

VALIDATION OF EDUCATIONAL TECHNOLOGY FOR PREGNANT WOMEN AND THEIR PARTNERS ON THE PREVENTION OF VERTICAL TRANSMISSION OF SYPHILIS

Validação de tecnologia educacional para gestante e parceiro sobre prevenção da transmissão vertical da sífilis

Validación de tecnología educativa para mujeres embarazadas y sus parejas sobre la prevención de la transmisión vertical de la sífilis

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ABSTRACT

The objective was to develop and validate an educational booklet aimed at pregnant women and their partners on the prevention of vertical transmission of syphilis, with the goal of contributing to the strengthening of educational actions during prenatal care. This is a methodological study conducted in Conceição do Araguaia, Pará, which included the stages of layout design, evaluation of the educational technology regarding content and appearance by 7 specialists using previously validated instruments, as well as spelling review, readability analysis, and semantic evaluation with 15 pregnant women from the target audience. The technology showed high validity indices: 0.941 for content, an average greater than 0.95 for appearance, and 0.97 for semantic validation, indicating high agreement regarding the clarity, relevance, organization, and visual adequacy of the material. It is concluded that the educational technology proved adequate to support educational actions during prenatal care, contributing to improving care and preventing congenital syphilis

Keywords: Syphilis, Congenital. Educational Technology. Pregnant Women.

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RESUMO

Objetivou-se desenvolver e validar uma cartilha educativa voltada para gestantes e seus parceiros sobre a prevenção da transmissão vertical da sífilis, visando contribuir para o fortalecimento das ações educativas no pré-natal. Trata-se de um estudo metodológico realizado em Conceição do Araguaia, Pará, que compreendeu as etapas de diagramação, avaliação da tecnologia educacional quanto ao conteúdo e à aparência por 7 especialistas, mediante a utilização de instrumentos previamente validados, além de revisão ortográfica, análise de legibilidade e avaliação semântica junto a 15 gestantes do público-alvo. A tecnologia apresentou elevados índices de validade: 0,941 para conteúdo, média superior a 0,95 para aparência e 0,97 para validação semântica, indicando alta concordância quanto à clareza, relevância, organização e adequação visual do material. Conclui-se que a tecnologia educacional mostrou-se adequada para apoiar ações educativas no pré-natal, contribuindo para qualificar o cuidado e prevenir a sífilis congênita.

Palavras-chave: Sífilis Congênita. Tecnologia Educacional. Mulheres Grávidas.

RESUMEN

El objetivo era desarrollar y validar un folleto educativo dirigido a las mujeres embarazadas y sus parejas sobre la prevención de la transmisión vertical de la sífilis, con el fin de contribuir al refuerzo de las acciones educativas durante el periodo prenatal. Se trata de un estudio metodológico realizado en Conceição do Araguaia, Pará, que abarcó las etapas de maquetación, evaluación de la tecnología educativa en cuanto a contenido y presentación por parte de siete especialistas, mediante el uso de instrumentos previamente validados, además de la revisión ortográfica, el análisis de legibilidad y la evaluación semántica con quince mujeres embarazadas del público objetivo. La tecnología presentó altos índices de validez: 0,941 en cuanto al contenido, una media superior a 0,95 en cuanto a la presentación y 0,97 en la validación semántica, lo que indica una alta concordancia en cuanto a la claridad, la relevancia, la organización y la adecuación visual del material. Se concluye que la tecnología educativa ha demostrado ser adecuada para respaldar las acciones educativas durante el periodo prenatal, contribuyendo a mejorar la calidad de la atención y a prevenir la sífilis congénita.

Palabras clave: Sífilis Congénita. Tecnología Educacional. Personas Embarazadas.

INTRODUCTION

Congenital syphilis (CS) is a serious but preventable condition associated with fetal loss, stillbirths, neonatal deaths, and infections in newborns¹. Despite advances in diagnosis and treatment, congenital syphilis remains a significant public health problem. In 2024, 24,443 cases of congenital syphilis were recorded in Brazil, representing a significant incidence among live births and resulting in 183 deaths, which highlight a worrying infant mortality rate².

