



INTEGRATIVE LITERATURE REVIEW ARTICLE

APP “SICKSEG” IN MOBILE PLATFORM FOR THE PREVENTION OF SKIN INJURIES* APLICATIVO “SICKSEG” EM PLATAFORMA MÓVEL PARA A PREVENÇÃO DE LESÕES CUTÂNEAS APLICACIÓN “SICKSEG” EN LA PLATAFORMA MÓVIL PARA LA PREVENCIÓN DE LESIONES CUTÂNEAS

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ABSTRACT

Objective: to create an app to aid the health professional in prescribing preventive measures to individuals at risk of developing skin injuries. **Method:** this is a bibliographic, descriptive study, type integrative literature review, with no time limit, with search on MEDLINE, LILACS, COCHRANE and SciELO Virtual Library. It is revealed that the development stages of the application structure were: “Analysis”, for the construction of the application flowchart; “Design” - for the planning and production of didactic content; “Development” - for the selection of the application tools, and “Implementation” - in which the application's functionality tests were carried out. **Results:** the SickSeg app is made up of 100 screens and is available for free on the Play Store. Functionality tests were performed on two types of notebook, six types smartphone and two types of tablet. During the tests, five problems in the operation of the app were identified, which were remedied. **Conclusion:** the app has been developed which has the potential to aid in the prevention of skin injuries through the indication of preventive measures, providing safety for the patient. **Descriptors:** Mobile Applications; Software; Pressure Ulcer; Dermatitis; Nursing Care; Health Promotion.

RESUMO

Objetivo: desenvolver um aplicativo para auxiliar o profissional da saúde na prescrição de medidas preventivas aos indivíduos em risco de desenvolver lesões cutâneas. **Método:** trata-se de um estudo bibliográfico, descritivo, tipo revisão integrativa da literatura, sem limite temporal, com busca na MEDLINE, LILACS, COCHRANE e Biblioteca Virtual SciELO. Revela-se que as etapas de desenvolvimento da estrutura do aplicativo foram: “Análise”, para a construção do fluxograma do aplicativo; “Design” - para o planejamento e a produção do conteúdo didático; “Desenvolvimento” - para a seleção das ferramentas do aplicativo, e “Implementação” - onde foram realizados os testes de funcionalidade do aplicativo. **Resultados:** compõe-se o aplicativo SickSeg por 100 telas e está disponível gratuitamente no Play Store. Realizaram-se os testes de funcionalidade em dois tipos de notebook, seis tipos smartphone e dois tipos de tablet. Identificaram-se, durante os testes, cinco problemas no funcionamento do aplicativo, os quais foram sanados. **Conclusão:** desenvolveu-se o aplicativo que tem o potencial de auxiliar na prevenção de lesões cutâneas por meio da indicação de medidas preventivas, proporcionando segurança para o paciente. **Descritores:** Aplicativos Móveis; Software; Lesão por Pressão; Dermatite; Cuidados de Enfermagem; Promoção da Saúde.

RESUMEN

Objetivo: desarrollar una aplicación para ayudar al profesional de la salud a prescribir medidas preventivas a las personas en riesgo de desarrollar lesiones cutáneas. **Método:** es un estudio bibliográfico, descriptivo, tipo revisión bibliográfica integradora, sin límite de tiempo, con búsqueda en MEDLINE, LILACS, COCHRANE y la Biblioteca Virtual SciELO. Se revela que las etapas de desarrollo de la estructura de la aplicación fueron: “Análisis”, para la construcción del diagrama de flujo de la aplicación; “Diseño” - para la planificación y producción de contenido didáctico; “Desarrollo” - para la selección de herramientas de aplicación e “Implementación” - donde se llevaron a cabo las pruebas de funcionalidad de la aplicación. **Resultados:** la aplicación SickSeg consta de 100 pantallas y está disponible de forma gratuita en Play Store. Las pruebas de funcionalidad se llevaron a cabo en dos tipos de notebook, seis tipos de smartphone y dos tipos de tablet. Durante las pruebas, se identificaron cinco problemas en el funcionamiento de la aplicación, que se solucionaron. **Conclusión:** se desarrolló la aplicación, que tiene el potencial de ayudar a prevenir lesiones cutáneas a través de la indicación de medidas preventivas, brindando seguridad al paciente. **Descriptor:** Aplicaciones Móviles; Software; Lesión por Presión; Dermatitis; Atención de Enfermería; Promoción de la Salud.

