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Building and validation of wireframe for software prototype aimed at occupational vaccines

Joice Rodrigues Machado Hahn[1*], Melanie Schröder[2], Silvana Aline Cordeiro Antoniolli[3], Elizete Maria de Souza Bueno[4], Luccas Melo de Souza[5] and Adriana Aparecida Paz[5]

[1]Grupo de Pesquisa Tecnologia, Gestão, Educação e Segurança no Trabalho, Universidade Federal de Ciências da Saúde de Porto Alegre, Rua Sarmento Leite, 245, 90050-170, Porto Alegre, Rio Grande do Sul, Brazil. [2]Curso de Bacharelado em Enfermagem, Universidade Federal de Ciências da Saúde de Porto Alegre, Porto Alegre, Rio Grande do Sul, Brazil. [3]Universidade Federal de Ciências da Saúde de Porto Alegre, Porto Alegre, Rio Grande do Sul, Brazil. [4]Programa de Pós-graduação em Enfermagem, Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil. [5]Departamento de Enfermagem, Universidade Federal de Ciências da Saúde de Porto Alegre, Porto Alegre, Rio Grande do Sul, Brazil. *Author for correspondence E-mail: joice.hahn@ufcspa.edu.br

ABSTRACT. To build and validate the functionality and interface of the wireframe of a software prototype for managing worker vaccinations. Study of technological production, based on User-Centered Design (UCD) and Scrum framework, with an exploratory and descriptive design using a quantitative approach. Study approved by the Research Ethics Committee (Opinion number 5.040.951/2021). The wireframe modeling of the software prototype was built in Bizagi Modeler® and validated by experts. The functionality and interface were considered satisfactory at 92% to 100%, respectively. The items with the lowest agreement were related to contraindications and information about vaccination coverage being in a place that was easy to view and understand, which reached a CI of 0.83. In the global validation of the wireframe, the experts' agreement reached a CI of 96%. The building of the wireframe took into account end user interaction. The validation of the software prototype wireframe provides an excellent CI result, which was achieved in all of its evaluated items. The software is able to optimize nurses' time in the management and control of vaccines in occupational health services, which contributes to increasing workers' vaccination coverage and protecting the community.

Keywords: Workers' health; occupational health program; information technology; data management; vaccines; nursing.

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Introduction

Currently, vaccination has gained prominence in the face of the pandemic caused by the transmission of the Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2). In January 2020, an International Public Health Emergency was declared by the World Health Organization (WHO). In Brazil, the Ministry of Health [Ministério da Saúde (MS)] received the first notification of a confirmed case of Corona Virus Disease 2019 (COVID-19), on February 26, 2020 ([MS], 2021). Faced with this health and epidemiological crisis, mass vaccination of the population took place with the aim of mitigating the impacts of the pandemic, especially premature deaths in priority groups and/or groups susceptible to severe complications from contact with SARS-CoV-2.

Occupational health is concerned with the health and safety of workers. When it comes to healthcare work, concern with biological risk has always been a constant for the field. Thus, since 2005, the Regulatory Standard **[**Norma Regulamentadora (NR)] 32 provides guidance on safety and health for work in health services. It is a strong ally of the Occupational Health Medical Control [Program Programa de Controle Médico de Saúde Ocupacional (PCMSO)] with regard to free-of-charge provision of active immunization. Vaccinations against Tetanus, Diphtheria, Hepatitis B, and those established in the PCMSO, are offered to workers and must be controlled and registered. Such measures are suggested to mitigate the risks of the community acquiring and/or transmitting vaccine-preventable diseases (Araújo et al., 2019; Ministério do Trabalho e Emprego [MTE], 2005).

The use of technologies has proven to be a powerful channel of communication in the health sector; in the context of Electronic Health Records [Registros Eletrônicos em Saúde (RES)], technological advancement is related to different lines of scientific knowledge and addresses concepts of e-Health or Digital Health on the applications of social networks, Internet of Things (IoT), artificial intelligence (AI), as well as new concepts ([MS], 2020). In recent decades, the use of technology has significantly impacted the way institutions deal

with their information. In the health field, there are specificities regarding the privacy and confidentiality of information in individuals' health records. However, gradually, paper records have been replaced by electronic ones (Sociedade Brasileira de Informática em Saúde [SBIS], 2019).

User-Centered Design (UCD) is a methodological process focused on the user and on meeting their needs and demands. It involves the end user and developers throughout the design process, resorting to strategies such as: surveys, tests, interviews, evaluative feedback regarding the product from a usability perspective (appearance, efficiency and relevance). A UCD aims to understand user needs in order to produce intelligent systems that can solve a truly relevant problem, generating greater satisfaction in experiences with the final design of the product. Scientific literature points out that UCD is a science that defines requirements from the point of view of those who will use the system (user), and not just the experience of developers (Stati & Sarmento, 2021; Lowdermilk, 2020; Monteiro, 2019).

