

VALIDITY OF A TECHNOLOGICAL REHABILITATION NURSING PROGRAM FOR PEOPLE UNDERGOING KNEE ARTHROPLASTY

Tiago Araújo^{1,2} 

Elsa Rodrigues² 

José Ribeiro Nunes² 

Mariana Mendes³ 

André Novo^{4,6} 

Olga Maria Pimenta Lopes Ribeiro^{5,6} 

¹Instituto de Ciências Biomédicas Abel Salazar. Porto, Portugal.

²Centro Hospitalar do Tâmega e Sousa. Penafiel, Portugal.

³Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Enfermagem. Florianópolis, Santa Catarina, Brasil.

⁴Instituto Politécnico de Bragança. Bragança, Portugal.

⁵Escola Superior de Enfermagem do Porto. Porto, Portugal.

⁶CINTESIS@RISE. Porto, Portugal.

ABSTRACT

Objective: to validate a Technological Rehabilitation Nursing Program for people undergoing total knee arthroplasty.

Methods: this is a qualitative study, carried out through a focus group, with 12 nurses, considered experts in the area of rehabilitation. The program was developed using digital technology, such as an application for a mobile device. Experts assessed the program structure, the content made available to people undergoing total knee arthroplasty pre-operatively and post-operatively and the follow-up and communication strategies with nurses.

Results: after content validity by experts, the final version of the program integrated three thematic areas and their respective categories: Rehabilitation program (Program phases, Program operationalization, Exercise plans included in the program); Useful information (Preparation for surgery, Care to be taken during surgery recovery); and Communication channel with nurses (Talk to a rehabilitation nurse, Self-assessment of health condition and Help with decision-making).

Conclusion: experts' contributions made it possible to achieve the content validity of the program and, consequently, improve patient literacy about the procedure, complication prevention and self-care; training patients to carry out exercise plans in the pre- and post-operative periods; and communication with nurses through application.

DESCRIPTORS: Rehabilitation nursing. Nursing. Telerehabilitation. eHealth strategies. Arthroplasty, Replacement, knee. Smartphone.

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VALIDAÇÃO DO PROGRAMA DE ENFERMAGEM DE REABILITAÇÃO TECNOLÓGICO PARA PESSOAS SUBMETIDAS A ARTROPLASTIA DO JOELHO

RESUMO

Objetivo: validar um Programa de Enfermagem de Reabilitação Tecnológico para pessoas submetidas à artroplastia total do joelho.

Métodos: estudo qualitativo, realizado por meio de *focus group*, com 12 enfermeiros, considerados peritos na área de reabilitação. O Programa foi desenvolvido com recurso de uma tecnologia digital, do tipo aplicativo para dispositivo móvel. Os peritos avaliaram a estrutura do Programa, os conteúdos disponibilizados às pessoas submetidas a artroplastia total do joelho no pré-operatório e pós-operatório e as estratégias de acompanhamento e comunicação com o enfermeiro.

Resultados: após a validação de conteúdo pelos peritos, a versão final do Programa integrou três áreas temáticas e suas respectivas categorias: Programa de Reabilitação (Fases do Programa, Operacionalização do Programa, Planos de exercícios incluídos no Programa); Informação Útil (Preparação para a cirurgia, Cuidados a ter durante a recuperação cirúrgica); e Canal Comunicacional com o Enfermeiro (Fale com enfermeiro de reabilitação, Autoavaliação da condição de saúde e Ajuda na tomada de decisão).

Conclusão: os contributos dos peritos permitiram alcançar a validade de conteúdo do Programa e, conseqüentemente, melhorar a literacia do paciente sobre o procedimento, prevenção de complicações e autocuidado; instrumentalização do paciente para a realização dos planos de exercícios nos períodos pré e pós-operatório; e a comunicação com o enfermeiro pelo aplicativo.

DESCRITORES: Enfermagem em reabilitação. Enfermagem. Telereabilitação. Estratégias de saúde. Artroplastia do joelho. Smartphone.

VALIDACIÓN DEL PROGRAMA DE ENFERMERÍA TECNOLÓGICA EN REHABILITACIÓN DE PERSONAS REALIZADAS EN ARTROPLASTIA DE RODILLA

RESUMEN

Objetivo: validar un Programa Tecnológico de Enfermería de Rehabilitación para personas sometidas a artroplastia total de rodilla.

Métodos: estudio cualitativo, realizado a través de un *focus group*, con 12 enfermeros, considerados expertos en el área de rehabilitación. El programa fue desarrollado utilizando tecnología digital, como una aplicación para un dispositivo móvil. Los expertos evaluaron la estructura del programa, los contenidos puestos a disposición de las personas sometidas a artroplastia total de rodilla en el preoperatorio y postoperatorio, y las estrategias de seguimiento y comunicación con la enfermera.

Resultados: luego de la validación de contenido por parte de expertos, la versión final del Programa integró tres áreas temáticas y sus respectivas categorías: Programa de rehabilitación (Fases del programa, Operacionalización del programa, Planes de ejercicio incluidos en el programa); Información útil (Preparación para la cirugía, Cuidados a tener durante la recuperación quirúrgica); y Canal de Comunicación con la Enfermera (Hablar con una enfermera de rehabilitación, Autoevaluación del estado de salud y Ayuda en la toma de decisiones).

