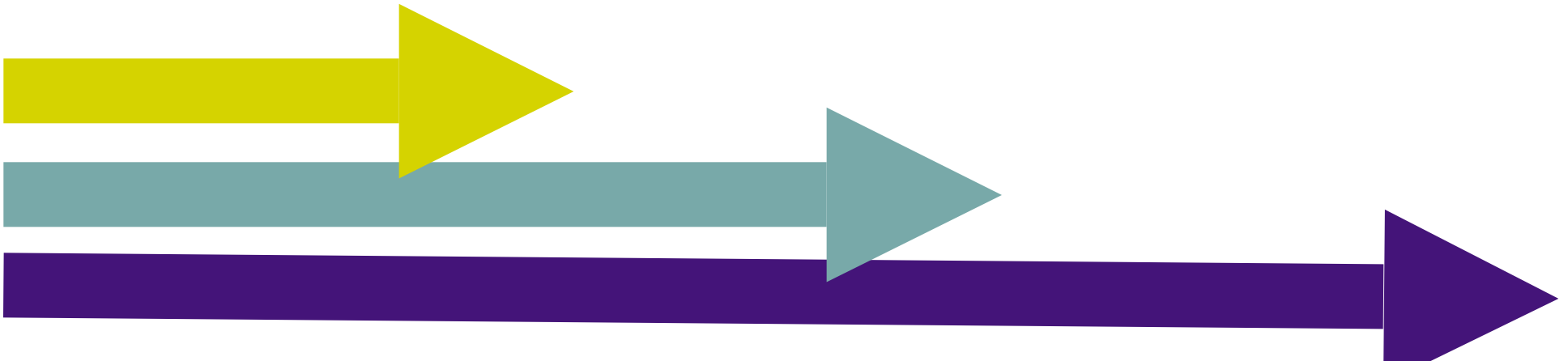


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# Conventional Solutions: Macro level adaptability

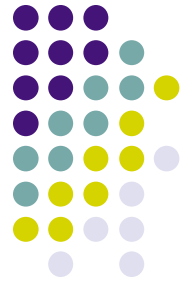


- Categorizing different components of the building in terms of functional service life periods
  - Primary system (about 100 years; building envelope, structure); (b) secondary system (about 20 years; interior walls, floor covering, ceiling), and (c) tertiary system (about 5-10 years; furniture, mechanical equipment, hospital supply). Kendall, 2004
  - Clinical labs “should be organized into **three flexibility zones** (highly flexible, semi-flexible, and least flexible) that correspond to technological requirements since the equipment is central to the function of the lab, [and] almost 90% of labs add new technologies and services at least once every two years.” Battisto, 2002, p. 2, 4
  - “It is argued that the separation of the systems will ensure **independence** of the lower level system[s] from the higher level system[s], affording flexibility to changes while **minimizing construction**.” Pati et al., 2008, p. 206



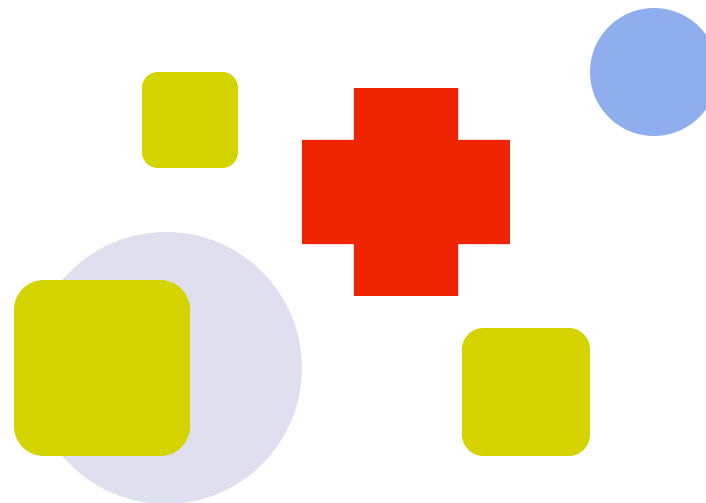


# Conventional Solutions: Macro level adaptability



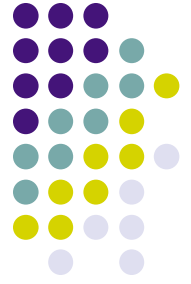
- Concentration of functions on same levels of interconnected buildings
  - “‘Hot spots’ such as operational theatres and intensive care units are as much as possible surrounded by ‘soft spaces’ such as waiting areas, administration, and ancillary spaces.” Carthey, Chow, Jung, and

