

# Construction and validation of an educational technology for the prevention of congenital syphilis

Construção e validação de uma tecnologia educacional para prevenção da sífilis congênita  
Elaboración y validación de una tecnología educativa para prevención de sífilis congénita

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## Abstract

**Objective:** To construct and validate the educational booklet entitled "How to prevent the transmission of syphilis from mother to child? Let's learn!".

**Methods:** Methodological, quasi-experimental study conducted according to the following steps: development of the educational booklet; face and content validation with 22 judges and 11 women diagnosed with syphilis during pregnancy; and evaluation of the effects on the Knowledge, Attitude and Practice (KAP) of 41 pregnant women before and after reading the educational booklet.

**Results:** The booklet was submitted to face and content validation with an Overall Content Validity Index (CVI) of 0.96, a total Cronbach's alpha of 0.955. The validation of judges by the Suitability Assessment of Materials was considered "superior". As for validation by the target audience, it obtained 100% concordance and an overall CVI of 1.00. According to the Flesch Reading Ease (FRE) test, reading was considered Very Easy or Easy. There was an increase in the percentage of women classified as having appropriate knowledge, attitude and practice after reading the booklet. This change in practice was statistically significant ( $p=0.002$ ), demonstrating that reading the educational booklet proved to be effective in promoting behavioral changes.

**Conclusion:** The material constructed is reliable and validated by specialists and the target audience and effective in promoting the improvement of the KAP of pregnant women with the aim to prevent vertical transmission of syphilis.

## Resumo

**Objetivo:** Construir e validar a cartilha educativa intitulada "Como prevenir a transmissão da sífilis de mãe para filho? Vamos aprender!".

**Métodos:** Pesquisa metodológica, associada a um estudo quase experimental, conduzida de acordo com as seguintes fases: elaboração da cartilha educativa; validação de aparência e conteúdo com 22 juízes e 11 mulheres com diagnóstico de sífilis na gestação; e a avaliação dos efeitos no Conhecimento, Atitude e Prática de 41 gestantes antes e após a leitura da cartilha educativa durante.

**Resultados:** Validou-se a cartilha quanto à aparência e conteúdo, com o Índice de Validade de Conteúdo (IVC) Global de 0,96, Alfa de Cronbach total de 0,955 e validação dos juízes pelo Suitability Assessment of Materials considerada "superior". Quanto à validação pelo público-alvo, obteve 100% de concordância e um IVC global de 1,00. O Flesch Legibility Test considerou a leitura Muito Fácil ou Fácil. Verificou-se um aumento da porcentagem de mulheres classificadas com um conhecimento, atitude e prática adequados após a leitura da cartilha. Essa mudança na prática foi estatisticamente significativa ( $p=0,002$ ), demonstrando que a leitura da cartilha educativa se mostrou efetiva para promover mudanças comportamentais.

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Conflicts of interest: nothing to declare.

**Conclusão:** O material construído é confiável e validado por especialistas e pelo público-alvo, como também eficaz para promover a melhoria do CAP das gestantes visando à prevenção da transmissão vertical da sífilis.

## Resumen

**Objetivo:** Elaborar y validar una cartilla educativa titulada "¿Cómo prevenir la transmisión de la sífilis de madre a hijo? ¡Vamos a aprender!".

**Métodos:** Investigación metodológica, asociada a un estudio cuasi experimental, llevada a cabo de acuerdo con las siguientes fases: elaboración de la cartilla educativa, validación de la apariencia y contenido por 22 jueces y 11 mujeres con diagnóstico de sífilis en el embarazo, y evaluación de los efectos en el conocimiento, las actitudes y la práctica de 41 mujeres embarazadas antes y después de la lectura de la cartilla educativa.

