

## Supportive Living Resident Suite Evaluation: Using Simulation to Evaluate a Mock-up

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To address the growing population of seniors, Alberta Health Services plans to provide 11,700 supportive living resident suites over the next decade. Before finalizing the design standards and guidelines for these facilities, a mock-up residential suite was constructed, outfitted with all necessary furnishings and equipment, and used to evaluate the proposed design. Evaluation of the physical space and accessibility for residents' and clinical tasks were accomplished using simulation, think aloud protocols and extensive debriefing sessions. Scenarios were created that focused on commonly-occurring tasks identified by frontline staff as being problematic for both residents and staff. These scenarios were then carried out by seniors and a variety of healthcare professionals to simulate expected room usage. Evaluation of the scenarios indicated that sufficient space was available in the design; however, areas prone to congestion were also identified. Recommendations to improve the design of the residential suite were made to improve accessibility (of cupboards, light switches and electrical outlets), storage (of power scooters / wheel chairs), and bathroom configuration (of emergency pull cord and grab bar locations).

### INTRODUCTION

Of the more than 3.5 million people currently living in Alberta, approximately 10% are over the age of 65 (Stats Canada, 2008). As 'baby boomers' age, this percentage is expected to rise in the coming years. To accommodate this increase, Alberta Health Services (AHS) plans to deliver 11,700 supportive living resident suites over the next decade.

Supportive living environments provide 24 hour/day scheduled and unscheduled professional and personal care in a structured, supportive, and supervised environment. Residents who will potentially occupy these suites will have been assessed as not being able to cope safely in their homes or in other facilities, and may require total meal, medication administration, and mobilization assistance. It is anticipated that their medical and behavior condition would be stable; however they may exhibit varying levels of dementia. While these facilities provide support and structure to residents, problems can still arise. For example, the most commonly reported incident in supportive living facilities involves residents falling. Contributing factors to falls include residents' age, eyesight, mobility status, and dementia, as well as

environmental hazards such as poorly-placed furniture (Public Health Agency of Canada, 2009). Interaction of these factors, combined with age-related frailty, can produce outcomes that are both individually detrimental and costly to the healthcare system.

### Design Background

The proposed design of these supportive living facilities consists of modular resident suites built off-site and then interconnected on-site. A decision to reduce the size of the resident suite from 35 to 32 square meters prompted concern about the adequacy of physical space for supportive living residents. Additional consideration for space requirements was needed.

Configuration of the suite is of particular importance. Thoughtful placement of safety equipment (i.e., grab bars, emergency pull cord) is essential to minimize falls or to alert others to a fall, particularly in the bathroom where falls are more likely to cause injury than in any other household area (Public Health Agency of Canada, 2005a). The absence of accessible light switches and grab bars, cupboards placed beyond reach, and appliance cords or other obstacles located where residents

walk, have all been cited as factors that contribute to residents falling at home (Public Health Agency of Canada, 2005b).

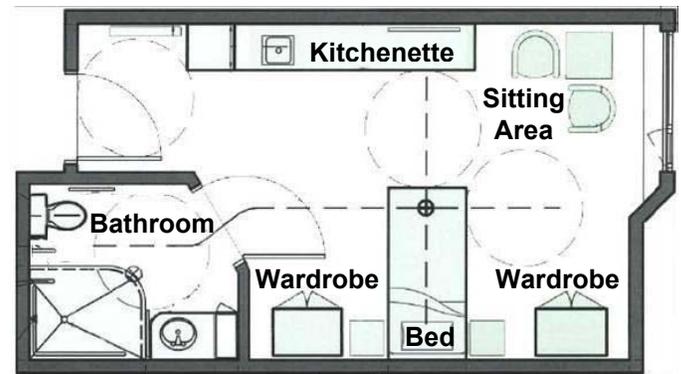
To ensure the suites would accommodate the supportive living needs of residents, AHS developed a draft set of facility design standards (mandatory) and guidelines (highly important), applicable to new construction and renovation of seniors' care facilities in Alberta (Alberta Health Services, 2009). A previous publication criticized regulations "mandating minimal expected environmental features" as being seldom research based (Cutler, Kane, Degenholtz, Miller, Grant, 2006). Therefore, the aim of this study was to use various human factors, simulation, and usability engineering methods to evaluate the proposed design (Chisholm et al., 2008) and incorporate findings into the draft facility design document. Specifically, we wanted to determine if the resident suite mock-up would accommodate all necessary furnishings and equipment (power scooter, wheelchairs, power lifts, exercise equipment), provide physical support for residents in both the standing and seated (in a wheelchair) positions to ensure resident access to essential items (cupboards, grab bars, electrical outlets, personal items), and reduce the risk of falls for residents who were prone to falling or who had reduced mobility.

