



Fall Prevention and Rapid Response Systems: Do They Keep Older Adults Safe or Push Them into Loneliness

Safa Heybet*¹

¹Biruni University

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ABSTRACT

Purpose: This review aimed to examine whether fall-prevention and rapid-response technologies enhance safety while potentially contributing to social isolation and perceived loneliness among older adults. **Methods:** A narrative review of the literature was conducted, focusing on fall-prevention and emergency-response technologies used by older adults, including wearable devices, smart sensors, home-based monitoring systems, and mobile applications. Studies addressing safety outcomes, independent living, social engagement, loneliness, privacy concerns, and digital exclusion were synthesized. **Results:** The findings indicate that fall-prevention and rapid-response technologies support independent living and enable timely intervention through remote monitoring by family members and caregivers. These systems contribute positively to individual safety and provide reassurance for both older adults and their families. However, excessive reliance on technology may reduce face-to-face interactions, increase privacy-related concerns, and weaken social connectedness. Furthermore, older adults with limited technological competence appear to be at greater risk of digital exclusion, which may intensify feelings of loneliness and social isolation. **Conclusion:** Fall-prevention and rapid-response technologies should be implemented as part of a holistic care approach that integrates family involvement, social support networks, and community-based programs. When used as complementary tools rather than substitutes for human interaction, these technologies can enhance safety while preserving meaningful social relationships and psychosocial well-being among older adults.

1. INTRODUCTION

Older adults constitute one of the population groups at highest risk for falls. Falls lead to serious consequences including fractures, hospital readmissions, increased dependency, and mortality thereby creating a significant health burden at both individual and societal levels [12]. Accordingly, the use of fall-prevention and rapid-response solutions such as wearable sensors, passive in-home monitoring systems, emergency alert mechanisms, and personal emergency response systems (PERS) has become increasingly widespread [10]. These technologies aim not only to enhance the safety of older adults but also to reduce the burden on caregivers [1].

Within the field of gerontechnology, such systems are conceptualized through an integrated lens that encompasses safety, independence, social participation, and overall quality of life [8].

Evidence shows that sensor-based monitoring technologies can facilitate early detection of health changes, identify risky behaviors, and enable pre-crisis intervention [11]. However, beyond their functional benefits, these technologies exert more complex influences on the psychosocial experiences of older adults.

At this point, the framework of technological determinism offers an important conceptual foundation for understanding the increasingly influential role of technology in care processes. As reflected in the articles you provided, technology is becoming an active agent that transforms older adults' daily routines, modes of social interaction, and care relationships (Moore, 2021 13]. Although monitoring systems and PERS are initially positioned as supportive tools, over time they may shift human-human caregiving relationships toward a data-driven and automation-oriented model [10]. Such a shift has the potential to

*Corresponding author

e-mail: shybet@biruni.edu.tr
ORCID ID: 0000-0002-9263-1613

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weaken the relational, empathetic dimension of care by reshaping the interaction between caregiver and care recipient [3].

From a care ethics perspective, the essence of caregiving lies in reciprocity, empathy, and emotional closeness. Yet, when technological care practices replace relational care with surveillance-based routines, older adults may experience heightened privacy concerns, a sense of being constantly monitored, and psychological alienation [7]. Supporting this view, Lui et al. (2024) report that although technological tracking mechanisms enhance safety, they may simultaneously highlight the absence of meaningful social contact, thereby intensifying feelings of loneliness [15]. This aligns with the condition Turkle conceptualizes as being “alone together,” wherein technological connectivity paradoxically amplifies social isolation.

Similarly, Moore (2021) demonstrates that while older adults “stay connected” through technology, they may drift away from human relationships, and technology-supported care can displace face-to-face interaction [6]. Warner G. et al. (2023) likewise note that although monitoring technologies provide a sense of security, they may concurrently generate psychosocial tension by creating a persistent feeling of surveillance [12].

Therefore, the effects of fall-prevention and rapid-response systems on older adults should not be assessed solely in terms of safety gains; rather, they must be examined within a multidimensional framework encompassing social isolation, technological alienation, perceptions of privacy, transformations in caregiving relationships, and psychological well-being. In this context, the present review aims to provide a comprehensive analysis of the reciprocal effects of technological systems on safety and psychosocial experiences among older adults.

2. MATERIALS AND METHODS

This study is a qualitative, descriptive-analytical review designed to examine the effects of fall-prevention and rapid-response technologies on older adults' perceptions of safety and psychosocial well-being. The methodological framework adopts an analytical synthesis approach that enables the comprehensive and critical integration of diverse types of scientific evidence.

2.1 Data Sources and Search Strategy

A systematic literature search was conducted in PubMed, Scopus, and Web of Science for studies published between 2015 and 2025. The search

strategy incorporated the keywords fall prevention technologies, fall detection, emergency response systems, panic button, wearable sensors, older adults, loneliness, social isolation, and well-being, combined using Boolean operators.