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INTRODUCTION

An injury can be defined as a damage, harm, act or effect of an injury. This general designation is given to all pathological changes in organs and tissues. Please be informed that the injury may be closed, with no continuity solution, or open, with continuity solution. During the hospitalization, the patient can be submitted to several procedures that contribute to the occurrence of skin injuries, such as: installation of drains and catheters; use of adhesive devices; use of sensors; body hygiene; dressing changes; decubitus change and use of diapers, among others, these factors being aggravating due to repetitive handling.¹⁻⁴

Skin injuries are classified as: hematoma; ecchymosis; infiltration; phlebitis; necrosis; pressure ulcer; friction ulcer and dermatitis associated with incontinence. These injuries are frequently observed in health services, occurring mainly in individuals hospitalized in intensive care units, medical clinics and in long-term care facilities, where patients have greater fragility, reduced mobility and difficulty in carrying out daily activities, deteriorating their quality of life and bringing great impact to the health sector and a burden for public spending.⁴⁻⁵

Patient safety is defined by the conceptual framework of the International Classification for Patient Safety, proposed by the World Health Organization (WHO), as reducing the risk of unnecessary harm associated with health care to an acceptable minimum. It is explained that damage is the impairment of the structure or function of the body and / or any effect arising from it, including injury, suffering, death, disability or dysfunction, thus it can be physical, social or psychological; risk is the probability that an incident will occur and incident is the event or circumstance that could have resulted, or already resulted, in unnecessary harm to the patient. It is added that a notifiable circumstance is the incident with potential damage or injury; potential adverse event (near miss) is the incident that did not reach the patient, as it was intercepted before its occurrence; incident without injury is the incident that reached the patient, but did not cause damage, and adverse event is the incident that results in damage to the patient.⁶

It is known that the use of educational technologies for the prevention and treatment of skin injuries, such as mobile applications and online courses, are viable alternatives for the dissemination of information and awareness of the population, and may open new paths for health promotion through people's participation in the shared construction of knowledge. Verbal guidelines are reinforced, in addition to enabling the patient and his/her family to read later,

serving as a guide in cases of doubt and assisting daily decision-making related to the prevention and treatment of skin injuries.⁷

It is pointed out that new technologies emerge daily and health professionals need to apprehend and master them, placing them at the service of the patient and thus allowing safe and quality care. It is believed that the technologies in the health area have the purpose of providing a broad and integrated assistance.⁸ There is the construction of a multimedia environment for the nursing professional who provides care to patients with skin injuries, shown to be valid as a training strategy, diagnosis and prescription of therapeutic conduct, mainly in the theoretical / practical relationship, in the interrelation of knowledge and contextualization of learning.⁹⁻¹¹

It is perceived that, when the professional uses applications or multimedia in patient care, he / she is providing care safely, preventing, improving or mitigating, to an acceptable minimum, the risks, damages and adverse events resulting from the health care process.

OBJECTIVE

- To create an app to aid the health professional in prescribing preventive measures to individuals at risk of developing skin injuries.

METHOD

This is a bibliographic, descriptive, integrative literature review, with no time limit, developed between April and September 2017. The application was based on the Contextualized Instructional Design (CID) methodology, which involves a constructivist proposal and consists of the intentional action to plan, develop and apply specific didactic situations, incorporating mechanisms that favor contextualization.²¹ The development of the multimedia application on a mobile platform for the prevention of skin injuries, aiming at greater patient safety, followed the steps of analysis, design, development and implementation.

It should be noted that the studies that served as theoretical references for the construction of the mobile application algorithms for the prevention of skin injuries were then analyzed. For this, a search was carried out in MEDLINE, LILACS, COCHRANE and SciELO Virtual Library, using combinations of Health Sciences Descriptors (Decs): dermatitis; pressure ulcer; friction; skin hygiene; patient safety and mobile apps or their English terms (MeSH terms). Using these descriptors, the selection of studies related to risk factors, signs and symptoms, classification and therapy for the prevention of skin injuries (friction ulcer, pressure ulcer and dermatitis associated with incontinence), patient safety, was allowed

and mobile applications, which were used for the construction of the application's algorithms. It is also detailed that the search in the databases and a search in the Google Play Store for applications associated with the theme served to confirm the originality of the study.

For the selection of publications to be included in the review, the following inclusion criteria were adopted: primary articles (evaluated by peers) that had a direct connection to the theme and reference works available in full, without delimitation, because the intention was to compile all studies that met the established criteria. Chapters of books, theses, dissertations,

monographs, technical reports and articles were excluded which, after reading the abstract, differed from the object of study proposed, in addition to publications that were repeated in the databases and virtual library. Much of the gray literature was also excluded, except for reference works.

