

Construction of Educational Technology to Prevent HPV and Cervical Cancer in Riverine Children and Adolescents

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Construção de Tecnologia Educacional para Prevenção do HPV e do Câncer do Colo do Útero em Crianças e Adolescentes Ribeirinhos
Creación de Tecnología Educativa para Prevenir el VPH y el Cáncer de Cuello Uterino en Niños y Adolescentes Ribereños

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ABSTRACT

Introduction: Cervical cancer is a serious public health problem in Brazil, especially in hard-to-reach regions such as riverine communities in the Amazon. HPV infection is the main risk factor for developing the disease. Low vaccination coverage and lack of knowledge about prevention make the use of accessible and culturally appropriate educational strategies urgent. **Objective:** To develop a health educational technology to prevent HPV and cervical cancer among riverine children and adolescents. **Method:** The construction of the HPreVine game was based on an integrative literature review. The data supported the development of the thematic content. The development phase followed the principles of instructional design, including the definition of the target audience, educational objectives and game structure (cards, board, pawns and manual). **Results:** The final product consists of a board game with accessible language, colorful illustrations and educational cards divided into categories. The game was designed to be utilized in schools or community settings, allowing mediation by health or education professionals. The proposal aims to stimulate playful learning, promote dialogue, and foster the collective construction of knowledge about HPV. **Conclusion:** The HPreVine is a low-cost, replicable educational technology suitable for the Amazonian reality, contributing to health promotion, child and youth empowerment, and the strengthening of prevention strategies in vulnerable areas.

Key words: HPV; Uterine Cervical Neoplasms; Primary Prevention; Play and Playthings; Educational Technology.

RESUMO

Introdução: O câncer do colo do útero é um grave problema de saúde pública no Brasil, especialmente em Regiões de difícil acesso como as comunidades ribeirinhas da Amazônia. A infecção pelo HPV é o principal fator de risco para o desenvolvimento da doença. A baixa cobertura vacinal e o desconhecimento sobre a prevenção tornam urgente o uso de estratégias educacionais acessíveis e culturalmente adequadas. **Objetivo:** Desenvolver uma tecnologia educacional em saúde para a prevenção do HPV e do câncer do colo do útero entre crianças e adolescentes ribeirinhos. **Método:** A construção do jogo HPreVine baseou-se em uma revisão integrativa da literatura. Os dados subsidiaram a elaboração do conteúdo temático. A fase de desenvolvimento seguiu os princípios do *design* instrucional, incluindo a definição do público-alvo, objetivos educacionais e estrutura do jogo (cartas, tabuleiro, pinos e manual). **Resultados:** O produto consiste em um jogo de tabuleiro com linguagem acessível, ilustrações coloridas e cartas educativas divididas em categorias. O jogo foi planejado para ser aplicado em espaços escolares ou comunitários, permitindo a mediação por profissionais da saúde ou da educação. A proposta visa estimular o aprendizado de forma lúdica, promover o diálogo e favorecer a construção coletiva de saberes sobre o HPV. **Conclusão:** O jogo HPreVine se apresenta como uma tecnologia educacional de baixo custo, replicável e adequada à realidade amazônica, contribuindo para a promoção da saúde, o empoderamento infantojuvenil e o fortalecimento de estratégias de prevenção em territórios de vulnerabilidade.

Palavras-chave: HPV; Neoplasias do Colo do Útero; Prevenção Primária; Brincadeiras e Brinquedos; Tecnologia Educacional.

RESUMEN

Introducción: El cáncer de cuello uterino es un grave problema de salud pública en el Brasil, especialmente en regiones de difícil acceso, como las comunidades ribereñas de la Amazonia. La infección por VPH es el principal factor de riesgo para el desarrollo de la enfermedad. La baja cobertura de vacunación y la falta de conocimientos sobre prevención hacen urgente el uso de estrategias educativas accesibles y culturalmente apropiadas. **Objetivo:** Desarrollar una tecnología de educación para la salud para la prevención del VPH y el cáncer de cuello uterino en niños y adolescentes ribereños. **Método:** La construcción del juego HPreVine se basó en una revisión bibliográfica integradora. Los datos respaldaron la elaboración del contenido temático. La fase de desarrollo siguió los principios del diseño instruccional, incluyendo la definición del público objetivo, los objetivos educativos y la estructura del juego (cartas, tablero, fichas y manual). **Resultados:** El producto final consiste en un juego de mesa con lenguaje accesible, ilustraciones coloridas y tarjetas educativas divididas en categorías. El juego fue diseñado para su uso en entornos escolares o comunitarios, permitiendo la mediación por parte de profesionales de la salud o la educación. La propuesta busca estimular el aprendizaje de forma lúdica, promover el diálogo y fomentar la construcción colectiva de conocimiento sobre el VPH. **Conclusión:** El juego HPreVine se presenta como una tecnología educativa de bajo costo y replicable, adecuada a la realidad amazónica, que contribuye a la promoción de la salud, el empoderamiento de niños y jóvenes, y el fortalecimiento de las estrategias de prevención en zonas vulnerables.

Palabras clave: VPH; Neoplasias del Cuello Uterino; Prevención Primaria; Juego e Implementos de Juego; Tecnología Educativa.

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INTRODUCTION

The human papillomavirus (HPV) is one of the most common sexually transmitted diseases. It is estimated that between 75% and 80% of the sexually active individual will be infected at some point in their lives and persistent HPV infection can cause diseases such as cervical cancer¹.