Conclusión: los aportes de los expertos permitieron lograr la validez de contenido del programa y, en consecuencia, mejorar la alfabetización de los pacientes sobre el procedimiento, la prevención de complicaciones y el autocuidado; entrenar al paciente para que lleve a cabo planes de ejercicios en los períodos pre y postoperatorios; y comunicación con la enfermera a través de la aplicación.

DESCRIPTORES: Enfermería en rehabilitación. Enfermería. Telerehabilitación. Estrategias de eSalud. Artroplastia de reemplazo de rodilla. Teléfono inteligente.

INTRODUCTION

Knee osteoarthritis is a degenerative joint condition that causes intense pain and restricted movement, which can become debilitating and limit the performance of activities of daily living¹⁻². Global trends point to an increase in osteoarthritis prevalence in knee joint, with a substantial impact on health systems with medical costs and treatments².

Osteoarthritis requires treatments for pain relief, functional restoration and improvement of quality of life, with total knee arthroplasty (TKA) being the most frequently used surgical procedure for severe cases of the disease³⁻⁴. In general, TKA is a successful procedure, but with a relatively long recovery period. It is believed that preparation for rehabilitation and recovery of people undergoing TKA should begin before surgery, in order to improve postoperative results⁵⁻⁶.

Rehabilitation programs that incorporate exercise therapy and educational means, preoperatively, improve performance in functional tasks and activities of daily living^{5,7}, increase lower limb strength⁸, reduce costs related to the surgical procedure and length of hospital stay⁹⁻¹⁰, and allow significant pain reduction¹¹. On the other hand, post-operatively, they increase people's positive expectations regarding surgery recovery⁶, reduce anxiety and increase people's cognitive component^{5,12}, contribute to reducing length of hospital stay⁹ and improving knees' functional capabilities, and pain relief¹³.

Given the need for effective preparation and follow-up, technological strategies such as telerehabilitation are beginning to stand out in the area of rehabilitation. In this context, telerehabilitation strategies acquire special relevance as they enable the provision of consultations, guidance, treatments and health follow-up at any time and distance^{7,10,13}. When it comes specifically to using mobile applications in health care, these prove to be an accessible and flexible means of delivery for telerehabilitation of people undergoing arthroplasty¹³⁻¹⁴.

Using digital technologies in the health sector is an important complement to conventional therapies, favoring the role of nurses in the area of digital health and rehabilitation. At a time when it is considered essential to guarantee access and proximity of nursing professionals to the population, it is important to rethink care models and, particularly, strategies that qualify the care provided to patients during the transitions experienced.

In this context, it is absolutely essential to develop technologies that enable involvement and communication between nurses and patients before, during and after TKA, in order to maximize health results. Therefore, the question arises: What information represents the content domain of rehabilitation nursing and should be included in a technological rehabilitation program in the pre- and postoperative period for people undergoing TKA? Therefore, this study aims to validate a Technological Rehabilitation Nursing Program (+PERTO® – *Programa de Enfermagem de Reabilitação Tecnológico*) for people undergoing TKA.

METHOD

This is a qualitative and exploratory study, conducted and structured in line with COnsolidated criteria for REporting Qualitative research (COREQ), with the aim of producing explicit and comprehensive reports of focus group studies¹⁵.

The +PERTO® development process began after realizing the preparatory, educational and follow-up needs of patients undergoing TKA in a public hospital in Portugal. In the program's idealization phase, the experience of the general care nursing team and the rehabilitation nursing team was considered as well as reports from patients from the same hospital about frequent doubts related to the procedure. Subsequently, integrated into the master's thesis in rehabilitation nursing

by the author of +PERTO[®], a literature review was carried out with the purpose of mapping scientific evidence on the essential components of a rehabilitation program aimed at people undergoing TKA.

The perception of nursing professionals and patients undergoing TKA in the hospital and the contributions from the literature review constituted the determining basis for the initial development of the program and for the choice of content that made up the structure of +PERTO[®]. Structurally, it is composed of a rehabilitation program with exercise plans aimed at the pre- and postoperative phases of people undergoing TKA; provides useful information with the potential to increase health literacy and empower these people to make informed decisions; and it ensures a communication channel with nurses, which, in addition to being important for clarifying doubts, provides greater proximity between patient and nursing professional.

+PERTO[®] was developed using digital technology, such as an application for a mobile device, giving rise to the first prototype of the application. The program contents were subjected to validity by experts, using the focus group technique, conducted in accordance with the methodological guidelines defined by Krueger and Casey¹⁶. Using focus group is effective for defining content and resources of eHealth platforms, namely mobile digital applications^{17,18,19}.

A focus group was carried out, in person, in a room at the hospital where +PERTO[®] would be implemented, in Portugal. The location ensured the participation of experts in a private and spacious environment.

To select experts, intentional non-probabilistic sampling was used. Experts with professional activities and work carried out in the area under study were invited to participate, in order to allow the discussion to be more enriching. Given these characteristics, 14 experts were intentionally identified. Nurses for at least 10 years, who are nurses specializing in rehabilitation nursing, carrying out professional activity as a specialist for at least 5 years and carrying out professional activity with people undergoing TKA for at least 2 years were included. Nurses who were away from work for reasons of any nature at the time of data collection were excluded.