Figure 1 shows how the selection of articles that served as the basis for constructing the SickSeg application was performed. The technological infrastructure was defined and a diagram was created to guide the construction of the tool (Figure 2).

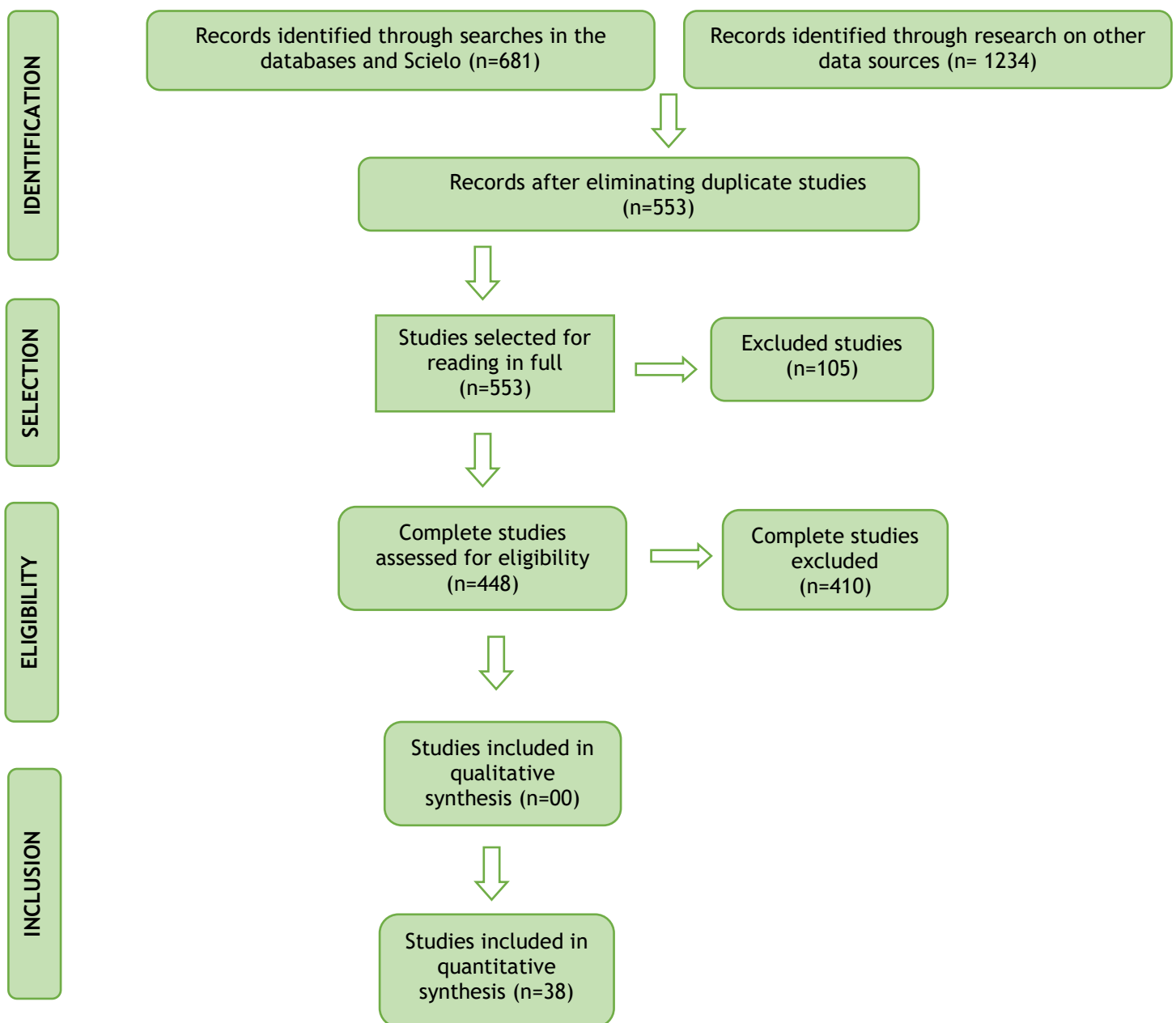


Figure 1. Flowchart of study selection adapted from Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2009). Pouso Alegre (MG), Brazil, 2018.

