Review Article

Technological strategies aimed at fall prevention in hospital environments: an integrative review

Estratégias tecnológicas voltadas para prevenção de quedas em ambiente hospitalar: revisão integrativa

Estrategias tecnológicas orientadas hacia la prevención de caídas en ambiente hospitalario: revisión integradora

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Abstract

Objective: To identify the knowledge produced about technological strategies aimed at fall prevention of adults in hospital environments.

Methods: This is an integrative literature review conducted in the Medical Literature Analysis and Retrieval System Online/National Library of Medicine (MEDLINE/PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Latin American and Caribbean Literature in Health Sciences (LILACS), Scopus and Web of Science databases published from 2017 to 2022.

Results: A total of 19 articles were included, most of them published in nursing journals (42%). The themes that emerged from the analysis were: types of technological strategies, costs, patient privacy and nursing professionals' relevance in device development, assessment and use.

Conclusion: The research revealed a range of technological resources aimed at fall prevention available in the market that can be incorporated into care practices. Hospitals must define which strategy applies most appropriately to their reality.

Resumo

Objetivo: Identificar o conhecimento produzido sobre estratégias tecnológicas voltadas para prevenção de quedas de adultos no ambiente hospitalar.

Métodos: Revisão integrativa da literatura realizada nas bases de dados Medical Literature Analysis and Retrieval System Online/National Library of Medicine (MEDLINE/ PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), Scopus e Web of Science publicados no período de 2017 a 2022.

Resultados: Foram incluídos 19 artigos, a maioria publicado em revistas de Enfermagem (42%). Os temas que emergiram da análise foram: tipos de estratégias tecnológicas, custos, privacidade do paciente e relevância dos profissionais de enfermagem no desenvolvimento, avaliação e utilização dos dispositivos.

Conclusão: A pesquisa revelou uma gama de recursos tecnológicos voltados para prevenção de quedas disponíveis no mercado que podem ser incorporados nas práticas assistenciais. Cabe aos hospitais definirem qual estratégia aplica-se de forma mais adequada à sua realidade.

Resumen

Objetivo: Identificar el conocimiento producido sobre estrategias tecnológicas para la prevención de caídas de adultos en el ambiente hospitalario.

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Conflict of interest: nothing to declare.

Métodos: Revisión integradora de la literatura realizada en las bases de datos Medical Literature Analysis and Retrieval System Online/National Library of Medicine (MEDLINE/ PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Literatura Latinoamericana y del Caribe en Ciencias de la Salud (LILACS), Scopus y Web of Science publicados durante el período de 2017 a 2022.

Resultados: Se incluyeron 19 artículos, la mayor parte publicados en revistas de Enfermería (42 %). Los temas que surgieron del análisis fueron: tipos de estrategias tecnológicas, costos, privacidad del paciente y relevancia de los profesionales de enfermería en el desarrollo, evaluación y utilización de los dispositivos.

Conclusión: La investigación reveló una variedad de recursos tecnológicos para la prevención de caídas disponibles en el mercado que pueden ser incorporados en las prácticas asistenciales. Cabe a los hospitales definir qué estrategia se aplica de forma más adecuada a su realidad.

Introduction

Providing damage-free assistance and consolidating itself as a highly reliable organization is a milestone sought by hospital institutions and, consequently, a major challenge since the provision of health care is considered a highly complex activity. The search for new treatments, more efficient equipment and innovations in technology represent a valuable contribution to hospital practices.[1,2]

In order to build a safety culture and mitigate the occurrence of adverse events such as the fall, health systems seek to adopt the principles of a high trust organization that include leadership development, implementation of quality improvement interventions, support for just culture and recommendations from organizations such as the Joint Commission and the Institute for Healthcare Improvement (IHI).[3]

Proposed by IHI, hierarchies of actions are intended to help teams identify which actions provide the strongest effect for system success and sustained improvement. Thus, in the face of the occurrence of an adverse event and proper root cause analysis, stronger actions are established to mitigate these weaknesses and provide continuous improvement, reducing the chances of an event recurring[3,4]

Strong actions require less human dependence and include categories of activities such as architectural and physical issues, implementation of new devices with usability testing, standardization of equipment or processes, tangible involvement of leadership, in addition to the application of technological strategies, which have had a significant impact on reducing the prevalence of accidents due to falls in hospitals.[4-6]