To recruit participants, four weeks before the focus group, experts were invited to participate in the study via email, and a guiding document was made available containing information about the study context and objectives. Upon acceptance of invitation, the Informed Consent Form was sent. At this time, they were also asked about their availability to hold the meeting using a form created using Google Forms[®] resources. On the day chosen by participants, by agreement, a focus group meeting was scheduled. A total of 14 experts were invited, with 2 experts not present due to personal/professional appointments, totaling 12 experts.

Data collection took place on a single day, in May 2023, through a focus group meeting, lasting 180 minutes. The main researcher, who led the group, and an investigator responsible for recording the meeting, observing and recording pertinent information in a field diary were present.

The order of work followed the following steps: 1) focus group legitimization (work presentation, request to record the session and sociodemographic and professional characterization questionnaire completion); 2) +PERTO[®] presentation (discussion and assessment of the essential components and methodology – duration, frequency, strategies, content to be validated by experts); 3) conclusion (consensual synthesis of decisions).

Regarding +PERTO[®] content assessment, the questions asked to experts aimed to assess the program structure, the contents made available to people undergoing TKA in the preoperative and postoperative periods and the follow-up and communication strategies with nurses. The questions were formulated by the main researcher and discussed by all experts. To assess the relevance

of the content proposed in +PERTO®, experts expressed agreement during the discussions, with disagreements being resolved through agreement.

It is noteworthy that the +PERTO® content assessment instrument was subjected to a pre-test carried out with five nurses external to the research team, who had similar characteristics to experts. This pre-test aimed to assess understanding of questions and identify the need for reformulation. Based on the results of pre-test, changes were made to five questions, and three of them were reformulated.

In the final version of the instrument, the questions were strategically directed to all components of +PERTO®, and the order of presentation to experts followed the application prototype structure, since it was decided to use it as the main researcher formulated the questions so that experts could visualize how content was structured and would be made available to patients.

The content discussed was recorded and, later, a full transcription of the meeting recording was made, which was complemented by notes collected by the researcher in charge. Qualitative data organization and coding used the ATLAS.ti software (version 23), and were analyzed following the precepts of thematic content analysis²⁰.

The degree of relevance of content and its inclusion/maintenance were obtained when experts' agreement was greater than 90%.

The present study is part of research project called “+PERTO® Programa de Enfermagem de Reabilitação Tecnológico”, approved by the Portuguese Ethics Committee and the Board of Directors of the hospital institution where it was developed. In addition to ethical approval, the study complies with the Declaration of Helsinki provisions.

All participants were informed about the objective of the study and signed the Informed Consent Form. In order to guarantee data anonymity and confidentiality, experts' reports were identified by the letter P, followed by an information collection order number (P1, P2...).

+PERTO® is registered with the General Inspection of Cultural Activities (IGAC – *Inspeção-Geral das Atividades Culturais*) of Portugal with work registration nº 2508/2021. It is also registered as National Trademark nº. 658687 at the National Institute of Industrial Property, classified as Class 41 according to the Nice classification and Class 16.1.11 according to the Vienna Classification.

RESULTS

Regarding the profile of the focus group participants, they were mostly female (n=7), with an average age of 36.5 years. In terms of academic degree, they were predominantly graduate (n=5) and master's degree holders (n=4), and had worked as nurses specializing in rehabilitation nursing for about 8 years and in orthopedics service for 8.5 years.

Regarding the relevance of new technologies for rehabilitation nursing, participants were unanimous in stating the importance of developing a technological rehabilitation nursing program, especially as it is an application, due to the ease of accessing content via mobile phone. They added the fact of responding to a current demand related to the need to follow up patients for longer in their health/illness transitions: [...] *technology is the future, it is necessary to keep up with the times* (P2); [...] *we have to combine the future with today* (P5); [...] *given the geographic area that the hospital supports, using technology is one of the few possibilities to guarantee proximity to people* (P10); [...] *even though low digital literacy can be a difficulty, there will always be the possibility of training the family member* (P11).

Considering participants' answers about the essential components of +PERTO®, the results obtained were divided into three thematic areas: (1) Rehabilitation Nursing Program for People

undergoing TKA, (2) Useful information to be made available to people undergoing TKA; and (3) Continuous follow-up strategy for people undergoing TKA.

Regarding the thematic area of Rehabilitation Nursing Program for People undergoing TKA, three categories emerged: Rehabilitation nursing program phases; Rehabilitation nursing program operationalization; and Exercise plans included in the rehabilitation nursing program (Figure 1).