**Resultados:** Se validó la cartilla con relación a la apariencia y contenido, con un Índice de Validez de Contenido (IVC) global de 0,96, un alfa de Cronbach total de 0,955 y la validación de los jueces mediante el Suitability Assessment of Materials fue considerada "superior". Respecto a la validación del público destinatario, se obtuvo un 100 % de concordancia y un IVC global de 1,00. A través del Flesch Legibility Test, la lectura se consideró "muy fácil" o "fácil". Se verificó un aumento del porcentaje de mujeres clasificadas con conocimiento, actitud y práctica adecuados después de la lectura de la cartilla. En la práctica, este cambio fue estadísticamente significativo ( $p=0,002$ ), lo que evidencia que la lectura de la cartilla educativa demostró ser efectiva para promover cambios de comportamiento.

**Conclusión:** El material elaborado es confiable y fue validado por especialistas y por el público destinatario, así como también es eficaz para promover la mejora de los CAP de las mujeres embarazadas con el objetivo de prevenir la transmisión vertical de la sífilis.

## Introduction

Congenital syphilis is an important public health problem and a determining factor in the elevation of maternal and perinatal morbidity and mortality indicators, despite being easily diagnosed and totally avoidable when the treatment of pregnant women and their partner is performed properly.

In Brazil, the infant mortality rate for syphilis was 7.2 per 100,000 live births in 2017. The number of cases of congenital syphilis is increasingly incident. There has been a progressive increase in the incidence rate of congenital syphilis, jumping from 2.0 cases/thousand live births in 2007 to 8.6 cases/thousand live births in 2017.<sup>(1)</sup> Therefore, creating new strategies to act on the real gaps that hinder the control of this problem is essential, such as educational technologies for the awareness and empowerment of women and their partners regarding the importance of their active participation in that process.

Nurses are the main responsible for the low risk prenatal care in the National Health System (Brazilian SUS). Among other skills, acting as a health promoter is intrinsic in nurses' training. The process of empowering pregnant women and their partners in relation to congenital syphilis requires the use of educational strategies to make informed choices and contribute to healthy behavior. In this scenario, several resources, methodologies and techniques can be used to facilitate the educational process.

Among educational technologies, booklets can be an efficient means of communication for health promotion. In addition to contribute to users' empowerment, when using booklets, users can act as multipliers by presenting the material to other subjects in the community. Booklets are printed materials useful for describing health-related issues. They can be used as a health promoting instrument to facilitate the educational process and improve readers' knowledge, attitude and practice (KAP).<sup>(2,3)</sup>

In a broad search in the literature, there was a shortage of methodological studies on congenital syphilis, with a predominance of epidemiological works. Added to this problem are the magnitude and repercussions of congenital syphilis, the need to empower pregnant women to control this condition and the importance of educational technologies aimed at this target audience.

Thus, the construction, validation and measurement of the effects of the educational booklet in the KAP of pregnant women about the theme are relevant for implementing this technology as a methodological resource for educational practices performed by nurses in prenatal care. In addition, they enable the multiplication of knowledge from one pregnant woman to another, the sensitization of the partner and the fixation of acquired knowledge, since the booklet can be consulted as many times as necessary.

Given the above, the objective was to construct and validate the educational booklet entitled "How to prevent the transmission of syphilis from mother to child? Let's learn!".

## Methods

Methodological, quasi-experimental study developed in three steps: development of the educational booklet; face and content validation; and evaluation of the effects of using the booklet as an educational strategy in prenatal care for improving the KAP of pregnant women about the prevention of vertical transmission of syphilis. All steps were developed between June and September 2016.

For the construction of this educational material, were followed the steps of bibliographic survey (selection, chronological and coherent organization of the content); development of educational material (development of the text and illustrations, diagramming); and validation of the material by experts and representatives of the target audience.<sup>(4)</sup>

The booklet content was based on five publications from the Ministry of Health<sup>(5-9)</sup> and 20 scientific articles selected through an integrative review. Then, the main information and illustrations relevant to the theme were defined for their systematic and sequential organization.

The theoretical and methodological references used highlight the elements considered in the development of printed educational materials with the aim to provide a better understanding for readers.<sup>(10,11)</sup> The illustrations and diagramming of the booklet were carried out by a trained professional designer.