In UCD, software design is incorporated, and creation occurs through the selection of tools based on the usability aspect and on User experience (UX). This methodology has proven to be successful in new technologies with its applicability, as the product is obtained in a shorter time and with reduced operational costs (Lowdermilk, 2020; Monteiro, 2019; Nielsen-Norman Group, 2021).

The objective of the study was to build and validate the functionality and interface of the wireframe of a software prototype for managing worker vaccinations.

Material and methods

Study of technological production, based on User-Centered Design (UCD) and Scrum framework, with an exploratory and descriptive design using a quantitative approach (Lowdermilk, 2020; Monteiro, 2019; Zangirolami-Raimundo et al., 2018). Following UCD, this stage consists of validating the functionality and interface of the product with end users (Monteiro, 2019; Lowdermilk, 2020; Stati & Sarmento, 2021).

Building stage

The building of the wireframe modeling of the software prototype was conceived from the user's interaction with the screens, the functionality options provided by the technology, and the content that was incorporated. The user's interaction with the wireframe represents a process that exposes the proposal and tests the use of the tool, considering the possibilities that the latter provides, without losing focus on the experience and needs of the end user (Rogers et al., 2013).

The wireframe is a visual sketch of the prototype in its static form. The design and development had the intention of applying UCD associated with UI and UX. The illustrations for the static screens were developed by the Scrum Team. The parameters for using the interface elements were established, and the latter were presented and validated in the Scrum Team's fortnightly meetings.

Both models were proposed so that the user could choose an option from the perspective of a user-friendly graphical interface (UFGI). These built wireframe models were stored on Google Drive®. The modeling was designed considering the creation of User Stories; definition of Functional Requirements (FRs) and Non-Functional Requirements (NFRs); technical specification using Unified Modeling Language (UML); and building of the modeling in Bizagi Modeler®.

The use of User Stories made it possible to organize the results on User Index Cards focusing on the main expectations and needs of users (occupational nurses) who work in the process of registering and controlling occupational vaccines. The question used for this purpose was "What are the needs you perceive when carrying out the process of registering and managing vaccination coverage effectively?"

Wireframe validation stage

With the wireframe built, it was sent to the product validation process, where the data collection instrument called "Wireframe validation" was created and edited on a Google Forms® form. This form has 21 questions distributed across three dimensions: functionality, interface, and sociodemographic and occupational characterization.

The electronic address of the Free and Informed Consent Record (FICR) was included in the data collection instrument for the participant's new access (if necessary), and the two prototype interface design options were identified as A and B. A preliminary test of this research instrument was conducted with two occupational nurses, who were not part of the User Experience Committee. With the application, it was

possible to qualify and improve the clarity, depth and sequence of the research questions. The time taken to fill out the instrument was around 20 minutes.

Thus, to proceed with the prototype validation process, the "User Experience Committee" was formed. To meet the recommendations for validation studies regarding content, the participation of six to twenty individuals is recommended, which is in contrast to UCD and UX, as they establish a minimum of five and a maximum of ten participants (Haynes et al., 1995; Lowdermilk, 2020;). Therefore, the decision was to select ten participants in this stage of the study.

The User Experience Committee was composed through two simple random draws. This way, all participants had the same chance to join in the validation stage. The participants had a number assigned to them in the database of phase 1 of the study, which sought to identify what they found difficult, easy, and their needs in managing vaccine records and vaccination coverage in occupational health; the online application named Sorteador® was used.

In the first draw, which took place in June 2021, ten participants were recruited. The alleged reasons for nonparticipation were: one participant chose not to continue in the study; and the other joined the Scrum Team of this study. Therefore, the decision was to hold a second draw in the same month as the first draw, with two participants. Of the ten selected, three did not respond to the invitation; however, as the researchers received feedback from seven participants, the decision was to continue with the sample, as recommended in the literature that states that, for validation in accordance with UCD and UX, there should be at least five and no more than ten participants (Haynes et al., 1995; Lowdermilk, 2020).

Data collection began with an invitation sent by email, whose address was informed by the participant selected in the draw. The participants' answers were stored in a Google Sheets® spreadsheet on Google Drive®. As soon as the collection was completed, the Google Sheets® spreadsheet was extracted from the shared environment to a local computer and then saved in Microsoft® Excel® format.

Afterwards, the data was processed, so that sensitive data was protected, making it impossible to identify the participant, despite their permission granted through acceptance in the FICR, and the information in electronic mail. The participant received the same numerical indicator that was defined in phase 1 of the study. In the treatment, the data were numerically coded, organized and assessed as to the existence of inconsistency and incoherence in the answers to be submitted for analysis, and subsequently transformed into a database, as recommended in the literature (Dancey et al., 2017).