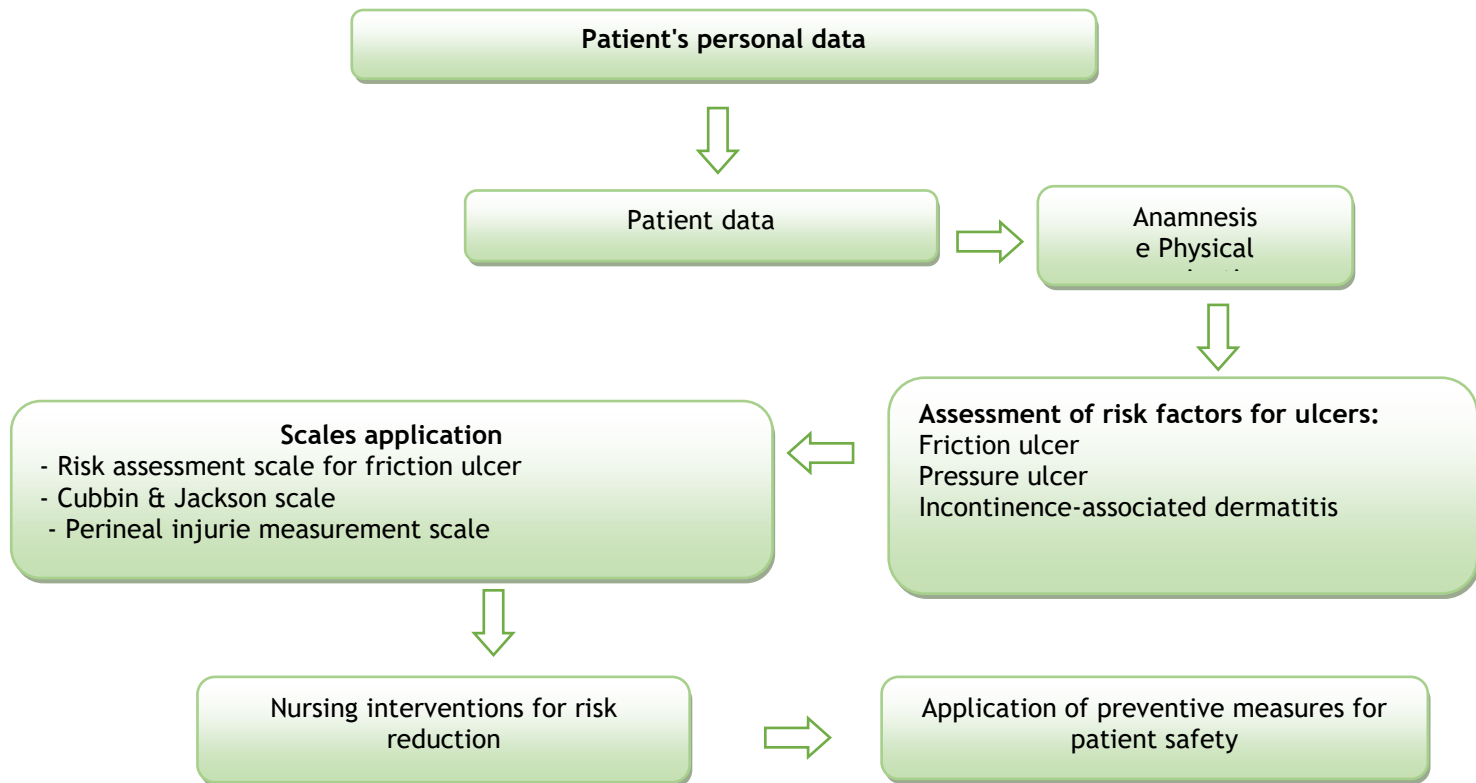


Figure 2. Technological infrastructure was defined and a diagram was created to guide the construction of the SickSeg application tool. Pouso Alegre (MG), Brazil, 2018.

In this step, the planning and production of didactic content, the definition of topics and writing of subjects, the selection of media and the design of the graphic interface (layout) were involved. Texts structured in topics and connected by hypertexts (links) were chosen to be used.

Included in the instruments selected to integrate the mobile application are risk scales for the development of friction ulcers, pressure ulcers and dermatitis associated with incontinence, in addition to the Richmond Agitation and Sedation Scale (RASS) and the Confusion Assessment Method for Intensive Care Unit (CAM-ICU). Professionals are helped by these scales to assess risk, formulate the diagnosis and determine the care plan, selecting them based on the professional experience of the authors and because they have been culturally adapted to Portuguese.

According to the literature, only by the Instrument for Risk Assessment for Friction Ulcer (Skin Integrity Risk Assessment Tool), the proposal for the prevention of friction ulcers is met. Despite being little used, simple measures are proposed to identify risk factors. By the application of this instrument, the presence or absence of intrinsic and extrinsic factors that represent a risk for the occurrence of friction ulcers is indicated.

