# TEXTO & CONTEXTO enfermagem

**TEXT & CONTEXT NURSING TEXTO & CONTEXTO ENFERMERÍA**

# MOBILE GAME: EDUCATIONAL TECHNOLOGY FOR HOME CARE OF PATIENTS UNDERGOING LIVER TRANSPLANTATION

Neide da Silva Knihs[1] 
Ariadne Matzembacher da Silva[1] 
Letícia de Oliveira Grespi[2] 
Aline Lima Pestana Magalhães[1] 
Sibele Maria Schuantes Paim[1] 
Pedro Henrique Braga Moraes[3] 
Marisa da Silva Martins[1] 
Patricia Treviso[4] 

[1]Universidade Federal de Santa Catarina, Programa de Pós-graduação em Enfermagem. Florianópolis, Santa Catarina, Brasil.
[2] Universidade Federal de Santa Catarina, Faculdade de Enfermagem. Florianópolis, Santa Catarina, Brasil.
[3]Universidade Federal do Rio Grande do Norte, Faculdade de Tecnologia da Informação. Natal, Rio Grande do Norte, Brasil.
[4]Universidade do Vale do Rio dos Sinos, Programa de Pós-graduação em Enfermagem. Porto Alegre, Rio Grande do Sul, Brasil.

## ABSTRACT

**Objective:** to develop and validate an educational game capable of supporting health education actions for patients undergoing liver transplantation.

**Method:** this is a study of a technological product, based on the User-Centered Design framework, carried out in a reference hospital for liver transplantation. Participants were patients undergoing liver transplantation, nurses and information technology professionals. Data collection took place through semi-structured interviews and a questionnaire, using Brazilian standards for usability assessment. Data analysis occurred through content analysis, based on the calculation model for the System Usability Scale.

**Results:** seventeen patients participated, including seven nurses and four information technology professionals. The game is made up of five paths with the main care to be carried out at home. Each path presents steps to be followed with its rules. As for validation, the overall mean was 1.38. Usability assessment by patients had a mean of 80 points, while by professionals it was above 75%.

**Conclusion:** it is considered that the aforementioned tool is capable of being used in practice by users. Furthermore, this was adjusted to meet the needs of patients undergoing liver transplantation to support and manage home care.

**DESCRIPTORS:** Health education. Educational games. Educational technology. Health promotion. Liver transplant. Nursing.

# MOBILE GAME: TECNOLOGIA EDUCACIONAL PARA CUIDADOS DOMICILIARES DO PACIENTE SUBMETIDO AO TRANSPLANTE HEPÁTICO

**RESUMO**

**Objetivo:** desenvolver e validar jogo educativo capaz de subsidiar ações de educação em saúde ao paciente submetido ao transplante hepático.

**Método:** estudo de produto tecnológico, sustentado no referencial do *Design* Centrado no Usuário, realizado em hospital de referência em transplante hepático. Participantes foram pacientes submetidos ao transplante hepático, enfermeiros e profissionais da tecnologia da informação. A coleta de dados ocorreu por meio de entrevista semiestruturada e questionário, utilizando as normas brasileiras para avaliação da usabilidade. A análise dos dados ocorreu por meio de análise de conteúdo, com base no modelo de cálculo para a escala de *System Usability Scale*.

**Resultados:** participaram 17 pacientes, dos quais, sete enfermeiros e quatro profissionais da tecnologia da informação. O jogo é formado por cinco caminhos com os principais cuidados a serem desenvolvidos em domicílio. Cada caminho apresenta etapas a serem seguidas com suas regras. Quanto à validação, a média geral foi de 1,38. A avaliação da usabilidade pelos pacientes teve média de 80 pontos, já pelos profissionais foi acima de 75%.

**Conclusão:** considera-se que a referida ferramenta está apta para ser usada na prática pelos usuários. Ainda, essa foi ajustada para atender às necessidades dos pacientes submetidos ao transplante hepático para apoiar e gerenciar os cuidados em domicílio.

**DESCRITORES:** Educação em saúde. Jogos educativos. Tecnologia educacional. Promoção da saúde. Transplante hepático. Enfermagem.

# JUEGO MÓVIL: TECNOLOGÍA EDUCATIVA PARA LA ATENCIÓN DOMICILIARIA DE PACIENTES SOMETIDOS A TRASPLANTE DE HÍGADO

**RESUMEN**

**Objetivo:** desarrollar y validar un juego educativo capaz de apoyar acciones de educación en salud para pacientes sometidos a trasplante de hígado.