Cervical cancer is the fourth most common neoplasm frequently diagnosed and the fourth main cause of death by cancer in women in the world, being nearly completely avoidable due to highly effective measures such as primary (HPV vaccine) and secondary prevention (screening)².

In that sense, preventive screening cervical cancer (Papanicolaou test) for early cancer detection in conjunction with vaccination programs and health education are considered preventive effective strategies. These approaches play a critical role to reduce mortality and incidence rates of HPV infections and cervical cancer^{3,4}.

Brazil is a vast territory with isolate and hard-to-reach communities, especially in the North region characterized by dense forests, long rivers and low populational density. However, high-rates of HPV infection and cervical cancer in this region are not explained only by geographical barriers. Studies demonstrate that mortality by cervical cancer in Brazil is significantly influenced by socioeconomic disparities and access to health services; the North region has the lowest socioeconomic indexes in relation to its mortality rates^{5,6}.

The promotion of health education, a pillar to prevent HPV and cervical cancer, encompasses educational technologies that can help the process of education and learning for children and adolescents. In that sense, this tool can enhance the construction of the knowledge in an innovative manner within an amenable and planned environment, allowing this public to attain a better knowledge and skills about the game content⁷.

Board games are one of the educational technologies encompassing verbal, visual, and sound elements and rules that propose a goal to be reached and can help involving adolescents in decision-making about their health, increasing the motivation to vaccination and long-term preventive behaviors⁸⁻¹⁰. The objective of this study is to develop a health educational technology in the format of a board game targeted to HPV and cervical cancer prevention in riverine children and adolescents living in the Amazon region.

METHOD

Descriptive, methodological study about the elaboration of an educational technology in the format of a

board game to prevent HPV infection and cervical cancer through a manual of instructions. The methodological research was aimed at the development, evaluation and improvement of methodological instruments and strategies.

For the construction of the three stages of the methodological study, it was utilized the theoretical-methodological referential adopted for the elaboration of the educational technology based on Pasquali¹¹ consisting in the theoretical, empirical and analytical poles. The theoretical addresses the construct of interest, the empirical, the application in the reality and the analytical, the utilization of statistical tests. The present study adopted the theoretical because the main concern was the analysis of the content, which favored a better understanding of the construct. The study was divided in two phases: literature review and construction of the technology.

The creation of an educational technology should be preceded by initial investigations such as the literature review. This process was aimed to explore relevant themes and find knowledge gaps, providing theoretical elements to support and strengthen the development of the technological proposal¹².

LITERATURE REVIEW

The literature review was selected because it favors the systematization and analyzes of published studies. This approach allowed to identify knowledge gaps and deepen the understanding of a certain theme based on the integration of independent studies.

The following stages were followed for the integrative literature review: 1 – Identification of the theme and selection of the research question; 2 – Definition of inclusion and exclusion criteria; 3 – Identification of pre-selected and selected studies; 4 – Categorization of the studies selected; 5 – Analysis and interpretation of the results; 6 – Presentation of the review/synthesis of the knowledge¹³.

The definition of the search strategy based on PICO (Population, Intervention, Comparison and Outcome) allowed the formulation of a structured question, guiding the beginning of the investigational process. The type of review selected will determine which PICO components will be utilized. In the present case, the component Comparison was not utilized. Therefore, the following research question was created: "What are the educational technologies developed to prevent HPV and cervical cancer in children and adolescents?"

The search strategy was based on the language associated with DeCS (Health Sciences Descriptors) such

as: Human Papillomavirus Viruses OR Human Papilloma Virus OR Human Papilloma Viruses AND Educational Technology OR Educational Technologies AND Child OR Children.

The search was conducted in the databases: MEDLINE (via PubMed), Virtual Health Library (VHL), Latin American and Caribbean Health Science Literature (LILACS), Scientific Electronic Library Online (SciELO) and Embase, Elsevier's biomedical research database. Additionally, a manual search was performed in the references of the studies included to identify relevant articles not captured in the electronic search.

Available full-text studies published in any language and any period of time, presenting methods and technologies utilized in health education of children and adolescents to prevent HPV infection and cervical cancer have been included in the survey.

After applying the search strategy, the results were compiled and duplicates were removed. Later, two independent reviewers analyzed the titles, abstracts and descriptors of the studies. Potentially eligible studies were fully read to confirm the inclusion. Finally, the data extracted included specific information about the title, year of publication, country of origin, design, number of participants and technology utilized. Two expert reviewers independently extracted the data from the publications. Discrepancies were resolved upon discussion or with a third reviewer.

In addition, to ensure the methodological quality of the data included in the integrative review, the risk of bias was evaluated utilizing the JBI Critical Appraisal Tools¹⁴ according to the type of study of each article.

CREATION OF THE BOARD GAME AND MANUAL OF INSTRUCTIONS

After the analysis of the literature, a board game (health technology) about the prevention of HPV infection and cervical cancer was elaborated. The game addressed, in the format of gamification, aspects of HPV, forms of transmission and prevention in addition to information on cervical cancer.

The next step was the development of the technology utilizing the software Adobe Illustrator® and the online design and visual communication platform Canva® because of their specific ability to create this type of material. The technology was modeled as a board game due to their acknowledged familiarity among children and adolescents, in addition to the respective manual of instructions with detailed information about the game.