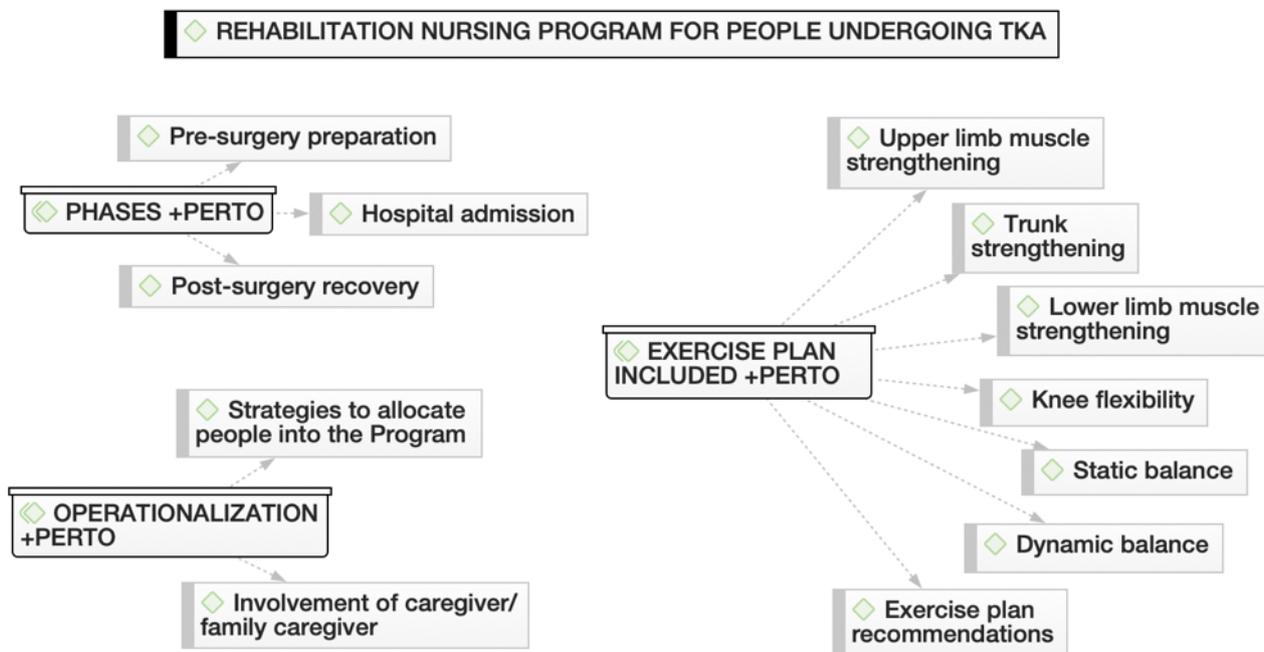


Figure 1 – Categories and subcategories related to Rehabilitation Nursing Program for People undergoing TKA, Porto, Portugal, 2023.

Regarding the phases of the rehabilitation nursing program for people undergoing TKA, everyone considered the existence of three phases to be relevant, comprising: pre-operative preparation phase; hospital admission phase; and post-surgery recovery phase: [...] *ideally, there should be 3 phases: Phase 1 – pre-surgery (preparation); Phase 2 – hospital admission; Phase 3 – post-surgery (recovery)* (P6); [...] *in the hospital admission phase, care will be those that are usually carried out by the service's rehabilitation nurses [...] the novelty is in the pre-operative and post-operative phase [...] without +PERTO®, patients in these two phases had no support at all [...] this is a significant advance in the care provided to these patients* (P9).

Regarding program operationalization, two important aspects emerged in participants' discussion: strategies for allocating people into the program and caregiver/family caregiver involvement. In this regard, as suggested by experts, on the day of the pre-operative consultation, users should be accompanied by caregiver/family member to be allocated into the program and receive guidance on how to use the application: [...] *so that the team has prior knowledge of eligible patients, their allocation to the program should take place on the day the doctor decides on the surgery [...] it was also a way of including the family member* (P12); *the fact that the application is presented to patient and family member will help clarify doubts from this initial stage* (P11).

Regarding the exercise plans included in +PERTO[®], participants highlighted the advantages of upper limb, trunk and lower limb muscle strengthening exercises. In addition to strengthening exercises for muscle groups, experts suggested knee flexibility exercises as well as static and dynamic balance training exercises, which were included in the program: [...] *exercise plans must be aimed at the upper and lower part of the trunk and lower limbs (P8); [...] exercises must focus on certain muscle groups (P10); [...] knee flexibility exercises and balance training, both static and dynamic, must be included (P7).*

Regarding the duration of the exercise plan proposed to be 30 days before admission and 42 days (6 weeks) after discharge, one of the participants mentioned that starting the program is too early, due to the risk of forgetting and giving up, and was advised to reduce it to 15 days: [...] *30 days is a lot. I think they will forget the information conveyed or end up giving up. The ideal would be 15 days (P10). The other participants agree with the period for +PERTO[®], considering that the application will issue notifications to users, but suggest contacts with people in order to maintain loyalty: [...] I agree with the 30 days, but I recommend telephone contact to make patients loyal to the program, to commit them and encourage them to perform the exercises (P6); [...] we know that 30 days before would be ideal, which is why pressure has to be put on the institution so that allocation of patients occurs one month before the surgery (P3); [...] up to 42 days after surgery is optimal and will coincide with the date of medical appointment, which in some way will promote patients' adherence to performing the exercises (P6).* In this regard, it was validated that the exercise plan will last 30 days before surgery, and 6 weeks after TKA, notifications will be maintained via application, and telephone contact will be made with users, as suggested by experts.

Regarding weekly frequency, participants suggest an exercise plan with 3 consecutive days of exercise and one day of rest. In terms of duration, there was agreement among experts to perform 30 minutes of exercise, consisting of 5 minutes for warming up, 20 minutes of activity and 5 minutes of cooling down/stretching: [...] *the best option would be three days of exercise and one day of rest and so on (P3); [...] five days of exercise in a row is very tiring, I suggest 3 days of exercise and one day of rest (P10); 5 consecutive days of exercise is too much [...] moreover, for patients not to lose the habit, there should not be more than one day off (P9).* Considering experts' assessment, it was established that the exercise plan will be carried out on 3 consecutive days, followed by a day of rest, totaling a duration of 30 minutes per session.

