

# Homecare in the bathroom: work postures and experienced stressors in three different bathroom designs

AnnaKlara Stenberg Gleisner\*, Natalie Papahristodoulou, Brenda Rodrigues Coutinho, Catherine Trask

\*Corresponding author e-mail: [ansg@kth.se](mailto:ansg@kth.se)

KTH Royal Institute of Technology, School of Engineering Sciences in Chemistry, Biotechnology and Health, Department of Biomedical Engineering and Health Systems, Division of Ergonomics

## PROBLEM STATEMENT

In hospitals and nursing homes, bathrooms are large, well-equipped, and designed according to specifications that accommodate a range of residents and caregivers, in addition to mobility aids. Small home bathrooms without basic assistance equipment are challenging for residents and homecare workers, for example with insufficient support handles, or equipment at inappropriate heights (Gleisner et al. 2022). Bathroom layout and equipment may be helpful, but it is unknown if physical and psycho-social loads are affected by these factors.

## RESEARCH QUESTION

Does bathroom design impact (A) trunk and upper arm postures and (B) health care workers' experiences when assisting residents during bathroom tasks?

## METHODOLOGY

The experiments involved health care workers performing standardized patient care tasks using wheelchair and walker in three designs: 1) standard equipped nursing home bathroom; 2) equipped home bathroom; 3) unequipped home bathroom. Homecare workers' trunk and arm postures were data-logged using battery-powered Inertial Measurement Unit (IMU) sensors (Lind et al., 2020). Interviews held with the health care workers after each test were analysed using an inductive content analysis approach (Elo and Kyngäs, 2008).

## RESULTS

Results showed no significant differences in trunk posture between bathroom designs although the 50th percentile median was highest in nursing home bathroom whilst the 50th percentile median was highest in the unequipped bathroom. Average upper arm posture and velocity were larger and faster in the nursing home bathroom. The 50th & 90th percentile right arm posture was significantly higher in the nursing home bathroom than in the unequipped bathroom. The 50th & 90th percentile left arm angular velocity was significantly higher in the nursing home bathroom than in the equipped and unequipped bathrooms.

However, interviews revealed a distinct difference in homecare worker experiences when conducting the work tasks in the three bathrooms. Factors such as space, equipment and responsibility were considered as challenges in the smaller bathrooms. For example, HCW have a great sense of responsibility for the safety and health/wellbeing of their patients i.e. fear of

hurting the patient or themselves due to lack of space or equipment. These factors may become stressors depending on context and hinder safe task completion.

## **DISCUSSION**

The posture results of this study are surprising, given our hypothesis of increased awkward posture exposures in the small, non-equipped, bathroom as opposed to the larger, equipped nursing home bathroom. The increased median and peak postures in the nursing home bathroom may be an indicator of what movements are possible, rather than a signal that the nursing home bathroom is a poorer work environment. Bigger nursing home bathrooms may simply allow for a greater range of motion during a demanding task in a way that the smaller, narrower apartment bathrooms do not; in the smaller bathroom, many workers would not have the space to bend forward very far before their head bumps the wall or fixtures.

During the interviews, following the trials, many participants mentioned that the apartment bathroom conditions felt very cramped and unsafe, with limited room to maneuver, suggesting that it would be inappropriate to interpret the nursing home bathroom as 'least desirable'. This presence of constrained movements and psychosocial stresses also introduces the notion that the most important risks of a smaller, unequipped bathrooms may go beyond posture exposures. Assessing physical exposures such as force and energy expenditure provide an important future opportunity.

## **REFERENCES**

- Elo, S., Kyngäs, H., 2008. The qualitative content analysis process. *J. Adv. Nurs.* 62 (1), 107–115. <https://doi.org/10.1111/j.1365-2648.2007.04569.x>.
- Gleisner, A. S., Rose, L., & Trask, C. (2022). Towards safety and autonomy in the home bathroom: Identifying challenges, needs and gaps. *Applied Ergonomics*, 105, 103865–103865. <https://doi.org/10.1016/j.apergo.2022.103865>
- Lind, C. M., Diaz-Olivares, J. A., Lindecrantz, K., & Eklund, J. (2020). A wearable sensor system for physical ergonomics interventions using haptic feedback. *Sensors (Basel, Switzerland)*, 20(21), 1–25. <https://doi.org/10.3390/s20216010>