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MOBILE APPS FOR PRESSURE INJURY MANAGEMENT: AN INTEGRATIVE REVIEW

Aplicativos móveis para o gerenciamento da lesão por pressão: uma revisão integrativa

Aplicaciones móviles para el manejo de lesiones por presión: una revisión integradora

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ABSTRACT

Objective: to identify scientific productions focused on the development of mobile applications for pressure injury management. **Method:** integrative literature review, carried out in MEDLINE, CINAHL, LILACS, SCOPUS and Web of Science databases. The guiding question was used What are the characteristics of educational mobile applications that aim to manage pressure injury prevention? **Results:** 576 articles were identified that, after applying the inclusion and exclusion criteria, the selected sample included 13 articles being discussed from four dimensions Prevention, evaluation and treatment: of PI; Prevention and assessment of PI; Evaluation and treatment of PI; and Evaluation. **Conclusion:** it was observed that most applications have influenced and/or have the potential to positively influence the assessment, prevention and treatment of pressure injuries, and these technologies are capable of improving knowledge on the subject and providing care for individuals or patients. caregivers of those who have LP.

DESCRIPTORS: Mobile applications; Nursing informatics; Software; Pressure injury.

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RESUMO

Objetivo: identificar produções científicas voltadas ao desenvolvimento de aplicativos móveis para o gerenciamento de lesão por pressão. **Método:** revisão integrativa da literatura, realizada nas bases de dados MEDLINE, CINAHL, LILACS, SCOPUS e Web of Science. Utilizou-se a questão norteadora: Quais características dos aplicativos móveis educativos que objetivam o gerenciamento da prevenção de lesão por pressão? **Resultados:** foram identificados 576 artigos que após aplicação dos critérios de inclusão e exclusão, a amostra selecionada incluiu 13 artigos sendo discutidos a partir de quatro dimensões: Prevenção, avaliação e tratamento das LP; Prevenção e avaliação de LP; Avaliação e tratamento das LP; e Avaliação. **Conclusão:** observou-se que a maior parte dos aplicativos influenciaram e/ou apresentam potencial para influenciar positivamente a avaliação, prevenção e tratamento das lesões por pressão, sendo estas tecnologias capazes de aprimorar o conhecimento acerca da temática e proporcionar o cuidado para os indivíduos ou cuidadores daqueles que possuem LP.

DESCRITORES: Aplicativos móveis; Informática em enfermagem; Software; Lesão por pressão.

RESUMEN

Objetivos: identificar producciones científicas enfocadas en el desarrollo de aplicaciones móviles para el manejo de lesiones por presión. **Método:** revisión integrativa de la literatura, realizada en las bases de datos MEDLINE, CINAHL, LILACS, SCOPUS y Web of Science. Se utilizó la pregunta orientadora: ¿Cuáles son las características de las aplicaciones móviles educativas que tienen como objetivo gestionar la prevención de lesiones por presión? **Resultados:** se identificaron 576 artículos que, luego de aplicar los criterios de inclusión y exclusión, la muestra seleccionada incluyó 13 artículos siendo discutidos desde cuatro dimensiones: Prevención, evaluación y tratamiento de la IP; Prevención y evaluación de IP; Evaluación y tratamiento de IP; y Evaluación. **Conclusión:** se observó que la mayoría de las aplicaciones han influido y/o tienen el potencial de influir positivamente en la evaluación, prevención y tratamiento de las lesiones por presión, y estas tecnologías son capaces de mejorar el conocimiento sobre el tema y brindar atención a las personas o cuidadores de los que tienen LP.

DESCRIPTORES: Aplicaciones móviles; Informática de enfermería; Software; Lesión por presión.

INTRODUCTION

Considered as an important problem that affects the general population, triggering damage to health and care, pressure injuries (PI) are characterized by a localized damage to the skin and/or underlying soft tissues, usually on a bony prominence associated with friction and/or shear of the skin. They may also refer to injuries caused by the use of medical devices resulting from pressure exerted by the device on the skin. They may present as intact or broken skin, and may or may not be painful. Other factors that favor the appearance of these lesions are related to sensory perception, mobility, humidity, nutrition, tissue perfusion and existing comorbidities.[1-2]

Annually, PL affects tens of millions of people worldwide, and can directly affect their well-being, extending hospitalizations, increasing morbidity, mortality and affecting the quality of life of patients with PI, and its occurrence is classified as an adverse event.[3] Its incidence is high, ranging from 23.1% to 59.5%,[4-5] assuming that it is related to the failure to develop preventive care properly. In view of this, it is necessary to build strategies and resources that enable the learning of care actions, being reflected in the improvement of care.[6]