**Método:** estudio de un producto tecnológico, basado en el marco del Diseño Centrado en el Usuario, realizado en un hospital de referencia para trasplante hepático. Los participantes fueron pacientes sometidos a trasplante de hígado, enfermeras y profesionales de tecnologías de la información. La recolección de datos se realizó a través de entrevistas semiestructuradas y cuestionario, utilizando estándares brasileños para la evaluación de la usabilidad. El análisis de los datos ocurrió a través del análisis de contenido, basado en el modelo de cálculo de la *System Usability Scale*.

**Resultados:** participaron 17 pacientes, entre ellos siete enfermeras y cuatro profesionales de tecnologías de la información. El juego se compone de cinco recorridos cuyo cuidado principal se realizará en casa. Cada camino presenta pasos a seguir con sus reglas. En cuanto a la validación, la media general fue de 1,38. La valoración de la usabilidad por parte de los pacientes tuvo una media de 80 puntos, mientras que la de los profesionales superó el 75%.

**Conclusión:** se considera que la herramienta antes mencionada es susceptible de ser utilizada en la práctica por los usuarios. Además, esto se ajustó para satisfacer las necesidades de los pacientes sometidos a trasplante de hígado para apoyar y gestionar la atención domiciliaria.

**DESCRIPTORES:** Educación en salud. Juegos educacionales. Tecnología educacional. Promoción de la salud. Trasplante de hígado. Enfermería.

## INTRODUCTION

Educational health games encourage the perspective of teaching, educating and raising awareness in an interactive, relaxed and playful way. This technology provides users with the opportunity to solve any doubts that arise in continuity of care at home, in addition to supporting care management[1–2].

It is worth highlighting that technological products provide exercise and perception for players, who need to put this learning into practice in their daily lives[3–4]. However, during the development of educational games, it is essential to make them reliable, supported by scientific evidence and with accessible language for the target audience that will use it[3–4].

Studies that tested the use of games showed that these resources bring a new perspective to learning in health education. Since they help to build knowledge in a light, participatory and innovative way, with players as the main agents of care[1,3].

Chinese research, focusing on young students with chronic diseases, attested to improvement of knowledge and care developed at home[5]. Other research, carried out in Brazil, also showed benefits in promoting cardiovascular health and knowledge of high-risk pregnant women, revealing developments also in adherence to treatment[2–6]. Furthermore, a game for nutritional support at home for children showed potential for providing health education with important gains in changing eating habits[7].

Therefore, we thought about developing an educational game for post-liver transplant (HTx) patients, considering the history of the effectiveness of this resource in different realities and the complexities involved in managing home care and self-care after the procedure. Home care for this population involves: checking vital signs every six hours; daily diuresis control; checking blood glucose levels three times a day; use of various medications; application of insulin in some cases; and management of signs and symptoms of complications, in particular for signs of organ rejection [8–9] . For this reason, these patients, family members and support network need to be empowered with information, knowledge, skills, at the same time as they need support and information about this care at any time at home.

From this perspective, the study has as its central proposal the construction of an educational, interactive and playful game in which, through different paths, care to be carried out at home is presented, and thus, patients are able to improve knowledge, store care-related information in a simple way, in addition to improving technical skills when viewing and playing, learning how each care should be carried out. Considering this reality, the guiding question of this study was: what information can support an educational game for health education for patients undergoing HTx? The objective was to develop and validate an educational game capable of supporting health education actions for patients undergoing liver HTx.

## METHOD

This is a study of a technological product, based on the User-Centered Design (UCD) methodological framework, focusing on product's end users' demands, which is made up of four steps: identify; analyze; design and test; and assess[10]. The study is part of a macro project entitled "*Cuidado da equipe multiprofissional no transplante hepático: um olhar para o viver saudável*". In this project, other studies have already been developed[11–13]. These support the creation and development of this technology.

This is a study carried out in an outpatient clinic of a public teaching hospital located in southern Brazil, a reference in liver HTx. The outpatient clinic at this institution is made up of 61 offices, four of which are reserved for HTx. It still has 274 hospital beds, 45 of which are intensive care (25 active and 20 deactivated), and is considered a large hospital.

This research includes three types of participants, which will be described below:

Participants (patients): over 18 years of age who underwent liver HTx at the aforementioned hospital between 2011 (beginning of HTx at this institution) and 2023. Patients who receive outpatient care, but did not undergo the HTx procedure in that same institution, were excluded. The sample of participants was intentional random, as the aim was to identify patients who had undergone HTx more than five years ago as well as recent HTx recipients.

