Technological innovation: Development of an application for professionals working in the area of intensive care – UTI AUX

Inovação tecnológica: Desenvolvimento de um aplicativo para profissionais que atuam na área de terapia intensiva – UTI AUX

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ABSTRACT | INTRODUCTION: Professionals working in the area of intensive care (ICU) are constantly challenged to present a high level of performance and knowledge. In this scenario, the phenomenon of the use of mobile applications (also known as APPS) among the world population stands out. Thus aiming at easy and quick access to information in order to assist in decision making. **OBJECTIVES:** Develop an APP aimed at intensive care professionals. **METHODS:** The development of the application (APP) was made from the Expo platform, it was prepared on a computer and made available for the Android and IOS platforms. The themes present in the application were defined based on the knowledge of two Physiotherapists specializing in Physiotherapy in Adult Intensive Care with more than 10 years of experience. **RESULTS:** The APP uses an intuitive, touch-sensitive interface with quick access to the information that the user requests. There is a menu showing the buttons representing each function of the APP, such as: indexes and calculations; functional scales; laboratory tests; vital signs; weaning; mechanical ventilation (MV); non-invasive ventilation (NIV). In this way, the APP presents seven modalities. Application development time was 12 months. **CONCLUSION:** We developed an APP focused on professionals who work in ICUs, with the objective that they obtain information at the bedside as well as ease of use of evaluative instruments.

KEYWORDS: Mobile apps. Medical informatics application. Technological Innovation. Physical Therapy Department. Intensive Care Units.

RESUMO | INTRODUÇÃO: Profissionais atuantes na área de terapia intensiva (UTI) são constantemente desafiados a apresentarem um alto nível de desempenho e conhecimento. Neste cenário, destaca-se o fenômeno da utilização de aplicativos móveis (também conhecidos como APPS) entre a população mundial, visando assim ao acesso fácil e rápido a informação a fim de auxiliar na tomada de decisão. **OBJETIVOS:** Desenvolver um APP direcionado para profissionais intensivistas. **MÉTODOS:** O desenvolvimento do aplicativo (APP) foi feito a partir da plataforma Expo, elaborado em um computador e disponibilizado para as plataformas Android e IOS. As temáticas presentes no aplicativo foram definidas com base no conhecimento de dois fisioterapeutas especialistas em Fisioterapia em Terapia Intensiva Adulto com mais de 10 anos de experiência. **RESULTADOS:** O APP utiliza uma interface intuitiva, sensível ao toque e de rápido acesso às informações que o usuário solicitar. Há um menu apresentando os botões referentes a cada função do APP, tais como: índices e cálculos; escalas funcionais; exames laboratoriais; sinais vitais; desmame; ventilação mecânica (VM); ventilação não invasiva (VNI). Desta forma, o APP apresenta sete modalidades. O tempo de desenvolvimento do aplicativo foi de 12 meses. **CONCLUSÃO:** Desenvolvemos um APP com foco em profissionais que atuam em UTIs, com o objetivo de que estes obtenham informações à beira leito assim como facilidade de utilização de instrumentos avaliativos.

PALAVRAS-CHAVE: Aplicativos móveis. Aplicação de informática médica. Inovação tecnológica. Serviço Hospitalar de Fisioterapia. Unidades de Terapia Intensiva.

Introduction

Technology is a complex term whose classification depends on its content. Thus, health technology can be described as a set of actions, which aim to optimize health practice.[1] The use of health technologies can provide greater resolution of damages, reliability and user satisfaction in relation to the health service offered.[2] The continuous increase in health expenditures, the increasing production of new technologies and the changes in the epidemiological profile of populations that have occurred in the last two decades have led to diversified needs for attention. Therefore, it is socially and politically necessary to develop articulation mechanisms between the sectors involved in the production, incorporation and use of technologies in health systems.[3]

However, Brazil has invested unsatisfactorily public resources in the development of science and technology. The business sector has also been investing timidly in new technologies.[4] According to Franco, "Health Technology Assessment (HTA) is well established in developed countries; however, it is still evolving in several countries, including Brazil".[5] The health professional has been gaining space and prominence in the application and development of technologies. When it is possible to aggregate them in contexts of assistance and education, its use shows great professional growth with benefits in the relationship between professional and client/patient.[6] Technology has been closely linked to health for a long time. Historic discoveries brought technology adapted to clinical needs. In the intensive care unit (ICU) it is no different.[7,8]