Despite its importance, the incorporation of innovations in the health area is still a challenge, not only due to the technological operationalization, but also due to the integration of humanistic issues related to care as well as behavioral and cultural aspects. Therefore, the application of results arising from innovations in technological segments still presents obstacles in nursing, with its practical implementation being carried out very slowly. In this regard, the dissemination of solutions, innovative proposals and patents can reduce the gap between theory and practical applicability.[7]

Considering the current scientific evolution, we observe the emergence of several resources aimed at accidents due to falls in order to detect the occurrence of these events. However, aiming at better quality standards, we move towards the search for devices for prediction and prevention, with greater potential to improve patient safety and quality of life.[8] In this sense, the present study aimed to identify the knowledge produced about technological strategies aimed at fall prevention among adults in hospital environments.

Methods

This is an integrative review study whose purpose is a broad literature analysis, synthesizing the results obtained in research on a theme or issue through a guiding question.[9] The following steps have been taken: 1) Identification of the theme presented in question form; 2) Definition of study inclusion and exclusion criteria; 3) Sample selection; 4) Inclusion of selected studies; 5) Analysis of results with the identification of similarities and conflicts; 6) Data presentation and discussion.[10] The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) recommendations were used as a reference for carrying out the research and report-

ing the results. The search in the electronic databases was carried out from March to April 2022.[11]

Articles published in the last five years, in English, Portuguese and Spanish, that addressed the use of technological strategies to prevent adult falls in hospital environments were included. Dissertations, theses, duplicate documents, editorials, reviews were excluded, as well as those not corresponding to the study's guiding question, such as technologies exclusive to children or not applicable to hospital environments. For the problem definition, the review's guiding question was: How is the production of knowledge about technological strategies aimed at fall prevention in adults in hospital environments characterized? The search was performed by online access in the following databases: Medical Literature Analysis and Retrieval System Online/National Library of Medicine (MEDLINE/PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Latin American and Caribbean Literature in Health Sciences (LILACS), Scopus and Web of Science.

In order to ensure a broad search for primary studies, the strategy comprised the controlled descriptors of health terminology of Health Descriptors in Health Sciences (DeCS) in English, Portuguese and Spanish: "Accidental Falls", "*Acidentes por Quedas*", "*Accidentes por Caídas*", "Technology", "*Tecnologia*", "*Tecnología*", "Hospitals", "*Hospitales*" and "*Hospitais*", which were combined using Boolean operators OR and AND. Figure 1 presents the selection process of articles until obtaining the final sample.

Initially, the title and abstract of all screened articles were read; then, a detailed reading of selected articles was carried out and those chosen to compose the final sample. The search and selection were carried out by reviewers independently by two researchers, resorting to a third researcher for cases of divergence. Data were collected and systematized in a summary table with the following information: article number, title, authors, year and place where it was published, database, type of study, technological specification, main findings, limitations and journal scope. The study is linked to the project Registration of patents related to nursing, CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 47943621.5.0000.5411, and approved by the Research Ethics Committee of UNESP's *Faculdade de Medicina de Botucatu,* under Opinion 4,841,423.

