

Nursing APHMÓVEL: mobile application to register the nursing process in prehospital emergency care

Nursing APHMÓVEL: aplicativo móvel para registro do processo de enfermagem na assistência pré-hospitalar de urgência

Nursing APHMÓVEL: aplicación móvil para registrar el proceso de enfermería en la atención de urgencia prehospitalaria

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ABSTRACT

Objectives: to develop an application for a mobile device for the registration of the Nursing Process by nurses of the Mobile Emergency Care Service. **Methods:** applied research with technology development based on software engineering and Apple's Human Interface Guidelines. It had the support of an application developer and a designer. The proposal was built in four steps (scope definition, planning, prototype creation and development). **Results:** the application "Nursing APHMóvel" allows to record the steps of the Nursing Process, such as history, nursing diagnoses, outcomes and interventions with the possibility of storing the data and/or file in printable format. The technological innovation has location features, scales with automatic sum of items, touchscreen, and offline operation. **Conclusions:** it was possible to develop the application with the potential for computerized documentation of the Nursing Process by nurses working in the Mobile Emergency Care Service.

Descriptors: Mobile Applications; Nursing Process; Prehospital Care; Electronic Health Records; Information Technology.

RESUMO

Objetivos: desenvolver aplicativo para dispositivo móvel para registro do Processo de Enfermagem pelo enfermeiro do Serviço de Atendimento Móvel de Urgência. **Métodos:** pesquisa do tipo aplicada de desenvolvimento tecnológico, alicerçada na engenharia de software e no *Human Interface Guidelines* da Apple. Contou com o apoio de um profissional desenvolvedor de aplicativo e um *designer*. A proposta foi construída em quatro fases (definição do escopo, planejamento, criação do protótipo e desenvolvimento). **Resultados:** o aplicativo "Nursing APHMóvel" permite o registro das etapas do Processo de Enfermagem, tais como histórico, diagnósticos, resultados e intervenções de enfermagem, com a possibilidade de armazenamento dos dados e/ou arquivo em formato para impressão. A inovação tecnológica apresenta os recursos de localização, escalas com somatórias automáticas, *touchscreen*, e funcionamento *off-line*. **Conclusões:** foi possível desenvolver o aplicativo com potencial para a documentação informatizada do Processo de Enfermagem pelo enfermeiro atuante no Serviço de Atendimento Móvel de Urgência.

Descritores: Aplicativos Móveis; Processo de Enfermagem; Assistência Pré-Hospitalar; Registros Eletrônicos de Saúde; Tecnologia da Informação.

RESUMEN

Objetivos: desarrollar una aplicación para dispositivo móvil para el registro del Proceso de Enfermería por parte de enfermeros del Servicio Móvil de Emergencias. **Métodos:** investigación aplicada con desarrollo tecnológico basado en ingeniería de software y las *Human Interface Guidelines* de Apple. Contó con el apoyo de un desarrollador de aplicaciones y un diseñador. La propuesta se construyó en cuatro fases (definición del alcance, planificación, creación y desarrollo de prototipos). **Resultados:** la aplicación "Nursing APHMóvel" permite el registro de las etapas del Proceso de Enfermería, como historia, diagnósticos, resultados e intervenciones de enfermería con la posibilidad de almacenar los datos y/o archivo en formato imprimible. La innovación tecnológica tiene características de ubicación, escalas de suma automática, pantalla táctil y operación fuera de línea. **Conclusiones:** fue posible desarrollar la aplicación con potencial para la documentación computarizada del Proceso de Enfermería por parte del enfermero que trabaja en el Servicio Móvil de Emergencias.

Descriptorios: Aplicaciones Móviles; Proceso de Enfermería; Atención Prehospitalaria; Registros Electrónicos de Salud; Tecnología de la Información.

