



## KEY POINT SUMMARY

### OBJECTIVES

This study sought to evaluate if alternative brake pedal locations and a retractable fifth wheel were effective to improve usability and lessen the physical demands on the healthcare provider.

## Effects of Two Hospital Bed Design Features on Physical Demands and Usability During Brake Engagement and Patient Transportation: A Repeated Measures Experimental Study

Kim, S., Barker, L. M., Jia, B., Agnew, M. J., Nussbaum, M. A.  
*2009 / International Journal of Nursing Studies*  
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### Key Concepts/Context

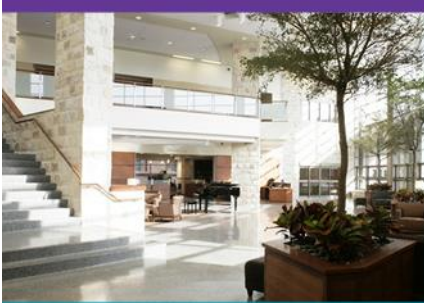
Healthcare work is physically demanding and often results in work-related musculoskeletal disorders (WMSDs). Most research in this area has focused on patient-handling techniques during activities that require direct patient contact, such as patient transfer. But healthcare providers perform other patient-handling tasks as well, such as engaging bed brakes and transporting patients in beds. These activities could also contribute to WMSDs.

### Methods

The researchers conducted two laboratory-based studies. Using simulated brake-engagement tasks, they tried three brake pedal locations (head end vs. foot end vs. side of a bed) and two hands conditions (hands free vs. hands occupied). They also simulated in-room and corridor patient transportation tasks, using steering-assistance features, such as a fifth wheel and/or front-wheel caster lock.

The investigators recruited 9 inexperienced participants from the student population and community for each study.

During brake engagement, the researchers used trunk flexion angle, task completion time, and questionnaires to quantify postural comfort and usability. For patient transportation, dependent measures were hand forces and questionnaire responses.



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## Findings

The study found that the location of the brake pedal in hospital beds as well as steering-assistance features significantly affected the physical demands on the users as well as the beds' usability during brake-engagement and patient transportation tasks. The researchers determined that a brake pedal at the head end of a bed increased trunk flexion by 74–224% and completion time by 53–74%, compared to other pedal locations. In addition, the study participants reported greater overall perceived difficulty and less postural comfort with the brake pedal at the head end.

## Limitations

The authors noted the following study limitations. First, the participants did not have any experience with patient transportation and brake-engagement tasks. Therefore, their ability to perform the tasks as well as their perceived physical demands may not mimic those of more experienced healthcare workers. However, participants did practice the tasks to minimize learning effects. Second, the authors noted that the participants were very similar in body size and ability and were younger than the average healthcare worker. The researchers used a within-subject experimental design for both tasks so that the effects of the design features would not be significantly confounded by individual differences such as body size and experience, but could differ in magnitude. The finding was relatively consistent across the participants, which suggests generality of in magnitude. Nonetheless, to better understand the effects of the design features, the study should be repeated with actual healthcare providers with a larger sample size. Lastly, the authors report, because of laboratory equipment constraints, participants were only allowed to push/pull on the load cells attached to the end of the bed during in-room transportation. They couldn't steer the bed using the sides of the bed frame. Therefore, the findings may only reflect the physical demands and usability of the bed in certain healthcare scenarios and may not be generalizable for more complex healthcare work environments.

*Reviewer note:* The flooring for this study was not noted.

## Design Implications

Brake-pedal locations on a hospital bed have important effects on physical demands and usability. Though steering-assistance features can reduce physical demands, these demands are still high and may expose healthcare workers to an elevated risk for work-related musculoskeletal disorders during patient transportation. The evidence supports ergonomics principles in the design of medical devices, specifically hospital beds, can reduce physical demands and improve usability. Designers should also be wary of the flooring selection as this would also impact these effects.