After the first version was constructed, the booklet underwent a face and content validation process by a group of 22 judges<sup>(12)</sup> recruited and selected according to the criteria described by Jasper<sup>(13)</sup> and through the network sampling. The 55 judges who reached the minimum score were selected through the information system (Lattes Platform) of the portal National Council for Scientific and Technological Development (Portuguese acronym: CNPq) and invited to participate in the study through an invitation letter sent by email or in person. Those who agreed to participate received the instrument for the validation of figures and texts according to three criteria: clarity of language; practical relevance and theoretical relevance; and the Suitability Assessment of Materials (SAM) of the

instrument for evaluation of the understanding of educational material.<sup>(14)</sup>

For analysis of the content validity of the booklet, the Content Validity Index (CVI) was used. It was calculated based on two mathematical equations: I-CVI - Level Content Validity Index and the S-CVI - Scale Content Validity Index.<sup>(15)</sup> The CVI varies from 0 to 1 and the item is considered valid when the concordance between judges is  $\geq 0.80$ .<sup>(16)</sup>

The exact binomial distribution test was used to estimate the proportion of judges who agreed with the relevance of items described in the booklet and the proportion of 0.8 concordance was considered as relevant. For the analysis of internal consistency in the opinion of judges about the questions, the Cronbach's alpha coefficient test was adopted with a minimum acceptable value of 0.7.<sup>(17)</sup>

For the analysis of SAM, which consists of 22 items distributed in six evaluation domains – content, appropriate language for the population, graphic illustrations, layout and typography, stimulation for learning and motivation, and cultural appropriateness - each item was classified as “superior”, “adequate” or “not suitable”.<sup>(18)</sup>

Subsequently, a descriptive and qualitative assessment of judges' suggestions was made. Most were accepted and the version to be implemented with the target audience was established.

For content and face validation with the target audience, an instrument was applied to evaluate the following domains of the booklet: comprehension; attractiveness; self-efficacy; cultural acceptability; and persuasion of educational material. In addition, the concordance and relevance of each page were evaluated.<sup>(19)</sup> This step was performed in a referral maternity hospital in the state of Ceará, in which a sample of 11 women was randomly selected<sup>(20,21)</sup> from the following inclusion criteria: pregnant women or postpartum women with VDRL reagent; pregnant women undergoing prenatal care or puerperal women in the institution's shared accommodation. Women with mental, cognitive problems or any disabling disease that hindered reading the booklet and communicating with the researcher were excluded. The validation of the booklet with individuals who experience or have already experi-

enced the theme addressed is necessary, since they are the focus of the educational activity that will be performed.<sup>(22)</sup> Data were analyzed from the Concordance Index (CI) among participants, and items that obtained a minimum CI of 80% were considered as validated.<sup>(15)</sup>

The Flesch Reading Ease (FRE) test was applied to ensure the use of a coherent language for the target audience. For the application of the test, the Automatic Grammatical Reviewer for Portuguese – ReGra, which identifies the sentence's syntactic structure, was used. An FRE index of 50 to 100% was accepted for this booklet, allowing an easy/very easy reading and corresponding to a minimum educational level of fourth grade of primary school.<sup>(23)</sup>

Then, the researcher's reading of the booklet with pregnant women was used as an educational intervention during prenatal care, sensitizing them to the importance of preventing vertical transmission of syphilis. The effects of this intervention were evaluated by comparing the results of participants' KAP before the intervention, immediately after the intervention and seven days after the intervention by telephone contact.

The population considered for this stage of the study was composed of pregnant women served at a health unit that hosts integrated and multidisciplinary actions of teaching, research and extension and offers free care to the population located in the city of Fortaleza (state of Ceará). The inclusion criterion were all pregnant women undergoing prenatal care at the selected health service during the data collection period. Women with mental, cognitive problems or any disabling disease that hindered reading the booklet and communicating with the researcher were excluded. Therefore, a sample of 41 pregnant women was considered, as estimated by McNemar's Chi-square test. Initially, 41 pregnant women participated in the pretest and immediate posttest. However, in the posttest of the 7<sup>th</sup> day, 38 pregnant women participated, since three did not answer the telephone contact made repeatedly at different times of the day.