The data were analyzed in terms of the agreement of the participants in the User Experience Committee. The analysis was applied based on the use of a five-degree Likert scale, ranging from 1 to 5 points, with the following parameters being established: 5 - completely agree; 4 - partially agree; 3 - neither agree nor disagree; 2 - partially disagree; and 1 - totally disagree. A free text question was also added to record notes, suggestions or recommendations from the participants (Polit & Beck, 2019).

For the purposes of analyzing the participants' consensus, the Consensus Index (CI) on functionality and interface was considered acceptable when at least $\geqslant 0.80$, and preferably $\geqslant 0.90$. These values are proposed in a content validation study (Alexandre & Coluci, 2011; Souza et al., 2017). The User Experience Committee's consensus was expressed by the sum of answers 4 and 5, divided by the sum of all answers.

The answers were grouped and assessed in accordance with the functionality and interface items for relevant changes consistent with the proposal to be made. The results of this stage of the study were discussed by the Scrum Team for the definition of improvements to requirements specifications and prototype programming. The use of UCD has the purpose of involving users in decision-making stages of the prototype development.

The present study was approved by the Research Committees (ComPesq) of UFCSPA and Plataforma Brasil, under legal opinions No. 029/2021 and 5.040.951/2021, respectively, for research at any stage in a virtual environment.

Results

The main expectations and needs of the application for future users (occupational nurses) who work in the process of registering and controlling occupational vaccines were portrayed in User Stories, which enabled the organization of User Index Cards. Figure 1 illustrates the cards created from the User Stories perspective.

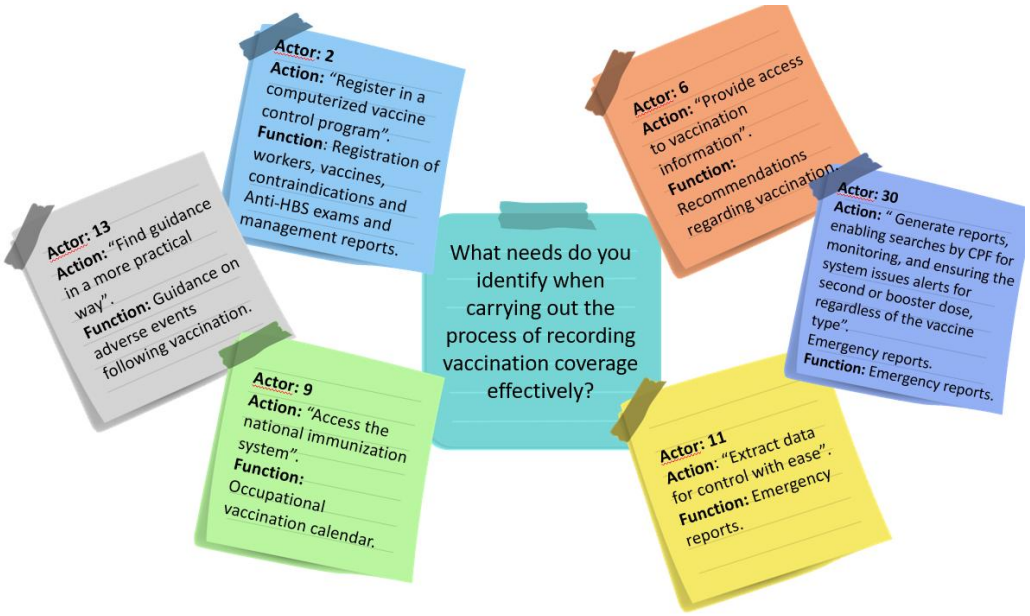

Figure 1. User Stories User Index Cards. Porto Alegre, Rio Grande do Sul, Brazil, 2022.

From User Stories, the FRs and NFRs were established for modeling the software prototype. All requirements are expressed in Table 1, which presents the set of tasks to be performed by the software prototype for the management of occupational vaccines and in line with the needs of the end user.

Table 1. Functional and nonfunctional requirements for the prototype modeling. Porto Alegre, Rio Grande do Sul, 2022.