## METHODS

### Simulation

A mock-up resident suite was constructed in Spruce Grove, Alberta, based on the proposed architectural designs, and incorporated all necessary furnishings and equipment (see Figure 1).

Five scenarios were developed to incorporate common activities and tasks that might be problematic for residents and healthcare providers (HCP). These scenarios included *residents' tasks* (i.e., manoeuvring wheelchairs within the suite, eating, socializing, and kitchenette usage), *clinical tasks* (i.e., medication administration, assessments, and wound care), *bathroom usage* (i.e., toileting and showering), and two '*resident fall recoveries*' (in the bathroom and entranceway).



**Figure 1.** The schematic of the supportive living resident suite.

Three seniors from a nearby supportive living facility volunteered to play the role of the residents for the simulation scenarios within the mock-up suite. A variety of HCPs (Registered Nurses, Licensed Practical Nurses, Occupational Therapists, Healthcare Aides, and Emergency Medical Services personnel) were also engaged to provide resident care during the scenarios. A total of 27 people attended the evaluation day.

Participants were instructed to think aloud during the scenarios, verbalising all thoughts and difficulties they perceived and encountered during scenario enactment (Ericsson & Simon, 1993). Four video cameras with microphones were mounted at strategic locations within the mock-up suite to capture all movement and vocalization the participants made during the scenarios. A live video and audio feed of the scenarios was provided for observers (design team members, facility managers, and clinical staff) in an adjacent space. An extensive debriefing discussion was held at the conclusion of each scenario and suggestions for improvements were elicited separately from both participants and observers of the scenarios.

Video and audio data capturing the scenario were analysed by two human factors consultants and combined with the debriefing discussion notes. Link analysis depicting movement within the suite of all participants in all scenarios was performed and locations of observed 'bumps' were plotted over the link analysis.

## RESULTS

Five specific design categories were identified that posed problems for residents and HCPs. These included available space, outlet locations, access requirements, mobility aide storage, and bathroom configuration. Solutions to these problems are discussed.

### Available Space

The suite was sufficiently large to accommodate the tasks and activities built into the residents' tasks scenarios (transfers at various locations, entertaining guests, preparing and serving light meals), as well as the clinical scenarios (medication administration and charting, wound care, various resident assessments and exercises). Link analysis suggested that all available space within the suite was used (see Figure 2). Space at the foot of the bed sustained the highest amount of traffic and became congested when multiple guests were in the suite. 'Bumps' and the highest density of movement paths were observed here. The pattern of bumps indicated that protective finishes, such as 'bump' guards, be added to doorjamb and cabinet corners. The wound care nurse was observed to move back and forth between the kitchenette area and bedside to retrieve supplies. It was inferred that wound care supplies were not conveniently located. A mobile work surface with storage for wound care supplies was recommended.



**Figure 2.** Link analysis depicting paths of movements of residents (blue), family members (green), and clinical staff (red) during the resident

and clinical task scenarios. Yellow dots indicate 'bump' locations.

### Outlet locations

Difficulties encountered during the scenarios identified design improvements that would better suit resident needs. For example, the phone jack was located by the bed; the TV jack and wall-mounted TV were near but not in the sitting area. Thus, when using the sitting area, residents could not see the TV and would also have to get up to answer the phone. Recommendations to improve flexibility of the space included installing extra phone and TV jacks, as well as having TVs that could be angled. Initially, two medical-grade electrical outlets were proposed for either side of the bed, to allow for devices such as oxygen concentrators. During the debriefing, EMS personnel noted that oxygen concentrators are noisy and are often placed in the bathroom when residents are sleeping. Relocating one of these outlets to the bathroom was recommended.