Regarding patient instructions to perform the exercises in the pre- and postoperative periods, 81 videos were validated with instructions directed to each type of exercise. Participants agreed that after completing their daily exercise plan, patients would answer feedback questions, such as: a) How do you assess today's exercise plan? I executed/I partially executed/I did not execute; b) What is the reason for not having performed the exercises in full? Extensive plan/Exercises that are difficult to perform/Another reason. Furthermore, participants suggest adding a space for suggestions: [...] *it is important to add a field for patients to put a suggestion at the end of the exercise plan (P12); [...] I agree with the creation of a field with suggestions for patients at the end of the plan (P6).*

Regarding reflections on +PERTO[®] content, experts agree that the concerns most frequently expressed by people undergoing TKA are related to pain, edema and surgical wound complications. Other participants added concerns regarding limb functionality and mobility and recovery expectations, with these contents also being included in the program: [...] *In addition to pain, edema and surgical wound complications, this type of patient also often presents concerns regarding functionality and how they will be able to lead a normal life (P7); [...] there is great concern about the mobility they will recover after surgery as well as expectations about how much they will improve (P3).*

In this follow-up, in relation to the thematic area Useful information to provide to people undergoing TKA, two categories were obtained: preparation for surgery and care to be taken during surgery recovery (Figure 2).

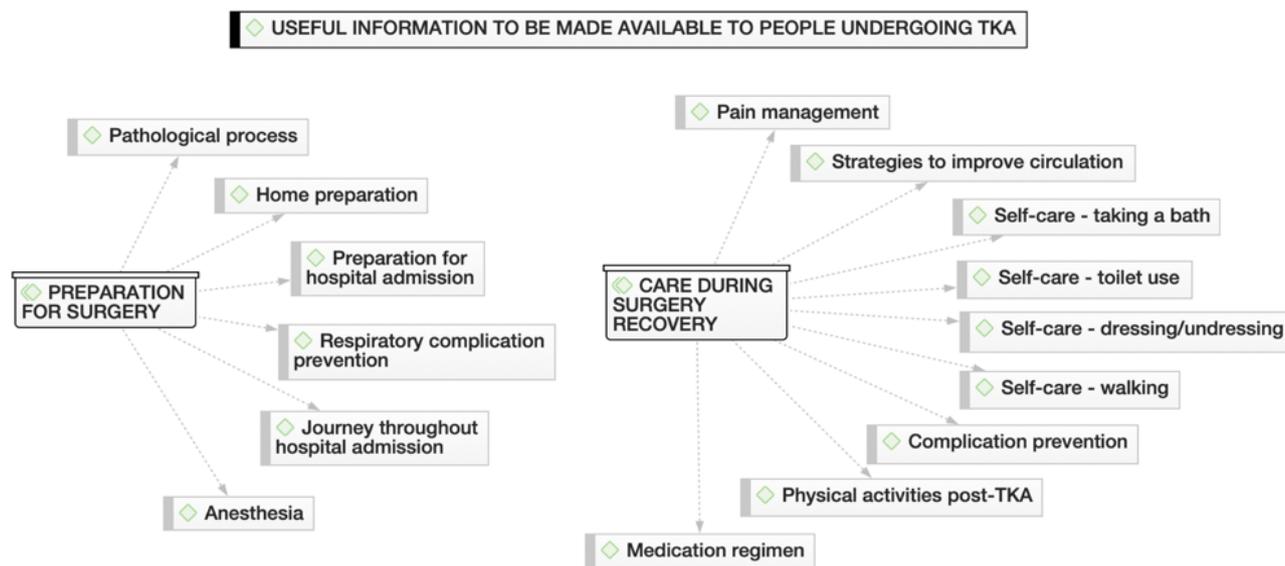


Figure 2 – Categories and subcategories in relation to the thematic area Useful information to be made available to people undergoing TKA, Porto, Portugal, 2023.

Participants agreed that the information useful to users in preparing for surgery, within the scope of knowledge about the pathological process, focuses on knee joint, osteoarthritis and TKA. Furthermore, regarding house preparation, the importance of adapting the home environment to facilitate mobility emerged, with this content being improved according to experts' suggestions: [...] *patients' homes have several barriers that, in addition to hindering mobility, increase the likelihood of knee complications (P3); [...] guidelines for adapting housing must be given before surgery, because afterwards patient and family will have more difficulties (P11).*

In the preparation phase for hospital admission, the content validated by experts focuses on personal utensils permitted in hospital environments, aiming to guarantee patients' comfort and well-being during their stay and the need for pre-operative bathing to prevent infection. As for postoperative complication prevention, content on the dissociation of respiratory rates, forced expiration and voluntary cough stands out. Regarding the journey throughout hospital admission, the knowledge available focuses on each phase of the process, from the days of hospital admission to the surgical procedure itself, as well as care on the first, second and third days of hospital admission after surgical procedure. With regards to anesthesia, knowledge refers to the main types, such as general anesthesia, spinal anesthesia and epidural anesthesia. [...] *information about what patients should take to the hospital is essential [...] as well as the need to remember to bathe to prevent infection (P3); [...] informing about the dissociation of respiratory rates, forced exhalation and coughing helps to prevent respiratory complications, especially in patients with previous respiratory problems (P9); knowing everything that will happen during hospital admission leaves patients more at ease (P3) [...] depending on the type of anesthesia that is planned for surgery, it must be ensured that patients are informed (P6).*

