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Major Article

Assessing the functionality of temporary isolation rooms

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Background: Challenges with limited single rooms and isolation facilities in hospitals have created an opportunity for temporary, portable isolation technology. This article describes the process used to evaluate the prototype of a new isolation room (RediRoom; CareStrategic Ltd, Brisbane, Queensland, Australia) that can be installed in existing hospital ward areas. Our aim is to assess the functionality of this new room, and in so doing, to evaluate the methods used.

Methods: We employed a mixed-methods approach involving video recording, interviews, and objective temperature and humidity measurements within a crossover interventional study. Participants completed a range of clinical activities in the RediRoom and a control. The setting for the study was a clinical ward environment at an Australian higher education institution.

Results: There were similarities between the RediRoom and the control using a range of measures. The time taken to complete a range of clinical activities in both rooms was broadly consistent. Network analysis also suggested broad similarities in the movement of nurses undertaking activities in both rooms.

Conclusion: Our study attempted to simulate a clinical environment and clinical activities and provide the best possible comparison by completing activities sequentially, with immediate feedback to researchers. Video recording added significant value to the process because it provided some objectivity. A form of reflexive ethnography with participants could be of value in similar studies in the future.

Health care-associated infections (HAIs) are acquired from transmissible pathogens in health care settings. They are characterized by an immune response and, over time, resistance of pathogens to modern pharmacologic agents. Such infections continue to be prevalent regardless of modern advances in infection control.[1,2] HAIs have a financial influence on health care systems and negatively influence efficiency[3,4] while causing higher rates of morbidity and lowering patients' quality of life.[5] Thus, the consequences of these infections provide a clear stimulus for developing advances in infection prevention techniques such as isolation.

A meta-analysis of the financial impact of HAIs on the US health care system estimated an annual financial burden of $9.8 billion, where half of these infections were found to be preventable.[6] These conclusions underscore the importance of preventing HAIs and their consequential losses, further proving the need for research into infection control techniques such as isolation technologies. One common approach to reducing the risk of infection transmission is isolation of patients, to avoid contact, droplet, and airborne transmission.

Isolating patients with potential or actual transmissible pathogens is among many methods for infection control. However, in comparison to other types of infection control, isolation has a limited (high quality) evidence base to support its role in preventing HAIs.[7-9] Isolation rooms provide a physical barrier for clients harboring transmissible pathogens or protection from pathogens for those who are immunosuppressed. Currently, isolation rooms may be either single-occupant rooms or engineered isolation rooms with multiple functions such as negative or positive

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Avondale College provided the lead researcher with generic funds to assist in his research work. Some of these funds were used to pay a research assistant and to pay participants for their time. Before study commencement, a research collaborative agreement was signed with CareStrategic Ltd (Brisbane, Queensland, Australia). This legal agreement provided exclusive rights to research and publish findings from research at the sole discretion of the researchers. The authors have no relationship whatsoever with the owners or manufacturers of the RediRoom. CareStrategic Ltd. The owners of the RediRoom, provided the RediRoom free of charge for the research. No member of CareStrategic Ltd or any of its partners was involved in the study design, data collection, analysis or manuscript preparation.

BM, TW, and ZW designed the study. BM and ZW were involved in data collection. BM performed data analysis and drafted the manuscript. TW and ZW performed critical review and input into the manuscript. All authors approved the final version of the manuscript.

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pressurization. In either case, the aim is to protect clinical staff and other patients from a transmissible pathogen or to protect immunologically compromised patients from infection risk associated with clinical staff.[9]

Modern isolation technologies within health care systems are limited in availability in most countries, and evidence-based research on the advantages of isolation technologies is currently insufficient to justify costs.[10-12] However, some research has suggested that single-occupancy rooms or patient isolation improve outcome and reduce the burden of HAIs, supporting a call to increase isolation capacity.[11,13] Despite the unavailability of current modern isolation technologies, there is debate on the benefit seen in dividing existing multioccupancy rooms into single-occupancy rooms due to refurbishment costs.[12] This barrier to building infection control facilities has created a market opportunity for financially viable, temporary, portable isolation technology. The market is potentially further enhanced by the potential need to isolate patients in a disease-relief scenarios, including situations that involve emerging and remerging infectious diseases.

New and improved technologies and techniques for patient isolation have evolved. Companies investing in this idea have created technologies such as the Bioquil Pod (Hampshire, United Kingdom),[14] ISOPORT (Eatontown, PA)[15] and the Isolation Canopy (Madison, WI).[16] These products aim to both improve hospital and staffing efficiency whilst providing a quick, financially justifiable way of temporarily converting multioccupancy rooms into single-occupancy rooms. A new portable temporary isolation room, the RediRoom (CareStrategic Ltd, Brisbane, Queensland, Australia) has recently been developed that also responds to these issues. There is, however, no standardized way to evaluate the effectiveness or practicality of new or innovative isolation spaces.

This article describes the process used to evaluate a prototype of a new isolation "room" (the RediRoom) that can be installed in existing hospital ward areas. A separate approach was taken to evaluate the RediRoom from an infection control perspective and presented in a different article.[17] For the purpose of this article, we use "isolation room," noting that there are different terms used in different countries. Further, the RediRoom is designed to provide barrier protection in patients requiring contact and droplet precautions, not airborne. Our aim is to assess the functionality of the RediRoom and, in so doing, to evaluate the methods used.

METHODS

Design

There is no documented approach in the literature for evaluating novel approaches to patient isolation in hospital. We therefore employed a mixed-methods approach, involving video recording, interviews, and objective temperature and humidity measurements within a crossover intervention study.

Setting

A simulated clinical ward environment at Avondale School of Nursing (clinical laboratory), Clinical Education Centre, Sydney, Australia, campus, was the setting for this study. The clinical laboratory is a mock hospital ward environment (Fig 1). It includes a patient care area consisting of beds, curtains, patient chairs, and bedside tables. It also provides staff access to equipment and facilities available in a hospital ward, such as oxygen, suction equipment, defibrillation, intravenous infusion pumps, and sterile equipment. The RediRoom was installed within the confines of an existing patient area in the clinical laboratory. The dimensions of the room were 2.88 m × 2.38 m × 2.09 m high (see Fig 1). Participants completed a range of nursing activities in the RediRoom. As a comparison, the same activities were completed in a patient room of the same size, referred to in this article as the "patient care area." The patient care area was the control. Participants undertook a sample of clinical nursing activities, including transferring patients, administration of medications, measurement of observations, performing an aseptic technique, bed bathing a patient, and cardiopulmonary resuscitation.

Participants

Because testing the functionality of the RediRoom primarily involved clinical nursing procedures reflecting usual clinical practice, the chosen discipline to recruit from was nursing. Three different groups took part in this study: 4 (undergraduate) nursing students in their second year of study, 3 (undergraduate) nursing students in their final year, and 6 registered nurses with at least 10 years' experience. Purposive sampling was used to recruit partici-

Simulated ward environment

RediRoom (CareStrategic Ltd, Brisbane, Queensland, Australia)™

Fig 1. Images of the study setting and RediRoom.