

Qualitative Article on Health Care Technologies*

* The article is derived from a section of the doctoral thesis entitled " Functionality and Usability of the software Individualized Nursing Care Plans for Patients with Cardiovascular Conditions" [*Funcionalidad y usabilidad del software Planes de Cuidados Individualizados de Enfermería para Pacientes con Afecciones Cardiovasculares*], which is currently in the process of being written as part of the doctoral program in Nursing Sciences at the Universidad Autónoma de Nuevo León, Mexico.

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Contribution to the discipline: This study reveals the experiences of nursing professionals regarding the use of nursing care plan (NCP) software and content requirements for generating individualized nursing care plans for cardiovascular patients. These findings will serve as a guide for developing the architecture of this computing tool or application for nursing care plans, which could be utilized in clinical, educational, or research settings within the field of nursing.

Abstract

Introduction: Experiences with the use of nursing care plan (NCP) software and the content requirements for software designed for individualized nursing care plans for cardiovascular patients must be identified to generate a computing tool focused on the needs of cardiovascular nursing professionals in practice. **Objective:** To identify the experiences of nursing professionals with the use of NCP software and the content requirements that the software for individualized nursing care plans (INCPs) for cardiovascular patients should have for its development. **Materials and Methods:** A qualitative, phenomenological study conducted in a tertiary care unit in Monterrey, Nuevo León, México, adhering to the planning phase of the SCRUM methodology's testing process, with a sample of 11 cardiovascular nursing professionals selected through non-random, purposive sampling. Data collection was conducted through semi-structured interviews, interpreted using interpretive phenomenology. **Results:** The categories of nursing professionals' experiences with the use of ECE software and the software requirements were identified, with subcategories related to hardware: practicality and design, interfaces, use of artificial intelligence, and expected benefits of the software. **Conclusions:** The experiences of nursing professionals regarding the use of ECP software and the content requirements of ECP software for cardiovascular patients were identified, providing the basis for its development.

Keywords (Source: DeCS)

Software; nursing care; computer programs; software applications; medical informatics; nursing care plans.

4 Artículo cualitativo de tecnologías para el cuidado de la salud*

* El artículo es derivado de una parte de la tesis de doctorado titulada “Funcionalidad y usabilidad del software: planes de cuidados individualizados de enfermería para pacientes con afecciones cardiovasculares”, que se encuentra en proceso de escritura en el marco del Doctorado en Ciencias en Enfermería de la Universidad Autónoma de Nuevo León, México.

Resumen

Introducción: las experiencias con el uso de softwares sobre planes de cuidados de enfermería y los requerimientos de contenido para planes de cuidados individualizados de enfermería en pacientes cardiovasculares deben identificarse para generar una herramienta informática centrada en las necesidades que presentan los profesionales de enfermería cardiovascular en la práctica. **Objetivo:** identificar las experiencias de los profesionales de enfermería con el uso de softwares de PCE y con los requerimientos de contenido que debe poseer el software de PCIE para pacientes cardiovasculares y desarrollarlo. **Material y métodos:** estudio cualitativo, fenomenológico, realizado en una unidad de tercer nivel de atención de Monterrey, Nuevo León, México, siguiendo la fase de planificación de pruebas de la metodología SCRUM, con una muestra de 11 profesionales de enfermería de servicios cardiovasculares, seleccionados mediante muestreo no aleatorizado, intencionado. La recolección de datos se realizó con entrevistas semiestructuradas interpretadas mediante fenomenología interpretativa. **Resultados:** se identificaron las categorías de las experiencias de los profesionales de enfermería con el uso de softwares de PCE y los requerimientos del software con las subcategorías de hardware: practicidad y diseño, interfaces, utilización de la inteligencia artificial y beneficios esperados del software. **Conclusiones:** se identificaron las experiencias de los profesionales de enfermería sobre el uso de softwares de PCE y requerimientos de contenido del software de PCIE para pacientes cardiovasculares, para generar su desarrollo.

Palabras clave (Fuente: DeCS)

Software; cuidado de enfermería; programas informáticos; aplicaciones de software; informática en salud; planes de atención en enfermería.