Regarding care during surgery recovery to manage pain, experts identified the need for information on analgesia, cryotherapy and relaxation techniques, including specific content on these topics. Strategies to improve circulation include techniques for mobilizing the ankle joint and contracting the quadriceps and glutes. In self-care, the activities to be carried out by the person and information about the use of adaptive equipment stand out, which in addition to facilitating the completion of activities, will help prevent knee complications. To prevent complications, in addition to surgical wound and knee complications, a topic was added to promote knowledge about preventing deep vein thrombosis as suggested by experts: [...] *there is no doubt that pain, surgical wound complications, and edema are the main complications [...] analgesics, application of ice, exercises to improve circulation are mandatory and patients must be taught how to do this* (P3); [...] *information about the adaptive equipment that you can use when carrying out self-care, namely bathing, using the toilet, dressing and walking, in addition to promoting autonomy, as it avoids complications* (P7).

It is noteworthy that the content validated by experts will be gradually made available to users throughout the program. The person will be able to assess the content by answering the questions: How do you assess the information provided? Understood/Did not Understand; If you did not understand, why? Too many technical terms/Extensive information/Other reason.

Considering pain, edema and surgical wound complications as the most frequent critical events in the postoperative period, a follow-up strategy was developed to help people control symptoms and minimize the need to seek emergency services. In this follow-up, in the thematic area Strategy for continuous follow-up of people undergoing TKA, two categories emerged: talk to a rehabilitation nurse and self-assessment of health condition (Figure 3).



Figure 3 – Categories and subcategories that emerged in relation to the thematic area Continuous follow-up strategy for people undergoing TKA, Porto, Portugal, 2023.

Regarding communication with a rehabilitation nurse, people undergoing TKA has the possibility of sending a written message to a nurse and/or sending a photograph. Participants agreed that this communication has the potential to prevent postoperative complications, in addition to promoting a real-time assessment of people's health situation, even if they are far from the hospital. In relation to the advantages mentioned, they made suggestions regarding the assessment of evolution of symptoms: [...] *I suggest taking a photo of the knee on the date of discharge and placing it on the patients' profile so that there is a term of comparison when patients send us photos of their knee with edema* (P6); [...] *the possibility of speaking to a nurse and being contacted by them will give patients more security when returning home and help to detect complications early* (P4). As suggested by experts, the program protocol includes photographic documentation of the operated limb at the time of discharge, allowing comparisons in the postoperative period.

Participants consider the availability of algorithms to support decision-making in the areas of pain, edema and surgical wounds, aimed at people undergoing TKA, to be pertinent. Following these algorithms, people assess pain, edema, and dressing or surgical wound. If necessary, they will be

able to send a photographic record of the change and, later, they will have instructions for controlling the signs/symptoms and/or looking for a health professional in person. The content and navigation of the algorithms were validated and tested by participants.

In order to portray all the potential of +PERTO®, Figures 4 and 5 show some real images of the application.

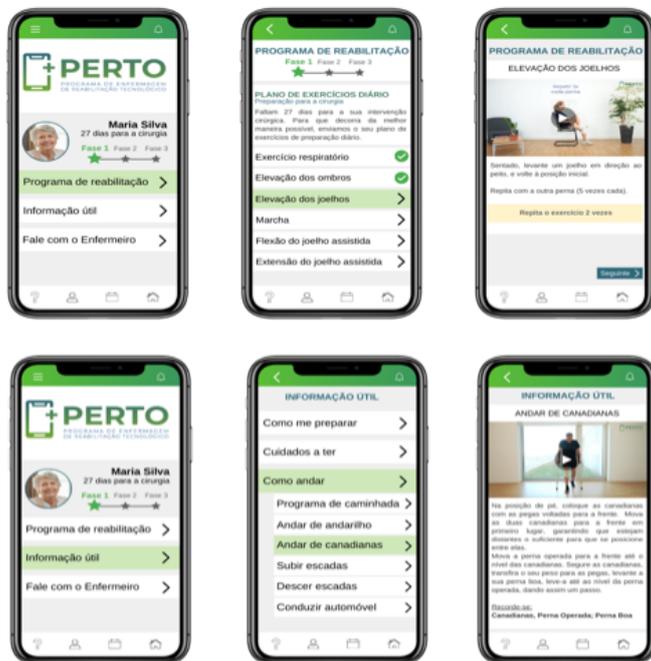


Figure 4 – +PERTO® functionalities in mobile application: Rehabilitation program and Useful information, Porto, Portugal, 2023.