Participants (nurses): expertise on the subject with proven experience for more than three years in liver HTx care transition. The search for these professionals occurred through contacts made with hospitals that have been performing HTx for more than ten years. To identify these hospitals, contact was made with the Brazilian Association of Organ Transplantation (ABTO – *Associação Brasileira de Transplante de* Órgãos) via email to help determine which hospitals would meet these criteria as well as these institutions' contact details. Furthermore, *curriculum lattes* was used, using the words liver transplant, transplant and nursing, in addition to the research group on organ and tissue donation at the *Universidade Federal de São Paulo*.

Participants (information technology — IT): to select these participants, it was necessary to demonstrate experience in producing educational games for more than three years. The identification of these professionals occurred through the *curriculum lattes* using the words educational games, online games and mobile game.

It is noteworthy that ethical and legal precepts were followed in all steps of the study, with all participants signing the Informed Consent Form in two copies, one of which was delivered to participants. Data collection took place between October 2022 and June 2023.

**User-Centered Design step development**

**Step 1** – Identify: for this step, a scoping review was developed, which aimed to map the educational technologies already created to promote health education in care transition in HTx to identify gaps in educational tools. The scoping review followed the determinations proposed by JBI Reviewers considering the following steps: 1) guiding question identification; 2) search for relevant studies; 3) study selection; 4) relevant data categorization; 5) synthesis; and 6) reporting results, identifying implications for policy, practice or research[14]. The guiding question followed the PCC proposal (Population, Concept and Context): What technological care strategies are being developed to improve treatment adherence for patients undergoing HTx? Medical Literature Analysis and Retrieval System Online (MEDLINE) was established, consulted through PubMed, Scopus, Web of Science, CINAHL, LILACS and SciELO. The following Health Sciences Descriptors (DeCS) (Portuguese, English and Spanish) were defined: transplantation; healthy education; patient adherence; medication adherence; patient care team; technology, innovation and nursing. It should be noted that, in each database, search strategies were constructed with descriptors, keywords and Boolean operators. The results obtained from database searches were exported to the Mendeley® bibliographic manager. Article selection was carried out independently by two blind researchers. In case of doubt regarding selection, a third researcher, with more than 23 years of experience in HTx and technology-themed research, solved the doubts and jointly decided on whether or not to include the study.

Studies developed in the macroproject were also used, which point out home care needs[11–13]. Added to these studies is qualitative research with patients undergoing HTx using a semi-structured script. This script contained six questions related to the profile and four open-ended questions: tell me what information would be important to contain in the home care educational game; tell me what care you tend to find most difficult to carry out at home; tell me what you think the game's steps should be like; tell me what you think the game should present to help you with home care. Data collection took place in the HTx clinic in a private location. The interviews were recorded lasting approximately

thirty-three minutes and conducted by two researchers. Then, the data collected in the interviews were analyzed using content analysis proposed by Bardin[15].

**Step 2** – Analyze: this step assessed the material generated in the identify step. To this end, four meetings were held between the researchers, aiming to reach consensus on the final content to make up the game, hypothesized solutions for the needs of patients, family members and support networks for care transition. After these meetings, the game's first version was formed (content, rules and steps).

**Step 3** – Design and test: six meetings were held with a design professional and a programmer, and a space was defined — the aim was to focus on the experience and/or skill to be acquired by players. Thus, the decision was to create a game with paths, with each path followed being a care to be developed/learned by players. For the authors, it was decided that a patient and a healthcare professional would take part in the game, thus determining the interaction between the two agents. All items were defined, such as thermometer, sphygmomanometer, cotton, health space figures, among other items that would be necessary to make up the game. Finally, challenges were created, defining the starting point of each path, and how they would evolve, the outcomes and scores.

Once the game's first version prototype was completed, it was assessed by professionals, nurses and patients according to the inclusion criteria. To assess the game's first version, participants received instructions via email and/or in person about what they should assess in the game, such as content presented, physical space, paths to be followed, game items as well as clarity and understanding of the game rules.

To assess each item in each of the paths, a Likert scale was used with the following scores: keep item (check 01); maintain with modifications (check 02); delete item (check 03); and add item (check 04). After assessment, adjustments were made to the game, forming the second version. For nurses, all materials were sent via email, while for patients, it was presented at the HTx clinic itself by the researchers.

**Step 4 –** Assessment: for the assessment step of the game's test performance by patients, the System Usability Scale (SUS) was used, a widely recognized tool for measuring the usability of applications. The results were considered good and acceptable, with a score above the overall mean of 68 points, indicating that the game had good usability for users. SUS consists of 10 questions, answered using a Likert-type scale from 1 to 5, ranging from "totally disagree" to "totally agree"[16].