Mills 2010, p. 113



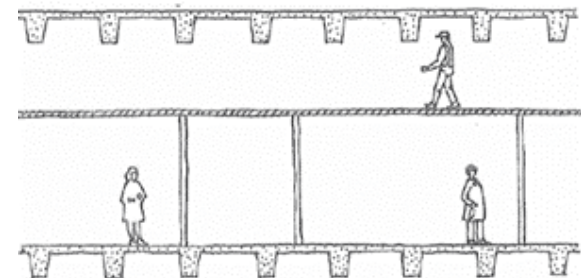


# Conventional Solutions: Macro level adaptability

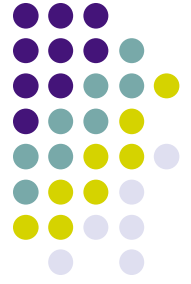


- Interstitial floors

- Modular, easily accessed, and easily modified mechanical, electrical, and plumbing systems and distribution
- Provides continuing adaptability and **vertical expansion** without disruption of floors below. Carr, 2010
- “Hospitals and other providers are building flexibility into design and construction of new facilities — especially structural components, mechanical/electrical systems and building perimeters — to enable them to adapt to the changing face of health care in the future” Building Systems Development & Stone et al, 1977



# Conventional Solutions: Macro level adaptability

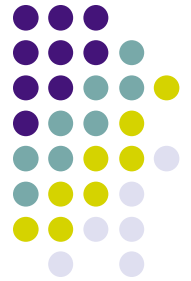


- Excess space programmed into each unit; construction of entirely new wings in anticipation of growth
  - **'Shell space'** is space constructed to meet future needs; it is space enclosed by an exterior building shell, but otherwise unfinished inside. The construction of shell space at the same time another facility is constructed, while adding to overall immediate construction costs, often can **lower total expenditures** over the long term. Kilgore, 1993
- Empty chair model
  - “As one part of the site developed, a vacant area is left for the next project.”  
Carthey et al., 2010, p. 112
- **Open-ended corridors** to allow buildings to expand in one or more directions



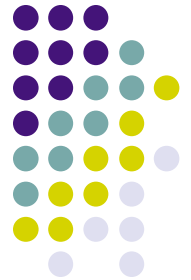
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# Conventional Solutions: Macro level adaptability



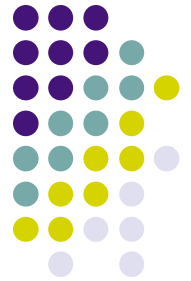
- Airport hanger/warehouse approach: open building management
  - “The provision of an **infinitely flexible** and adaptable building from the beginning. This approach provides a stage on which a very varied range of activities can be conducted with minimal change to the building fabric as a result of changing use or emphasis. However this implies a constant need for the spatial area provided—it may be difficult to anticipate and incorporate requirements for additional capacity or space requirements without physically extending or adding to the building. Similarly it may be difficult to contract to meet less demand or to co-locate alternative uses within the overall fabric of the building” Carthey et al., 2010, p. 110
  - “Not only [does this design] fit into a coherent urban pattern, but they are also simple to build and offer spaces of remarkable quality as well as **spatial and technical capacity**. Most important, they are not tightly integrated with programs of use—they are not defined “functionally.” They are “open” buildings, sustainable in the large sense because they can accommodate change.” American Institute of Architects, 2004

# Conclusion: Take-away Innovations

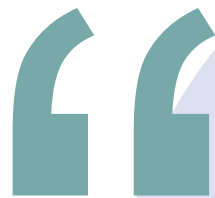


**Acuity adaptable** and **standardized universal rooms** are crucial for inpatient unit flexibility as well as **patient, staff, and caregiver experience**. This design is accommodated by **decentralized, pod** or **satellite** nursing station designs, **interstitial floors** that allow for the flexible dispersion of technologies, modular furniture and equipment arrangements, and **peer and patient visibility** within all unit arrangements. These units could be somewhat subdivided into **zones of care** for initial patient room assignment to control for skepticism on the part of upper level management and physicians about nurses' **ability to handle high acuity situations** should they arise. Within these zones of care, the ratio of critical care nurse to medical nurse could be assigned appropriately.

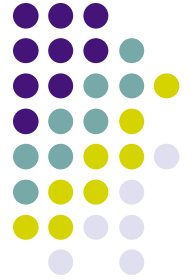
# Conclusion: Take-away Innovations



Spaces not directly related to activities within the medical surgical unit could also be located within their own zone, and standardized for **functional flexibility** according to the idea of **hoteling**. The hospital could potentially **displace** offices, service closets, and storage in uniform spaces within **non-public service corridors** located around the periphery of medical-surgical units or within a vertical circulation core. This would open up and simplify the care unit by avoiding a mixing of tasks and services, as well as accommodate a **modular, universal facility design**. The extra space for these corridors would therefore be justified if they could be utilized for other functions.



“The availability of space to expand support core functions adjacent or close to the unit is warranted for long-term flexibility. In the short run, it could take the form of a hotel-type unassigned space on each floor of the unit. This space offers two distinct points of flexibility. First, it can accommodate a specialty support function associated with the clinical service assigned to that floor – for example, a physical therapy satellite for an orthopaedic unit or a satellite pharmacy area on an oncology unit. Second, it can serve as an equipment or technology garage to centrally hold many of the necessary support tools used infrequently on today’s inpatient care units, such as bariatric chairs or beds or patient lifts. In the long-term, areas in the support core needing additional space could replace the hotel-type function.” Pati et al., 2008, p. 226



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