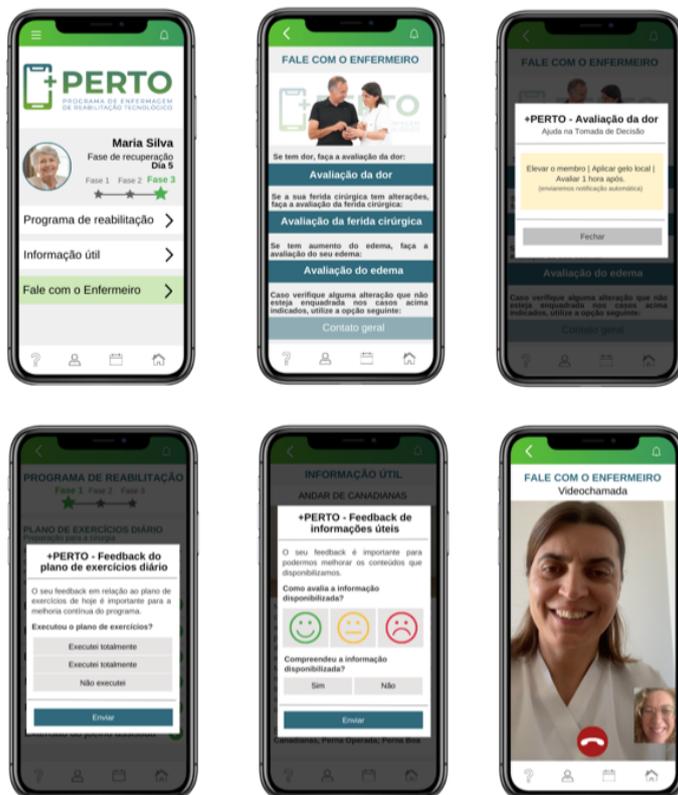


Figure 5 – +PERTO® functionalities in mobile application: Talk to a Nurse (communication channel) and Feedback system, Porto, Portugal, 2023.

DISCUSSION

The construction of +PERTO® for people undergoing TKA arose from the need to provide more comprehensive preoperative preparation and more effective postoperative recovery. +PERTO® implementation, through a mobile application, brings health care closer to patients, providing them with continuous access to resources and support.

The proportion of the population in Portugal who did not have access to health care for financial reasons, waiting lists or distance from health care services increased from 1.1% in 2008 to 2.9% in 2022²¹. In this context, digital health is presented as an efficient resource for patients, professionals and health services, based on the use of information and communication technologies (ICT), with the aim of expanding access to health care, reducing inefficiencies and health system costs, improving quality of care, and providing more personalized care for patients²². +PERTO® can help overcome these challenges, allowing patients to receive guidance and be followed up remotely.

In fact, accessibility barriers constitute a major challenge for the health sector. Equity in digital health seeks to reduce inequalities in access to digital services²²⁻²³, known as Digital Redlining, in which vulnerable groups are deprived of equal access to digital tools, which can negatively impact health outcomes²³. In this study, experts agree that +PERTO® helps to bring patients, families and professionals closer together, but that low digital literacy can be a difficulty, being an aspect to be developed throughout the program.

In today's digital era, validating emerging technologies becomes imperative. Therefore, ensuring the effectiveness, security and usability of a digital tool like +PERTO® goes beyond mere compliance, it is a responsibility towards end users. Patients, caregivers and health care professionals trust the accuracy and reliability of these tools to make critical decisions and improve health outcomes. Content validity ensures that the program is not only relevant, but also robust, secure and reliable.

In addition to contributing to achieving more satisfactory results and expanding users' access to health care, +PERTO® also contributes to a more qualified performance by nurses. These professionals play an essential role in patients' rehabilitation journey, not only due to their technical training, but also due to their ability to understand and respond to the emotional, social and psychological needs of patients and their caregivers.

Even though the design of rehabilitation programs is clearly defined in the specific competencies of nurses specializing in rehabilitation nursing²⁴, given the innovative nature of +PERTO®, its validity with experts in this area of specialization constituted a crucial phase. This also comes from the fact that international literature in this field is limited, as this area of specialization in nursing is still non-existent in some countries.

Regarding the structure of +PERTO®, experts highlighted the importance of offering structured content in relation to the preoperative, hospital admission and postoperative phases. In a randomized study, the use of mobile technologies for TKA prehabilitation was considered safe and generated good patient satisfaction⁶, similar to what was found in a study that assessed the involvement of patients undergoing TKA with educational tools based on applications, which showed the preference for educational content with exercise videos and anxiety/stress/pain management¹⁴.

Regarding the exercise plan, upper limb, trunk and lower limb muscle strengthening as well as knee flexibility exercises and static and dynamic balance training aim to promote faster recovery and restore patients' functional capacity. An appropriate set of exercises improves patient-reported functional outcomes such as muscle strength, range of motion, and pain relief⁷.

From this perspective, starting preoperative telerehabilitation 3 weeks before TKA demonstrates significant improvements in results after surgery⁷. Programs that incorporate exercise therapy at least 4 weeks before the procedure enhance the strength of the operated leg 6 weeks after the

intervention²⁵. Most patients who undergo TKA achieve maximum joint range of motion within 6 weeks postoperatively²⁶.

The contents of daily exercises will be made available in video format with demonstrations of execution and guidance on how to perform them safely. The plans were designed to provide an effective approach to rehabilitation, with a specific time structure for each component for the pre- and post-operative periods. Research on the subject^{5,8,24} recommends that exercise plans include warming up, muscle strengthening exercises and cooling/stretching, aiming to maximize the benefits of rehabilitation and minimize potential risks. According to ACSM guidelines, physical activity of 150 minutes per week is recommended²⁷. Furthermore, the duration of exercise sessions in a TKA rehabilitation program should vary between 30 minutes to 1 hour^{28,8}.