Artigo qualitativo sobre tecnologias para cuidados de saúde*

* Este artigo é derivado de uma parte da tese de doutorado intitulada “Funcionalidad y usabilidad del software: planes de cuidados individualizados de enfermería para pacientes con afecciones cardiovasculares”, que se encontra no processo de escrita no âmbito do doutorado em Ciências em Enfermagem da Universidad Autónoma de Nuevo León, México.

Resumo

Introdução: as experiências com o uso de softwares para planos de cuidados de enfermagem (PCE) e os requisitos de conteúdo para planos de cuidados individualizados de enfermagem (PCIE) em pacientes cardiovasculares devem ser identificados para gerar uma ferramenta informática centrada nas necessidades apresentadas pelos profissionais de enfermagem cardiovascular na prática. **Objetivo:** identificar as experiências dos profissionais de enfermagem com o uso de softwares de PCE e com os requisitos de conteúdo que o software de PCIE deve possuir para pacientes cardiovasculares e desenvolvê-lo. **Material e métodos:** estudo qualitativo, fenomenológico, realizado em uma unidade de terceiro nível de atendimento em Monterrey, Nuevo León, México, em conformidade com a fase de planejamento de testes da metodologia SCRUM, com uma amostra de 11 profissionais de enfermagem de serviços cardiovasculares, selecionados por meio de amostragem não aleatória e intencional. A coleta de dados foi realizada por meio de entrevistas semiestruturadas analisadas segundo a fenomenologia interpretativa. **Resultados:** foram identificadas as categorias das experiências dos profissionais de enfermagem com o uso de softwares de PCE e os requisitos do software com as subcategorias relacionadas ao hardware: praticidade e design, interfaces, utilização de inteligência artificial e benefícios esperados do software. **Conclusões:** foram identificadas as experiências dos profissionais de enfermagem sobre o uso de softwares de PCE e os requisitos de conteúdo do software de PCIE para pacientes cardiovasculares, para gerar seu desenvolvimento.

Palavras-chave (Fonte DeCS)

Software; cuidado de enfermagem; programas de computador; aplicativos de software; informática em saúde; planos de cuidados de enfermagem.

Introduction

Nursing care is an organized, dynamic, and interactive process aimed at addressing the specific health needs of individuals with various pathologies, intending to improve their health status (1-4). This requires increasing attention from both the patient and their family at all levels of care (5, 6) but becomes particularly significant at the tertiary and quaternary levels, as managing high-complexity diseases in these stages necessitates the use of technology (7, 8).

A priority group for nursing care is patients with cardiovascular diseases (CVD), as these diseases represent the leading cause of death worldwide (9). In the United States, CVD is one of the main causes of mortality, while in Latin America, 1.6 million people die from these diseases, and in Mexico, more than 1 million individuals die annually (9-13). In light of this situation, Cordero et al. (14) emphasize the need for nursing professionals to provide care to patients with these conditions.

Regarding this situation and the complexity involved in cardiovascular nursing care, Miranda et al. (15) state that it must be based on scientific knowledge or evidence and nursing-specific language systems that facilitate linking with the nursing process (NP). The NP is a methodological tool in nursing practice that underpins care through the design, implementation, and evaluation of nursing care plans (NCPs) (16-18), which enable continuity of care by standardizing or individualizing the nursing interventions (19). In this regard, Visiers (19) indicates that NCPs can be generated either in a standardized or individualized manner through standardized nursing care plans (SNCPs) and individualized nursing care plans (INCPs).

These NCPs have undergone significant evolution, transitioning from physical records to execution through information and communication technologies (ICT), utilizing systems, software, and mobile applications (20). Regarding technologies for NCPs, implemented through systems and software, the nurse support documentation system (21) and the computerized NANDA-NIC-NOC consultation software (22) are identified, which aid in decision-making regarding the selection of nursing diagnoses and interventions for children and adolescents (23). Gacela Care (24), Community Health Centers (25), and the nurse support documentation software (ADPIECare) (26) allow for the collection and storage of patient data during nursing assessments and suggest NCPs to nursing professionals.