Guidelines on language, illustration and layout to elaborate educational material have been followed to make the product readable, applicable, understandable

and culturally relevant for the population assisted by the National Health System (SUS). The information and techniques included in the educational game considered social and cultural contexts of the Amazon region as well as dialects and regional behaviors with local characteristics for improved knowledge and consistency.

The analysis by an ethics committee was waived because only secondary and deidentified data have been utilized in compliance with Directive number 510/16¹⁵ of the National Health Council (CNS).

RESULTS

Initially, 83 articles have been identified in the databases selected for the study. After the reviewers analysis according to the inclusion and exclusion criteria, eight articles have been selected. The flowchart of data selection portrays the search and choice of the studies (Figure 1¹⁶).

The eight articles included in the review were published from 2013 to 2024, 62.5% in English and 37.5% in Portuguese in the following countries: Australia¹⁷, USA^{18,19}, Brazil²⁰⁻²², The Netherlands²³ and Italy⁹.

The studies included encompassed mostly 9-17 years old school-age adolescents, mean age of 12.5 years (± 1.41 years), demonstrating that the intervention was targeted to pre-adolescents and adolescents. The mean sample of the studies was 224 participants (± 226.86) per study, ranging between 33 and 554 participants.

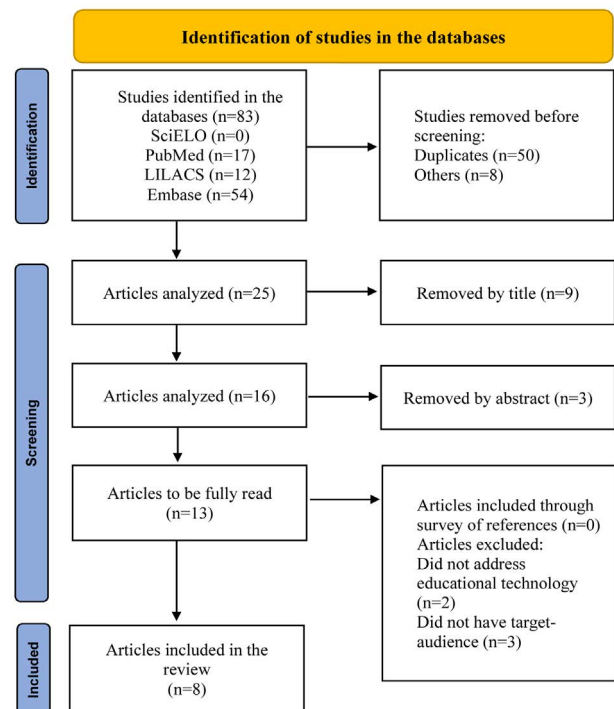


Figure 1. Flowchart of data extraction
Source: Adapted from PRISMA¹⁶.

The educational strategies included comic books, animated videos, web-based games, informative leaflets and illustrated guides. Overall, the studies showed positive effects on vaccination arising from increased knowledge and attitudes changing.

Interactive technologies such as videos and web-based games^{9,19} were effective to promote involvement and expand the participants understanding. The comic books developed^{18,20,21} were validated as playful and accessible tools, being well evaluated by experts and target-audience. Illustrated guides and informative leaflets^{21,23} have also contributed to expand the knowledge in despite of some limitations regarding the depth of the information absorbed.

Chart 1 presents the characterization of the study sample: author, year of publication, objective, educational strategy, main outcomes and educational technology utilized.

Most of the studies presented low risk of bias. Two studies had moderate risk of bias: the study by Hofman et al.²³ due to poor details of the influence of confounding factors, mainly in the pre-test evaluation and the study by Occa, Stahl, Julien-Bell⁹ because of mixed methods (discussion and experiment) and incomplete details on the control of variables. Chart 2 portrays the risk of bias of each study reviewed.

After the analysis of the literature review and the methodological quality of the studies, it has been decided to incorporate the content addressed by the technologies investigated in the game HPreVine. Therefore, the themes that included the contents of the cards were: what is HPV?; types of HPV; forms of transmission; HPV prevention; HPV vaccination; HPV and its relation with cancer.

The educational technology developed was a 29.7 cm x 42 cm board game titled HPreVine depicting a pathway with houses of questions and answers, referring the HPV virus and its prevention, the objective of the game.

HPreVine consists in a board, three pawns, one pawn representing the virus HPV, a manual of instructions, rules of the game and 16 cards: true or fake, question and curiosity. Four players may join each round, being three action players and one mediator responsible to guide the participants through the game, reading the cards and determining the actions according to each one of them.

The game begins when the participant chooses the color of the pawn that will be parked in the starting point of the pathway. A dice will define the sequence the player will follow and the pawn will navigate through each station of the board, where the importance of HPV and cervical cancer prevention is reinforced.

The game consists in command houses and action houses. These encompass houses with “True or Fake”,

“Question” and “Curiosity”. If the player rolls the dice and is steered to an action house, the action described should be performed. Each action house has a set of cards that can be utilized to move on along the game. The content of the cards was elaborated from the information extracted from the studies selected organized in six theme axes. Chart 3 presents examples of the contents in each card.

Each action house has its own dynamics in terms of playability: in the action houses “True or Fake”, the participant should state whether the affirmation is or isn't right. Contingent on the response, the participant will move the number of houses determined by the card. The same applies to the houses “Questions”, that consist of questions with three response options (A, B and C). Finally, the houses “Curiosity” contain curiosities about the theme.