INTRODUCTION

The use of Information and Communication Technologies (ICTs) in the health area has grown worldwide⁽¹⁾. The scientific literature provides aspects related to the nursing documentation associated with the use of ICTs. This approximation of nursing with new technologies contributes to improve nurses' computer vocabulary and encourages Electronic Health Records (EHR), wearable technologies, big data, analytical data and greater patient involvement⁽²⁾. Computational resources are considered an alternative for the application of the Nursing Process (NP) for its integration into a logical structure of data, information and knowledge for the decision making of systematized care⁽³⁾.

When approximating technological issues and the context of Mobile Prehospital Care (MPHC), there is a specific system, the e-SUS of the Mobile Emergency Care Service (Portuguese acronym: SAMU), for the management of procedures in mobile emergency care⁽¹⁾. However, when it comes to mobile technologies, scientific productions on the use of a mobile device application (app) to record nursing care in the SAMU are currently unknown.

The aforementioned problem and the existing scientific gap in relation to this topic and still fostered by professional experience show the need to create a mobile technological tool for the electronic record of the NP in MPHC, seeking a safe, systematic and technological professional practice.

The exercise of nurses' practice at the MPHC is based on clinical reasoning to guide decision making regarding priority nursing care. In this sense, mobile technologies in Nursing emerge to facilitate systematization and contribute to the care process in the different practice scenarios.

Therefore, more research related to mobile devices and aimed at nursing practice should be developed, implemented and evaluated⁽⁴⁾. The aim of such practice is to accompany the pace of technological evolution in health predicted by research describing the trend for 2025, in which nurses will certainly live in a practice environment very different from nowadays and technology will be fundamental in this transformation⁽²⁾.

OBJECTIVES

To develop a mobile device application that allows nurses from the Mobile Emergency Care Service to record the Nursing Process.

METHODS

Applied research with technology development. The app was developed in one of the steps of the doctoral thesis titled "Technology for the record of Nursing Process in Mobile Prehospital Service: Nursing APHMóvel" from the Nursing Postgraduate Program at the *Universidade Federal do Paraná*. The app development step was between February and March 2019.

The planning of the app's structure was based on the software engineering proposed by Pressman⁽⁵⁾ and on criteria recommended by Apple described in Human Interface Guidelines⁽⁶⁾. Four steps were followed: scope definition, planning, prototype creation, and development.

The first step was the definition of the scope and started with the identification of requirements and textual organization. The content resulting from the first step of the thesis was considered, including the record of the Nursing Process in Mobile Prehospital Care. The foundation adopted included the conceptual model of Basic Human Needs, the International Classification for Nursing Practice, version 2017 (ICNP[®]), and the international protocols that guide emergency care (Prehospital Trauma Life Support). A record should include the summary of data collected, and nursing diagnoses, outcomes and interventions for the context of MPHC, built and validated in the initial step of the aforementioned thesis.

In the planning step, the content following an order by screens was structured; the name of the app was defined; and the financial and computational resources necessary for the production of the app were analyzed. Given the technical requirements necessary to make the technological product, we decided to hire the professional services of an application developer and a designer.

The meetings held with technical support professionals were based on the ideas and content illustrated on paper by researchers, called paper prototyping. The professional designer collaborated in the execution of the app icon and in the transformation of paper prototyping into a mockup presentation. The professional app developer collaborated with the architecture project, the function of the prototype and the development of the software, which was the last step, always aligned with researchers and with their technical endorsement.