Congenital syphilis (CS) can be prevented with prenatal screening and timely treatment of the pregnant woman. Adequate monitoring during pregnancy is essential to prevent vertical transmission and protect both mother and baby^{1,3}. For intervention to be effective, it is crucial not only to adequately treat the mother and newborn, but also to ensure that the pregnant woman's sexual partners are properly tested and treated⁴.

The development, validation, and implementation of new information technologies in different health contexts are fundamental strategies, especially in the areas of sexual and reproductive health, with an emphasis on the prevention of Sexually Transmitted Infections (STIs), such as syphilis⁵. In this scenario, educational technologies play a central role in health promotion and the prevention of congenital syphilis, as they integrate teaching, research, and maternal and child care. In addition to improving healthcare work processes, they strengthen transformative educational practices that consider the emotional and cultural aspects of pregnant women, fostering dialogue, active participation, and continuous care from pre-conception onwards⁶⁻⁷.

Among the resources used, educational booklets stand out for expanding pregnant women's knowledge about the prevention of vertical transmission of syphilis, encouraging the adoption of health promotion practices and providing a better perception of the care received⁸. This technology is also relevant for stimulating autonomy in the learning process, allowing the target audience to access information independently and continuously⁹.

This study also aligns with Sustainable Development Goal (SDG) 3 - Good Health and Well-being of the UN 2030 Agenda, by contributing to the reduction of maternal mortality, prevention of avoidable newborn deaths, and expansion of access to sexual and reproductive health¹⁰. In this sense, it is justified by guiding pregnant women and their partners regarding the prevention, early diagnosis, and treatment of syphilis, with the aim of developing and validating an educational technology (ET) focused on the gestational period.

METHOD

This is a methodological study, developed in sequential stages for the elaboration and validation of an educational booklet. The written educational material was used as a resource to support communication in health, favoring the understanding of information, autonomy in care, and the possibility of rereading by the target audience¹¹. The methodological path was guided by the instrument construction model, structured in theoretical, empirical, and analytical procedures¹². The preliminary version was developed in Canva. The content was based on scientific literature and protocols from the Ministry of Health, guided by the principles of health literacy, with simple, objective information suitable for the target audience¹³.

For the evaluation of the content and appearance of the educational technology, seven nurses working in the Family Health Strategies (FHS) in the urban area of the municipality of Conceição do Araguaia, Pará, participated, encompassing the nine existing units, selected by convenience sampling. Validation was carried out using an online form (Google Forms), applied between November 2024 and February 2025, after signing the Informed Consent Form (ICF). Professionals with a municipal employment contract and a minimum of six months of service were included, excluding those on vacation, medical leave, or who did not respond to the instrument within 30 days.

The instrument was structured in three parts: characterization of the experts; content validation, carried out with the Instrument for Validation of Educational Content in Health (IVECH)¹⁴, composed of 18 items distributed in the domains of objectives, structure/presentation and relevance, with a Likert scale from 0 to 2; and appearance validation, conducted with the Instrument for Validation of Appearance of Educational Technologies in Health (IVAETH)¹⁵, using a five-point scale. Both instruments included space for suggestions from the evaluators.

The nurses from the Family Health Strategy (FHS) were invited after the study objectives were explained, and they received access to the booklet, the electronic form, and the informed consent form. The deadline for returning the forms was 20 days, extended by another 10 days, and two participants who did not respond within the established period were excluded.

Data analysis was based on descriptive statistics. For the IVECH, the Content Validity Index (CVI) was calculated for each item and domain, adopting a cutoff point of ≥ 0.78 , with 95% confidence interval estimates. In the appearance validation, the Appearance Validity Index (AVI) was obtained from the proportion of positive responses, adopting values equal to or greater than 0.78 as the validity criterion¹⁶. Statistical analyses and characterization of experts were performed using the R software.

After validation by experts, the ET was submitted to spelling and grammar review by a professional in the field of Letters, aiming to ensure linguistic adequacy and formal correctness of the text. No suggestions for changes regarding the content or appearance of the ET were recorded. The readability of the material was evaluated using the ALT algorithm – Textual Readability Analysis, a free *online* tool that uses formulas adapted to the Portuguese language to measure textual complexity, mainly considering sentence length and word complexity¹⁷.