The final objective of the game is to “eliminate the HPV” that will be represented by a special pawn in the end of the board, the winner will be the participant who reaches as fast as possible the final house and defeat the pawn that represents the virus of HPV, becoming the “Health Guardian” whose mission is to disseminate the knowledge acquired.

The construction of the educational content of HPreVine was based on the synthesis of the themes found in the educational technologies analyzed in the studies reviewed such as: HPV vaccination, HPV transmission and prevention and relation HPV-cancer.

The contents selected to be included in the cards of the game were defined from the findings of the integrative review and later checked for consistency with the current national guidelines and scientific evidences.

The Brazilian guidelines for cervical cancer screening⁴ were utilized as guiding document, it establishes the official Brazilian cervical cancer recommendations of the Ministry of Health with emphasis on oncogenic HPV detection as central strategy of secondary prevention.

Based on this document, the following themes were addressed in the game:

a) Relation between HPV and cervical cancer: the contents of the game that address the association of the persistent infection by oncogenic types of HPV and the development of cervical cancer were compared with the guidelines of the Ministry of Health that reaffirms HPV as necessary cause for the development of this neoplasm and substantiates the adoption of molecular tests for its detection.

b) HPV vaccination: the contents related to the importance, indication and HPV vaccination program were checked in light of the recommendations of the national immunization program of the Ministry of Health that recommends vaccination as primary strategy of

Chart 1. Data obtained from the articles selected for integrative review

Author/year	Objective of the study	Population	Educational strategy	Main outcomes	Technologies utilized
Occa, Stahl, Julien-Bell, 2022 ⁹	Assess the feasibility of using an evidence-based animated video and a web-based game to help children participate in discussions about their health	11 and 12-year old children	Focus group discussions and experiments with children	Increased children's knowledge and positive perceptions about HPV and HPV vaccination	Web-based game and animated video
Davies et al., 2021 ¹⁷	To examine the effect of a human papilloma virus (HPV) vaccination education and logistic intervention on adolescent psychosocial outcomes	12-13-year old adolescents	Supporting tool for decision sharing – STI (sexually transmitted infections)	Improved psychosocial outcomes of the adolescents and increased the adolescents knowledge about HPV, vaccination and vaccination process	Guidelines for decision-making
Katz et al., 2014 ¹⁸	Describe the development of a theory-based comic book about HPV vaccination	9-14-year-old children	Theory of Planned Behavior and Health Belief Model	The comic book is a good way of learning about health	Comic book
Webster et al., 2024 ¹⁹	Develop and test a novel interactive education resource designed to educate parents and adolescents about HPV vaccine	11-17 year-old children and adolescents older than 18 years	Watched web-based videos of the Patient Activated Learning System (PALS) in mobile devices	Feasible, acceptable and improved knowledge among the population. Positively influenced HPV vaccination rates	Videos
Cruz et al., 2019 ²⁰	Construct and validate a comic-based educational technology about the HPV vaccine	7th grade elementary school adolescents	Validation of technology	Educational technology considered valid by the judges and target-audience and can be used as an educational tool to guide the practice and improve the adherence to the vaccine	Comic book
Oliveira et al., 2023 ²¹	Produce and validate an illustrated guide as a technological resource for boys and girls about the HPV vaccine	Boys (11-14 year-old) and girls (9-14 year-old)	Validation of technology	Technological resource considered satisfactory by experts and target-audience	Illustrated guide
Silva et al., 2023 ²²	Construct and validate an educational technology as a comic book about the HPV vaccine aimed at adolescents	Expert judges	Validation of technology	Tool valid to inform playfully about the HPV vaccine	Comic book
Hofman, 2013 ²³	Evaluate to what extent reading an official informative leaflet about HPV contributes to the knowledge girls have	11-14 year-old girls	Evaluated the knowledge about HPV vaccination and demographic characteristics	Positive effect on knowledge, can be useful to increase awareness about these aspects	Informative leaflet

Chart 2. Risk of bias of studies included according to the JBI guidelines

Author	Type of study	JBI tool	Risk of bias
Occa, Stahl, Jukien-Bell, 2022 ⁹	Quasi-experimental study	JBI checklist for quasi-experimental studies	Moderate
Davies et al., 2021 ¹⁷	Clinical randomized study (CRS)	JBI checklist for CRS	Low
Katz et al., 2014 ¹⁸	Methodological study	JBI checklist for validation studies	Low
Webster et al., 2024 ¹⁹	Methodological study	JBI checklist for validation studies	Low
Cruz et al., 2019 ²⁰	Methodological study	JBI checklist for validation studies	Low
Oliveira et al., 2023 ²¹	Methodological study	JBI checklist for validation studies	Low
Silva et al., 2023 ²²	Methodological study	JBI checklist for validation studies	Low
Hofman et al., 2013 ²³	Cross-sectional study	JBI checklist for cross-sectional studies	Moderate