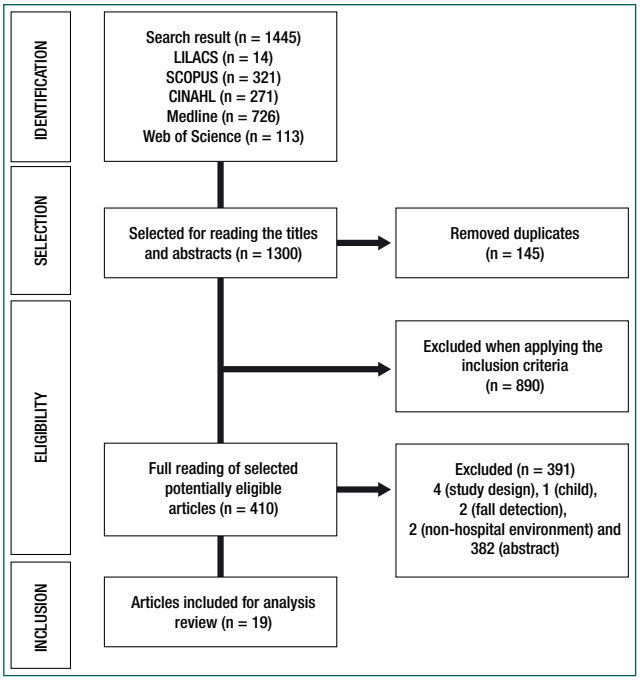

Figure 1. Article selection process flowchart for sample composition

Results

Of the 1,445 articles located, 19 were established as the body of analysis, most of which were published in 2017[12-18] and 2018[19-22] (58%), in the United States[14,15,17-19,23-26] (47.4%), Australia,[12,13] Germany,[27,28] Brazil[21,22] and Japan[16,20] (10.5%) and United Kingdom[29] and Singapore [30] (5.3%). We identified 14 usability and product presentation studies,[13-16,18,19,21-28,31] two control case studies,[17,20] a comparative retrospective study,[30] a randomized controlled study[29] and a comparative prospective.[12] Most articles were published in journals specialized in nursing,[17,19,20,21, 25,26,28,30] (8/42.1%), followed by gerontology and geriatrics[12,14,23,24] (4/22.1%) and medical informatics[15,16,26] (3/15.8%). The other publications were in journals with engineering[13,27]

(2/10.5%), patient safety[18](1/5.3%) and medical sociology[29] scopes (1/5.3%). Among the technological strategy specifications, seven articles referred to environmental devices,[15,18,19,21,25,29,30] five for wearable devices,[13,14,23,27,28] five for information technology program/tool[12,16,20,22,24] and two articles were focused on educational processes.[17,26] The work made it possible to identify technological strategies aimed at fall prevention in hospital environments, as shown in Chart 1.