RESULTS

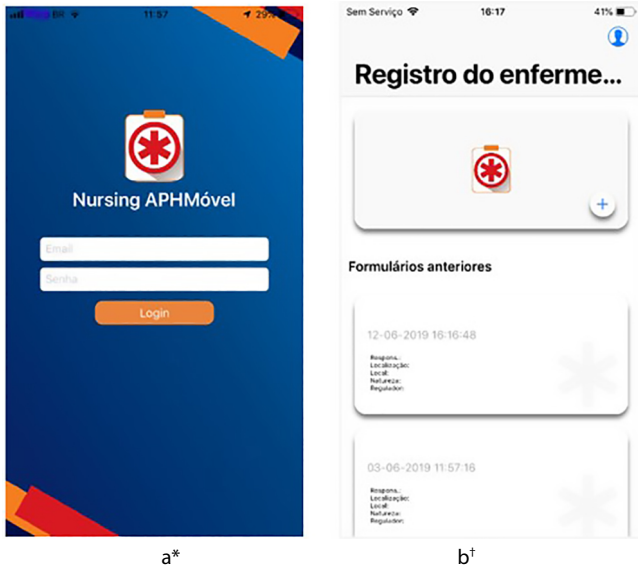
The name of the app "Nursing APHMóvel" means Nursing APHMobile and was called this way because it represents nursing in Mobile Prehospital Care. For this study, we chose to create the app in iOS format, Test Flight version, available for both iPhone and iPad, because these devices were available for the development of the study. Recommendations of the Apple Develop were followed.

The app has an icon representing the function of the app, created using the colors of SAMU. The image is presented in PNG, resolution of 1024x1024 pixels, in compliance with Apple requirements. The layout of the app interface was built from the mockup. The Adobe Illustrator and XD tools that simulated the app screens were used to this end. Based on the mockup, the app development process was initiated, using the Objective-C programming language, which is a reflective object-oriented language used by Apple in the development of applications for iOS.

The architecture developed in the application was the MVC (Model-View-Controller), which allows the communication between the application and a server with the function of storing the information saved by the application. The communication between the application and the server is "end-to-end" encrypted in order to meet users' security and privacy standards.

The "Nursing APHMóvel" app allows nurses to register data and information about the occurrence and the patient, as well as steps of the NP, such as: history and nursing diagnoses, outcomes and interventions during care at SAMU.

Figure 1 illustrates the initial screens of the app, showing the login screen to the app (Figure 1a). For security reasons, one must enter the user's login (email) and password; both are registered by the administrator user. If the user enters an invalid email and/or an incorrect password, an error message appears on the screen. Right after activating the login, the home screen opens to create records and view old records, as shown in Figure 1b.



*a – login; †b = create and view records.

Figure 1 - Initial screens of the “Nursing APHMóvel” application

In the app interface objects such as the following were applied: text field; segmented control; labels; button; picker (scrollable); switches; and touchscreen. The “System font regular” from Apple Inc. sizes 13 and 17 was used. All fields for recording data and patient information are self-descriptive and follow a logical sequence for filling in, and each screen is separate by colors. In order to proceed, the option “next” must be selected; the option “cancel” is used to interrupt; and the option “return” returns to the previous screen. When clicking on create record, the first screen opens for entering data and information of the occurrence, as represented by Figure 2.

Figure 3 illustrates the screens for filling in the nursing history. The app information does not fill the entire screen so as not to compromise visibility when the keyboard appears. This app has different functionalities according to the patient's age that can be characterized as baby (months), child (years) and adult (years).

The completion of the Glasgow and Trauma scales stands out. When clicking on them, a new screen opens with the scale and its score, and this completion automatically generates the total score of the scale. Still regarding history, the app offers two screens for touchscreen interaction with the picture representing the patient, according to the patient's age.

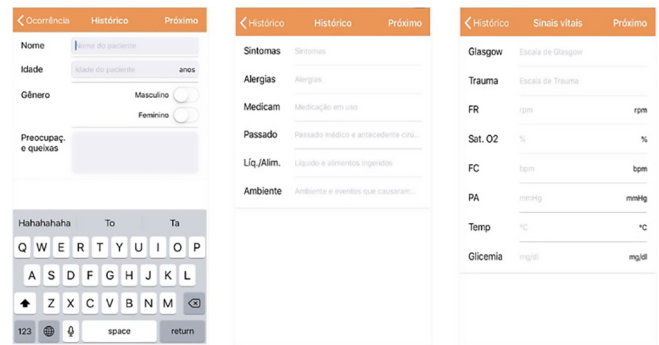
After the nursing history, the app has space for selecting nursing diagnosis, outcomes and interventions listed by care priorities as shown in Figure 4. When selecting a Basic Human Need priority (Figure 4a), the screen with the ND list opens (Figure 4b), and when clicking on a diagnosis, the NI list that can be selected opens below it (Figure 4c).



a*

*a – occurrence data.