Chart 3. Examples of contents addressed in HPreVine cards

Type of card	Theme	Example of content
Question with alternatives	HPV vaccination	What is the age recommended for HPV vaccination?
Question with alternatives	Forms of transmission of HPV	HPV is a virus mainly transmitted by...
Question with alternatives	HPV and its relation with cancer	What helps to prevent cancer caused by HPV?
True or fake	HPV vaccination	HPV vaccine is only for girls
True or fake	HPV and its relation with cancer	HPV vaccine protects against cervical cancer
Did you know?	Types of HPV	That there are more than 150 types of HPV?
Did you know?	HPV prevention	That condoms and vaccination prevent HPV?
Did you know?	HPV prevention	Prevention is a super power anyone can have with vaccines, care and information!

cervical cancer prevention with priority to the 9-14 age-range, the target-audience of HPreVine. The guidelines reinforce vaccination as indispensable measure of the screening strategies.

c) Forms of transmission and prevention measures: the contents about the HPV transmission routes and preventive measures (condoms, vaccination and screening texts) were associated with recommendations of the guidelines and evidences identified in the studies reviewed ensuring the consistency and update of the information of the game.

The construction of the contents of HPreVine was double-checked: the identification of the scientific-evidences through the integrative review and verification of the alignment of these evidences with the official guidelines of the Ministry of Health, ensuring whether the information transmitted in the game were updated, scientifically justified and consistent with the current Brazilian health public policies.

After the analysis of the articles and selection of the content for the cards and board, the material was prototyped with an attractive, colorful, illustrative visual presentation to favor its acceptability by the target-audience. Clearly, the game has an educational rather than punitive character to promote knowledge and adherence.

HPreVine was developed to be applied with the mediation of an educator or health professional during the play. It is recommended to present a brief 10-minute introduction before the game when the mediator describes the objectives of the activity and the basic rules according to the manual of instructions. However, the game does not require any early presentation about the theme since the content of the cards is self-explanatory and informative allowing learning while the game develops.

A manual of instructions enclosed with the game was created to guide the participants on how to play and determine the rules; the 14.8 cm x 21 cm board of HPreVine was graphically created through Adobe Illustrator® and Canva®, an online graphic design platform. After the manual was graphically edited, it was submitted

to the “*Câmara Brasileira do Livro (CBL)*” to obtain the International Standard Book Number (ISBN) and the respective cataloging record.

The manual is a guiding document enclosed with the game containing a detailed presentation, objectives, components (board, cards, pawn and dice), guidelines for preparation and assembling, description of the rounds and criteria to end the game. In addition, the standardization of the activity promotes the understanding of the rules by educators and mediators, ensures that the pedagogic objectives are reached during the application of the game and strengthens the autonomy of the players, promoting active learning and encouraging that the

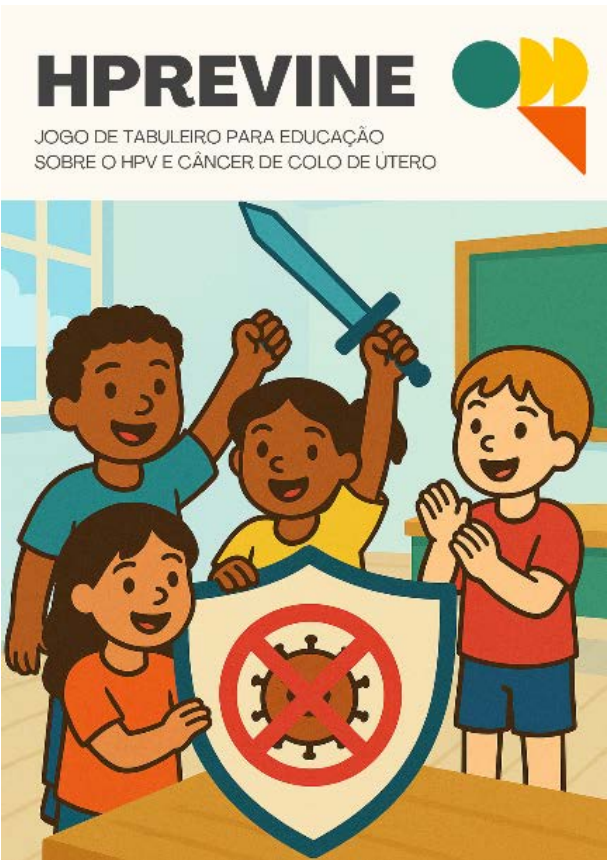


Figure 2. Front cover of the instructions manual of HPreVine



“health guardian”, the winner of the game, shares the knowledge acquired with colleagues and family, expanding the educational action.

Considering the specificities of the Amazon riverine population, the game was adjusted to ensure its adequacy to the local context: the language utilized common words avoiding complex technical terms and incorporating regional expressions as applicable. The graphic design consisted of visual representations reflecting the ethnical diversity and Amazon context.

The information on prevention considered the reality of access to health of riverine communities. These adjustments were necessary to make the game attractive and most of all comprehensible for this population to reach the final goal: health literacy and increased adherence to vaccination. However, the validation of these adaptations by the target-audience will be the future stage of this study.

DISCUSSION

There are still many challenges to meet in the North region to reduce HPV infection and cervical cancer. A recent systematic review about the barriers to cervical cancer screening in the Amazon region identified that the most frequent obstacles are organizational and of the health system, mainly access to vaccine and effective screening measures²⁴. In light of this scenario, strategies of health education adapted to the local reality are essential to expand the knowledge about HPV, strengthen the adherence to the vaccination and promote preventive habits since childhood.