Semantic validation was performed with 15 pregnant women undergoing prenatal care at Family Health Units (FHU) in the urban area of Conceição do Araguaia/PA, between February and April 2025. These women were selected by convenience sampling, as recommended in the literature for evaluating the comprehension and suitability of educational technologies for the target audience. Pregnant women over 18 years of age, linked to the FHS and available at the time of data collection were included; those who were illiterate or had visual impairments that prevented them from evaluating the printed material were excluded.

Data collection was carried out using a printed form, applied after the signing of the informed consent form. The instrument included the sociodemographic characterization of the participants and the semantic validation of the educational technology, based on an adapted instrument, structured in the blocks of organization, writing style, structure and motivation, evaluated on a four-point Likert scale, with space for suggestions¹⁸. Pregnant women received a printed version of the booklet for reading and assessment of their understanding of the content, in a private setting at the health units.

The data were organized in a spreadsheet and analyzed using the Semantic Validation Index (SVI), adopting as a minimum validity criterion values equal to or greater than 0.70, calculated per block and for the total instrument¹⁸. The suggestions presented by the participants were systematized to support any necessary adjustments to the material. The final version of the booklet was made available in PDF format to the nurses of the Family Health Strategy (FHS) in the municipality, as a tool to support health education actions in prenatal care.

The study was approved by the Research Ethics Committee of the Federal University of Tocantins, under the Certificate of Presentation of Ethical Appraisal (CPEA) No. 81338924.0.0000.5519 and Opinion No. 6.937.890. The generative artificial intelligence tool Copilot was used to refine the writing of some paragraphs of the introduction and discussion, and all content was reviewed and validated by the author, who assumes full responsibility for the originality and veracity of the text, in accordance with CNPq Ordinance 2.664/2026.

RESULTS

The literature points to the use of various educational technologies, such as apps, videos, and booklets, generally developed from literature reviews and focus groups, many of them validated by experts and/or the target audience, highlighting concerns about the quality of educational materials intended for pregnant women¹⁹. The development of an educational booklet was chosen in light of the identified gap regarding the validation of these materials in the context of prenatal care in Primary Health Care (PHC).

After defining the content, the text was written, illustrations were created, and the preliminary version of the booklet was laid out, comprising 36 pages. Content and appearance validation was performed by seven nurses, predominantly female, aged between 30 and 56 years, most with postgraduate specialization and extensive professional experience. Their years of experience ranged from 6 to 24 years, with most having more than eight years of experience in prenatal care and STI management. All evaluators reported experience in monitoring pregnant women with syphilis, which reinforces the suitability of the specialists' profile for validating the proposed educational technology.

Table 1 presents the CVI values and their respective 95% confidence intervals. A high degree of agreement was observed among the specialists, with 11 of the 18 items (61.1%) presenting a CVI equal to 1.00, indicating absolute consensus. The remaining items (38.9%) obtained a CVI of 0.857, a value higher than the recommended cutoff point (≥ 0.78), although with wider confidence intervals, suggesting variation in the judges' perceptions, especially regarding subjective aspects such as stimulation of reflection, encouragement of behavior change, accessible language, and the level of interest generated. The scale-level content validity index based on the average (S-CVI/Ave) was 0.944, demonstrating excellent content validity. Overall, the results indicate high content validity, demonstrating that the ET is appropriate and consistent with the proposed objectives.

Table 1 - Distribution of items according to the Content Validity Index of the “Health Educational Content Validation Instrument”.

