Sensor-based prevention of falls and pressure ulcers: A scoping review

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Purpose Global population aging increases the demand for long-term care due to functional and cognitive decline among older adults. Adverse events, particularly falls and pressure ulcers (PUs), are common in long-term care, challenging patient safety and healthcare resources. Both movement-associated phenomena severely affect quality of care (Lampersberger et al., 2022). Falls can cause physical injuries and psychological effects, leading to reduced mobility and quality of life (Cameron et al., 2018). Similarly, PUs are a serious complication with high incidence and prevalence among nursing home residents (Sugathapala et al., 2023). Sensor technologies offer promising solutions for preventing these adverse events by enabling continuous monitoring and early intervention. Given their dependence on nursing care, falls and PUs are key indicators of nursing-sensitive outcomes. Therefore, examining sensor-based strategies for both phenomena together is crucial. We conducted a scoping review to investigate the effects of sensor-based prevention strategies for falls and PUs in long-term care and to explore the experiences of patients and healthcare professionals with these technologies. **Method** This scoping review was conducted following the JBI Reviewer's Manual and PRISMA-ScR guidelines. A comprehensive literature search was performed in MEDLINE, CINAHL, Web of Science, and Google Scholar for studies published from 2014 to 2023. The MMAT and JBI appraisal tools were applied for quality assessment. Extracted data were synthesized both narratively and descriptively. **Results and Discussion** Among 31 included studies, 22 focused on fall prevention, 8 on PU prevention, and 1 on both phenomena. Sensor technologies were categorized into user-based and context-based types. User-based sensors in the form of accelerometers showed positive effects for both fall and PU prevention. Regarding fall prevention, a sensitivity of 80.0% has been reported. For PU prevention, accelerometers improved adherence to repositioning protocols, reducing PU incidence from 5.24% to 0.0% and achieving a 94.0% reduction in facility-acquired PUs. In terms of context-based sensors for fall prevention, Doppler radar achieved 90.0% fall detection but generated up to 49 false alarms per month. Webcams had fewer false alarms but were less reliable than Kinect, which had minimal false alarms within a 4-meter distance. Range sensors demonstrated high accuracy with 94.5% precision and 86.7% recall. For PU prevention, a context-based accelerometer was promising, whereas pressure sensors provided unreliable data. Manual assessments remained crucial for complementing sensor data and improving predictive accuracy. Patients showed higher acceptance for non-obtrusive, user-friendly sensors. Health professionals valued real-time monitoring and alert capabilities, stressing the importance of seamless integration into care routines and documentation. Privacy and data security remained significant concerns. Sensor technologies show positive outcomes for fall and PU prevention in long-term care, pointing to a need for further refinement of context-based sensors regarding PU prevention. The combination of technological advancements and standard care methods can improve patient safety and care quality. Future research should expand randomized controlled trials and explore sensor technologies in various long-term care settings. Addressing privacy and ethical concerns is essential for increasing acceptance of these technologies.

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