The utilization of health educational technologies such as the board game HPreVine is an innovative and effective strategy in the teaching-learning process, especially in contexts of limited access to digital resources. Board games play a key role in the promotion of several cross-sectional aspects for the success of the learning process both at psychological and cognitive levels, being applicable to different areas of knowledge as a tool for educational improvement able to stimulate the involvement and motivation of the participant^{25,26}.

Designed to the target-audience (9-14 year-old children), the game developed aims to promote knowledge about HPV and its relation with cervical cancer, addressing forms of transmission, prevention and importance of vaccination. While incorporating playful and interactive elements, HPreVine favors the involvement of the participants and actively stimulates the construction of the knowledge significantly reinforcing self-care practices since childhood and contributes to the promotion of health and prevention of diseases.

According to Epstein et al.²⁷, the elements found in games can contribute to health behavior changes such as modifying the thoughts about the health status and change of habits. In addition, the authors reinforce that the visual presentation of the games helps to define and prompt the behavior of the individual considering that the dynamics, the esthetic and the emotions of the games are essential to make these changes.

Another important factor is the inclusion of the child and of the adolescent in the decision-making process about the vaccination and preventive methods. According to Davies et al.¹⁷, this public is frequently excluded from the decisions about vaccination because of the age, limited understanding of the process, challenges in communicating with their parents and scarce information. Therefore, educate and inform the target-audience increases health awareness and, consequently, favors habit changing in adolescents.

The choice of the format of the game HPreVine, its colors and language focused to the target-audience aligned with the findings of the integrative review demonstrates the potential of educational technologies as effective tools in health promotion and awareness about HPV in children and adolescents. Corroborating this perspective, Epstein et al.²⁷ and Silva Carvalho et al.²⁸ indicate that educational games can be effective and engaging strategies for behavior changing since their design takes into consideration the characteristics and necessities of the public they are addressed to.

In this context, as observed by Silva Carvalho et al.²⁸, board games are an attractive, active and playful pedagogic strategy that can create motivation among the participants. In addition to promoting playful learning, HPreVine was developed to strengthen the bond among health professionals, educators and the students, creating a space for dialogue and knowledge exchange.

The playful approach allows children to absorb complex information in a light manner, which contributes for the internalization of healthy behaviors. In addition, the mediation by an educator or health professional during the game expands the possibilities of clarifying doubts, reinforcing the educational and preventive character of the activity.

The teachers can perform an important role in the formation and education of the adolescents as well as the transmission of knowledge to the parents, especially in the context of vaccination in schools. In that line, Choi, Gabay, Cuccaro²⁹ and Fu et al.³⁰ demonstrate that health programs in schools can improve more effectively the administration of vaccines, reducing the necessity of visits to health clinics and contributing to reduce the incidence rates of cervical cancer in the long term.



The relation of the students and their social mean is equally relevant since this interaction affects both the behavior of the parents and of the children and adolescents. According to Mansfield et al.³¹ negative attitudes towards vaccination and other aspects involving HPV such as preventive exams, definitively influence the decision-making.

In light of this scenario, the choice of a board game was strategic, considering the reality of many communities of the Amazon region where access to Internet and electronic devices is limited. It is crucial to include forms of health education in schools, mainly in low socioeconomic regions with high rates of cervical cancer such as riverine populations to stimulate preventive habits in children and adolescents³².

The contents approached in the cards such as myths and trues about HPV, forms of transmission, importance of the vaccine and preventive measures were based on scientific evidences and aligned with the guidelines of the Ministry of Health⁴. These themes have also been approached in studies that supported this educational technology^{9,17-23}. This represents a significant sample for the evaluation of educative interventions and validation of technologies. The diversity of methods utilized and consistency of positive results suggest that visual, interactive and playful resources are promising strategies to face vaccine hesitancy and strengthening the knowledge on HPV in the young population.

Strategies of health education through educational technologies have been shown to be useful to help decision-making about vaccination and prevention habits, in addition to being attractive, increasing the involvement and adherence of the children and adolescents to the proposals offered³³. Furthermore, the identification of educational technologies on HPV that contribute to engage the population in vaccination helps and guides the job of health and education professionals³⁴.

In that perspective, the participants of the studies analyzed in the integrative review emphasized that resources as comic books and videos facilitated the understanding and made the theme more accessible, in addition to contributing to begin family conversations about prevention. As a complementation, the results of Drokow et al.³⁵ demonstrate that health education through videos can lead to perception changes, improvement of self-efficacy and understanding what screening of cervical cancer means and HPV vaccination.

An exploratory study with the target-population to identify their necessities and knowledge was not conducted, which is one of the study limitations. In addition, the population of the studies of the integrative review were formed by children and adolescents, which

makes the adequacy to the riverine population restricted. Furthermore, the content, semantics and appearance were not validated so far, they are necessary for replication and disclosure of the game.

CONCLUSION

The construction of the educational game HPreVine, based on scientific evidences and focused to the local sociocultural reality, can contribute to strengthen health education, especially in hard-to-reach areas such as those where riverine children live in the Amazon region.

The utilization of simple language, attractive colors and playful dynamics make the game accessible and engaging, allowing that complex information about HPV and prevention of cervical cancer are easily understood by the target-audience. In addition, the aim of the game can promote the construction of the knowledge and encourage the dialogue among the students, teachers, health professionals and their communities, creating positive impact over change of behaviors and attitudes around preventive health.

