SMART technologies: the challenges and potential for addressing falls.

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Falls are a significant and rapidly growing public health problem. It is estimated that 37.3 million falls require medical attention, and more than 684,000 falls-related deaths occur globally each year.[1] Falls occur across the lifespan, but they are a well-documented issue for older adults, and the rising rate of falls is associated with the ageing population.[1] Falls occur in a range of settings, and there is a substantial body of evidence investigating falls prevention and detection in both community dwelling[2] and, as reported in this issue of JBI Evidence Synthesis, in adult hospital in-patients.[3] However, there is still work to be done in this area, with the World Health Organization earlier this year calling for falls prevention and management to be pushed "higher up the planning, policy, research and practice agenda…to reduce the burden…on a local and global scale".[4ppvii]

A broad range of health technologies (defined as the application of organized knowledge and skills in various forms; e.g., exercise, quality improvement strategies, and assistive technology) have been implemented in attempts to reduce falls and to detect them in a timely manner when they do occur, in community,[2] care,[5] and hospital settings.[3] Over the last decade there has been increased focus on SMART (self-monitoring, analysis and reporting technologies) technologies in both falls detection and prevention. Whilst there appears to be great enthusiasm for, and development of, SMART technologies and the use of data in general to address falls in adults, there are many challenges that remain to be addressed. Further research and evidence synthesis is required before SMART technologies evaluated in small-scale research studies can be implemented extensively in real-world settings and consequently contribute to a reduction in falls and their associated harms.

In our scoping review,[3] we mapped the technologies being used or developed for falls prevention or detection in adult hospital inpatients. SMART health technology was predominantly reported for falls detection 'devices' such as fixed or wearable pressure or movement sensors, and depth cameras. Such devices were the second most frequently reported technology after various combinations of health technologies with or without falls risk assessment (i.e., multifactorial or multicomponent interventions). However, over two-thirds of reports on these 'devices' were categorized as 'emerging technologies', meaning they were conducted in laboratory-based or mock clinical settings rather than the real-world hospital environment, with many reports focusing on descriptive accounts of the SMART technology and its performance, and not on robust evaluation of their effectiveness for detecting falls. Whilst it is encouraging that such SMART

technologies are being developed, as long as the technology readiness levels remain low and issues of acceptability, feasibility, cost and barriers to use remain unaddressed,[6] many will not progress to widespread adoption and their potential to influence this important public health issue will not be realized.

Our research group has also recently conducted a review[7] identifying over 60 SMART technologies for falls prevention in the community setting alone, including a plethora of digital health applications (mobile apps) aimed at maintaining or increasing physical activity and preventing frailty; a range of fixed and wearable sensors; and a handful of technologies using Artificial Intelligence to predict the risk of falls and enable early intervention. Such technologies have clear potential in terms of personal benefit to those most at risk of falls, and economic benefits to healthcare services if even a proportion of falls and their consequences, including hospital admission, could be prevented.

However, there remain a number of limitations associated with the use of SMART technologies and challenges in their widespread adoption. For example, many wearable SMART technologies must be worn for lengthy durations, which can be inconvenient or uncomfortable for individuals. Many operate via devices which require charging, and those that require a mobile phone to operate also require syncing and the ability to navigate a mobile app. [7] Additionally, some technologies produce a large volume of data which may overwhelm individuals and their carers alike. As with any health promotion intervention, behaviour change is required for optimal engagement and outcomes. Research demonstrates that individuals tend to disengage with SMART technologies for self-monitoring after only 4-months,[8] and "alarm fatigue" is a well-documented barrier to the effectiveness of bed exit alarms in hospitals.[9pp5] Technology alone will not solve the growing issue of falls; a cultural change among individuals, healthcare workers and services will be required for technology to reach its full potential. In conclusion, SMART technologies have clear potential for the prevention and detection of falls in adults. Future global collaborative research must focus on addressing the challenges identified, particularly moving research to the real-world setting and addressing barriers to widespread adoption.

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