Chart 1. Synthesis of studies included in the review

Sequence	Authors/Year/ Country	Objective	Technology specification	Main findings
1	Teh RC, et al. 2017. Australia[12]	Assess health information technology (HIT) compared to the Fall Risk for Older Persons (FROP) tool in screening for risk of falls.	Program/information technology tools	The HIT system presented the same acceptability and score compared to the FROP.
2	Wickramasinghe A, et al. 2017. Australia[13]	Analyze radio frequency identification label (RFID) responses without battery through bed exit movements.	Wearable device	Using battery-free identification label indicated effectiveness of the bed-out monitoring structure.
3	Razjouyan J, et al. 2017. USA[14]	Assess the feasibility of using a chest sensor during hospitalization to determine the risk of fall.	Wearable device	The sensor demonstrated the feasibility of wearable technology to monitor physical activity, sleep, postures and heart rate variation as potential fall risk markers.
4	Balaguera HU, et al. 2017.USA[15]	Conduct a technology assessment, including feasibility, usability, and user experience, of a medical sensor-based Intranet of Things (IoT) system to facilitate nursing response to bedside exits in an intensive care hospital.	Environmental devices	The IoT system integrated into nursing workflow reduced risk of fall in patients' bed.
5	Yokota S, et al. 2017. Japan[16]	Assess the risk of inpatient falls using a support vector machine.	Program/information technology tools	The adoption of the method based on daily data recorded in electronic medical record was able to assess risk of falls without overloading the nursing staff.
6	Opsahl AG, et al. 2017. USA[17]	Assess the use of clustered falls prevention interventions highlighted by a patient/family engagement educational video.	Educational process	Fall prevention program including educational video for patients and their families resulted in positive trends for a decrease in fall rates in the care scenario, in addition to providing the family with the opportunity to participate in the discussion and educational process.
7	Potter P, et al. 2017. USA[18]	Report the first application of the complete fall detection sensor system for use in fall prevention in an acute care setting.	Environmental devices	The fall detection sensor system gave the team a better awareness of fall prevention and offered a level of vigilance that standard fall alert systems do not.
8	Cournan M, et al. 2018. USA[19]	Compare fall rates before and after implementing a video surveillance system, in addition to quantifying the costs saved by reducing falls.	Environmental devices	The implementation of video surveillance resulted in all and cost drop by reducing the need for companions (sitters), in addition to improving patient, family and team satisfaction.
9	Yokota S, et al. 2018. Japan[20]	Investigate the effect of using a fall risk screening tool on an electronic medical record system.	Program/information technology tools	The probability of occurrence of falls decreased after implementing the tool, but its use did not reduce the actual occurrence of falls, reinforcing the need to maintain the preventive measures adopted.
10	Sakano LMN, et al. 2018. Brazil[21]	Describe the development of a fall prevention device for older adults while using the toilet.	Environmental devices	The "Safe Embrace" device was positively assessed by the health team, patients and caregivers. Through the benefit obtained, the device has been patented so that other institutions can take advantage of the resource.
11	Nuñez Filha MCA, et al. 2018. Brazil[22]	Develop a mobile web electronic tool that helps health professionals in assessing risk of falls in older adults using instruments adapted to Brazilian Portuguese, validated for older adults and widely used in the literature.	Program/information technology tools	The developed application was fast, easy to operate and had the main instruments to identify risk of falls in older adults.
12	Baker PA, et al. 2021. USA[23]	Assess whether PUP® socks (Patient Is Up) Smart Socks prevent falls of patients at high risk of falls in hospital environments.	Wireless wearable device	The technology resulted in a significant reduction in drop rates among patients at high risk of fall.
13	Sun R, et al. 2019. USA[24]	Assess the primary validity and usability of a Kinect camera-based fall risk assessment system in a hospital environment.	Program/information technology tools	The system offers an objective, low-cost, self-guided fall risk assessment, in addition to being accepted by older adults.
14	Hebb A, et al. 2021. USA[25]	Determine team satisfaction and acceptance of continuous video monitoring (CVM) technology compared to assistants.	Environmental devices	Understanding staff satisfaction and acceptance of technology is imperative for nursing and management leaders when implementing new technologies.
15	Duckworth M, et al. 2019. USA[26]	Examine whether the Fall TIPS modality affects patient engagement in the 3-step falls prevention process and its effectiveness.	Educational process	The 3 Fall TIPS modalities effectively facilitated patient involvement in the fall prevention process and proved to be an effective strategy for dissemination, allowing institutions to choose the modality that best fits their reality.
16	Jähne-Raden N, et al. 2019. Germany[27]	Introduce The Inexpensive Node for Bed-Exit Detection (INBED), a signaling system for bed exit detection and loss prevention.	Wireless wearable device	Wearable device that detects patient movement and their data are forwarded to a central connected to the nursing staff through a wireless infrastructure.
17	Jähne-Raden N, eta al. 2019. Germany[28]	Introduce INBED, a comprehensive beacon system for bed exit detection.	Wearable device	INBED, a comprehensive fall prevention signaling system, can detect various types of movement that are relayed to nursing staff over the network. The system can help relieve care staff and provide greater freedom of movement and privacy to patients.

Continue...

Continuation.

Sequence	Authors/Year/ Country	Objective	Technology specification	Main findings
18	Timmons S, et al. 2019. United Kingdom[29]	Analyze the weaknesses of bed and chair pressure sensors to prevent falls at the bedside in hospitalized elderly.	Environmental devices	Bed and chair pressure sensors are not profitable as they have not reduced falls.
19	Seow JP, et al. 2022. Singapore[30]	Examine the effectiveness of an integrated three-mode bed exit alarm system in reducing inpatient falls in an acute care hospital setting in Singapore.	Environmental devices	Using a bed exit alarm system is associated with a reduction in incidence of falls.