Still associated with exercise plan, a field for suggestions and feedback was included after carrying out each activity in order to provide a personalized and interactive approach, adapted to each patient's individual needs. Valuing user feedback allows to create friendly and relevant interventions, arousing the interest of the target audience in using the application through co-design²⁹. This participatory approach allows users to contribute to the development of technologies built and used by them^{22-23,29}.

In this regard, +PERTO[®] use and assessment by people undergoing TKA is essential to qualify the application regarding content, interface and usability, consisting of the next phase of program analysis and assessment to be carried out by researchers together with technology users. Furthermore, the choice of useful information made available in the application was based on patients' main needs, based on their most common complaints, during contact with rehabilitation nurses in hospital environments.

In the context of useful information, we sought to provide educational content through accessible and objective language, with an emphasis on self-care in surgical preparation, recovery and rehabilitation. Studies have demonstrated that educational interventions using ICT are effective, with a high rate of patient adherence to educational content related to TKA^{7,14,30}.

+PERTO[®] believes that expanding the knowledge of patients undergoing TKA can make the experience more beneficial and safer, with the main focus being effective rehabilitation and full health/illness transition. Therefore, it is essential to increase patients' literacy regarding the most frequent critical events during the postoperative period, such as pain, edema and surgical wound complications^{1,31}. These findings reinforce the need to establish a follow-up strategy that helps patients control symptoms and minimizes recurrent visits to emergency services, with a consequent reduction in costs.

In this study, an even more innovative aspect is added with regard to continuous follow-up and support of patients undergoing TKA, through interaction with rehabilitation nurses in real time and remotely. +PERTO[®] allows patients to receive individualized guidance and support, clarify doubts and share their progress by sending messages and/or photos through the application, which are received by a rehabilitation nurse for assessment and feedback.

The implementation of follow-up by rehabilitation nurses aims to improve rehabilitation results, providing patients with confidence that they are being assisted in all phases of the TKA process³²⁻³³. In this patient-centered care scenario, it is essential to develop participatory digital health strategies in order to involve them in the entire continuum of care related to joint replacement^{14,22}, preventing them from needing to make important decisions without the participation of a health care professional, which could put their lives at risk²².

Thus, when analyzing the application's contents, experts identified that they enable patients to become active in their own rehabilitation process. Based on these observations, decision-making support algorithms were developed that allow self-assessment of health condition and management of symptoms based on patients' answers while using the application. However, decision-making by

patients must occur in collaboration with the health care team³³, from a perspective of co-responsibility, especially due to the diverse circulation of recommendations regarding the return to activities of daily living after TKA³⁴.

Ultimately, +PERTO[®] contributes significantly to the area of nursing and rehabilitation through an evidence-based approach, providing specific guidance and resources for pre- and post-operative care regarding muscle strengthening, flexibility, balance and other aspects of rehabilitation. Furthermore, it plays a fundamental role in optimizing rehabilitation nursing care for people undergoing TKA, in particular by allowing continuous patient interaction with nurses throughout the rehabilitation journey.

Data collection using the discourse of a group of experts constitutes a limitation, suggesting the need for future studies with the contribution of the expertise of a larger number of experts. Although patient reports were considered contributions to developing +PERTO[®], it is suggested that the final version of the application be validated by the target audience, which effectively already has a favorable opinion from Research Ethics Committee and is in progress.

CONCLUSION

+PERTO[®] is an innovative initiative with a patient-centered approach, allowing easier access to health care and continuous support from rehabilitation nurses, with an emphasis on patient autonomy. The unprecedented nature and gaps in international literature, closely related to the non-existence of this area of nursing specialization in some countries, made content validity with experts essential.

Considering that the content validity of +PERTO[®] was achieved, the results of this study can help in the recovery of people undergoing TKA through the inclusion of algorithms to support decision-making, enabling them for self-care. Additionally, continued access to useful information and support through the mobile app has the potential to reduce geographic barriers, expand access to care, and avoid visits to emergency departments for preventable causes.

Although studies are needed to achieve higher levels of evidence, +PERTO[®] represents an intelligent application of technology with the potential to integrate good practices that enhance health care transformation and promote better health and well-being results for patients, contributing to more effective rehabilitation and a more positive overall patient experience.

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NOTES

ARTICLE ORIGIN

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CONTRIBUTION OF AUTHORITY

Study design: Araújo T, Rodrigues E, Nunes JR, Novo A, Ribeiro OMPL.

Data collect: Araújo T, Rodrigues E, Nunes JR, Novo A, Ribeiro OMPL.

Data analysis and interpretation: Araújo T, Rodrigues E, Nunes JR, Mendes M, Novo A, Ribeiro OMPL.

Discussion of results: Araújo T, Rodrigues E, Nunes JR, Mendes M, Novo A, Ribeiro OMPL.

Writing and/or critical review of content: Araújo T, Rodrigues E, Nunes JR, Mendes M, Novo A, Ribeiro OMPL.

Review and final approval of the final version: Araújo T, Rodrigues E, Nunes JR, Mendes M, Novo A, Ribeiro OMPL.

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CORRESPONDING AUTHOR

Mariana Mendes

mariana.mendes@unochapeco.edu.br