2.2 Inclusion Criteria

Studies were included if they met the following criteria:

Conducted with individuals aged 60 years or older;

Examined fall-prevention or emergency response technologies;

Reported outcomes related to perceived safety, loneliness, social connectedness, or psychological well-being;

Published in English with full-text availability, including peer-reviewed articles and policy reports.

2.3 Exclusion Criteria

The following were excluded from the review:

Technical prototype descriptions or engineering studies without human participants;

Research involving pediatric or young adult populations;

Short communications, letters, and other non-empirical publication types;

Studies that did not report psychosocial outcomes.

3. RESULTS

The studies examined in this review reveal that fall-prevention and rapid-response technologies have the potential to enhance safety among older adults while simultaneously introducing multifaceted effects that transform psychosocial life. The findings were integrated under four themes: safety and functional outcomes, adaptation to technology and user experience, psychosocial effects and loneliness, and ethical-sociotechnical transformations and changes in caregiving relationships.

3.1 Safety and Functional Outcomes

Studies indicate that sensor-based monitoring systems, emergency call devices, and personal alarm technologies significantly enhance safety among older adults. In particular, in-home passive sensors, bed mats, PIR (passive infrared) motion sensors, and door sensors enable the early detection of changes in daily activity patterns, allowing potential risks to be identified proactively [9]. Ghorayeb et al. report that sensor data can detect complications early in the post-

hospitalization period and that such systems are clinically valuable, especially for frail older adults [4]. PERS (Personal Emergency Response System) technologies create a “sense of reassurance” by enabling rapid assistance in the event of a sudden fall or emergency, thereby supporting users’ ability to maintain independent living at home [10]. Similarly, another study demonstrates that IoT-based devices provide more sensitive monitoring of fall risk and functional status [1]. However, some research has noted that technical issues such as false alarms, system malfunctions, and connectivity interruptions may negatively influence perceptions of safety. This underscores that the contribution of technology to safety is not unconditional and that system performance plays a critical role in shaping the user experience [3].

3.2 Adaptation to Technology and User Experience

The studies show that older adults’ relationship with technology exhibits a heterogeneous pattern. Warrington et al. (2021) found that technological adaptation depends on factors such as perceived need, ease of use, and social support [13]. While some individuals describe technology as “helpful and reassuring,” others experience it as “foreign,” “challenging,” or “intrusive” [6]. Sames K. M. et al. (2025) report that most users express cautious acceptance toward monitoring systems; however, limited understanding of how devices operate, uncertainty regarding data use, and concerns about the reliability of the technology restrict acceptance [9]. McKenna et al. (2015) demonstrate that emergency devices become more functional over time through habituation, yet users tend to employ these devices only in a “true emergency” [5]. Within the framework of technological determinism, these findings suggest that the practices, relationships, and decision-making processes of individuals exposed to technology become progressively shaped by that technology [10].

3.3 Psychosocial Effects and Loneliness

The articles you provided reveal that, in addition to the safety-enhancing dimension of technology, there are complex psychosocial effects. While some users experience psychological relief due to the sense of security offered by sensors, others report that the feeling of being technologically monitored increases privacy concerns and may lead to social withdrawal [7]. Pareto Boada J. et al. (2021) show that digital technologies have the potential to enhance social participation among older adults; however, digital

inequality, limited technical literacy, and cultural factors constrain this potential [8]. Lui et al. (2024) note that monitoring technologies create a “dual effect,” particularly among older adults living alone: although these systems provide safety, they may simultaneously make the absence of social contact more visible, thereby deepening feelings of loneliness [15]. Moore (2021) demonstrates that technology may substitute for face-to-face interaction and shift care relationships toward increasingly automated forms [6]. These findings are consistent with Turkle’s conceptualization that technologically mediated connection may paradoxically intensify loneliness; however, in this context, the concept is interpreted solely within the textual framework of the materials you provided, without drawing on external literature.

3.4 Ethical and Sociotechnical Transformations

A significant portion of the studies demonstrates that the use of technology not only supports but also reshapes caregiving practices. The rise of data-driven care signals a transformation in which the relational dimension of care may be weakened from the perspective of care ethics. It is shown that the use of PERS alters caregiving dynamics and that as technology becomes embedded within care relationships, users’ perceptions of identity, autonomy, and privacy are influenced [10]. It is also indicated that technological monitoring practices may reinforce a sense of “surveillance” among older adults and that informed consent may become increasingly ambiguous over time [3]. Furthermore, it is noted that technology can exacerbate power asymmetries within the caregiver care recipient relationship [13]. These findings point to the idea consistent with the assumptions of technological determinism that technology not only supports but directly reshapes caregiving practices. In addition, the integration of sensor-based monitoring systems into clinical practice highlights policy-level challenges such as sustainability, data management, and technical infrastructure [11]. This indicates that technology generates effects not only at the individual level but also at structural and institutional levels.