It is expected that HPreVine, as a low cost, pedagogic and replicable technology can be validated and applied in schools, community actions and health services, expanding their reach and promoting robust transformations in the reality of vulnerable populations.

CONTRIBUTIONS

All the authors contributed substantially to the study conception and design, acquisition, analysis and interpretation of the data, writing and critical review. They approved the final version for publication.

DECLARATION OF CONFLICT OF INTEREST

There is no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

All the content underlying the text is contained in the manuscript.

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REFERENCES

1. Jain M, Yadav D, Jarouliya U, et al. Epidemiology, molecular pathogenesis, immuno-pathogenesis,

- immune escape mechanisms and vaccine evaluation for HPV-associated carcinogenesis. *Pathogens*. 2023;12(12):1380. doi: <https://doi.org/10.3390/pathogens12121380>
2. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2021;71:209-49. doi: <https://doi.org/10.3322/caac.21660>
 3. Brotherton JML, Wheeler C, Clifford GM, et al. Surveillance systems for monitoring cervical cancer elimination efforts: focus on HPV infection, cervical dysplasia, cervical screening and treatment. *Prev Med*. 2021;144:106293. doi: <https://doi.org/10.1016/j.ypmed.2020.106293>
 4. Instituto Nacional de Câncer. Diretrizes brasileiras para o rastreamento do câncer do colo do útero: volume 1 - Rastreamento organizado com teste molecular para detecção de DNA-HPV oncogênico [Internet]. Rio de Janeiro: Instituto Nacional de Câncer; [acesso 2025 jul 24]. Disponível em: https://ninho.inca.gov.br/jspui/bitstream/123456789/17858/3/Diretrizes%20para%20o%20Rastreamento%20do%20câncer%20do%20colo%20do%20útero_2025_completo.pdf
 5. Duarte DV. Perfil das mulheres ribeirinhas com infecção pelo papilomavírus humano, com ênfase nos tipos 16 e 18, em populações da Amazônia oriental [dissertação]. Belém: Universidade Federal do Pará; 2015.
 6. Damasceno HC, Cavalcante RL, Oliveira OP, et al. Caracterização da situação socioeconômica e identificação de fatores de risco para câncer cervical em comunidades ribeirinhas da Região Xingu-Pará. *RSD*. 2021;10:e51810515255. doi: <https://doi.org/10.33448/rsd-v10i5.15255>
 7. Grigoroglou M, Papafragou A. Interactive contexts increase informativeness in children's referential communication. *Dev Psychol*. 2019;55:951-966. doi: <https://doi.org/10.1037/dev0000693>
 8. Gauthier A, Kato PM, Bul KCM, et al. Board games for health: a systematic literature review and meta-analysis. *Games Health J*. 2019;8:85-100. doi: <https://doi.org/10.1089/g4h.2018.0017>
 9. Occa A, Stahl HM, Julien-Bell S. Helping children to participate in human papillomavirus-related discussions: mixed methods study of multimedia messages. *JMIR Form Res*. 2022;6(4):e28676. doi: <https://doi.org/10.2196/28676>
 10. Ruiz-López T, Sen S, Jakobsen E, et al. FightHPV: design and evaluation of a mobile game to raise awareness about human papillomavirus and nudge people to take action against cervical cancer. *JMIR Serious Games*. 2019;7(2):e8540. doi: <https://doi.org/10.2196/games.8540>
 11. Medeiros RKS, Ferreira Júnior MA, Pinto DPSR, et al. Modelo de validação de conteúdo de Pasquali nas pesquisas em enfermagem. *Rev Enferm Ref*. 2015;serIV(4):127-35. doi: <https://doi.org/10.12707/RIV14009>
 12. Teixeira E. Nascimento MHM. Pesquisa metodológica: perspectivas operacionais e densidades participativas. In: Teixeira E, organizadora. *Desenvolvimento de tecnologias cuidativo-educacionais* Porto Alegre: Moriá, 2020. (vol II).
 13. Whittemore R, Knafl K. The integrative review: updated methodology. *J Adv Nurs*. 2005;52(5):546-53. doi: <https://doi.org/10.1111/j.1365-2648.2005.03621.x>
 14. Joanna Briggs Institute. JBI Critical Appraisal Tools [Internet]. Adelaide: Joanna Briggs Institute; 2017 [acesso 2025 jul 24]. Disponível em: <https://jbi.global/critical-appraisal-tools>
 15. Conselho Nacional de Saúde (BR). Resolução nº 510, de 7 de abril de 2016. Dispõe sobre as normas aplicáveis a pesquisas em Ciências Humanas e Sociais cujos procedimentos metodológicos envolvam a utilização de dados diretamente obtidos com os participantes ou de informações identificáveis ou que possam acarretar riscos maiores do que os existentes na vida cotidiana, na forma definida nesta Resolução [Internet]. Diário Oficial da União, Brasília, DF. 2016 maio 24 [acesso 2024 abr 7]; Edição 98; Seção 1:44. Disponível em: http://bvsms.saude.gov.br/bvs/saudelegis/cns/2016/res0510_07_04_2016.html
 16. Page MJ, Moher D, Bossuyt PM, et al. Prisma 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ*. 2021;372:n160. doi: <https://doi.org/10.1136/bmj.n160>
 17. Davies C, Marshall HS, Zimet G, et al. Effect of a school-based educational intervention about the human papillomavirus vaccine on psychosocial outcomes among adolescents: analysis of secondary outcomes of a cluster randomized trial. *JAMA Netw Open*. 2021;4(10):e2129057. doi: <https://doi.org/10.1001/jamanetworkopen.2021.29057>
 18. Katz ML, Oldach BR, Goodwin J, et al. Development and initial feedback about a human papillomavirus (HPV) vaccine comic book for adolescents. *J Cancer Educ*. 2014;29(2):318-24. doi: <https://doi.org/10.1007/s13187-013-0604-8>
 19. Webster EM, Ahsan MD, Kulkarni A, et al. Building knowledge using a novel web-based intervention to promote HPV vaccination in a diverse, low-income population. *Gynecol Oncol*. 2024;181:102-9. doi: <https://doi.org/10.1016/j.ygyno.2023.12.005>
 20. Cruz GCV, Vasconcelos MGF, Maniva SJCF, et al. Construction and validation of an educational technology on human papillomavirus vaccine for adolescents. *Esc*