To do this, the game was installed on two researchers' cell phones. They presented the game to research participants (patients), and they played it. This activity was carried out in the HTx clinic during routine consultations. After using the game, they accessed the SUS scale via an online Google® form. After assessment by patients and adjustments made, the third version of the prototype was created. This version was then assessed by professional nurses with expertise in the subject and information technology professionals to validate the game. This step used the snowball technique.

The number of participants for each group complied with Brazilian Standards (NBR ISO/IEC – 14598-6), which indicates a minimum of eight evaluators to obtain reliable results[17]. To carry out assessment, an instrument was sent, which aims to measure the game effectiveness considering aesthetics, efficiency, functionality and flexibility. First, professionals received the email address to install the game and play. When the game was installed, they used this tool and subsequently accessed an email address where they responded to the questionnaire on Google Forms® with the following items: aesthetics; efficiency; functionality; and flexibility. The following scores were used: totally agree (03); agree (02); disagree (01); totally disagree (0.0). At the end of this step, new adjustments were made, forming the latest version of the game.

For qualitative data, the Bardin[15] framework was used for content analysis in three phases: pre-analysis, covering reading the material, organization and systematization of information and initial ideas, allowing the elaboration of first impressions about the content covered; data exploration, in which the content emerging from the interviews is coded; treatment and interpretation of results, carrying out analysis based on the thematic presence of respondents' statements. As for quantitative data, these were entered into a Microsoft Excel® spreadsheet, which were grouped into categories and compared quantitatively. To analyze categorical variables, absolute (n) and relative (%) frequency distributions were used. For quantitative variables, mean, median and standard deviation were presented. For SUS, the proposed standards for analyzing data from this scale were considered.

Data from SUS validity were analyzed using simple statistics considering the following calculation: odd questions, 1 was subtracted from the answer, and even questions, 5-x was used, with x being the value of the answer. Finally, everything was multiplied by 2.5. With this done for each user assessment, the mean between all of them was added and used to obtain the final score. When the result is less than 60, it is unacceptable, 60 – 70 is acceptable, 70 – 80 is good, 80 – 90 is excellent and greater than 90 is the best possible usability. During the process, suggestions for changes regarding the game composition as a whole were also considered, which were assessed and properly implemented according to user needs.

At all times, participant anonymity was maintained, with patients identified by P1, P2 … and professionals by Nur.01; Nur. 02; IT 01; IT 02. The study was approved by the *Universidade Federal de Santa Catarina* Research Ethics Committee. The aforementioned game is registered with the Brazilian National Institute of Industrial Property, under registration BR512023000738-2.

## RESULTS

The research results will be presented according to the steps proposed by UCD. In the first phase, "Identify", scoping review, 19 studies were mapped regarding educational technologies to support care transition for patients undergoing HTx. Educational game production was not identified in the mapped materials. The most prominent educational strategies were educational videos and applications[12].

In the descriptive qualitative study,12 HTx patients participated. Indication for HTx was related to virus C in four cases, followed by two cases due to alcoholic cirrhosis and hepatocellular carcinoma, two due to cryptogenic cirrhosis and four cases due to other pathologies. The average time on the list was two months. The mean MELD value was 14.75. Of the 12 participants, 10 were male and two were female. The main care needs identified were: preparation, organization and checking of blood glucose levels; insulin preparation, organization and administration; adjustments of immunosuppressant doses; storage and use control; identification and/or warning of signs and symptoms of complications; healthcare related to personal and home environment hygiene; and daily controls with checking vital signs and diuresis control.

In the "Analyze" step, the following objectives were formed for the game: promote health education in care; improve knowledge; empower patients regarding their self-care; and provide quality of life aiming at patients' relationship in home care after HTx. Furthermore, the game format was developed. Firstly, the game was designed using the Canva tool to better understand the steps by researchers, design and information technology professionals regarding the flow of the game's steps, paths to be followed as well as the rules of the game. Subsequently, design professionals created all the figures that would make up the game and the animations. Subsequently, information

technology professionals developed the project with Unity Game Engine version 2021.3.11f1, a tool for developing digital games for different platforms.

In the case of our project, for smartphones with the Android operating system. After developing the game and testing users, some changes were requested, such as changing the font, changing the sizes of the game's letters, correcting spelling errors, changing the map from horizontal to vertical, markers on the map to indicate players the last phase played and, finally, an initial screen of instructions to contextualize the game.

Game rules and paths to be followed**:** The game consists of a path format (steps). There are five paths that participants must complete. Participants will be represented by an avatar. To be able to move on to the next path, participants (avatar) must reach the maximum score on the first path and so on with the other paths. The game ends when players/avatars reach the maximum score on the fifth path. If the required points on each path are not reached, participants must start the same path again.