Code	Functional requirements (FRs)
	User/Record
FR 01	The software will allow the nurse to be registered.
FR 02	The professional's record must contain full name, Brazilian Individual Taxpayer Registration Number (CPF), employee registration number, and occupation.
FR 03	The software will allow vaccinated workers to be registered.
FR 04	The record of vaccinated workers must contain full name, CPF, telephone number, email, department, and leader.
FR 05	The nurse must accept the privacy policy of the software prototype.
FR 06	The nurse must accept the terms of use of the software prototype.
	User/Activities
FR 07	The software will allow registering occupational vaccines containing their traceability data.
FR 08	The software will allow registering medical contraindications related to vaccination.
FR 09	The software will allow registering the results of the Anti-HBs test to prove the effectiveness of the Hepatitis B vaccine.
FR 10	The software will allow access to recommendations regarding occupational vaccination and NR32.
FR 11	The software will allow access to guidance on Adverse Events Following Immunization (AEFI).
FR 12	The software will allow access to the occupational vaccination calendar.
FR 13	The software will allow access to management reports with a filter by total number of vaccinated workers.
FR 14	The software will allow access to management reports with a filter by total number of past due vaccines.
FR 15	The software will allow access to management reports with a filter by worker's vaccination status.
Code	Nonfunctional requirements (NFRs)
NFR 01	The software must be clear and intuitive.
NFR 02	The interface must be pleasant and easy to use.
NFR 03	Users must be registered in advance.
NFR 04	User access will be via login and password.
NFR 05	The software must be compatible with the following browsers: Chrome®, Edge®, Firefox®, Internet Explorer®, Safari®, QQ®, Sogou Explorer®, Opera®, Yandex®, UC Browser®.
NFR 06	The software will use a WebService in the Dart® language to send data to Google Drive® and to exchange resources.
NFR 07	The software will interoperate with other applications, WebServices and other interfaces with external systems.
NFR 08	The occupational vaccination calendar must be updated in the software in accordance with SBIm guidelines.
NFR 09	The software must meet legal standards that guarantee information security (LGPD).
NFR 10	The software must be in Portuguese.

Furthermore, these FRs and NFRs present the necessary information to support the modeling of the wireframe of the software prototype. However, to achieve a fully functional prototype, it may be necessary to make unforeseen changes to the requirements defined for now, as tests may be carried out in the future.

Based on the UML, an Entity Relationship Diagram and a Use Case Diagram were developed to address the technical specificity and expected user interaction with the software prototype. The diagram summarizes the details that are presented in Figure 2 of the Entity Relationship Diagram.

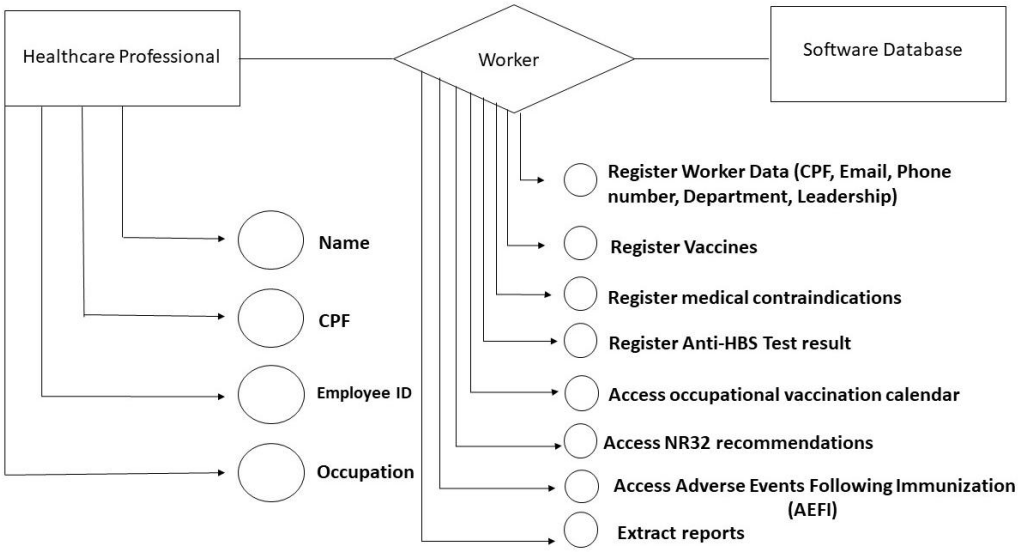

Figure 2. Entity Relationship Diagram. Porto Alegre, Rio Grande do Sul, Brazil, 2022.

Then, the Use Case Diagram was prepared based on the notes by the occupational nurses, on the experiences of the Product Owners, on the User Stories User Index Cards, and on the defined FRs and NFRs. The technical characterization was recorded in a document called "Prototype specification". Figure 3 expresses the Use Case Diagram of the software prototype for managing worker vaccinations.