Item	IVC*	95% CI†
1. Does the content fully address the proposed topic?	1.000	[1.000; 1.000]
2. Is the material suitable for the teaching and learning process?	0.857	[0.598; 1.116]
3. Does the information presented clarify any doubts about the topic?	1.000	[1.000; 1.000]
4. Does the content encourage reflection on the topic discussed?	0.857	[0.598; 1.116]
5. Does the material encourage behavioral changes in the target audience?	0.857	[0.598; 1.116]
6. Is the language used accessible and appropriate for the target audience?	0.857	[0.598; 1.116]
7. Is the language appropriate for the format of educational material?	1.000	[1.000; 1.000]
8. Does the content use interactive language, encouraging engagement in the educational process?	1.000	[1.000; 1.000]
9. Is the information presented accurate and based on evidence?	1.000	[1.000; 1.000]
10. The material communicates the information in an objective and clear manner.	1.000	[1.000; 1.000]
11. Does the content clarify any potential questions the target audience may have?	1.000	[1.000; 1.000]
12. Is the information relevant and necessary for understanding the topic?	1.000	[1.000; 1.000]
13. Is the sequence of ideas logical and does it facilitate understanding?	0.857	[0.598; 1.116]
14. Is the topic addressed up-to-date and aligned with current guidelines?	1.000	[1.000; 1.000]
15. Is the text size appropriate for easy reading and comprehension?	0.857	[0.598; 1.116]
16. Does the material stimulate learning and content assimilation?	1.000	[1.000; 1.000]
17. Does it significantly contribute to expanding knowledge in the field?	1.000	[1.000; 1.000]
18. Does the topic spark the target audience's interest?	0.857	[0.598; 1.116]

*Content Validity Index; †Confidence Interval.

Source: Research data, 2025.

Table 2 presents the CVI values by domain of the CVIES and the total value of the instrument. The “Objectives” domain obtained an IVC of 0.914 (95% CI: 0.759–1.000), indicating high agreement among the evaluators. The “Structure/Presentation” domain presented an CVI of 0.957 (95% CI: 0.879–1.000), demonstrating robustness in the validation of the organization and clarity of the material. The “Relevance” domain achieved an IVC of 0.952 (95% CI: 0.866–1.000), confirming the pertinence and contribution of the content. The total CVI was 0.941 (95% CI: 0.598–1.000), reinforcing the overall validity of the instrument. The results indicate high agreement among the experts and consistency in the validation of the ET.

Table 2 - Content Validity Index of the domains analyzed in the “Health Education Content Validation Instrument”.

Domains	IVC*	IC + 95%	Situation
Objectives	0.914	0.759 < CVI < 1.000	Little or no variation between raters.
Structure/Presentation	0.957	0.879 < CVI < 1.000	Little or no variation between raters.
Relevance	0.952	0.866 < CVI < 1.000	Little or no variation between raters.
IVCES Total	0.941	0.598 < CVI < 1.000	Little or no variation between raters.

*Content Validity Index; †Confidence Interval.

Source : Research data, 2025.

For validation of appearance (AVI) the IVAETH was used. As presented in Table 3, 10 of the 12 evaluated items achieved an AVI equal to 1.00, indicating unanimous consensus among the specialists regarding the visual adequacy of the material. The items related to the harmony between figures and text and the size of the illustrations presented an AVI of 0.857, with wider confidence intervals, suggesting lower agreement among the evaluators regarding these aspects. Even so, the values remained above the cutoff point recommended in the literature (≥ 0.78). Overall, the results demonstrate an excellent evaluation of the appearance of the educational technology, especially regarding the adequacy of the illustrations, arrangement of the visual elements, and graphic organization of the material, with a mean AVI greater than 0.95, confirming its appearance validity.

Table 3 - Items evaluated in AVITES regarding the appearance of illustrations in educational materials.

Item	VAT*	95% CI†
1. Are the illustrations appropriate for the target audience?	1.000	[1.000 ; 1.000]
2. Are the illustrations clear and easy to understand?	1.000	[1.000 ; 1.000]
3. Are the illustrations relevant for the target audience to understand the content?	1.000	[1.000 ; 1.000]
4. Are the colors in the illustrations appropriate for the type of material?	1.000	[1.000 ; 1.000]
5. Are the shapes of the illustrations appropriate for the type of material?	1.000	[1.000 ; 1.000]
6. Do the illustrations depict the daily life of the target audience?	1.000	[1.000 ; 1.000]
7. Is the arrangement of the figures in harmony with the text?	0.857	[0.598; 1.116]
8. Do the figures used illustrate the content of the educational material?	1.000	[1.000 ; 1.000]
9. Do the illustrations help in presenting the theme and are they in a logical sequence?	1.000	[1.000 ; 1.000]
10. Are there an adequate number of illustrations in the educational material?	1.000	[1.000 ; 1.000]
11. Are the illustrations the right size in the educational material?	0.857	[0.598; 1.116]
12. Do illustrations help change the behaviors and attitudes of the target audience?	1.000	[1.000; 1.000]

*Appearance Validity Index; †Confidence Interval.