In terms of ICT applications for nursing care plans (NCPs), the app for the use and monitoring of standardized nursing care plans (SNCPs) is identified, designed with the agile methodology for project generation (MAPGP) using Extreme Programming, as well as the Nursing APHMóvel app, developed for nurses in emergency services (17, 27). These applications facilitate the development of NCPs through methodologies that enable their creation and are based on nursing

taxonomies. Therefore, ICTs currently represent an opportunity for innovation and improvement in healthcare systems, as when applied to nursing practice, they are utilized as tools for the diagnosis, assessment, planning, implementation, and evaluation of NCPs (17, 28-30).

Currently, ICTs for nursing care plans (NCPs) suggest designing systems, software, or apps for individualized nursing care plans (INCPs) through iterative and rational methodologies that guide their design and architecture (17, 25, 27). In this regard, the Mexican Ministry of Health in 2019 stated that tools should be created to assess health outcomes through INCPs (31), and regarding this, Changrong (32) and González (33) emphasize that nursing professionals must apply individualized care according to ICTs.

Thus, upon observing ICTs developed using the MAPGP (17) and recognizing the lack of a specific computing tool, such as a system, software, or app for INCPs for cardiovascular patients, the need for such a tool, created using a methodology that enables the generation of its design and architecture, is identified. Therefore, for the purposes of this study, the decision was made to address the first phase of the SCRUM MAPGP (Test Planning Phase), which aims to identify content requirements for the software through qualitative approaches with the professionals for whom it will be created. These requirements are defined as characteristics or functionalities that a product must possess to meet the needs of a user or business client (34, 35).

Therefore, the objective of this study was to identify the experiences of nursing professionals in the use of nursing care plan (NCP) software and the content requirements that the software for individualized nursing care plans (INCPs) for cardiovascular patients (INCP-CV software) should possess to develop it. In this way, the aim is for the results of this study to contribute to guiding the design and architecture of such software.

Materials and Methods

The research was a qualitative, phenomenological study was conducted in a tertiary care unit in Monterrey, Nuevo León, Mexico, which has over 100 registered beds and serves more than 90% of patients undergoing invasive treatments for cardiovascular conditions in this city. This study was conducted following the test planning phase of the SCRUM MAPGP methodology, to identify the lived experiences of nursing professionals regarding the use of NCP software. Subsequently, content requirements were identified to develop the software for individualized nursing care plans for cardiovascular patients (INCP-CV).

The sample included 11 nursing professionals, selected through non-random, purposive sampling, until data saturation was reached. The inclusion criteria considered nursing professionals

assigned to cardiovascular care services, such as the Adult Intensive Care Unit (ICU) and the Intermediate Care Unit (IMCU), who had more than six months of experience working at the institution with these patients and using NCP software. Professionals who did not wish to participate in the study or who lacked experience in the use of NCP software, and those with less than six months of experience in managing cardiovascular patients were excluded.

Data collection was conducted in May 2024 through the “Semi-structured Interview Guide for Cardiovascular Nursing Professionals,” which explores their experiences with the use of NCP software and their expectations for the development of INCP software. This guide was developed by clinical experts and researchers. Initially, data regarding the participants’ profiles were collected to establish a control and identify each interview. The guide contains questions focused on identifying the professionals’ experiences with INCP software and the content requirements that the INCP-CV software must possess to be developed.

The interviews were conducted individually and in groups, in a meeting room, ensuring a private environment for their development. First, the study’s objective was explained to the participants, and informed consent was obtained for their participation. The semi-structured interview questions were then posed to ensure comprehensive data collection. The interviews lasted approximately 30 minutes and were recorded and transcribed verbatim by the researchers.

For data analysis, based on the interview questions, the qualitative analysis software MAXQDA (36) was used to graphically and contextually identify the emerging categories and subcategories, in combination with the interpretive phenomenological analysis proposed by Smith (37). This approach allowed for the following steps: reading and re-reading, content analysis, identification of emerging themes, connections across themes, interconnections through the interviews, and the search for common patterns. To broaden the perspective and depth of the study, triangulation was employed by a clinical expert in cardiovascular care and a researcher, who analyzed the data and reflections obtained in the study (38, 39).