Information and Communication Technologies (ICT), exemplified by notebooks, tablets and smartphones with internet access, have allowed professionals and students to access educational information anytime and anywhere. These resources can guide health professionals with guidelines, classes, textual resources and audiovisual content. Thus, the mHealth (mobile health) concept emerged, which corroborates with medical and health practices in general, aided by smartphones among other technological materials.[7]

With the growth and impact of technology on society, mobile applications become an important tool for educational support in the health area. And associated with this, applications, which are software for storing information, enable task specification, as well as user linkage with the device and the content to be offered, constituting mobile communication and information technologies.[8] The literature corroborates that in recent years, there has been a growth in the emergence of mobile applications for care purposes, maintaining information in a timely manner and applying quality care.[9]

The recognition of patients at risk for PI and the designation of factors that lead to its development is essential to reduce the incidence of PI. However, there is a scarcity of methodological data regarding the development of mobile applications for the prevention of PI. Thus, with the proposal to identify the evidence of mobile applications for PI prevention and as a way to identify gaps to be researched in this area, the objective of the study was to identify scientific productions focused on the development of mobile applications for PI management.

METHOD

This is an integrative literature review that consists of presenting a synthesis of existing studies in the literature in order to provide knowledge for their use in clinical practice. For the development of this study, it is necessary to follow some steps: definition of the guiding question; establishment of inclusion and exclusion criteria; literature search; data collection; critical evaluation of studies with the adoption of a tool for data collection; interpretation of data extracted from studies; presentation of the review.[10]

The research question was structured using the acronym PICO - Population (people affected by PI); Intervention (Application); Comparison (not applicable) and Outcomes (Prevention of PI).[11] In view of this, the study question is: What are the characteristics of educational mobile applications that aim to manage PI prevention?

Inclusion criteria were established as studies available in full, in Portuguese, English and Spanish; without determining the interval and that constituted the main objective of this research. Theses, dissertations, editorials, opinion articles, systematic and integrative reviews, as well as technical reports and experience reports were not included during the screening of studies. In addition, those studies that referred to the development of applications associated with other technological devices, telehealth or that were developed for computers and that made it impossible to use the application on mobile devices, were also excluded.

Data collection took place during the month of March and April 2021 in the databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Latin American and Caribbean Literature in Health Sciences (LILACS), Medical Literature Analysis (PubMed/MEDLINE), SCOPUS and Web of Science, characterized as national and international platforms for broad online indexing of journals and scientific studies in health.[12]

The Health Sciences Descriptors (DeCs) Mobile Applications, Mobile Apps, Nursing Informatics, Software, Smartphones, Pressure Injury and the Medical Subject Headings (MeSH) descriptors Mobile Applications, Mobile Application, Mobile Apps, Mobile App, Medical informatics Applications, Nursing informatics, Software, Smartphones, Pressure Ulcer were used.

The selection of studies was performed using the Boolean operators AND, OR and NOT between the search terms,[13] with the first two being used to outline the strategies shown in Table 1.

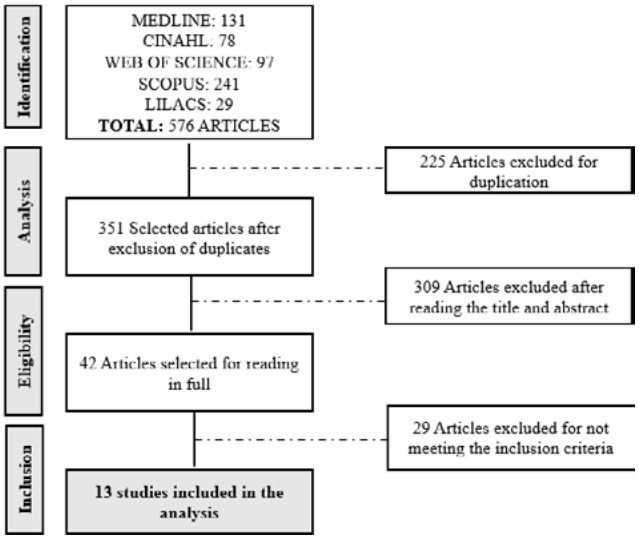
The process of screening and selection of studies was based on the references of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)14 (Figure 1). At first, the studies were selected by reading the title and abstract. Subsequently, the full file of those selected through the initial screening was read, looking for evidence of applications that prevent PI in line with the guiding question of this