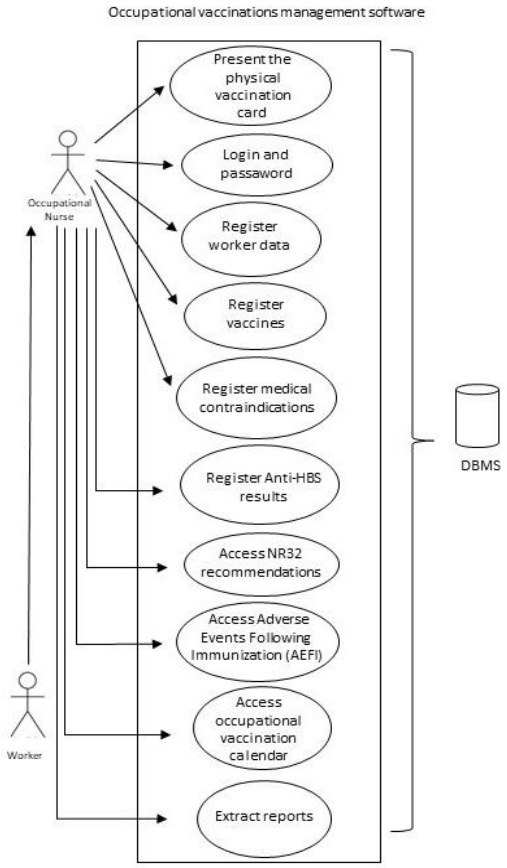

Figure 3. Use Case Diagram of the software prototype for managing worker vaccinations. Porto Alegre, Rio Grande do Sul, Brazil, 2022. DBMS – Database Management System.

In the diagram, the actions that the user (occupational nurse) can perform in the software are represented by ellipses. Below is the specification of each functionality described in the Use Case Diagram:

1. User access: the healthcare professional (occupational nurse) will access the system via login and password.
2. Worker registration: the healthcare professional (occupational nurse) will register the worker with data such as full name, CPF, telephone number, email, department, and leader.
3. Vaccine registration: the healthcare professional (occupational nurse) will register the vaccines that the worker has had: Hepatitis B, Diphtheria and Tetanus, MMR, Influenza, COVID-19, and other recommended vaccines and/or that the worker has had.
4. Medical contraindication registration: the user (occupational nurse) will register medical contraindications for any reported vaccine, if the worker reports and presents the evidence.
5. Anti-HBs test registration: the user (occupational nurse) will register the result of the biological indicator that identifies that the worker is immunized against the hepatitis B virus.
6. Access to NR 32 recommendations: the user (occupational nurse) will have access to the general recommendations screen regarding legal compliance and mandatory occupational vaccination.
7. Access to Adverse Events Following Immunization (AEFI): the user (occupational nurse) will be able to access the screen with guidance on AEFI and, if necessary, on how to report it.
8. Access to vaccination calendar: the user (occupational nurse) will be able to access the worker's vaccination calendar screen if they have questions about the vaccination schedule.
9. Access to management reports: the user (occupational nurse) will be able to access management reports, choosing the type of filtering they want: a) total number of vaccinated workers; b) total number of past due vaccines; c) worker's vaccination status.
10. Based on this conception of what is expected from the prototype, from the user's perspective, the modeling of the software prototype is presented, which shows the stages of the process that the user (occupational nurse) may go through. Figure 4 illustrates the process modeling that was structured in Bizagi Modeler®.