This research study received approval from the Research and Ethics Committees of the School of Nursing at the Universidad Autónoma de Nuevo León, which granted the following registration numbers: No. 13 CI 19039046 and 19-CIE-20180614. Finally, the confidentiality and anonymity of the participants were respected, with their identities protected using alphanumeric codes: PENF 001, PENF 002, etc.

Results

This section includes the participants’ profile, as well as the phenomenological analysis described below:

Participants' Profile

Regarding the participants' profile, 8 nursing professionals (72.2%) are female, and 3 (27.2%) are male. The mean age was 38.5 years ($SD = 10.2$), and the average years of experience in caring for patients with cardiovascular conditions was 3.5 years ($SD = 3.2$). Seven professionals (63.6%) are assigned to the ICU service, and 4 (36.3%) to the IMCU service. Regarding their work shifts, 4 nursing professionals (36.3%) work the night shift, 4 (36.3%) the evening shift, and 3 (27.2%) the morning shift. As for educational level, 10 nursing professionals (90.9%) reported holding a post-technical degree in critical care, while one professional (9.0%) reported holding a bachelor's degree in nursing.

Phenomenological Analysis

The data analysis was conducted using the MXQDA program in combination with the interpretive phenomenological method. These tools allowed for the identification, firstly, of the category "lived experiences in the use of NCP software by nursing professionals." Subsequently, the category titled "requirements for the INCP software" was identified, which includes the following subcategories: hardware of the INCP-CV software, practicality and design of the INCP-CV software, interfaces of the INCP-CV software, use of artificial intelligence in the INCP-CV software, and expected benefits of the INCP-CV software.

These categories and subcategories are presented in the following diagram (see Figure 1).

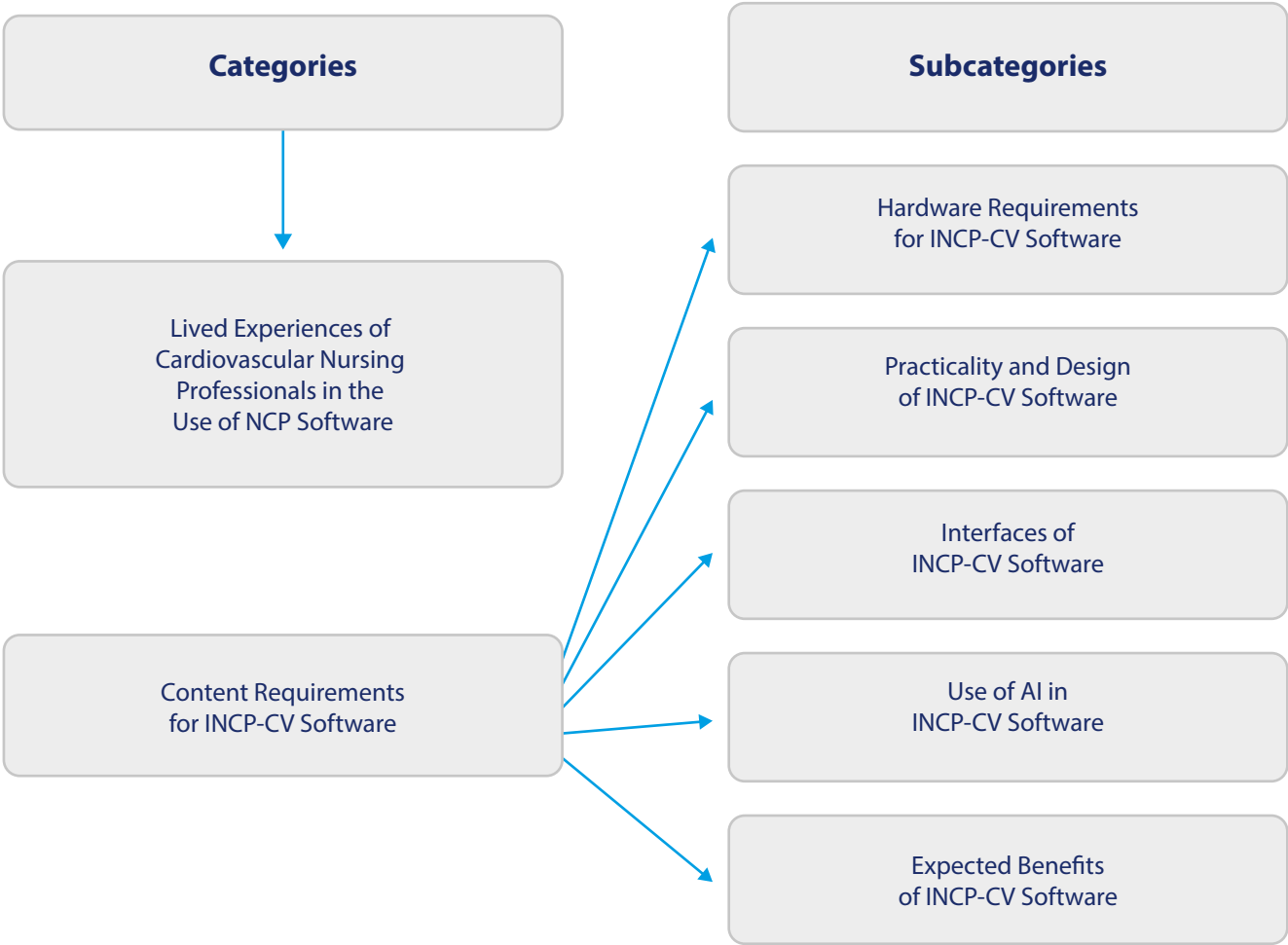
A category titled "Lived Experiences of Cardiovascular Nursing Professionals in the Use of NCP Software" was identified, which encompasses the reflections of nursing professionals regarding their experience with the use of NCP software. To explore this, the participants were asked about their views on the use of NCP technology, and they noted the following:

Could you describe your experience with the use of NCP software?

PENF001: I have used some NCP software in my professional life that are designed for SNCPs, and these have allowed me to identify effective nursing interventions. A while ago, the institution provided us with one to use, but I feel it is very general. It would need to be updated to provide individualized care for patients based on their specific needs.

PENF006: In my practice as a student and professional, I have used different NCP software, which were good as they suggested nursing diagnoses and interventions. Currently, the institution uses very outdated software, as it only includes a limited number of diagnoses and interventions.

PENF011: I have worked in different institutions, and most of them use NCP software. However, these systems utilize outdated taxonomies. It would be important for the software used in our institution to be updated to the latest versions and potentially include evidence-based practices (EBP).



Source: Prepared by the authors.

Subsequently, the category titled “Content Requirements for INCP-CV Software” was identified, which encompasses all reflections regarding the content requirements that this computing tool must possess to generate INCPs for cardiovascular patients. This category, in turn, includes five subcategories: hardware of the INCP-CV software; practicality and design of the INCP-CV software; interfaces of the INCP-CV software; use of artificial intelligence in the INCP-CV software, and expected benefits of the INCP-CV software.

The first subcategory, titled “Hardware Requirements for INCP-CV Software,” contains reflections regarding the hardware on which the software should be available. The participants indicated that for the software’s information to be stored correctly, it must be accessible on a tablet or iPad, where users can log in with a username and password. The participants agree on this and mention the following:

According to your experience, through which computing tool could the INCP-CV software be designed?

PENFo01: Based on my experience, an iPad or tablet would be better, as it would allow you to move with the patient and not have to leave them alone in the unit. You could complete it on the spot, as if it were the written patient file.

PENFoo8: I believe that, based on the experience many of us have in using them, it should be designed through an iPad, as the nurse must always be attentive to the patient. This tool would facilitate their work and allow for an appropriate assessment.

According to your experience with the use of NCP software, what should the INCP-CV software be, and what should its design be like?

The second subcategory identified, titled “Practicality and Design of INCP-CV Software,” encompasses reflections on how the software should function and the type of design it should have. The participants mentioned that, based on their experience, the software should be a practical tool for use in nursing tasks and should feature an appealing design for them, with screens in white or blue tones. They agree on this and state the following:

PENFoo5: The design could remain in white, as it might be interesting, based on the experience with the software we currently have here, to also add signage, such as high fall risk indicators or a banner for nursing care. Therefore, a very practical software is needed, as we are working with a limited time.