Pressure ulcers, due to their multifactorial etiology, stand out among the skin injuries frequently found in critically ill patients. The risk assessment scale must be adapted to the specificities of these patients, presenting comprehensive assessment items and being less generalist, resulting in greater reliability and risk prediction capacity. It is detailed that studies directed at intensive care units indicated that the

Cubbin and Jackson scale is the most suitable for assessing the risk of developing pressure ulcers in critically ill patients.¹²

Since the 1990s, several instruments have been developed to facilitate the identification, classification and evaluation of dermatitis associated with incontinence. The Perineal Assessment Tool (PAT) was chosen for this study because it is only focused on risk assessment and prevention of the development of dermatitis associated with incontinence, before the injury is installed. This instrument evaluates the duration of skin contact with the irritant, the condition of the perineal skin, the type and amount of irritants and irritating factors, including the use of antibiotics, diarrhea, enteral tube diet and hypoalbuminemia.¹³

RASS scales are applied¹⁴ and CAM-ICU¹⁵ part of the care of patients at risk for friction ulcer and pressure ulcer. The degree of agitation / sedation of the patient are assessed using the RASS scale and the CAM-ICU scale contributes to the diagnosis of delirium. Both have been culturally adapted and validated for use in Brazil and they are routinely applied in the intensive care setting.¹⁴⁻⁵

In the development stage, the selection of the tools of the multimedia application, the definition of the navigation structure and the planning of the configuration of environments were understood. The mobile application with Android operating system was developed using the Android Studio integrated development environment, made available by Google. The Android platform was used initially because it is more popular in Brazil due to the lower cost of mobile devices that operate with this platform, thus allowing a greater number of professionals to have access to the

application. The application is currently being implemented for the iOS operating system to expand the access of professionals to this tool.

The educational tools and technological resources were then configured, an Internet environment was created to download the application and installed on the mobile device.

In the functional evaluation stage, the usability, performance, compatibility and functionality tests of the mobile application were performed, as described below:

Usability test - the application was tested to verify that the user could intuitively use the software from the initial screen until the final result was obtained. The software was tested five times by the researchers by filling in the user and patient records and performing the procedures described on each application screen;

Performance test - responsiveness was evaluated after each command was given. The startup time, screen changes and software completion by the systems analyst and researchers were verified. For each screen, access to the software, registration of a new patient and carrying out the procedures described were taken into account;

Compatibility test with the theoretical framework - this test was divided into two phases: in the first phase, the semantic and syntactic analysis of the software content was performed and, in the second phase, the functional test or black box was used to test the system, this test being conducted by the systems analyst;

Functional test - for this test, some devices were chosen (two types of notebook, six types of smartphone and two types of tablet) that had Android technology as determinants and were characterized as mobile type equipment, with Wi-Fi available for wireless network access. Usability and compatibility tests were carried out on these devices.

The functional evaluation of the mobile application is indicated for studies where the validation of the tool was not carried out before it was made available to users. The entire testing process was conducted by both the researchers and the systems analyst, and the application was only made available after the detected problems were corrected.

It is explained that the multimedia application on a mobile platform for the prevention of skin injuries for patient safety (SickSeg) was registered in the computer program registration at the National Institute of Industrial Property Ministry of Development, Industry and Foreign Trade under the number of protocol: BR: 512017-001264-4. The SickSeg application is available for free at the link:

<https://play.google.com/store/apps/details?id=com.ceosware.sickseg>.

The study was approved by the Research Ethics Committee of the College of Medical Sciences Dr. José Antônio Garcia Coutinho of the University of Vale do Sapucaí (UNIVÁS) under opinion No. 1,771,889.

RESULTS

Please note that the application has a graphical user interface that is easy to handle. The logo with the name of the application is shown on the opening screen: SickSeg - Daily Patient Safety. On the next screen, the user must register, indicating the type of council [Regional Nursing Council (COREN) or Regional Medical Council (CRM)] to which he/she belongs, registration number in the respective council, name complete, electronic address (e-mail), date of birth and password (Figure 2 / left). It is necessary to enter, to include a patient, the respective medical record number (or a reference number to differentiate homonymous patients with the same date of birth in the application database), in addition to the name and date of birth and, to exclude a patient, just click on the trash can icon (Figure 2 / center). It is revealed that the options for patient assessment are: friction ulcer, pressure ulcer and incontinence-associated dermatitis, in addition to the RASS and CAM-ICU instruments, as shown in figure 3 / right.