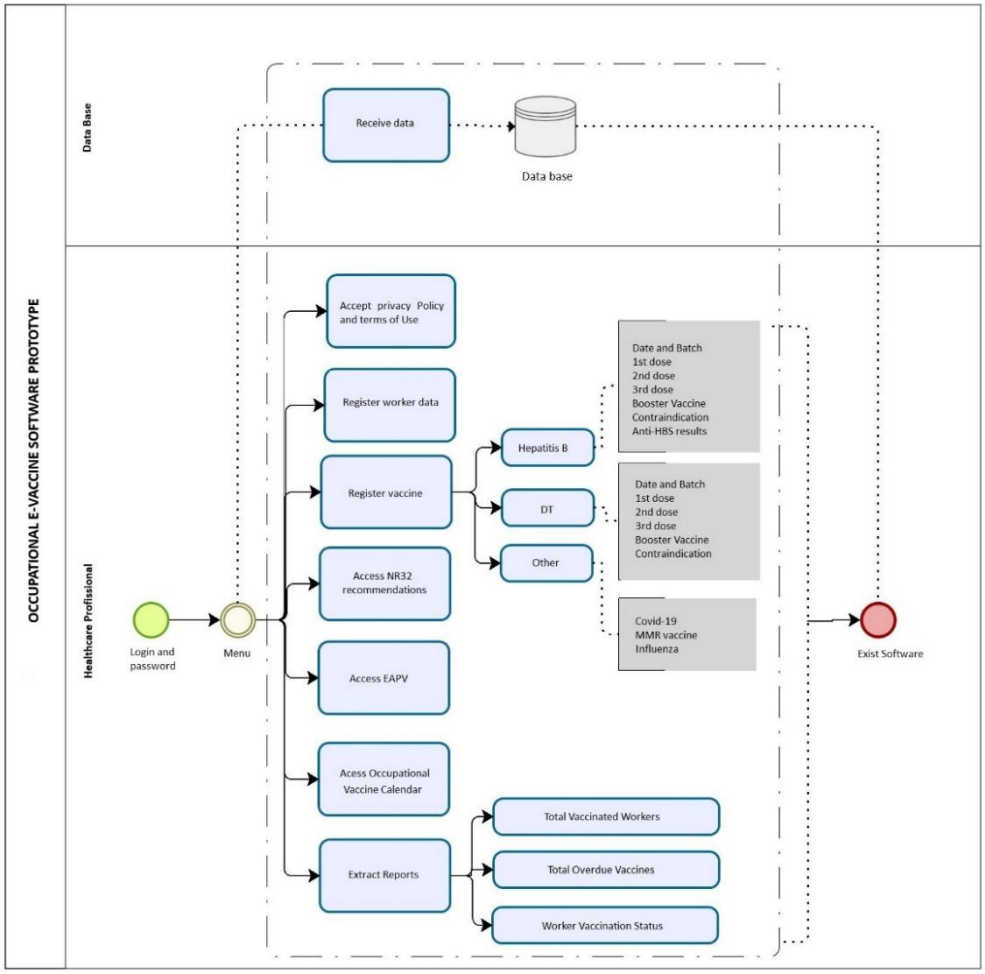

Figure 4. Software prototype modeling. Porto Alegre, Rio Grande do Sul, Brazil, 2022.

The name of the software was created together with the development team and Product Owners as "Occupational E-Vaccines" [*E-Vacinas Ocupacionais*], which refers to the potential that the technological tool can provide. In this sense, the letter "E" refers to electronic, as in these examples: e-SUS, e-Saúde, etc. On the other hand, to complement, "occupational vaccines" are the immunobiologicals necessary for the individual and collective protection of workers in the workplace.

With regard to visual attributes, user interaction elements – User Interface (UI) – were incorporated into the interface, always seeking to establish a UFGI with regard to typography, colorimetry, iconography and logography. Attractive colors, letters and icons were selected so that the user's attention is kept, and the experience is pleasant while using the software.

Typography was considered for the visual aspects related to legibility and the reading of the prototype's functions and information. The criteria associated with typography were the feasibility of use, which sought visual cohesion, in textual terms, with the other objects in the interface. Fonts with a simple appearance and a friendly and humanistic characteristic were defined to meet the objectives, with a view to not hindering the technicality of the content represented in the interface. Font choices were made using Google Fonts® (https://fonts.google.com/) to meet UI requirements.

The colorimetry for the software prototype was established by the visual values that are expressed in health and vaccines, with the purpose of showing the technical reliability of the information. The decision was to use neutral colors for the background and striking colors to highlight functions and features to provide greater visibility. The two color palettes were defined in accordance with the visual cohesion and the value indication of the prototype in Adobe Color® (https://color.adobe.com/), in order to assist in identifying the data recorded in the prototype.

The iconography was applied in accordance with the content of the prototype's functions. The icons available for public use were selected from Google Fonts. For each function, two icons were selected, which constitute two options. These options formed a set of distinct icons added to the prototype.

Likewise, in relation to the logography for both interface design proposals, two logos were created in the CANVA® software. Based on elements that symbolize vaccines, the Scrum Team sought to diagram the logos with images available free of charge in the software in order to generate the prototype's visual identity possibilities. Interface design elements are relevant to users' experience in the interactive process.

For option 1 in the design of the logography of the "Occupational E-Vaccines" software prototype, a heart and a cross were used, which depict love, care and healthy well-being; the syringe symbolizes one of the instruments present in the application of vaccines. In option 2, the syringe was kept with the same meaning as its aforementioned expression, and a check symbol was added, confirming the importance of up-to-date vaccination. Figure 5 displays the logography of the "Occupational E-Vaccines" software prototype, containing the two options that were made available for the Expert Committee to choose.