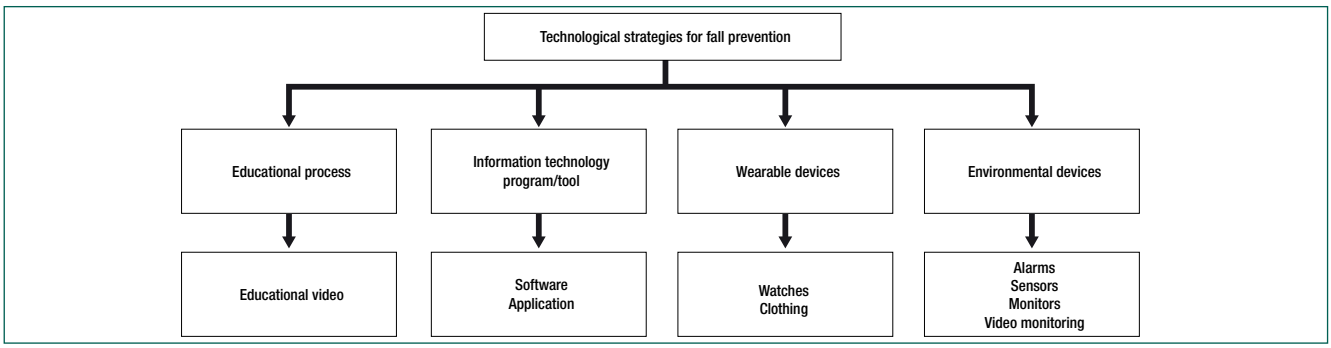

Figure 2. Types of technology strategies

After analysis, from the perspectives proposed by the authors, research was found on technological strategies aimed at preventing adult falls from various aspects, with the following themes emerging: a) types of technological strategies; b) costs; c) patient privacy; d) nursing professionals' relevance in device development, assessment and use. The types of technological strategies are presented in four strands as shown in Figure 2. In the costs theme, in addition to the analysis for implementation, studies are presented that reveal devices that can reduce expenses with care, or even those spent on treatment of damage resulting from fall in hospital environments. Privacy is addressed in issues related to acceptability by patient, family and team, in addition to restrictions and legal aspects. The last theme portrays the importance of nurses' role in device assessment and use as a criterion for product acceptability, in addition to pointing out the need to involve these professionals in the development of assistive technologies aimed at fall prevention in hospital environments.

Discussion

Our study portrays the diversity of strategies that have been developed for fall prevention, mainly demonstrating the usability of these resources. The study's findings revealed that developed countries tend to invest more in technology and innovation, reflecting concerns about patient safety, as well as taking into account the aging population present in these countries. In Brazil, despite the scarcity of investments in innovative science, there is a growing trend of deaths from falls with increasing age, which can be avoided by adopting preventive measures.[13-17,19,22-26,28,32,33]

Types of technology strategies

With technological advances, there has been an increase in use of technological strategies aimed at monitoring and preventing falls in hospital environments. This is a positive fact, since hospitalization and length of stay considerably increase risk of fall, due to change and lack of knowledge of the environment.[34-36] Devices such as hardware and software, sensors and information technology enabled virtual environment integration with face-to-face daily activities, in addition to contributing to expanding access to information and care.[37] In the study, it was possible to identify environmental devices, such as video monitoring, which is a non-invasive mechanism for fall prevention in hospitalized patients, in rehabilitation or even with cognitive impairment, and technologies of 3D im-

age capture systems with motion detector sensor may also be used. Integrated alarm systems capable of signaling the attempt and exit of patient from bed, pressure-sensitive pad that is placed under the mattress of the bed and the padding of the chair that transmits an alert to a central monitor on the ward if plaque pressure is reduced and wireless sensors placed at the bedside to target pressure injuries and monitor vital signs. Mechanical containment equipment also plays an important role in fall prevention, such as the device developed for safe toilet use.[15,18,19,21,25,29,30] Among the wearable devices, we find INBED, a resource to be placed on the upper half of patients' leg to detect various types of movements, PUP smart socks, which signal when patients get out of bed and step on the floor, detecting pressure through sock sensors and triggering an alert, battery-free radio frequency identification (RFID) tag attached to patients' chests using standard electrocardiogram electrodes (ECG), to analyze bed exit movements and in addition to being able to record biological parameters, including ECG, respiratory rate, body temperature and three-dimensional acceleration.[13,23,27,28] Among the software and applications developed as a resource for fall prevention, we observed risk screening systems using a Kinect camera and a support vector machine, in addition to those based on HIT and FROP. They all seek to parameterize risks of falls by identifying or using information previously stored in a database such as an electronic medical record. However, there are more accessible software that allow the computerized use of validated scales already used in professional practice, such as the Berg Balance Scale, Tinetti Scale, Dynamic Gait Index and the Timed Up and Go (TUG) test, offering a final score and reporting capability.[12,16,20,22,24] The educational video, planned and developed for use by the care staff, aims at the adoption of preventive measures for falls, allowing the involvement of family members in the discussion and raising awareness on the subject. Still on educational processes, the Fall TIPS Toolkit, developed in the USA, is based on risk assessment carried out by nursing professionals who then prepare a personalized fall prevention plan, and this information is made available on a bedside monitor for patient and family, providing engagement, showing adherence of more than 80% to the protocol.[17,26] Device range expansion has a direct impact on the population' health as they are made available in hospital networks. Despite the significant evolution of the incorporation of health technologies in the Brazilian public sphere, constant improvements are necessary for this process to occur in a sustained and transparent manner, guaranteeing efficacy and safety for users.[38]