- Anna Nery. 2019;23(3):e20190050. doi: <https://doi.org/10.1590/2177-9465-EAN-2019-0050>
21. Oliveira MMC, Teixeira E, Ribeiro MNS, et al. Diga sim à vacina contra o Papilomavírus Humano: produção e validação de um guia ilustrado. *Rev Baiana Enferm.* 2023;37:e49470. doi: <https://doi.org/10.18471/rbe.v37.49470>
 22. Silva PGC, Ferreira IP, Vasconcelos LA, et al. Construction and validity of educational technology about the human papillomavirus vaccine for adolescents. *Rev Bras Enferm.* 2023;76(6):e20230048. doi: <https://doi.org/10.1590/0034-7167-2023-0048>
 23. Hofman R, Schiffrs PAWH, Richardus JH, et al. Increasing girls' knowledge about human papillomavirus vaccination with a pre-test and a national leaflet: a quasi-experimental study. *BMC Public Health.* 2013;13:611. doi: <https://doi.org/10.1186/1471-2458-13-611>
 24. Oliveira MHR, Aparício SL, Silva JAC, et al. Barriers to accessing cervical cancer screening and treatment in the Amazon region: a systematic review. *J Clin Med.* 2026;15(3):1206. doi: <https://doi.org/10.3390/jcm15031206>
 25. Raskurazhev A, Kuznetsova P, Khizhnikova AE, et al. Neuropoly: an educational board game to facilitate neurology learning. *Front Syst Neurosci.* 2021;15:688210. doi: <https://doi.org/10.3389/fnsys.2021.688210>
 26. Sousa C, Rye S, Sousa M, et al. Playing at the school table: systematic literature review of board, tabletop, and other analog game-based learning approaches. *Front Psychol.* 2023;14:1160591. doi: <https://doi.org/10.3389/fpsyg.2023.1160591>
 27. Epstein DS, Zemski A, Enticott J, et al. Tabletop board game elements and gamification interventions for health behavior change: realist review and proposal of a game design framework. *JMIR Serious Games.* 2021;9(1):e23302. doi: <https://doi.org/10.2196/23302>
 28. Silva Carvalho I, Mendes RCMG, Lima LHSS, et al. Effect of a board game on imprisoned women's knowledge about sexually transmitted infections: a quasi-experimental study. *BMC Public Health.* 2023;23:690. doi: <https://doi.org/10.1186/s12889-023-15646-3>
 29. Choi J, Gabay EK, Cuccaro PM. School teachers' perceptions of adolescent human papillomavirus (HPV) vaccination: a systematic review. *Vaccines (Basel).* 2024;12(4):361. doi: <https://doi.org/10.3390/vaccines12040361>
 30. Fu LY, Bonhomme LA, Cooper SC, et al. Educational interventions to increase HPV vaccination acceptance: a systematic review. *Vaccine.* 2014;32(17):1901-20. doi: <https://doi.org/10.1016/j.vaccine.2014.01.091>
 31. Mansfield LN, Vance A, Nikpour JA, et al. A systematic review of human papillomavirus vaccination among US adolescents. *Res Nurs Health.* 2021;44(3):473-489. doi: <https://doi.org/10.1002/nur.22135>
 32. Ifediora C, Veerman L, Azuik E, et al. Outcomes from integrating anti-cervical cancer teachings into the curriculum of high schools in a South-Eastern Nigerian State. *BMC Public Health.* 2022;22:1914. doi: <https://doi.org/10.1186/s12889-022-14231-4>
 33. Cates JR, Fuemmeler BF, Diehl SJ, et al. Developing a serious videogame for preteens to motivate HPV vaccination decision making: Land of Secret Gardens. *Games Health J.* 2018;7(1):51-66. doi: <https://doi.org/10.1089/g4h.2017.0002>
 34. Interaminense INCS, Oliveira SC, Leal LP, et al. Tecnologias educativas para promoção da vacinação contra o papilomavírus humano: revisão integrativa da literatura. *Texto Contexto Enferm.* 2016;25(2):e2300015. doi: <https://doi.org/10.1590/0104-07072016002300015>
 35. Drokow EK, Effah CY, Agboyibor C, et al. The impact of video-based educational interventions on cervical cancer, Pap smear and HPV vaccines. *Front Public Health.* 2021;9:681319. doi: <https://doi.org/10.3389/fpubh.2021.681319>

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