## Avatar (player)

In this game, avatars will be: avatar 1 – patient who underwent HTx (idea that may have an abdominal scar characteristic of liver HTx) and avatar 2 – professional nurse who must be wearing a mask.

First path – daily care: The first path has a final score of 1,000 points. To play this step, players will have to face three challenges related to this care.

Second path: hygiene and comfort: The second path has a total score of 1,100 points. In the first step, they must score 300 points. In the second step, they will add 800 points, and to add these points they need to complete the care activities requested in this path.

Third path: medication use: The third path has a total score of 900 points. In the first step, they must score 300 points. In the second step, they will gain 600 points. Each of these points represents an activity of this care to be carried out.

Fourth path: blood glucose check: The fourth path has a total score of 650 points. In the first step, they must score 250 points. In the second step, they will add 400 points. The points mentioned refer to care actions along this path.

Fifth path: insulin use: The fourth path has a total score of 1,000 points. In the first step, they must add 400 points to the total. In the second step, they will add 450 points. On the third step, they earn 100 points. In the fourth step, they will add 50 points. Again, each of these points is an action for practicing insulin application.

The game was titled "*Aprendendo TX — tudo que você precisa saber sobre cuidados pós-transplante hepático*" (Learning TX — everything you need to know about post-liver transplant care), aiming to propose a self-explanatory name so that players, just by reading the title, would know what it was about, along with the idea of helping them with post-HTx care. The game is available for download via the following website: https://drive.google.com/drive/folders/1wzu5H1hr2sUHf8FQevy3JBtEwMDF8qgg. Figure 1 shows the game's initial screen, with the path to be followed.
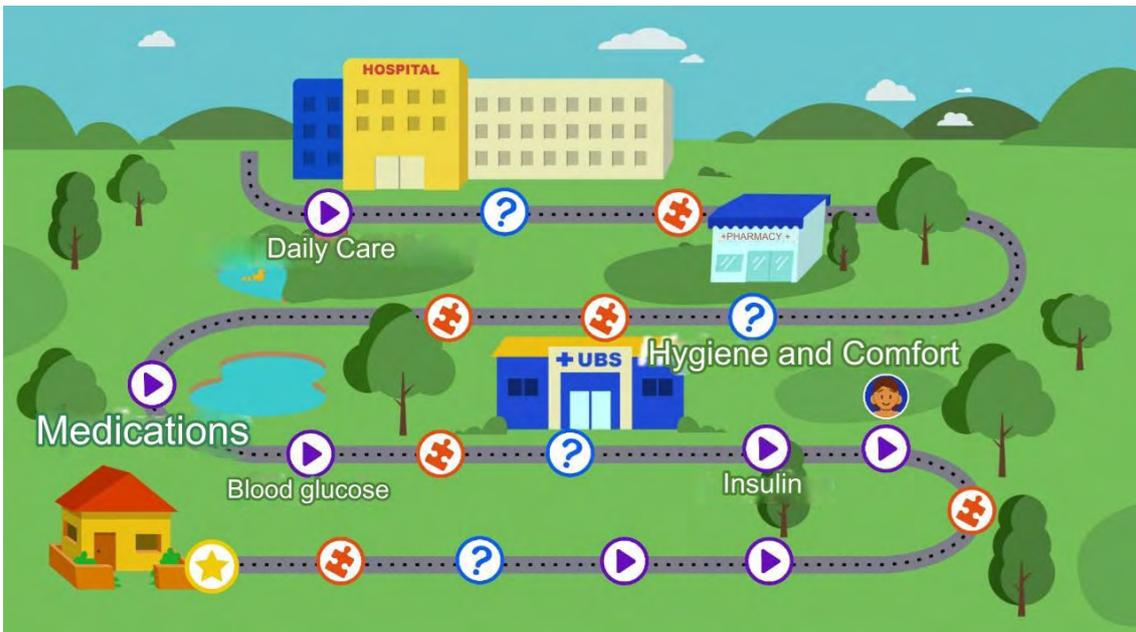
**Figure 1** – Game screen image with the paths to be followed. Florianópolis, SC, Brazil, 2023.

In the "design and test" step, the game's first version was sent for assessment and content validation by three nurses with expertise in care transition, and seven patients, who had already participated in qualitative study and were available to participate in this step. Below, as an instance, in Chart 1, is a care that makes up the game, "weight check", through a chart, in which the first column presents the first version prepared by researchers, and the second column contains the same information from reformulated care after requests for adjustments by nurses and patients. Due to information volume, only an example of care will be presented here. It is worth noting that this version was first sent to nurses when adjustments were made and then sent to patients.