Table 1 - Search strategy in each database, João Pessoa, Paraíba, Brazil, 2022

Databases	Search filter	Crossing Descriptors
MEDLINE/ PubMed	Mesh Terms	"Mobile Applications" OR "Mobile Application" OR "Mobile Apps" OR "Mobile App" OR "Medical informatics Applications" OR "Nursing informatics" OR Software OR Smartphones AND "Pressure Ulcer"
CINAHL	Mesh Terms	"Mobile Applications" OR "Mobile Application" OR "Mobile Apps" OR "Mobile App" OR "Medical informatics Applications" OR "Nursing informatics" OR Software OR Smartphones AND "Pressure Ulcer"
Web of Science	TOPIC (Title, abstract and key words)	"Mobile Applications" OR "Mobile Application" OR "Mobile Apps" OR "Mobile App" OR "Medical informatics Applications" OR "Nursing informatics" OR Software OR Smartphones AND "Pressure Ulcer"
Scopus	(Title, abstract and key words)	"Mobile Applications" OR "Mobile Application" OR "Mobile Apps" OR "Mobile App" OR "Medical informatics Applications" OR "Nursing informatics" OR Software OR Smartphones AND "Pressure Ulcer"
Lilacs	Words	Aplicativos Móveis OR Apps Móveis OR Informática em Enfermagem OR Software OR Smartphones AND Lesão por Pressão

Source: data from the review, João Pessoa, PB, 2022.

Figure 1 - Flowchart of the selection of review articles, according to PRISMA. João Pessoa, Paraíba, Brazil, 2022



Source: Adapted from PRISMA14 recommendation, João Pessoa, PB, 2022.

study. Articles that were repeated in more than one database and that met the search criteria were examined only once.

To assess the level of evidence[15] of the publications, the classification proposed by Melnyk and Fineout-Overholt, which establishes the following criteria, was used: (I) evidence resulting from relevant meta-analysis and systematic review; (II) evidence obtained from clinical trials with well-designed randomization; (III) well-designed evidence obtained from clinical trials without randomization; (IV) evidence from cohort and case-control studies; (V) evidence from systematic review of descriptive and qualitative studies; (VI) evidence based on descriptive or qualitative study; (VII) evidence based on opinions of authorities or research committee.

RESULTS

The search in the databases resulted in a total of 576 articles, 225 of which were excluded at the first moment because they were duplicated. The titles and abstracts of the 351 manuscripts were read, and 309 were excluded because they did not meet the inclusion criteria. Therefore, 42 articles were read in full, of which 13 articles were part of the universe of this study, as listed in Table 2. Figure 1 illustrates the flowchart of the screening procedure of the studies in this review.

Table 2 - Synthesis of the studies included in the review according to authors' names and year of publication, objectives, application characteristics, accessibility, application language and level of evidence of the studies. João Pessoa, Paraíba, Brazil, 2022

Authors and Year	Objectives	Mobile app features	Accessibility	Application Language	Level of Evidence
Salomé; Ferreira.[17] (2018)	Develop a mobile application for use by health professionals in the prevention and treatment of PI.	Patient registration, Braden scale, risk factors for PI development, algorithm for wound size and tissue types, exudate characteristics, wound cleaning; PI staging and treatment.	Android (Inaccessible) and web access portal (Accessible)	Portuguese	NA*
Rodrigues; et al.[18] (2013)	Development of an integrated mobile system for monitoring pressure ulcer treatment.	Alerts to fill in the Braden scale, treatment, relevant medical and protocol information, recording the wound with photos.	Inaccessible	English and Portuguese (Portugal)	NA*
Garcia-Zapirain et al.[19] (2018)	Development and evaluation of a mobile application for PI targeting and assessment, without contact with the affected area, reducing discomfort and infection.	Segment and parameterize PI for diagnosis and follow-up.	Inaccessible	English	Level III