The technology in the health area is well established, it appears in several devices used for the evaluation and treatment; as an example, imaging exam technologies, or even the mechanical ventilator. In this scenario, mobile technologies (tablets, smartphones, among others) stand out, especially mobile applications (APPS). APPS are defined as tools designed to perform specific tasks. In a current context, it is possible to observe an increase in technologies and mobile applications that are directing the construction of a new modality of health care, in which health-related information is safe and easily accessible, being possible to access it at any time and anywhere.[9]

Studies indicate that the applications, and their generated information, can be used to improve results and reduce health risks, as well as to understand the determining factors that promote health and/or lead to disease.[10] Although technology suggest the optimization of health in several aspects and areas, there is a lack of studies that bring innovation in technologies. With this, this article aims to develop a mobile application that assists the decision-making of intensive care professionals at the bedside.

Materials and Methods

The APP was developed through a team of three physiotherapists, and a software developer. Of these physiotherapists, one is active in the area and two are specialists in Intensive Care Physiotherapy with more than 10 years of experience. The first step consisted of searching for safe and effective bibliographic references to be used in the information present in the application. The Scielo, Pubmed, Medline and Lilacs databases were used. Regarding the development and life cycle of healthcare technology, we have reached the pre-development and development stage.

For the options indices of calculations, vital signs, mechanical ventilation (MV), non-invasive ventilation (NIV) and weaning, the reference chosen was the "Brazilian recommendations of mechanical ventilation 2013. Part I".[11]

For laboratory tests, the chosen one was Interpretation of "Interpretação de Exames Laboratoriais para o Fisioterapeuta".[12]

For the scales, their validation articles were used: "Perme Intensive Care Unit Mobility Score and ICU Mobility Scale: translation into Portuguese and cross-cultural adaptation for use in Brazil"[13]; "Validation of the brazilian version of Functional Independence Measur"[14]; "Brazilian version of the Functional Status Score for the ICU: translation and cross-cultural adaptation"[15]; "Validation of the Barthel Index in elderly patients attended in outpatient clinics, in Brazil".[16]

For the development, the Systematic Instructional Design (DIS) method was used. It has a systems approach. This method has the stages of analysis, design/development, implementation and evaluation.[17]

The development of the APP was done in a web programming language, using Javascript with the React Native framework through the Expo platform. The APP was built from a base component that provides navigation to all other screens using react-navigation. To create the user interface, the React Native Paper component package was used.

Registration on Android and IOS platforms

Android (Google Play)

It was necessary to create an account as a developer at Google, costing $25 USD. After the processes guided by the platform, the application was submitted.

IOS (Apple Store)

An account was created in the IOS Developer Program, the fee was $99 USD. Then, after carrying out the processes guided by the platform, the application was submitted.

Results

The APP has an intuitive, touch-sensitive interface and quick access to the information that the user will request. The APP presents a main menu screen where there is a menu with the buttons representing each APP function, such as: indexes and calculations; functional scales; clinical and laboratory tests; vital signs; weaning; mechanical ventilation (MV); non-invasive ventilation (NIV). In total, the application has seven modes.

When the user accesses the "indexes and calculations" option, the APP will present the options: ideal weight, lung compliance (static and dynamic), shallow breathing index (SBI), airway resistance (RAW), oxygenation index (OI), age-expected PaO_2, minute volume (MV), body mass index (BMI) and mean arterial pressure (MAP). When data is entered into the APP, it processes the information, performs the calculation, and delivers the result on the screen.

The function named "functional scales", has on the screen the options of scales applied in ICU: PERME, FSS-ICU, MIF and BARTHEL, Glasgow Coma Scale (ECG) and Functional Status Scale in ICU. The user will click on the desired scale, where he has the options to be filled in according to the patient. At the end, when all the information is already in the APP, it shows the patient's score. In this function, the user will find theoretical information for each functional scale.

In the option "clinical and laboratory tests", the user will have access to the standards of values, such as: spirometry, arterial blood gases, blood count, leukogram, plateletogram, among others.