**Chart 1 –** Presentation of an example of care in the first and second version after assessment by nurses and patients. Florianópolis, SC, Brazil, 2023.

| Care: weight check (material: scale) | |
|---|---|
| The game's first version was created by researchers. | Second version of the game, after adjustments requested by evaluators (nurses and patients). |
| During the walk, the avatar finds a box with the question "How many times should the weight be checked per day?". The options are every thirty minutes, three times a day, once a day, and every four hours. The correct answer is once a day. Then, the avatar must identify the time to check the weight, choosing the image of sun rising, which represents dawn. The wrong options are afternoon (full sun) and night (moon). By getting all the answers right, the avatar earns 100 points. | During the walk, the avatar comes across a box containing the question "How many times should the weight be checked per day?". The options are every thirty minutes, three times a day, once a day, and every four hours. The correct answer is to check weight once a day. Next, the avatar needs to identify the appropriate time to check the weight, choosing the image of sun rising, which represents dawn. The incorrect options are afternoon (full sun) and night (moon). Below the images, there should be the words "morning", "afternoon", "night". Upon getting all the answers correct, the avatar receives 100 points. |

Table 1 shows the overall mean scores given by nurses and patients during the assessment of the game's first version prototype. It is noted that the overall mean with the lowest score was in

care path related to checking blood glucose levels followed by insulin use path. The best paths' mean was assessed by patient four and six.

**Table 1** – Presentation of the assessments carried out by nurses and patients on the paths of the game's first version content. Florianópolis, SC, Brazil, 2023 (n=10).

| Paths | P.1 | P.2 | P.3 | P.4 | P.5 | P.6 | P.7 | E.1 | E.2 | E.3 | Overall mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st – Daily care path | 02 | 01 | 02 | 01 | 02 | 01 | 02 | 02 | 01 | 02 | 1.6 |
| 2nd – Hygiene and comfort path | 02 | 01 | 01 | 01 | 03 | 02 | 01 | 01 | 02 | 01 | 1.5 |
| 3rd – Medication use path | 01 | 02 | 02 | 01 | 01 | 01 | 02 | 02 | 02 | 02 | 1.6 |
| 4th – Blood glucose checking path | 01 | 02 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 1.1 |
| 5th – Insulin use path | 01 | 01 | 02 | 01 | 01 | 01 | 01 | 02 | 01 | 01 | 1.2 |
| Mean | 1.4 | 1.4 | 1.6 | 1.0 | 1.6 | 1.0 | 1.4 | 1.6 | 1.4 | 1.4 | 1.38 |

Scores: Maintain the item (mark 01); Keep with modifications (check 02); Delete the item (check 03); and Add item (check 04).

In the game assessment step, in which patients reassessed the second version of the prototype after adjustments using SUS, 17 people participated, eight women and nine men. Age ranged from 16 to 76 years. As for SUS results, Table 2 shows a final score above 80 points. Regarding the mean score for patients, the best mean was for patients 1 and 9. The worst average score was for patient 08, followed by patient 12. SUS also helps to assess various aspects of a product, mainly the game's effectiveness, efficiency and satisfaction for users. Therefore, the mean score among users is a positive response regarding these criteria.

**Table 2 –** Final score for each study participant. Florianópolis, SC, Brazil, 2023 (n=17).

| Participants | Patient final score |
|---|---|
| Patient 1 | 100.0 |
| Patient 2 | 77.5 |
| Patient 3 | 95.0 |
| Patient 4 | 97.5 |
| Patient 5 | 82.5 |
| Patient 6 | 62.5 |
| Patient 7 | 82.5 |
| Patient 8 | 57.5 |
| Patient 9 | 100.0 |
| Patient 10 | 97.5 |
| Patient 11 | 80.0 |
| Patient 12 | 45.0 |
| Patient 13 | 90.0 |
| Patient 14 | 97.5 |
| Patient 15 | 87.5 |
| Patient 16 | 97.5 |
| Patient 17 | 90.0 |
| **(Mean) overall score: 84.7 points** | |

The assessment carried out by professionals included eight participants, four from the health sector, all with expertise in post-HTx care transition, and four technology professionals, who produce educational games. Participants' age ranged between 23 and 47 years. These professionals' experience was about 12.5 years.