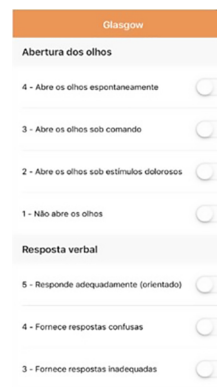
Figure 2 - First screen of the “Nursing APHMóvel” application



a*

b†

c‡



d§



e||

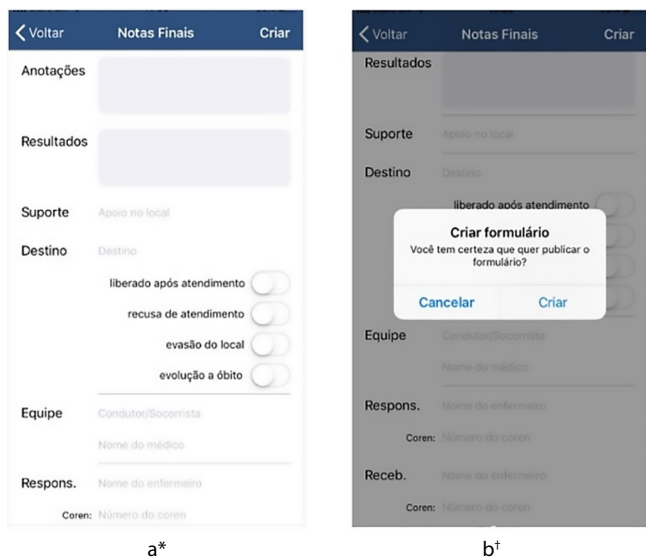
*a – patient data and complaints; †b – Signs/Symptoms, Allergies, Medications, Pertinent Medical history, Last oral intake, Events leading to present illness/injury; ‡c – vital signs and scales; §d – partial Glasgow scale; ||e – findings.

Figure 3 - Screens of the nursing history of the “Nursing APHMóvel” application



*a – Priority Basic Human Needs; †b – Diagnosis and Outcomes; ‡c – Interventions.
Figure 4 - Screens of nursing diagnoses, outcomes and interventions of the “Nursing APHMóvel” application

To complete the registration of the NP, the app presents the last screen for filling out the outcome of the service, as shown in Figure 5a. To finish the record in the app, the nurse must click on “create” in the upper right corner of the app, which generates a message to confirm the creation of the record, as shown in Figure 5b. The app offers the option to cancel if one still needs to review and complete the registration.



*a – final remarks; †b – confirmation message.
Figure 5 - Final screen of the “Nursing APHMóvel” application

Upon confirming the creation of the record, the app returns to the home screen and confirms that the record was generated (Figure 1b). The app generates a record of the NP completed by the nurse that is available on the system or a PDF file can be generated for printing.

DISCUSSION

Mobile applications are considered the most challenging software systems under construction⁽⁵⁾. For this study, the challenge to develop the app was finding the best way to incorporate the necessary content for the record of the NP in SAMU so that the

computational logic was appropriate for the necessary interaction of this app with the user.

The use of the theoretical bases mentioned in the method and the requirements demanded by Apple were evidently fundamental for the quality of the product developed. A good mobile application should be based on the following project goals: simplicity, ubiquity, personalization, flexibility and location⁽⁵⁾.