Frisen; Hamel; Mcleod[20]. (2013)	Report feedback on the design and functionality of the app and evaluate practitioners' experiences when using the wound care app.	Patient registration, enter and assess wounds, suggest treatments using Pressure Ulcer Scale for Healing (PUSH tool), Braden scale and Bates-Jensen tool, enabling photographic records.	Inaccessible	English	Level III
Kryger et al.[21] (2019)	To determine whether iMHere use would be associated with improved health outcomes over a nine-month period.	Reminders for medication administration, skin care tracking with photo and messaging features, to communicate with professional.	Inaccessible	English	Level II
Jun et al.[22] (2016)	Present and evaluate the effectiveness of the app equipped with a basic wound assessment algorithm and a guide to an appropriate dressing solution.	Direct appropriate dressing based on wound assessment, verifying the need for debridement, infection control, revascularization and exudate control, determining wound chronicity and assessing the upper skin surface.	Inaccessible	English	Level III
Campos et al.[23] (2020)	Develop and evaluate an app with guidance on PI identification, staging and prevention in adults.	Concept and risks, staging with imaging, Braden scale, prevention and references used.	Android – Acessível e portal de acesso na web – Acessível	Portuguese	Level III
Vitoriano et al.[24] (2016)	Evaluate the "Pressure Ulcer Indicator Application (PUIA)" software.	Braden Scale, evolution of lesions and patient risk score, prevention and/or treatment of PI.	Inaccessible	Portuguese	Level III
Raipaul; Acton.[25] (2015)	Educational app development, testing and implementation, followed by a review of qualitative data.	Prevention, classification, treatment, risk assessment of PI with testing for finalization of modules.	Inaccessible	English	NA
Casal-Guisande et al.[26] (2020)	Design, definition and evaluation of a new decision support methodology to be applied to the monitoring and evaluation stages of the PI treatment process.	Data collection, image processing, calculation and modeling of results, Braden scale, lesion assessment, interpretation of results and generation of alerts, decision making and treatment application.	Inaccessible	English	Level III
Fiordelli et al.[27] (2020).	Describe the participatory identification of evidence-based content to inform the development of a PL self-management app with individuals with spinal cord injury (SCI).	Prevention and management of PI in individuals with SCI related to: support surface, repositioning, nutrition, skin assessment and care, exercise; collaboration with health professionals or caregivers, transfers, clothing.	Inaccessible	English	NA

Orciuoli; Orciuoli; Peduto.[28] (2020)	Propose a mobile application implementing a Clinical Decision Support System (CDSS) to assist in the assessment, classification of PI, trace its evolution and decision making regarding treatment.	Classifiers, measuring tool and record of previous injuries.	Inaccessible	Spanish	Level III
Branco et al.[29] (2019)	To evaluate the performance of an automatic technique in the extraction of PI tissue types by digital image processing.	Analysis of the type of lesion and identification of the tissue present from image processing through the app.	Inaccessible	Not available	Level III

Source: review data, João Pessoa, PB, 2022.
*NA= Not applicable.

Of the 13 selected, five (21.8%) studies were indexed in Medline/Pubmed, five (21.8%) in CINAHL, nine (39.1%) in Scopus, three (13%) in Web of Science and one (4.3%) in Lilacs. As for the years of publication, 2020 presented the highest number of publications with four (30.8%) studies, while 2013, 2016, 2018 and 2019 presented a total of eight (61.5%) publications, two articles in each year and one (7.7%) article in 2015. Regarding the language of the studies, nine (69.2%) were published in English and four (30.8%) articles in Portuguese.

Regarding the objectives of the studies, five (38.5%) were aimed at evaluating applications, two (15.4%) to prevent, evaluate and treat PI, one (7.7%) to prevent and evaluate, one (7.7%) to evaluate and treat and one (7.7%) to only evaluate PI; another five articles (38.5%) covered development and evaluation, three (23%) related to prevention, evaluation and treatment of injuries, one (7.7%) for prevention and evaluation and one (7.7%) for evaluation only; and those that discussed application development were three (23%), two (15.4%) focused on prevention, evaluation and treatment of injuries and one (7.7%) on prevention and evaluation simultaneously.

Based on the results of this research, with a focus on the study of the characteristics arranged in the PI applications, the content was divided into four dimensions: "Prevention, evaluation and treatment of PI"; "Prevention and evaluation of PI"; "Evaluation and treatment of PI"; and "Evaluation".

DISCUSSION

The data reveal the year 2020 as the one with the most publications focused on the development of applications aimed at PI. This number is justified by the popularization of smartphones, corroborating the growth of their use in health care.[30]

Regarding the language of publication of articles and applications, most belonged to English. A similar finding was observed in a literature review that aimed to detect mobile applications in the context of nursing, with a predominance of international publications.[7]

It is noteworthy that most of the mobile technologies found in the articles described were not accessible, that is, they were not found for use or access. Thus, an obstacle was identified, since mobile information technologies have easy and quick access to the content proposed in it, aiming at varied and attractive forms of knowledge transmission, which can be disseminated in the health area for professionals, students and even the population without training in the area, being family caregivers and patients.[7]