PENFoo10: I would prefer white screens that allow me to clearly visualize all the patient data.

PENFoo4: Based on my experience with other software, this should be a practical tool that guides the care process. By providing diagnoses and interventions, I wouldn't get lost or have to search for what I need to do for the patient.

PENFoo7: From my practical experience, it would be very beneficial if it were a practical tool to visualize the patient's progress.

The third subcategory, titled “Interfaces of the INCP-CV Software,” contains reflections on the interfaces that the software should include. The participants indicated that the software's first interface should feature a comprehensive assessment. They suggested that the proposed assessment prototype should incorporate additional data to provide individualized care for the patients. Subsequently, they noted that the software's second interface should include catalogs of NANDA-NIC-NOC taxonomies and guidelines for clinical practice (GPC) and EBP. In the third interface, a summary of both digital and printed INCPs should be included. They agree on this and state the following:

Based on your experience with the use of NCP software, what process or interfaces should the INCP-CV software contain?

PENFoo1: Based on my practical experience and use of some software, I would add data on ventilatory modality in the assessment interface, as well as the use of medications such as inotropes, which we also use. Regarding diets, I would include vegan diets, as many patients currently request them. Additionally, I would incorporate pain assessment scales (EVA) and fall risk scales.

PENFoo8: I would add data on enteral diet and patient mobility to the assessment, in order to assess the risk of falls and pressure ulcers, as well as whether the patient is accompanied or not.

PENFoo11: I would add an image of the human body showing any wounds or medical devices the patient has, along with a screen where we, as nurses, can report any patient-related incidents.

PENFoo2: Based on experience, it is important for the software to include NANDA-NIC-NOC, clinical practice guidelines (CPG), and EBP, so that the software can generate a NCP based on these.

PENFoo4: I believe the software should include tools such as NANDA-NIC-NOC, CPG, and EBP, as these would allow us to individualize care.

PENFoo8: The key is that the nurse should be able to perform the assessment in the first interface, and in subsequent interfaces, the software should suggest nursing diagnoses and interventions. Later, I should be able to select these tools for an individualized care plan.

PENFoo10: I believe it is important for the software to have multiple interfaces, because after performing a proper assessment, it will be able to suggest the priority diagnosis and interventions, allowing me to create an individualized care plan for the patient and prioritize care accordingly.

The fourth subcategory, “Use of Artificial Intelligence (AI) in INCP-CV Software,” encompasses reflections on what elements the software requires in order for nursing professionals to identify INCPs and data. The participants indicated that the software should incorporate AI, enabling it to suggest INCPs for cardiovascular patients and provide real-time data. The nursing professionals mentioned and agreed on the following:

Based on your experience with the use of NCP software, how could nursing professionals identify INCPs for cardiovascular patients or any other data?

PENFoo3: AI could be used to avoid entering patient data that has already been collected upon their admission, allowing this information to be automatically updated through this tool.

PENFoo10: Since we are discussing patients with cardiovascular conditions, I believe that if we use AI through photos or alarms for cardiac arrhythmias, it could alert us, allowing us to recognize what is happening with the patient in real time. At the same time, it would automatically generate the nursing care plan.

PENFoo11: I believe that using AI would make nursing work easier. I would even like it to be able to generate the care plan and take photos of wounds and track their progression.

The fifth subcategory, “Expected Benefits of INCP-CV Software,” contains reflections on the advantages that nursing professionals expect the software to offer. The participants agreed and mentioned the following:

Based on the previously mentioned points, what do you expect from the INCP software?

PENFoo5: The care and diagnoses could be individualized, and the NOC outcomes could be applied correctly.

PENFoo9: I think it's great that this tool could be designed because it will be focused on individualized patient care. For nursing, it could improve and support our practice and care times will be reduced.

Discussion

The results of this study indicate that the participants must meet a specific profile; in this regard, they had an average of 3.5 years of experience in managing cardiovascular patients, and 90.9% hold a post-technical degree in critical care. Similar to these findings, González et al. (40) state that nursing professionals' experience in managing patients enables them to perform an advanced role in clinical care. Suárez et al. (41) note that having specialized nursing education generates competencies that allow for the provision of comprehensive, efficient, and high-quality care.