The partnership with the professional app developer ensured the technical production of the software and the security criteria of the app, demonstrating that support from an Information Technology professional is essential to develop secure technological systems for health care⁽⁷⁾. The partnership with the professional designer resulted in the quality of the interface aspects of the app. According to the literature, including the designer as a professional capable of designing and ensuring an adequate interaction between the product and the end user is essential⁽⁸⁾.

In view of this, the interface of the “Nursing APHMóvel” app was designed to be simple, understandable and with few interaction elements in order to have a pleasant and easy to use appearance and facilitate the completion by nurses. The interface also took into account the complexity of the mobile prehospital service and the challenge of implementing the electronic record.

Regarding typography, the literature points out that it influences the dimension of legibility and readability in mobile interaction devices⁽⁹⁾. For this study, the white background was chosen, as Apple values clean, refined and easy-to-use interfaces⁽⁶⁾.

Thinking of the visual aspect as a way to differentiate the screens, the use of colors was maintained based on the SAMU shade palette. Apple considers color a great way to convey vitality, which provides visual continuity with feedback in response to user actions in order to facilitate data visualization⁽⁶⁾.

With regard to visual design, one of the observed advantages was the adaptation of the app to iOS, allowing the automatic change of elements and interface layouts according to the size (iPhone or iPad) and position (horizontal or vertical) of the screen. This was designed with the aim of offering nurses several options for handling the app to enable the best user experience in the ambulance.

One of the relevant points regarding the architecture of the app was the option to customize the keyboard. This customization allowed the standardization of each field with the choice between letters, characters or numbers to reduce the time searching for characters and contribute to an agile and assertive record.

The content was separated by screens to contemplate a logical sequence of completion, both to meet the sequential steps of the NP and support the clinical reasoning of the nurse, based on patient care priorities at the MPH. A study reinforces that mobile technologies in Nursing are tools for the expansion of knowledge and systematization of practice that have shown to be innovative in healthcare practice and impacted on the way nurses perform their interventions⁽¹⁰⁾.

The app contemplates the registration of the different age groups of patients, from newborns to older adults, and grants the registration of the various areas of care performed by SAMU, such as clinical, psychiatric, trauma, surgical, gynecological-obstetric.

We also highlight the app developed because it includes scientific scales with the automatic sum of the score. The touchscreen is used to signal findings in the representation of the patient’s human

body with just a touch. The possibility of printing the records of the app can contribute to the communication and continuity of care initiated at the MPH. The app also provides automatic location information when connected via internet and loads the identification of the nurse who made the record by the login. These facilities exempt the user from having to manually insert data.

The produced app is a technological tool that allows improvement and adjustments of layout and content when new versions are released. It will also be possible to obtain the registration and later, the most appropriate way to proceed with the technology transfer will be evaluated. In the near future, the app is expected to launch on the Apple platform.

Study limitations

The main limitation of the study was the initial development only for the Apple (iOS) platform, which does not prevent further development for other platforms. Another limitation was the lack of an evaluation of the app's ergonomics and usability criteria to verify the practical applicability in the scenario under study, correct the system's functional flaws and improve the app in terms of organization, interface and content. In addition, there is the high financial cost for the development of the app and its launch in the virtual store.

Contributions to the nursing field

This app is an innovative technological tool that contributes to professional practice. It is the first app created in Brazil that allows nurses to register the NP in SAMU and provides the selection of representative nursing statements in MPH.

This study may encourage new research aimed at the use of technologies in mobile prehospital services and the development of new technological tools with a view to computerizing the Nursing Process in other scenarios of nursing practice.

CONCLUSIONS

In this study, the mobile device application called "Nursing APHMÓVEL", which enables the documentation of the care practice of nurses working at SAMU, was developed. The application includes the steps of the Nursing Process, which are considered as a mandatory record by professional legislation.

The app allows the recording of data and information on the occurrence and the patient's history, as well as the selection of nursing diagnoses, outcomes and interventions in patients seen at the mobile prehospital care. The application presents itself as a technological product that supports the nurse's practice and guarantees the registration of the care information for the use of patients, in addition to providing indicators for service management and future research.