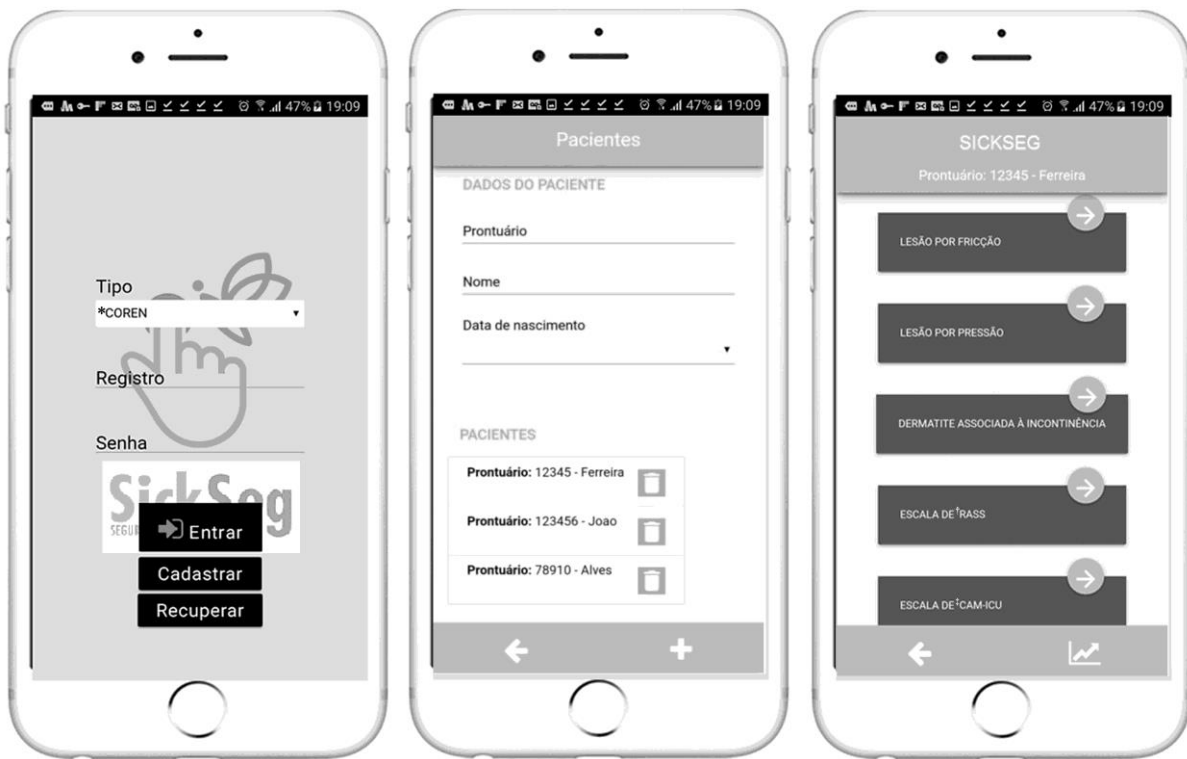


Figure 3. Examples of screens showing the graphical interface. (Left) SickSeg application home; (center) Patient registration and (right) options for patient evaluation. * COREN - Regional Nursing Council; † RASS - Richmond Scale of Agitation - Sedation; ‡ CAM-ICU - Mental Confusion Assessment Method in the Intensive Care Unit. Pouso Alegre (MG), Brazil, 2018.

In the option “Friction Ulcer”, the screen “Instrument for Risk Assessment of Friction Ulcer” opens (Figure 4 / left). More than one item can be selected during the evaluation according to the characteristics presented by the patient. Criteria not mentioned in the aforementioned instrument are defined by anamnesis and physical examination, also allowing the selection of more than one item for evaluation. Nursing care corresponding to each type of injury is presented according to the item selected during the assessment.

The Cubbin & Jackson Scale, which will assist in the identification of risk factors for pressure ulcers, opens in the second option corresponding to “Pressure Ulcer” (Figure 3 / center). For each question, four possible answers are presented, with scores between one and four. Only one answer can be selected in each question. Scores on the selection screen are omitted so as not to influence the user in the classification of low and high risk. The total score of the risk classification varies from 12 to 60, with scores between 12 and 29 resulting in a high risk alert for the development of pressure ulcers, and scores between 30 and 60 correspond to a low risk of pressure ulcer. Nursing care related to each risk classification is presented on a different screen.

In the option “Dermatitis Associated with Incontinence”, the “Perineal Lesion Measurement Scale” (Figure 3 / right). In each question, three possible answers are presented, with scores from one to three. Scores on the selection screen are omitted so as not to influence the user in the classification of low and high risk. The total score

of the risk classification varies between four and 12, with scores between four and seven corresponding to low risk, and scores between eight and 12 result in a high risk alert for the development of dermatitis associated with incontinence. Nursing care is presented according to the items selected in the Perineal Lesion Measurement Scale, anamnesis and physical examination.