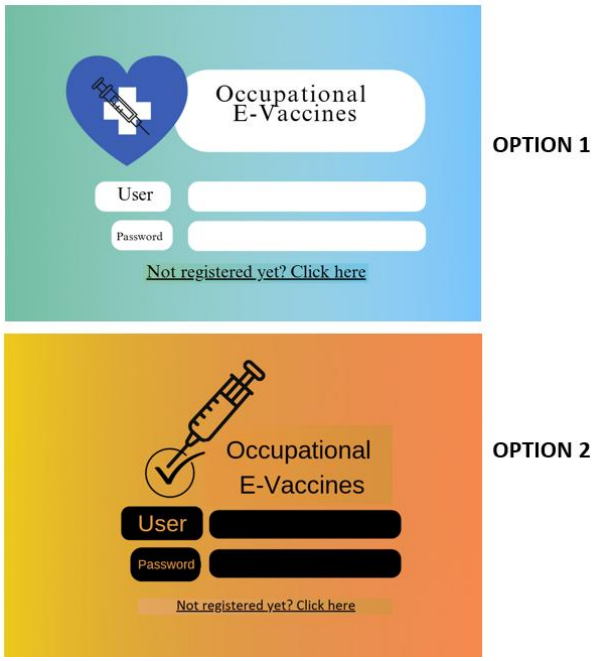

Figure 5: Logography options for the "Occupational E-Vaccines" software prototype. Porto Alegre, Rio Grande do Sul, Brazil, 2022.

Once the interface design was established, and in accordance with the modeling previously presented, the wireframe of the "Occupational E-Vaccines" software was built, which is a visual sketch of the software in its static version, seeking to express all screens and functionalities as to how the technology is expected to be obtained from the perspective of the Product Owners and the development team. It was built on the Figma® application, with the aim of providing an excellent UI, presenting the visual proposal merged with the layout.

The software prototype was developed in accordance with UI and UX, to be used on desktop and be responsive on screens of different sizes, which allows it to be installed on any computer.

Seven women participated in the validation stage, and all had a graduate degree in Occupational Nursing. The average age was 41.5 ± 5.9 years. As for the Federation Units (FUs) of the participants, 3 (42.8%) work in Rio Grande do Sul; 2 (28.6%), in São Paulo; 1 (14.3%) in Mato Grosso do Sul, and another works in Minas Gerais. (Table 2) presents the results obtained from the validation process with the users regarding the functionality and interface expressed by the wireframe of the "Occupational E-Vaccines" software prototype.

Table 2. Consensus Index on the functionality and interface of the prototype wireframe (n = 7). Porto Alegre, Rio Grande do Sul, Brazil, 2022.

Variables	CI*	Mean(SD)†
Functionality	0.92	4.25(1.22)
Easy location of occupational vaccines to be applied and/or registered	0.97	4.29(1.5)
Provides recommended vaccines and relevant information on adult and worker vaccination schedule	1.00	4.71(0.49)
Easy visualization and understanding of vaccine contraindications	0.89	3.86(1.68)
Easy location of information on workers' vaccination coverage	0.83	4.14(1.21)
Interface (UI)	1.00	4.79(0.43)
Learning and using the features is easy to remember	1.00	4.86(0.38)
The information displayed is visually pleasing and makes understanding easy	1.00	4.71(0.49)
The occupational vaccination calendar provides recommended vaccines	1.00	4.71(0.49)
Provides relevant information to guide the worker	1.00	4.86(0.38)
Global Consensus Index	0.96	4.52(0.83)

Research data (2022). *Consensus Index; † Mean ± Standard Deviation.

The experts approved the functionality and user interface, with consensus being reached, respectively, as satisfactory (0.92) and full (1.00). The items with the lowest consensus were specific to functionality: ease of locating information on workers' vaccination coverage (0.83); and ease of viewing and understanding vaccine contraindications (0.89). However, the values assigned by the team of experts reached the minimum recommended by the literature, which is CI > 0.80.

When it comes to the ease of locating information, considering the means of the answers obtained in the wireframe functionality validation process, greater variability was observed in the answer to how easy it is to visualize and understand vaccine contraindications. This result is important to qualify the presentation of vaccine contraindications in a more dynamic and interactive way.

About the colorimetry (which expresses the colors and contrasts), typography (expresses the font of the letters) and iconography (expresses the idea of functionality) pleasant for the interface (use, content reading, and style) of the "Occupational E-Vaccines" wireframe, it was found that 4 (57.1%) of the User Committee participants prefer Option 1.

Regarding functionality, only one occupational nurse suggested a "training focused on the occupational healthcare field" (UX2). With regard to UI, the participants contributed with suggestions related to providing a "search key in the management report, with an option by company, through CNPJ (Brazilian National Registry of Legal Entities)" (UX5), as well as a "folder to file or scan a photo of the vaccination certificate "(UX7).

Discussion

The sociodemographic characterization of the participants confirms the prevalence of females in Nursing, a profession historically exercised mainly by women (Lombardi & Campos, 2018). Corroborating the present study, the research carried out by COFEN and Fundação Oswaldo Cruz (FIOCRUZ) found that females account for 85.1% of nursing professionals, and in Rio Grande do Sul, the figure stood at 84.6%. The study also points out that, despite the significant number of women in the nursing profession, there is a trend of a greater male presence. This trend reveals that the nursing workforce has been changing over recent years compared to previous studies (Machado et al., 2017).