Source: Research data, 2025.

In the spelling validation, specific adjustments were made related to spelling, accentuation, agreement, and text standardization, with the aim of improving the clarity and understanding of the content.

The readability analysis indicated that the material is well-suited to an audience with schooling ranging from the end of elementary school to the beginning of high school, with an average readability score of 9.2. Variation was observed among the sections of the booklet (levels from 5 to 13), highlighting simpler and more complex sections. Regarding classification, 96.97% of the leaflets showed high readability and 3.03% average readability, with the majority classified as simple or extremely simple text. The material demonstrated high textual accessibility, predominantly targeting the adolescent age group, especially those aged 14 to 15.

Validation with the target audience involved 15 pregnant women. Regarding age, the average was 28.2 years, with values ranging from 18 to 38 years. In terms of education, most pregnant women had completed high school (53.3%). Other participants had a bachelor's degree (20.0%), incomplete primary education (13.3%), postgraduate studies (6.7%), and incomplete high school education (6.7%). Regarding marital status, most pregnant women declared themselves married (46.7%). Other participants reported being single (33.3%) or in a stable relationship (20.0%). Regarding the number of children, most pregnant women reported having between 1 and 3 children (73.3%). Three participants (20.0%) reported having no children, while only one pregnant woman (6.7%) declared having more than three children. When asked if they had ever heard of syphilis, the majority of pregnant women (86.7%) answered affirmatively, while only two (13.3%) stated they had never heard of the infection. Regarding participation in educational activities, 46.7% of pregnant women

reported having participated in some activity with this focus, while 53.3% stated they had never participated. A total SVI of 0.97 was achieved, above the recommended minimum of 0.70, as shown in Table 4.

Table 4 - Results of the Semantic Validation Indices assigned to the thematic blocks of the instrument applied to the target audience.

Items	Semantic Validation Index
Block 1 – Organization	0.95
Block 2 – Writing Style	0.98
Block 3 – Structure	0.98
Block 4 - Motivation	0.99
GLOBAL TOTAL	0.97

Source : research data, 2025.

In Block 1 – Organization, item 1.6 ('The number of pages is appropriate') presented an SVI of 0.73, corresponding to the lowest index among the evaluated items, although still above the recommended cutoff point (≥ 0.70). Considering that the booklet was organized into thematic blocks and includes interactive resources to facilitate reading and understanding of the content, no need for adjustments to the length of the material was identified.

DISCUSSION

With the aim of reducing low levels of health literacy among the target audience, it is essential to carefully evaluate the educational materials used, ensuring that the information is presented in a clear, accessible, and understandable manner²¹. Health literacy is a central element for individuals to access, interpret, and apply knowledge related to their own health care, contributing to better clinical outcomes. In this sense, educational technologies emerge as effective strategies, especially when directed at groups in situations of social vulnerability²². Given this relevance, the present study focused on the development of an educational technology based on the principles of health literacy, with the aim of ensuring a comprehensible, culturally sensitive material capable of promoting the autonomy of pregnant women and their partners in the care process.

Validation of educational technologies is an essential step to ensure that these instruments truly promote quality learning, with safety, effectiveness, and suitability to the context in which they will be applied²³. Among the procedures adopted, content validation stands out, carried out through the judgment of experts or judges, who evaluate aspects such as clarity, relevance, and scope of the materials. However, this process must be articulated with other strategies that guarantee the technology's ability to measure what it proposes to measure, which is crucial for the production of reliable instruments in the field of nursing²⁴. Although not mandatory, the participation of the target audience in the validation of educational technologies is widely recommended²⁵, as it favors scientific rigor, reinforces the safety and uniformity of the content, and contributes significantly to the achievement of the established educational objectives²⁶.

In this context, the relevance of educational technologies in addressing congenital syphilis stands out, a condition that still represents a significant challenge for public health and demands the strengthening of actions for prevention, diagnosis, and timely treatment²⁷. This condition, although preventable, still represents a significant health problem, especially due to the deficiencies observed in the quality of prenatal care, which compromise early diagnosis and timely treatment of syphilis, contributing to the persistence of vertical transmission²⁸.