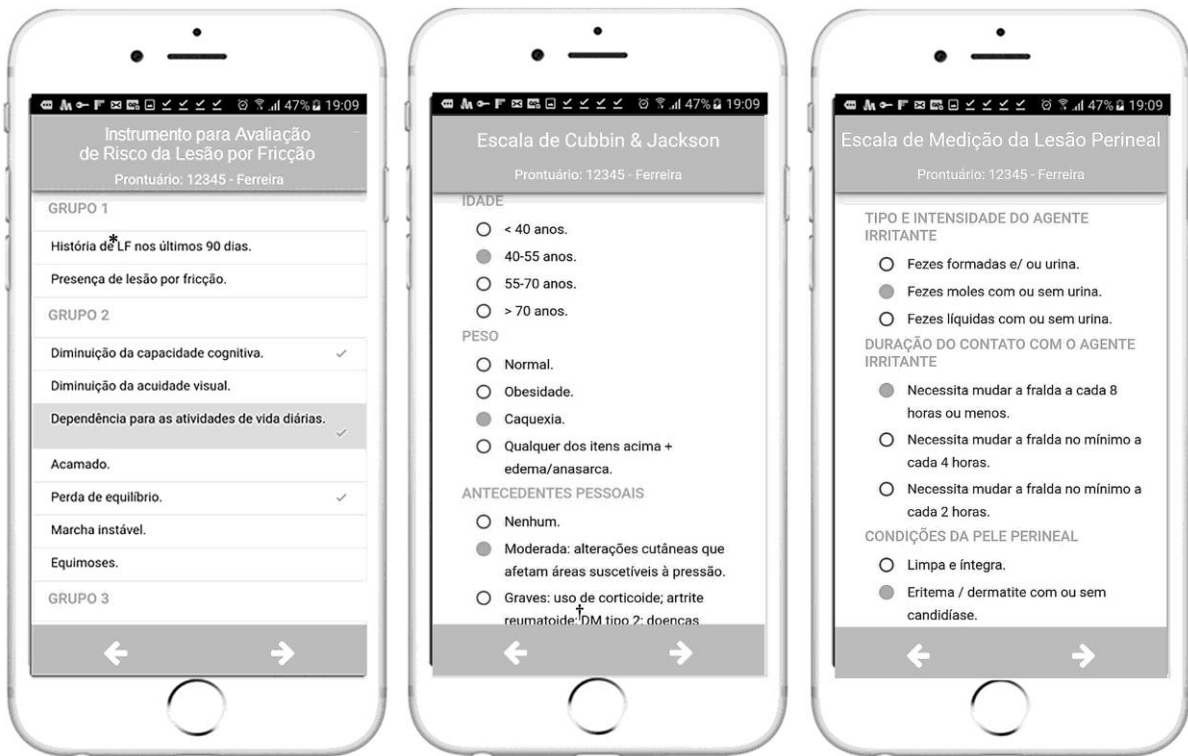


Figure 4. Examples of screens showing the graphical interface. (Left) Risk assessment for friction ulcer; (center) Cubbin & Jackson scale and (right) Perineal injury measurement scale. * LF-friction ulcer; † DM- Diabetes Mellitus. Pouso Alegre (MG), Brazil, 2018.

It is noted that the two other options correspond to the RASS and CAM-ICU instruments, which are mentioned in the care of friction ulcers and pressure ulcers. The degree of agitation and sedation of the patient is assessed by RASS (Figure 4 / left) and CAM-ICU contributes to the diagnosis of delirium (Figure 5 / center). You can follow the progress of each registered patient by period; just complete the desired time interval. Thus, all the evolution records made in that period will be

opened. Remember that for evolution data to be recorded, they must be sent to the database when internet access is available. It is added that the evolutionary record shows which skin injury was selected (friction ulcer, pressure ulcer or incontinence-associated dermatitis), which score was found in the evaluation and which items were selected in the anamnesis and physical examination (Figure 4 / right).



Figure 5. Examples of screens showing the graphical interface. (Left) * RASS scale; (center) † CAM-ICU scale; (right) Evolution of the patient. * RASS - Richmond Scale of Agitation - Sedation; † CAM-ICU - Mental Confusion Assessment Method in the Intensive Care Unit; ‡ h- hours; §S- seconds. Pouso Alegre (MG), Brazil, 2018.