In "vital signs", there are two titles that expand when clicked, the title named "normality" shows the usual values of each item, and the title named "parameters with indication for ventilatory support (MV and NIV)" shows the altered values that indicate the need for ventilatory support. The items are: heart rate (HR), respiratory rate (RR), blood pressure, arterial O2 saturation.

The "weaning" option has information related to ventilatory weaning and extubation of the patient, including: identifying whether the patient is able to start weaning, how to assess the moment of extubation, use of NIV in the removal of IMV, how to manage the patient with weaning failure and how to manage the patient with extubation failure.

Accessing the "mechanical ventilation" button provides information about the mechanical ventilator adjustment: initial adjustment of the invasive ventilator, mechanical ventilation in COPD and ventilator programming for patients with asthma.

In the last topic of the main menu, the user will find the option "non-invasive ventilation", which contains theoretical and practical information about: CPAP, BIPAP, types of interfaces and contraindications.

The APP also has two side menus. The one on the left shows all the options of the main menu mentioned above, and the option of "references" where the

user can access all the quotes used in the content of the APP. In the right menu the user will find the buttons "about", "who we are" and "talk to us"; the "about" button brings an introduction to the APP, the "who we are" option is represented with the curriculum and contact of the development team, in the "talk to us" the user can send a message via the APP to support with questions or suggestions.

To facilitate the necessary updates in the APP, the over-the-air (OTA) system was used, which consists of searching for new updates on the Expo servers and making them immediately available to users, without the need to go through the stores of the Android platforms and IOS.

The method applied for the development allows the APP evaluation process and adjustments made to be as close as possible to the professional's need.

Figure 1. Demonstration of the UTI AUX APP interface and themes present in it, as well as an example of a thematic screen
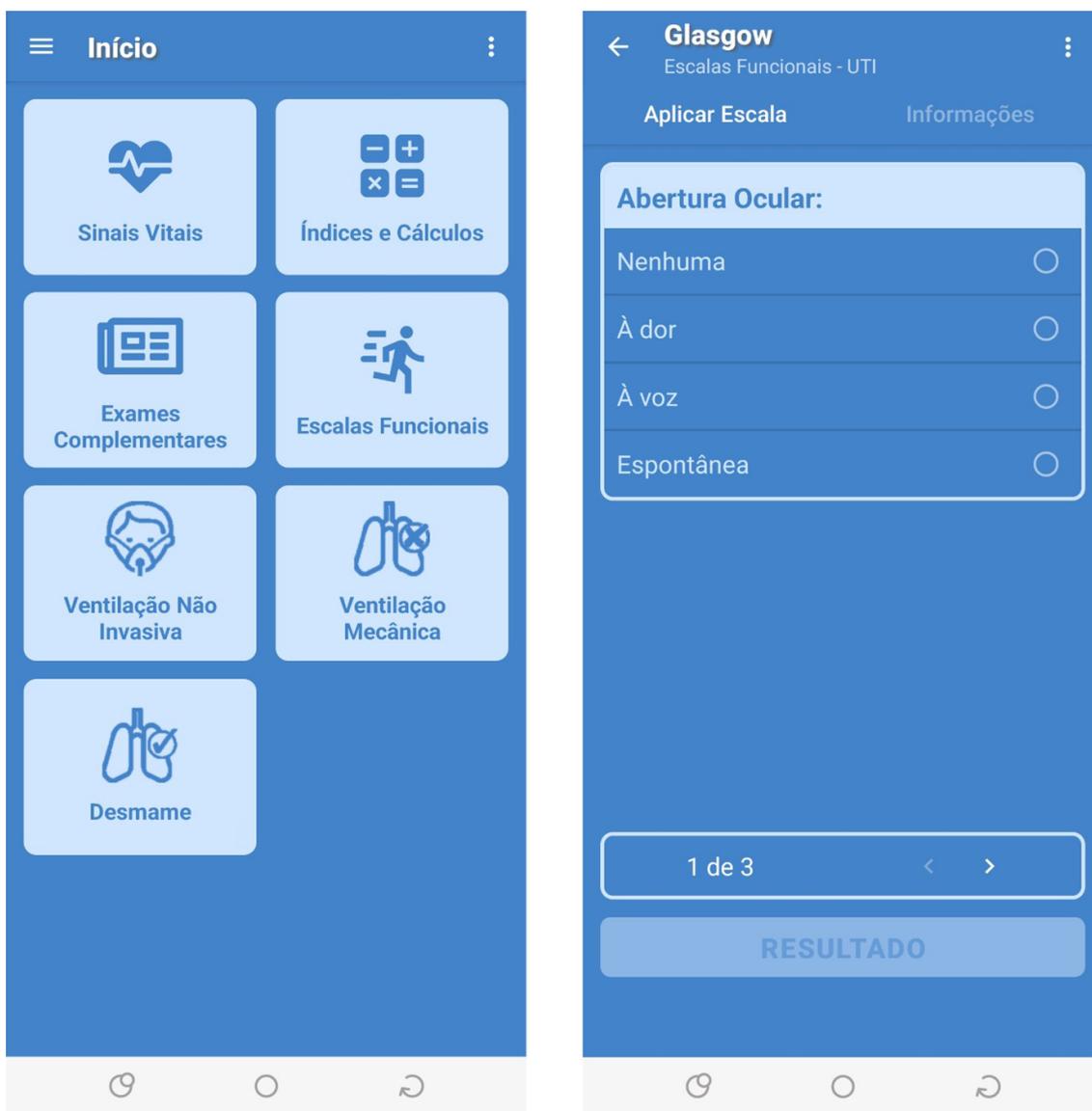
Discussion