Costs

Falls are responsible for increasing treatment and hospital stay costs, in addition to generating changes in emotional aspects in the health team and negatively impacting the institution credibility in society. A Canadian study showed that the average excess cost spent by the hospital with a severe fall was C$30,969 compared to patients who did not have this outcome. The mean length of hospital stay was 45 days for patients who fell and 11 days for those who did not. An Australian study revealed an increase in hospitalization time of eight days, in addition to generating an additional cost for the hospital of A$ 6,669. In Brazil, hospitals have considerable expenses in hip fracture treatment in older adults. A study showed that values ranged from R$ 1,700.00 (*reais*, Brazilian currency) for care per patient in the Unified Health System (SUS - *Sistema Único de Saúde*) to R$ 24,000.00 for care per patient in health insurance companies. One of the justifications for this high cost is the time between trauma and surgery due to the unavailability of operating rooms and materials needed for the procedure, in addition to the long preoperative patient preparation time.[36,39-41] The validity, feasibility and acceptability of devices designed to prevent falls can help reduce costs related to this adverse event in hospital environments, in addition to reducing nursing staff workload while increasing quality of care and patient safety. Some devices aimed at monitoring several patients simultaneously can reduce costs, in addition to the fact that the amounts invested in the acquisition and implementation of devices can be recovered in a short period of time as a result of reductions in falls and funds that would be directed to hiring a caregivers.[14,19,25] Resources that use commercially available imaging technologies pres-

ent themselves as more cost-effective solutions, such as low-cost cameras with video/depth detection with 3D motion tracking, such as Microsoft Kinect™ and Orbbec Astra. Moreover, using battery-free sensors that do not require maintenance can also represent low investments for their implementation. The latest wearable technologies add multiple functionalities at a low cost, optimizing physical space and teams. Products that use information technology tools focused on risk assessment can also be low-cost, providing an effective and low-value intervention. Simple ideas, without using state-of-the-art technologies for fall prevention, are low-cost solutions that can be implemented in regions with financial constraints.[12-14,21,22,24,27,28] On the other hand, it is observed that some of the devices analyzed were not effective in reducing costs, since their implementation requires expensive investments or they are still not capable of reducing incidence of falls in hospital environments. Other studies reinforce the need for additional research to verify the cost-effectiveness of using their system.[15,19,23,29,30,38] Using health innovations has an impact on reducing mortality, especially when it comes to elderly patients and disabling diseases, reinforcing the fact that the internet of things can act directly to reduce care costs. However, a rigorous assessment process for the incorporation of technologies will certainly result in better clinical benefits for patients and budgetary benefits for healthcare institutions.[42,43]

Patient privacy

Although the strategies that use imaging technologies allow for great advances in fall prevention, legal restrictions and difficulties of acceptance by patients are pointed out due to the feeling of exposure of their intimacy. On the other hand, there are reports that they may be less intrusive than caregivers, and may lead to less patient agitation.[18,19,25] Some of the devices, such as sensors, although considered less invasive, may be resistant to their implementation, since older patients consider discretion as a key acceptance criterion, which can be seen as an obstacle to the transposition of technology into practice.[13,21,27,28] The adoption of mechanized technologies can offer solutions for environments that require greater privacy, such as toilets, eliminating the need to capture images and movements or even the monitoring of caregivers.[18,21] Despite the benefits arising from using health technology, it is necessary, for its implementation, to carry out previous regulatory studies and also to take into account the ethical issues related to health users, who have the right to privacy, comfort and confidentiality of all and any personal information, even if little known by patients.[38,44,45]

