OBJECTIVES
The objective of this paper was to apprise nurses of the kind of information needed to equip themselves with about the ICU environment to make effective contributions to the planning of an ICU using computer simulation modelling.

Planning intensive care unit design using computer simulation modeling: Optimizing integration of clinical, operational, and architectural requirements

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Key Concepts/Context
Simulation modeling, according to the author, is a cost-effective way to test equipment utilization or the required number of beds, staffing models, and to examine 'what-if scenarios' for the design of Intensive Care Units (ICUs). The input of a nurse is valuable to both the design and simulation processes. This paper outlines the information a nurse needs to be equipped to be an effective participant in the planning team with architects and simulation engineers.

Methods
The author adopts a case study approach to outline the knowledge and information a nurse would contribute to the process of designing a new ICU with computer simulation. The author does not indicate the method used for compiling the information.

Findings
Understanding the ICU is part of a complex and adaptive system:

- The first thing is to understand the ICU from a patient's perspective – it is central to everything in a hospital and is reflected in a hospital’s mission and integrated into the guidelines. So it is necessary to familiarize oneself with:
  - The hospital’s mission, its policies relating to staffing, technology, quality, budget, safety, about the stakeholders, market share, and information systems
SYNOPSIS


PUBLIC HEALTH REGULATORY SYSTEMS, STATE BUILDING CODES, NATIONAL ACCREDITATION, JOINT COMMISSION, AGENCY FOR HEALTHCARE AND QUALITY AND NATIONAL COMMITTEE ON QUALITY ASSURANCE

RESEARCH ORGANIZATIONS: CENTER FOR HEALTH DESIGN; ROBERT WOOD JOHNSON FOUNDATION

Understanding the planning process as an integration of clinical, operational, and architectural guidelines:

- It is important to understand that every evidence-based solution recommended will be reviewed to meet budgetary, the ICU team’s, and the stakeholders’ requirements.
- The question being addressed in this case study is: How many beds are needed in the new ICU?

Understanding the workflow of one’s ICU:

The following information is helpful to determine the input and output patient volume of the ICU:

- Arrival sources of the patient:
  - Outside the hospital: emergency department, transfer, or direct admission
  - Inside the hospital: surgical suites, inpatient units
- Disposition locations:
  - Outside the hospital: transfers
  - Inside the hospital: inpatient units, morgues
- Determining what contributes to the blocking or backing up of ICU beds. Increasing ICU capacity will not work if the inpatient unit does not have adequate numbers of beds to receive patients discharged from the ICU, consequently affecting the emergency department. Increasing the capacity of the ICU must also take into consideration how it will affect the capacity at the arrival sources and discharge locations. Several ‘what-if scenarios’ could be considered and tested on the simulation model.
- Throughput: Develop a workflow chart that reflects your activities in a typical 12-hour shift day. This helps the architect to see the number of trips made to the medication room, supply room, charting areas, waiting area, etc.

Understanding the architectural process and data:

- Architects collect the following data as they begin to design the new ICU:
  - Review state and federal guidelines for ICU design
  - Review the existing floorplan and compare it with current conditions
  - Understand how nurses use and work in the present space
SYNOPSIS

- Refer to the guidelines of the Facility Guidelines Institute
- As architects import the floorplan into their software, they will also:
  - Measure spaces to confirm what the drawings say
  - Perform code checks to see if the present space conforms to the minimum standards

Understanding the simulation engineers’ process to integrate all information:

- A simulation model is built in steps. The first model reflects the assignments or activities of one nurse in one day. To answer the basic question of how many beds are needed in the new ICU, the model will include a series of input and output data.
- Input data includes:
  - This case: patient type by acuity, diagnosis-related groups, synergy-level classifications, demographics, and length of stay.
  - Operational data: nurses’ work schedule, individual workflow processes
  - Architectural data: distances traveled, capacity, room sizes, equipment, functions in different spaces, floorplan
- Output data would include (only illustrative):
  - Number of requests or nurse-scheduled times in the shift
  - Number of times requests are made in a day
  - Average wait time for requests

Limitations

Limitations associated with this paper

- There is no systematic methodology used for compiling the information.