In the category "Lived Experiences of Cardiovascular Nursing Professionals in the Use of NCP Software," the participants agreed that they have used NCP software with outdated nursing taxonomies and data, indicating that these software systems need to be updated. Benavente (42) emphasizes that nursing professionals must use computing tools with current nursing methodologies to support their practice. These data, derived from the phenomenological method, allowed for an understanding of the lived experiences of nursing professionals in the use of NCP software, which in turn facilitated the identification of content requirements for the INCP-CV software.

Regarding the subcategory "hardware of INCP-CV software," the participants agreed that this computing tool should be available on a tablet or iPad, allowing for the registration of INCPs and requiring login via a username and password. In relation to these findings, López and Álvaro (43) state that developing software available on digital tablets enables the organization and real-time storage of patient data, while Benavente (42) highlights that nursing professionals currently need to have digital tools in their practice that allow them to record INCPs using their own username and password.

In the subcategory titled "Design and Practicality of INCP-CV Software," the participants agreed that the INCP-CV software should be a practical tool to use and should feature an attractive design with screens in white and blue. Similar to these findings, Benavente (42) states that nursing professionals need to use practical computing tools that allow them to support their work and provide individualized care. Furthermore, Delgado and Díaz (44) emphasize that, to develop high-quality software, it must have an architecture and design that are appealing to the users for whom it is intended.

In the subcategory titled "Interfaces of INCP-CV Software," the participants agreed that, based on their experience with other software, the INCP tool for cardiovascular patients should, in its first interface, include a comprehensive cardiovascular nursing assessment; in its second interface, it should contain and suggest nursing methodological tools; and in its third interface, it

should generate a summary of the INCPs. Guzmán et al. (45) state that nursing professionals must use comprehensive cardiovascular assessment tools to address the specific needs of patients, while Vintimilla et al. (46) note that utilizing nursing taxonomies NANDA-NIC-NOC, as well as scientific evidence from CPG and EBP in computing tools, allows for individualized care.

Similarly, in the subcategory “Interfaces of INCP-CV Software,” the participants agreed that, in the second interface of the software, they need to be able to select the suggested nursing methodological tools, and in the third interface, have both digital and printed INCPs for cardiovascular patients. Similar to these findings, Sampedro et al. (47) state that software should be developed with icons that allow users to select and enhance activities performed in daily practice. De Lima et al. (23) mention that, currently, software should generate both digital and paper-based NCPs.

In the subcategory “Use of Artificial Intelligence in INCP-CV Software,” the participants agreed that the software should use AI through biometric data from photos of the monitor and the patient’s wounds, which can be directly stored in its operating system. Regarding this, Benavente (42) and Gutiérrez and López (48) state that nursing professionals, by using computing tools with biometric features in their daily practice, can remotely monitor patient data, thus providing individualized care to achieve “precision nursing” and enabling the real-time collection and storage of patient data.

Finally, in the subcategory titled “Expected Benefits of INCP-CV Software,” the participants mentioned that they expect this software to enhance their clinical practice by enabling them to provide individualized care for patients and support their professional practice. Similarly, Sampedro et al. (48) note that developing software contributes to providing nursing professionals with computing tools that facilitate their work activities and enable them to base their practices on solid foundations.

Conclusions

The results of this study allowed for the identification, through the experiences of nursing professionals in using NCP software, that tools of this nature should be developed with NANDA-NIC-NOC taxonomies and current scientific evidence from CPG and EBP recommendations. Furthermore, by identifying the content requirements that the INCP-CV software must have, these can serve as a guide for the development of its design and architecture, which is intended to be an agile and functional tool for cardiovascular nursing professionals, addressing the individualized care needs of patients based on their health status.

In this regard, it is expected that the results presented in this article may serve as a guide for future research in the development of INCP software that can be used in nursing practice, education, and

research. Therefore, it is recommended that healthcare institutions replicate this study for the development of different INCP software for various patient populations.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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