The applications arranged in the first dimension, characterized as "Prevention, evaluation and treatment of PI" comprised of seven articles, bring together characteristics such as: registration of patients in an individualized way, with demographic and clinical characteristics of patients and users;[17-18,24] risk factors for PI development;[17,25-26] PI staging6,[17]; algorithm through photograph of the lesion to evaluate the size of the wound,[17-18,26,28] type of tissue present, exudate characteristics; [17] assessment of the lesion from the Pressure Ulcer Scale for Healing or the Bates-Jensen Wound Assessment Tool;20 type of treatment and coverage to be applied according to different stages of the lesions17-18,20,24-26 Braden scale for assessing skin conditions and risks for PI development,[17-18,20,24,26] recommendations for PI prevention;[24-25] generation of alerts for decision making.[18,26]

It is through mobile technologies that the training of professionals, caregivers and patients is made possible; promotes better adherence to treatments and development of users' autonomy, allowing reminders for the use of medicines; communicating with health professionals in an easy and non-bureaucratic way.[9]

Regarding the second dimension regarding "PI prevention and evaluation" described in the mobile applications, the following information was incorporated: PI concept and risk factors for involvement with these lesions;[23] PI staging, with illustrations;[23] Braden scale for application of preventive measures after generation of injury risk score[23]; assessment of pressure injuries through photographed wound image[21]; skin assessment;[27] preventive actions[23,27] such as support surface, repositioning, nutrition; guidelines on skin care in general,[27] area of the caregiver or health professional.[27]

The recognition of risk conditions associated with daily skin assessment, and their subsequent implementation, are fundamental pillars for the prevention of PI onset. Daily and thorough skin assessment should be one of the main means of initiating prevention, given the fact that any redness may imply rupture and rapid development to the other stages of lesions.[31]

In the applications in which a scale for assessing the risk of PI was used, all of them instituted the Braden Scale. The Braden Scale, developed by Barbara Braden and Nancy Bergstrom in 1987, assists in assessing the risk of developing PI and consists of six subscales: sensory perception, moisture, activity, mobility, nutrition and friction and shear.[32]

Mobile applications are characterized as a support tool for professionals, caregivers and patients in hospital, outpatient and home settings, especially when it comes to prevention, for the management of care with reminders and daily care information, assisting in the continuity of knowledge and improvement of knowledge.[9]

Regarding the "Evaluation and treatment of PI", there is the development and application of the "DIRECT" algorithm, which evaluates through the need for debridement, if there is infected tissue and the need for revascularization, exudate control, determines the chronicity of the wound and evaluates the tissue present in the injured region; guides the ideal treatment for each type of wound.[22] This application enables a basic and simple approach, being aimed at beginners and evaluation and treatment of PI, whose evaluation was more useful for professionals without experience in wound care, than the treatment, the latter being similar to that implemented by experienced professionals.[22]

Regarding the classification and staging of PI, the NPIAP system is globally used in clinical practice, in which it classifies lesions according to their depth of tissue damage.[1]

Finally, the "Evaluation", which was described in two articles, with the characteristics related to obtaining photographs of the lesion for its evaluation, for the purpose of accurate diagnosis and reducing discomfort for the patient and wound infection.[19]

In this context of the four dimensions mentioned, it is observed that all the elements mentioned are necessary for the composition of a mobile application related to PI, with educational purpose or aimed at the care of the person with injury. As described in a study,[22] the aspects that make up an application aimed at the prevention, evaluation or treatment of PI, must be associated with the characteristics of the physiological functioning of the body, which influence the choice of treatment; as well as the classification or staging system of the lesions must be clear, reliable for decision making based on the evaluation; the choice of treatment must be broad and flexible for various stages of lesions and their location.

CONCLUSION

It was found that most of the applications influenced or could positively influence the evaluation, prevention and treatment of PI, these technologies being able to improve knowledge about the subject and provide care for individuals or caregivers of those who have PI. It was realized that the insertion of mobile technology in the scope of health care can guarantee access to education aimed at the needs of that individual, even when there are impossibilities of professional improvement.

It was also verified that there is a scarcity of applications available in the studied area, in the data sources selected for the study, identifying a small variety of professionals for the management of PI evaluation, prevention and treatment, considering a block to guarantee access to content for learning and assistance in care. Thus, new studies are suggested, with the availability of mobile technology respectively, contemplating the accessibility that this type of medium provides daily for the different audiences of society.

As a limitation of this study, there is the identification of insufficient clarity in the methodological path of most studies of development and evaluation of applications, making them not very understandable for the description in this research, as well as their low level of evidence.

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