This study was carried out with the objective of developing an application for intensive care professionals; additionally, this application will enable the improvement of knowledge as well as assisting decision-making at the bedside. Another point to be highlighted was the search for innovation and technological development associated with health. This application is essential in the economic and social sphere, taking into account the advantages it provides to the professional and the patient, and the technological impulse related to health and its accessibility.

According to Barra et al.[18], there has been a growing construction of new technologies in recent decades, aiming at the development of technological tools (named mobile applications), which make it possible to advance in the teaching-learning process and improve the performance of users in the most diverse contexts. This shows a similarity with our study, suggesting that it is collaborating with the technological evolution in health care.

The study by Osaku[19], entitled "Desenvolvimento de um software didático para o apoio ao aprendizado de ventilação mecânica", shows similarities with our study, since it brings the development of a software for physical therapists and physical therapy students with the educational objective focused on mechanical ventilation, bringing similarity with our work in the aspects of software development, technological innovation and physical therapy and mechanical ventilation/ICU, suggesting that the use of educational software are mediating artifacts enabled for a better teaching/learning process.

Blumenthal et al.[20], did their work with the aim of understanding physical therapists' attitudes towards mHealth and the use of technology in their practice. For this, they developed a questionnaire that was administered online with 76 participants. No evidence was found that age, sex, experience or practice had any influence. Participants demonstrated favorable attitudes towards mHealth tools in clinical practice. But research suggests that an important determinant of early adoptive behavior is how useful the technology appears to be in clinical practice and its benefits to practitioner and patient.

Barra et al.[17], suggested in their study that the Systematic Instructional Design method allows developers to create their own instructional design method/process aiming at unique solutions to specific problems or needs in their practical situations. This method can be used for several technologies, in the case of the present study for mobile application. He also highlighted that this model is based on several existing perspectives in the learning process, corroborating the development of our application, suggesting that it can contribute to the learning of its users.

This study has as a limitation: the evaluation of the application was carried out by professionals specializing in the area, in an informal way. The usability scale was not applied, nor was the validation with professionals working in the area of intensive care.

Conclusion

Mobile technologies are great facilitators in several areas of health, so the development of this software is of great importance for professionals working in intensive care units, as it directly contributes to the technological improvement in the care of critical patients. Technology is an essential means for the growth and improvement of the performance of intensive care physical therapists, suggesting that we should invest in new technological tools that bring us benefits for the work of physical therapists in intensive care units.

Conflicts of interest

No financial, legal or political conflicts involving third parties (government, companies and private foundations, etc.) were declared for any aspect of the submitted work (including, but not limited to grants and funding, participation in an advisory board, study design, preparation manuscript, statistical analysis, etc.).

Authors' contributions

Silva JSM participated in the development of the application, was mainly responsible for all the research of the product's content, writing of the scientific article. Forgiarini Junior LA participated as advisor, collaborated in data collection, APP development and article writing. Pasini GA was the technical developer of the entire application and assisted in writing the methodology of the scientific article. Forgiarini SGI participated as a co-advisor, collaborated in data collection and development of the APP.

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