Table 3 presents the assessment carried out by these professionals considering aesthetics, efficiency, functionality and flexibility. It is noted that, in the assessed items, the percentage of "totally agreed" was above 62% in practically all items. Only in the flexibility item in the easy installation and uninstallation sub-items, "totally agree" was 25%. However, flexibility in use was 75%. It is worth noting that so far this game is only enabled for use on devices with the Android operating system, and it is not yet possible to use it on iOS. This may have been one of the main reasons for the "agree" score to be higher than the "totally agree" score in this assessed item.

Table 3 – Final result of educational game assessment by professionals. Florianópolis, SC, Brazil, 2023 (n=8).

| Assessed items | Number of answers | Totally agree (TA) in % | Agree (A) in % |
|---|---|---|---|
| Aesthetics | | | |
| Game general organization | 8 | 75 | 25 |
| Text structure and rules | 8 | 62.5 | 37.5 |
| Content and animation presentation strategy | 8 | 75 | 25 |
| Efficiency | | | |
| Goals according to home care | 8 | 100 | 0 |
| Objectives are clear. presented in a simple way | 8 | 75 | 25 |
| How to use the game is simple | 8 | 87.5 | 12.5 |
| Functionality | | | |
| Able to improve skills in care development | 8 | 75 | 25 |
| Users have the opportunity to improve knowledge | 8 | 87.5 | 12.5 |
| Allow to clarify doubts about home care | 8 | 87.5 | 12.5 |
| Flexibility | | | |
| Easy to install | 8 | 37.5 | 50 |
| Easy to uninstall | 8 | 37.5 | 62.5 |
| Is simple to use | 8 | 75 | 25 |

## DISCUSSION

Educational games are important technological tools to assist teams in education, prevention and health promotion. Especially for nurses who work directly on the front line with the population, these technologies can contribute to improving quality of life, as they help with specific demands of home care. Encouraging the use of health technologies can also establish greater contact between professionals and patients and patients themselves with better care practices to enhance and/or restore health[3–4,18]. In this regard, it is understood that the tool developed in this study will have a strong impact on the adherence of patients undergoing liver HTx because it is a current, simple, clear and easily accessible technology to install and play at any time.

The research, using qualitative data, revealed the difficulty of patients in continuing the proposed care at home, especially checking blood glucose levels and insulin therapy, despite the guidance and self-care encouraged by the team during hospitalization. Still, they have doubts about the step-by-step technique as well as the blood glucose results. It is worth noting that the majority of these patients before HTx did not use insulin because they were not diabetic, at the same time that they did not control their blood sugar. However, after HTx, due to the use of medications and liver's inflammatory process, which is in the healing process, it is necessary to control blood glucose levels and, in many cases, insulin use. It is noteworthy that studies with diabetic and insulin-dependent patients highlight the difficulties faced in providing this care, in addition to the risk of misinterpreting the blood glucose result. Thus, these authors point out the role of nurses as educators[19–20].

It is emphasized that in HTx failures regarding the self-application of insulin can lead to a greater risk of developing diabetes and cardiovascular diseases. Insulin, in many cases, has an important action to prevent hyperglycemia, since some immunosuppressants used in post-HTx therapy have the effect of reducing insulin secretion by the organ[21–23]. International authors point out the need for strict blood glucose control in order to prevent early graft dysfunction, in addition to minimizing the risk of infections[24–25].

From this perspective, it is observed that the game proposed in this study provides security, support, minimizing the risk of complications, in addition to promoting the development of skills, strengthening knowledge, while facilitating care management for post-HTx patients as well as caregivers and support network, considering that all of them can access the game and practice caution before carrying it out.

It is also noteworthy that, in the scoping review carried out in this study, educational games to be used in HTx were not mapped. Only educational videos and applications were identified. Therefore, it is worth highlighting the gap in gaming technology capable of supporting patients and families in returning home post- HTx. It is worth highlighting that the technological tools identified in the scoping review do not provide the opportunity to improve skills as the aforementioned game in this study allows. The game presents, in each of the paths, actions with scores, which provide support for carrying out the care technique. This means that each time players reinforce their step-by-step knowledge of care as well as the materials they need to develop this care in a playful and interactive way.

Studies show that educational videos have an important impact on communication with patients. However, games provide opportunities for learning in a playful way when educating, teaching and learning, making learning relaxed with a greater probability of storing information as well as better chances of memorizing the sequences of care to be carried out at home[1–2,26]. International studies reinforce that games promote interaction between family members, where everyone starts to learn and strengthen knowledge on a certain subject to support and promote adherence to treatment[27–28].