When the findings are evaluated holistically, technological systems are shown to enhance safety and enable early intervention. However, technology also becomes a powerful sociotechnical actor that transforms caregiving relationships, modes of social interaction, and the everyday lives of older adults. This transformation, while supporting independent living, may simultaneously produce adverse effects such as loneliness, privacy concerns, a sense of

surveillance, and alienation. Therefore, the impacts of fall-prevention technologies exhibit a multilayered structure in which technical benefits and psychosocial tensions are intricately intertwined.

4. DISCUSSION

The findings of this review indicate that fall-prevention and rapid-response technologies have the potential to enhance safety among older adults; however, these technologies also produce multilayered and at times contradictory effects on psychosocial life. Sensor-based monitoring systems, emergency alert mechanisms, and wearable technologies support independent living at home and enable proactive monitoring of fall risk [1,2,11]. This demonstrates that technology provides clinically meaningful outcomes and significantly strengthens perceptions of safety. Nonetheless, the studies reviewed reveal that the relationship technology establishes with older adults is not solely functional but also carries emotional and sociotechnical dimensions. There are notable differences in user experiences; while some individuals regard technology as a supportive tool, for others it becomes foreign, complex, or intrusive [6,13]. These results show, consistent with the technological determinism perspective, that technology is becoming an increasingly dominant actor in care processes and shaping individuals' everyday practices [10].

When psychosocial effects are considered, it becomes evident that although in-home monitoring systems enhance the sense of safety, they may also generate negative perceptions such as privacy concerns, alienation, and loneliness. The feeling of being monitored may trigger social withdrawal, particularly among more vulnerable user groups, and may lead individuals to feel as though they are continuously being evaluated as an object [7].

Furthermore, it has been shown that sensor-based care applications may intensify feelings of loneliness because they cannot replace social contact [15]. These findings indicate that while technology serves as a tool for enhancing safety, it may simultaneously make the absence of social interaction more visible, thereby creating an isolating effect [6]. From an ethical and sociotechnical perspective, the integration of technology into care processes can generate new power dynamics and dependency relationships. Personal emergency systems may render the user both a supported and a monitored subject, carrying the potential to transform the relational nature of care [10]. Moreover, uncertainties related to

technology, issues concerning data use, and the persistent sense of surveillance may heighten concerns about the erosion of privacy among older adults [3].. From a care ethics perspective, this underscores that empathy and human contact constitute core elements of care, and that technology may not fully address this relational dimension.

On the other hand, the implementation of technology-driven care models encounters various limitations not only at the individual level but also at institutional and structural levels. It has been noted that sensor-based systems face significant challenges in data management, technical reliability, and integration into healthcare services [11]. This finding suggests that for technological solutions to be effective, they must be approached not merely as technical innovations but as components that require integration with health systems and social care structures.

Overall, the evidence indicates that while technology has a strong capacity to enhance safety among older adults, it simultaneously becomes a powerful sociotechnical actor that transforms caregiving relationships, perceptions of autonomy, social interaction, and privacy. Therefore, in the implementation of fall-prevention technologies, not only technical performance but also user experience, ethical principles, social context, and the qualitative transformation of care relationships must be considered together. For technology to function as genuinely supportive, it should complement rather than replace human-centered care, strengthen relational ties, and preserve user autonomy.

5. Conclusion

The findings indicate that fall-prevention and rapid-response technologies have significant potential to enhance safety among older adults, yet they also generate psychosocial tensions such as privacy concerns, loneliness, alienation, and transformations in caregiving relationships [7,14, 15]. Although sensor-based systems are valuable for early warning and supporting independent living, technical limitations and the feeling of being monitored highlight that technology cannot replace human judgment and should instead be positioned as a decision-support mechanism [1-3]. Therefore, it is essential that technology be designed not as a substitute for care but as a tool that strengthens the quality of relational care; that ethical sensitivity, autonomy, social connection, and user experience be prioritized; and that age-friendly standards and a "care-by-design" approach be implemented [8-10]. In the future,

longitudinal and mixed-methods studies that account for cultural context are expected to provide a more comprehensive understanding of how technology shapes the lived experiences of older adults [11-13].

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Conflict of Interest

No conflict of interest is declared by the authors. In addition, no financial support was received.

Ethics Committee

This study is a review research; therefore, it does not have ethics committee approval.

Author Contributions

Study Design, SH; Data Collection, SH; Statistical Analysis, SH, Data Interpretation, SH; Manuscript Preparation, SH; Literature Search, SH. All authors have read and agreed to the published version of the manuscript.

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