DISCUSSION

It is known that the accelerated development of scientific and technological modernization in the health field has been generating new ways of building knowledge related to the care of patients with wounds. It is believed that, in the coming years, advances in computer technology will revolutionize processes at all levels of nursing services and provide operational and strategic benefits for the organization and practice of professionals.¹⁶

The importance of using smartphones resides in the clinical practice of the professional who provides assistance to patients at risk of developing any type of injury in the fact that, with this resource, the professional has the possibility to choose the best strategy to prevent development of the injury. It is understood that computational technology is a resource that has had a positive impact when incorporated into the teaching and learning process.¹⁷ This type of device is considered a pocket computer with access to millions of applications. It is noteworthy that, in 2012 alone, more than 40 billion applications were downloaded on smartphones and that number exceeded 300 billion in 2017. This is mainly due to the ease with which these applications can be accessed in their respective virtual stores. In this way, the development of computational solutions in the form of mobile applications is represented as an effective means of making the tool available and reaching the desired target audience.¹⁷ It is indicated, by several studies, that the use of applications in the health area enables a continuous process of updating / training of professionals. Applications can also be used as support in medical and nursing diagnosis, in decision making, in the use of electronic medical records, control of medication stocks and bed management. It is also worth mentioning the support to the patient through the sending of appointment / return reminders via Short Message Service.¹² It was concluded, by authors, in studies describing the development of mobile applications for the evaluation and conventional treatment¹⁸⁻⁹ or laser treatment²⁰ wounds, that the applications developed can be very useful in clinical practice, helping both in the selection of nursing interventions and in the education and training of health professionals.¹⁹⁻²⁰

The application was developed, taking these factors into account, with a graphical user interface that is easy to manage. The content of the application was developed through the integrative review of primary articles (evaluated by peers) and reference works, and the text was written in scientific language, with relevant information so that the health professional can provide safe assistance based on evidence.

Therefore, it is believed that the content of the SickSeg application probably complies with institutional guidelines and protocols that have been developed based on scientific evidence. It is important that an application is developed in a coherent, adequate and according to the user's needs to meet specific demands, which must be tested during the research process and implemented in practice.²¹⁻²

It is believed that SickSeg is a technological innovation in the health area as it is the first mobile application produced in Brazil that offers nurses the means to provide assistance related to skin injuries, with scientific basis, with the minimum acceptable risk, free damage and adverse events, that is, safe care for critical patients. SickSeg seeks to meet the needs of patient care, especially those under critical care, unlike the applications currently available, which mostly address theoretical aspects and have little to do with clinical practice. The instrument assists in the assessment of risks, formulation of diagnoses and, as a final result; it provides the care plan to maintain the integrity of the skin, thus increasing the safety of hospitalized patients.

The creation of protocols, online courses and applications as tools that promote safe practices in the prescription of prophylactic injury care stood out in national and international literature, in order to reduce the incidence of adverse events in public and private health services, thus contributing to the prevention of skin injuries.²³

It was indicated, through the integrative literature review, that digital materials (applications, online courses and others) must be constructed in a clear way, with an adequate vocabulary and simple and attractive images. The digital materials collaborated in the dissemination of the theoretical framework that supports practices, streamlining teaching and enabling the use of active learning methods, breaking with the traditional teaching of demonstrating and repeating procedures.²⁴ A photo of the injury is uploaded by the user through the application so that the system processes the image and the algorithm implemented in the application makes a suggestion of the probable injury category.²²

It is believed that, when constructing an application, the professional should offer content with clearly defined concepts, using relevant vocabulary and sufficient information, through short texts, avoiding ambiguity and allowing the transmission and understanding of knowledge. It is reminded that texts should be easy to read and quickly promote the expected learning results.¹⁹ In the choice and presentation of the content, its ability to activate the previous knowledge of students and professionals must be taken into account. Intuitive knowledge is provided by the

image, in addition to increasing motivation, enabling the understanding of concepts that, if they were only arranged by textual way, would be more difficult to assimilate.¹⁸⁻²⁰

This research was limited by the non-validation of the application by nurses and doctors. Future studies are needed to validate the developed tool, assessing its impact on clinical practice and highlighting its effect / impact on patient safety.

CONCLUSION

According to this study, according to the proposed objectives, the stages of planning and developing the multimedia application on a mobile platform for the prevention of skin injuries, aiming to reduce the occurrence of errors in clinical practice and adverse events. It was indicated, through the steps taken, that the SickSeg application has great potential to be used in Nursing practice, assisting health professionals in the decision making of therapeutic conducts, to interrelate signs, symptoms and risk factors and to detect points crucial in the clinical examination, providing a correct assessment and selection of appropriate care, thus contributing to greater patient safety.

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