However, in order for the developed game to meet the population's/users' needs, it is necessary for the product to be assessed by these people at the same time as having their participation in all steps of technological tool construction[11,18,29]. Thus, this study included the participation of patients undergoing HTx who had already returned home and were performing this care as well as nurses with experience of practice with these patients. The participation of these people gave them the opportunity to learn about and interact with technology at all steps of product construction. Therefore, adjustments were proposed throughout the game development. This made it possible to reconcile the information as well as game objectives and rules according to needs in practice, making language as simple and understandable as possible. Furthermore, it allowed them to suggest the removal and/ or addition of data and/or information as well as game rules. This aspect reinforces how necessary

user participation is in product construction. Studies show the relevance of educational and digital technologies for treatment adherence. However, these same studies reiterate the importance and importance of users' participation in product construction and validity so that it can meet their health needs and thus encourage them to access such tools[30–31].

Studies of technological productions developed with the UCD method support highlight user participation in the step-by-step of tool construction. These authors explain that participation allows users to adjust and reformulate steps that are not clear[19–32]. Furthermore, based on the importance of UCD in agile methodologies for usability assessment, the UCD method can bring benefits to companies, researchers and users, as it includes improving user experience, customer satisfaction and reducing rework as well as identifying opportunities for innovation[32].

Regarding the participation of patients in using SUS, Table 2 shows an excellent overall mean regarding these people's assessment, given that the author of this scale proposes a score above 68 points as an acceptable average. In this study, the overall mean was above 80 points. The aforementioned author also highlights that technologies with scores below 68 points tend to face serious problems in their usability[16].Considering this information, it is understood that in this study the educational game approaches patients' needs, in addition to being easy to use in reason for usability assessment being higher than 80 points.

An integrative review study on the usability of technologies using SUS shows scores between 70 and 85 points. These results are similar to those identified in this study[33]. Other studies reinforce that this scale assesses various aspects of usability and provides insights for educational technology design, identifying areas for improvement and development of more intuitive interfaces and providing relevant information for improving these technologies and guiding a design and content that is more familiar to target users[33,34,35]. In this study, the SUS contribution provided opportunities for adjustments and improvements in the different paths of the game, aiming to improve the game for patients' reality.

With regard to the data obtained in Table 3, all assessed items were considered to have an excellent assessment, due to the predominance of "totally agree" and "agree" scores, showing that the game is considered a viable technological product to be used by patients post-HTx in order to promote health education, support practice, in addition to providing opportunities for the management of this care at home. Such data from this study reveal that the game is capable of being used in everyday life by patients, considering that it has gone through all the steps proposed by the method and has obtained a significant assessment in all steps.

Given the need and relevance of assessing usability by users, as well as experts in the field and technology professionals[35–37], two of these studies involving the HTx process reinforce the need for the product to be as close as possible to users so that it can meet the reality of these people while making it viable for use[36–37].

## CONCLUSION

The study presented the development and assessment of educational technology capable of supporting health education actions for patients undergoing liver HTx. This tool presents five care paths, which are developed by patients at home. Each of these paths has steps to be developed in the game, leading patients, family and support network through the steps of care organization and technique description and/or care to be performed.

It is worth highlighting that, in all steps of the methodological framework, there was the participation of patients, professionals with expertise in care transition, design professionals and IT professionals both in game development and usability assessment. Considering the participation of

these people and professionals at all steps, the game was adjusted, which allowed the completion of this product in order to meet users' needs.

As for the contribution of this product, it will support healthcare professionals in the education and promotion of home care for patients undergoing HTx, at the same time that it will benefit these people to ensure the development of safer and more effective care, thus promoting quality and safety in managing care and self-care at home.

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## NOTES

### CONTRIBUTION OF AUTHORITY
Study design: Knihs NS, Silva AM, Magalhães ALP, Paim SMS.
Data collection: Silva AM, Grespi LO.
Data analysis and interpretation: Knihs NS, Silva AM, Grespi LO.
Discussion of results: Knihs NS, Grespi LO.
Writing and/or critical review of content: Knihs NS, Grespi LO, Silva AM, Magalhães ALP, Paim SMS, Moraes PHB, Martins MS, Treviso P.
Review and final approval of the final version: Knihs NS, Grespi LO, Silva AM, Magalhães ALP, Paim SMS, Moraes PHB, Martins MS, Treviso P.

### APPROVAL OF ETHICS COMMITTEE IN RESEARCH
Approved by the *Universidade Federal de Santa Catarina* Research Ethics Committee, Opinion 1.575.457/2016, CAAE (*Certificado de Apresentação para Apreciação* Ética – Certificate of Presentation for Ethical Consideration) 54900716.8.0000.0121.

### CONFLICT OF INTEREST
There is no conflict of interest.

### CORRESPONDING AUTHOR
Letícia de Oliveira Grespi
grespileticia@gmail.com