Nursing professionals' relevance in device development, assessment and use

The predominance of studies in journals specialized in nursing highlights professionals' relevance in preventing this type of incident, through measures such as risk assessment, planning and providing individualized care, in the educational process and in carrying out intentional rounds in the rooms.[17,20-22,25,28,30,46] In several cases, the nursing staff considers it useful to use alerts and systems that are adequate and integrated into the workflow, revealing the acceptability of these technological devices. However, there is a need for the team to be involved in implementation of new technologies as well as investigation of professionals' satisfaction, aiming at better product acceptance.[15,19,25,47-49] Brazilian nursing has been advancing scientifically in the field of technology, appropriating innovative resources and strengthening care practice, education and health management, despite the scarcity when compared to the international context.[50] In this sense, using technology can become capable of improving nursing staff workload, optimizing care time and allowing professionals to carry out other activities while patients are "protected" by the device, such as the Safe Embrace.[21,27,41] However, the team may be dissatisfied with resulting problems, such as the inadequate number of professionals to respond to the alarms, forgetting the beep at the nursing station and the hierarchy of priorities when they are activated, since they could often be treating another patient, which would make it impossible to go to the place where the alarm was triggered. In addition to this, it is worth noting that when the institution chooses to use a sound device, the effects of alarm fatigue must be taken into account, which may result in a delay

in care or a reduction in the response rate due to excessive exposure to alerts.[23,29,30,51] Using monitoring systems can bring interesting benefits by allowing the review of fall videos, enabling the nursing staff to establish individual intervention plans for patients who need more effective interventions, taking into account the reasons for the incidents, since bundles may not include appropriate care measures for all patients.[18] Meetings of care teams to analyze adverse events can become promising for detecting demands and designing or adapting products aimed at fall prevention. It is important for professionals from different areas to participate, such as clinical engineering, architecture, information technology, hospitality, property security, among others, as they can collaborate with complementary ideas and concepts, seeking viable alternatives for developing new solutions.[21,52] The care staff partnership remains a fundamental point for the development of effective tools that are applicable in practice.[12,35] Despite its relevance, nursing still plays a discreet role in product innovation. Nurses should be encouraged in the development of materials, equipment and services, with due registration in the patent system. In this sense, teaching entrepreneurship appropriate to this new professional context must be incorporated into the undergraduate nursing course curriculum, further encouraging students to seek assistance at technology transfer centers for patent registration and technological innovations present in several universities.[21,47,48,53]

Since this is an integrative review, some study that did not meet the inclusion criteria, as well as implemented strategies, but described in other forms of publication, despite the adoption of strict criteria for the literature survey, may have been disregarded. Another limitation refers to the scarcity of articles that answered the guiding question of this study, since most researches tend to investigate devices that aim to signal the moment of the incident, after its occurrence. The study suggests that further research in the area be carried out, seeking solutions capable of helping to prevent falls. We provide nursing professionals with information about the technological strategies developed and their possible applicability. Data on costs and privacy act as additional information to assist in the decision-making process about the most suitable resources. It is also expected to bring reflections and inspirations for the creation and improvement of health technologies so that they meet the market's predispositions, requiring less and less human dependence on processes aimed at the prevention of adverse events, allowing the care staff to be focused on the planning and delivery of individualized care based on quality and patient safety.

Conclusion

The research identified several technological strategies that can be applied to prevent falls among adults in a hospital environment, in addition to bringing reflections on measures applied to prevent falls, revealing a range of resources developed and available on the market, which can be incorporated into care practices composing institutional policies. Among the technological strategies, those related to the educational process, information technology programs/tools, wearable and environmental devices stand out. Studies show that some devices can reduce expenses with care, or those resulting from falls in hospital environments. However, attention should be paid to patient, family and team privacy issues, in addition to restrictions and legal aspects. It is up to hospitals to define which strategy is most appropriately applied to their reality, taking into account the budget available for investment, public served, number of nursing staff, sector where it will be implemented, availability for training the team before the start of use, epidemiological profile of patients, among others. It becomes relevant to broaden the discussions for the formulation of programs and institutional policies for fall prevention, composed of technological strategies and differentiated interventions aimed at patient safety, going beyond the practice of isolated actions in hospital environments. Moreover, nursing staff should be encouraged to participate in the development of materials, equipment and services, revealing the importance of their role through scientific dissemination and patent registration.

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