The technical support of the professional app developer and the designer was essential to ensure the assertiveness, security and quality in the development of the app thus, the approximation of nursing with other areas of knowledge is emphasized.

SUPPLEMENTARY MATERIAL

Thesis result manuscript. Pizzolato, AC. *Tecnologia para registro do processo de enfermagem no serviço pré-hospitalar móvel: Nursing APHMÓVEL* [Internet]. 2019. *Universidade Federal do Paraná*. Available from: <https://hdl.handle.net/1884/66263>

REFERENCES

1. Vieira ACG. National health card project and ehealth design in Brazil. In: Barbosa AF, (Coord.). *ICT in Health 2013 Survey on the use of Information and Communication Technologies in Brazilian Healthcare Facilities*[Internet]. 2. ed. São Paulo: Comitê Gestor da Internet no Brasil; 2015 [cited 2019 Apr 5]. p. 171-183. Available from: <http://cetic.br/media/docs/publicacoes/2/tic-saude-2013.pdf>
2. Risling T. Educating the nurses of 2025: technology trends of the next decade. *Nurs Educ Pract*. 2017;22:89-92. <https://doi.org/10.1016/j.nepr.2016.12.007>
3. Dal Sasso GTM, Barra DCC, Paese F, Almeida SRW, Rios GC, Marinho MM, et al. Computerized nursing process: methodology to establish associations between clinical assessment, diagnosis, interventions, and outcomes. *Rev Esc Enferm USP*. [Internet]. 2013[cited 2019 May 17];47(1). Available from: http://www.scielo.br/pdf/reeusp/v47n1/en_a31v47n1.pdf
4. Johansson P, Petersson G, Saveman B, Nilsson G. Using advanced mobile devices in nursing practice--the views of nurses and nursing students. *Health Informatics J*. 2014;20(3):220-31. <https://doi.org/10.1177/1460458213491512>
5. Pressman RS. *Engenharia de software: uma abordagem profissional*. 8ed. Porto Alegre: AMGH; 2016.
6. Apple Inc. *Human Interface Guidelines* [Internet]. 2019 [cited 2019 Sep 14]. Available from: <https://developer.apple.com/app-store/review/>
7. Marin HF. Information and Communication Technologies and patient safety. In: Barbosa AF (Coord.). *ICT in Health 2013 Survey on the use of Information and Communication Technologies in Brazilian Healthcare Facilities*[Internet]. 2. ed. São Paulo: Comitê Gestor da Internet no Brasil; 2015 [cited 2020 Apr 18]; p. 207-213. Available from: <http://cetic.br/media/docs/publicacoes/2/tic-saude-2013.pdf>
8. Castro E, Reis C, Spinillo CG, Oliveira AEF. 2015. Graphic-informational interface of health education applications: an analysis of the app - Children's Health I of UNA-SUS/UFMA. In: Spinillo CG, Fadel LM, Souto VT, Silva TBP, Camara RJ, (Eds.). *Anais [Oral] of the 7th Information Design International Conference. Blucher Design Proceedings*[Internet]. 2015 [cited 2019 Apr 07];2(2). Available from: http://pdf.blucher.com.br/s3-sa-east-1.amazonaws.com/designproceedings/cidi2015/cidi_105.pdf
9. Padovani S, Puppi MB, Schlemme A. Descriptive framework for smartphone application interfaces. [Internet]. 2017[cited 2019 Aug 23];17(1):123-143. Available from: <https://www.infodesign.org.br/infodesign/article/view/514/317>
10. Silva AMA, Mascarenhas VHA, Araújo SNM, Machado RS, Santos AMR, Andrade EMLR. Mobile technologies in the Nursing area. *Rev Bras Enferm*. 2018;71(5):2570-2578. <https://doi.org/10.1590/0034-7167-2017-0513>