The age of the participants ranged from 41 to 59 years old, which confirms the findings in the literature. The research conducted by COFEN and FIOCRUZ found that the age range of around 40% of nursing professionals is between 36 and 50 years old. Thus, it is noteworthy that 61.7% of the contingent – which represents over 1 million and 100 thousand workers – are up to 40 years old. This shows that this professional category is made up of young adults. Furthermore, the same survey revealed that 13.2% of professionals are between 41 and 45 years old, 10.7% are between 46 and 50 years old, and 7.5% are between 51 and 55 years old (Machado et al., 2017).

Another research that built and validated a protocol for evaluating safety in vaccine care observed a similarity in the age profile, which ranged from a minimum of 31 years to a maximum of 57 years among the participating nurses (Medeiros et al., 2019).

This study was submitted to validation by a User Experience Committee and obtained a CI⩾ 0.90 regarding interface and usability. When it comes to technology validation, the literature recommends that the end user participate in the validation stages as the prototype evolves (Monteiro, 2019; Lowdermilk, 2020).

From this perspective of qualifying the vaccine management process in Occupational Health Services (OHSs) with real-time information through management reports, process modeling contributed to expressing the prototype's functionalities. The modeling included the functions available from the occupational nurse's first access to the software until the software was closed.

In a study on modeling evaluation, the consensus index reached 0.41, which enabled discussion and collective building with participants. The final version of this modeling reached a CI = 0.94 (Izaguirres et al., 2022). The relevance of the process modeling development was evidenced when ideas, needs and demands were explored collectively about what needs to be structured and, at the same time, understood by those who developed it.

In this way, modeling mapping is fundamental for process management, as it builds a flow of actions that illustrates the prototype for the software development stage (Bizagi, 2022). In another study, it is reinforced that the use of process modeling to control the risk of injury due to perioperative positioning is a technological innovation for developing systems to support nursing decision-making (Rodrigues et al., 2021).

A patient hospitalization time management software was submitted to a committee made up of 15 healthcare professionals who validated its appearance and content, reaching values of 0.93 and 0.80, respectively (Aragão et al., 2019). In another study that validated the "Health Retirement" [*Aposentar com Saúde*] web software, the overall content validity index was 0.97 for usability aspects, and full (1.00) for content (Pissinati et al., 2021).

In a similar way, the building of educational software for personality disorders was validated from Software Engineering principles validated by 26 nursing students, based on the Reeves method. The software obtained an average of 9.7 points for the criteria related to the user interface regarding ease of navigation, screen design, spatial compatibility of knowledge, presentation of information, aesthetics and functionality (Botti et al., 2011).

This study found some limitations such as the lower-than-desired participation of occupational nurses, as there is a significant contingent of professionals in this thematic area of the study. The sample made up of participants from the same FU as the headquarters of this study was significant. A second limiting factor may have been how long the research remained available for data collection, despite its wide dissemination on social media, including by COFEN itself. It is believed that professional exhaustion may have contributed to the occupational nurses' being less willing to participate in the study.

Final considerations

The topic of vaccines has never been so popular, mainly due to the epidemiological situation of the COVID-19 pandemic. Vaccines are considered a technological resource and used as the most relevant and effective preventive measure in healthcare worldwide. By contributing to a decline in hospitalizations and in the burden on workers in healthcare services, as well as to reducing the severity of morbidity, they lower the mortality of the disease and minimizes the worsening of cases and mortality, preventing subsequent socioeconomic and occupational damage resulting from the high transmissibility of preventable morbidities.

The Occupational Health Nurse's challenge is to contribute to mitigating workers' health problems by taking a stance towards adopting and using technologies and management methods that facilitate their work process. In this way, it is possible to contribute to quality management, monitoring and modification of the health profile of workers and the community.

Among all the activities of occupational nurses, the management of occupational vaccine control has proven to be increasingly complex, given the large number of workers who start receiving vaccine doses and do not follow the vaccination schedule. This occurs not only because of the responsibility of the nurse, but for a set of reasons that contribute to a low compliance with vaccines and a less-than-ideal control.

The results presented in this study confirm the importance of building the modeling, taking into account the end user (occupational nurse), and validating the wireframe of the software prototype for the management of occupational vaccines, which led to an excellent CI result, achieved in all of its evaluated items. The software is able to optimize nurses' time in the management and control of vaccines in occupational health services, which contributes to increasing workers' vaccination coverage and protecting the community.

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