Thus, pregnancy presents a strategic opportunity for educational actions aimed at preventing congenital syphilis. This is because many pregnant women have limited knowledge about the modes of transmission, possible complications for the baby, and available diagnostic methods, revealing weaknesses in the guidance received during prenatal care²⁹. However, it is important to highlight that educational actions aimed at preventing

syphilis should also be encouraged in the pre-conception period and among sexual partners, promoting timely diagnosis, appropriate treatment, and interruption of the transmission chain.

Furthermore, the absence or inadequacy of treatment for gestational syphilis intensifies this scenario, being one of the main determinants for the occurrence of the congenital form. In this sense, early initiation of therapy is capable of significantly reducing the risks of fetal impairment³⁰. Supporting this perspective, the importance of raising awareness among pregnant women and their partners about the possible consequences of syphilis for the child's health is highlighted³¹. Thus, the urgency of investing in educational strategies that contribute to raising awareness among pregnant women and their partners is evident, promoting actions aimed at prevention, early diagnosis, and proper management of syphilis. Such strategies should include guidance on risk factors and the social and cultural determinants related to sexual and reproductive health³². Furthermore, strengthening public awareness through educational actions and interventions aimed at expanding diagnosis and improving the quality of case registration is fundamental³³.

In this context, care-educational technologies present themselves as promising alternatives to improve health actions. The creation of materials such as low-cost booklets, with accessible language and adapted to local realities, can complement the instruments already offered by the Ministry of Health, favoring the engagement and understanding of pregnant women during prenatal care³⁴.

However, for these technologies to be truly effective, it is essential that they overcome linguistic, cultural, and accessibility barriers, as well as stimulate interactivity and the adoption of more conscious care practices. In this sense, it is necessary to rethink their conception, considering planning and application aligned with the reality and needs of the target audience. In the field of Nursing, the production of new technological solutions has intensified as a response to the demands of daily professional life. In this process, praxis assumes a central role, being understood as a reflective practical action, guided by theory, that makes it possible to transform reality through critical understanding³⁵.

Supporting this perspective, evidence suggests that well-planned educational interventions are effective in increasing pregnant women's knowledge about syphilis. One study demonstrated that educational activities promoted greater understanding of the infection, favoring adherence to the VDRL test, early initiation of treatment, and dissemination of information among partners and other pregnant women³⁶. Complementarily, a methodological study with pregnant women diagnosed with syphilis demonstrated that the use of a validated booklet promoted improvements in the participants knowledge, attitudes, and preventive practices, highlighting the effectiveness of these materials when developed with rigorous scientific criteria³⁷.

Finally, it is worth highlighting that content validation is essential to ensure the credibility of an assessment as a whole, requiring the adoption of a structured process, based on evidence and guided by established practices³⁸. This practice is part of a methodological rigor that aims to ensure that educational instruments faithfully reflect the proposed objectives, in addition to providing greater reliability to the results obtained.

CONCLUSIONS

The validation results demonstrated high acceptability and relevance of the educational technology, with validity indices exceeding the cut-off points established in the literature, both by experts and the target audience. Statistical validation showed consensus regarding the clarity, organization, thematic relevance, and visual suitability of the material, which reinforces its potential applicability in the context of the Family Health Strategy (FHS) and other maternal and child care settings.

Making the educational booklet available in health units, in both printed and digital formats, can broaden access to information and strengthen educational practices during prenatal care, promoting autonomy, critical awareness, and shared responsibility among pregnant women and their partners in the prevention of congenital syphilis.

Therefore, it is concluded that the educational technology developed and validated in this study presents itself as a tool to support health education, with the potential to contribute to the reduction of congenital syphilis indicators. Its adoption as a complementary resource in reproductive health education actions is recommended, as well as its adaptation and application in other contexts and populations. Furthermore, the material can be used as an educational resource by health professionals, expanding its potential application in health promotion practices. Future studies could expand the analysis of the material's effectiveness in larger-scale interventions and in different sociocultural realities, strengthening the role of educational technologies in comprehensive maternal and child health care.

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