### Access Requirements

Participants who used wheelchairs during the scenarios encountered a number of difficulties (see Figure 3). For example, only items located on the bottom shelves of kitchenette cupboards were accessible. Wall-mounted electrical outlets and light switches at the back of the kitchenette and bathroom counters were difficult to reach. In addition, the thermostat and door viewer were mounted at a height best for an individual standing and not for one seated in a wheelchair.



**Figure 3.** A resident strains to reach a kitchenette cupboard and an electrical outlet in the bathroom.

Recommendations included having wall strips or mounting tracks to allow the height of the cupboards to be adjusted to the needs of individual residents. Relocating lights switches and frequently used electrical outlets to the side of lower cabinets, or under counter tops was recommended. We considered the problem of electrical outlets for items that are used frequently and that are not unplugged very often. Accessing outlets on the wall above a counter is difficult for individuals seated in a wheelchair, if the counter has drawers or a cupboard below. We therefore recommended that these outlets be positioned on the wall above a counter without drawers or a cupboard below. Installation of a thermostat, with very large font, situated at a lower than usual height would improve visibility of the display for residents with age-related visual problems and those in wheelchairs. Having two door viewers, one for those standing and one for those seated, would also better accommodate residents' needs.

### **Mobility Aide Storage**

The mocked-up design had insufficient storage space for mobility aides, and in particular, powered scooters and wheel chairs. During the scenarios, various locations used to store these devices (i.e., by the kitchenette, along the wall between the sitting area and the wardrobe, and just inside the entrance) were found to constrain access and flow through the room, blocked access to other items (such as wardrobes), were not in close proximity to an electrical outlet, or required difficult

maneuvering in reverse to exit a room. Recommended design modifications included adding a 'parking coral' for power scooters at the facility's entrance. Power wheelchairs are easier to maneuver making the wall by the sitting area more accessible. Electrical outlets were also added behind the wardrobes for residents who chose to have these removed as alternate storage / charging locations.

### **Bathroom**

Grab bar locations and the use of other bathroom fixtures for the same purpose (i.e., towel and toilet paper holders) were identified as having important safety implications. During the resident fall recovery scenario in the shower, the resident had difficulty reaching the emergency pull cord. This is of particular concern given that pendant alarms (a redundant alerting system) are typically removed from the neck or wrist when showering. Re-locating the pull cord to a position between the shower and toilet was recommended to improve access. Configuration of the proposed vanity cupboard was identified as suboptimal with respect to access. Removal of doors to the cupboards where frequently used items were stored, and installation of drawers rather than cupboards at lower heights, would improve access and visibility for a resident in a wheelchair.

## **DISCUSSION**

Building a mock-up suite provided a rich testing environment to allow for a systematic evaluation of the proposed resident suite. More than 60 specific recommendations were presented to the design team, most of which were immediately incorporated into the draft design standards and guidelines that are planned for use in future facilities. Once the standards and guidelines are approved, future research will re-examine a finished resident suite as part of the procurement process. This research will expand on the current evaluation to include additional factors, such as flooring, lighting and communication systems, which were not built into the mock-up space, but are known factors that contribute to resident falls (Public Health Agency of

Canada, 2005b). Usability testing is also being proposed for certain devices that will be procured for these facilities. Many issues identified during the evaluations were not anticipated when examining the architectural drawings or within group discussions. Spaces often look ideal on paper; however when they are functional with equipment and personnel difficulties can quickly become apparent. Mock up evaluations provide an opportunity to “kick the tires” and fully test out the functionality of such spaces before final decisions are made.

### Limitations

Differing room configurations were possible with varied use of facility-provided items (i.e., cupboard and wardrobe configuration) and resident-provided items (i.e., furniture, mobility devices, bed size). However, input was gathered from clinical users only, and not from residents, to determine the most common suite configuration, which was then used for mock-up and evaluation purposes.

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