The posttest and pretest had the same questions, which enabled to discover the effects of the educational intervention when comparing the perfor-

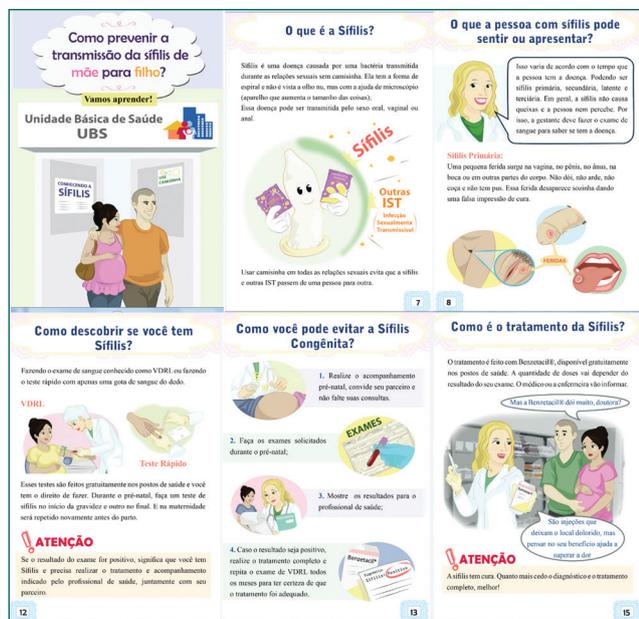
mance of participants. The KAP survey constructed and validated for this study followed some definitions, namely: knowledge was classified as appropriate when the woman obtained four to seven correct answers in a total of seven questions; the attitude was appropriate when the pregnant woman answered six Likert-type items with five ordinal levels (strongly agree, partially agree, I have no opinion, partially disagree and strongly disagree) and showed a favorable attitude in at least four of them; and practice was appropriate when pregnant women were asked about the implementation of four recommendations from the Ministry of Health for the prevention of congenital syphilis, and they answered to have performed at least three of them. Such data received an exploratory analysis.

The study was approved by the Research Ethics Committee of the Universidade Federal do Ceará under number 1.615.683 and Resolution number 466/12 was followed. This technology is registered with the Brazilian Book Chamber under number ISBN 978-65-00-00278-2.

## Results

During the construction of the educational booklet, care was taken to make it accessible and suitable for the target audience by organizing the relevant information in a simple and objective way. Illustrations were used to make the information more attractive and enlightening, enabling the development of educational material that facilitates the health education process by approaching the content in a logical sequence and adapted to readers' cultural knowledge. The content covered was organized from the following domains: Presentation; What is syphilis?; What can the person with syphilis feel or present?; What is congenital syphilis?; How to find out if you have syphilis? How can you avoid congenital syphilis? How is syphilis treatment?; What is the importance of treating the partner?; We will summarize the information in the booklet through a Question&Answer section; Closing the booklet; Do you have any doubt? Write it down here! To make the booklet even more attractive and bring it

closer to the reality of the target audience, characters representing a pregnant woman with her partner and a nurse were created and they established dialogues/interacted between them and the reader. The A5-size booklet (148x210 mm) was prepared, containing 22 pages in its pre-validation version and 25 in the post-validation version, with 14 pages for content, five pretext pages and six post-text pages. Figure 1 shows some pages of the final version of the booklet.



**Figure 1.** Pages in the booklet entitled “How to prevent the transmission of syphilis from mother to child? Let’s learn!”

In the face and content validation phase, most pages of the booklet obtained CVI higher than 0.80, except for the page referring to the treatment of syphilis, regarding the clarity of the language, in which changes in the language were made according to judges’ recommendations (Table 1).

In the three dimensions, CVI mean values were above 0.8, thereby validating the content of the educational booklet. The overall CVI of the booklet was 0.96, which is quite satisfactory and makes it possible to consider it as validated in terms of content. The total Cronbach’s alpha value of the booklet was 0.955, demonstrating excellent homogeneity between the responses of participants.

Among the pertinent suggestions made by judges regarding the booklet, the main ones were replacement of technical terms; reformulation and addition of illustrations; simplification and rewriting of phrases to make the language clearer; definition of acronyms or necessary technical terms; addition of some information they deemed necessary.

As for the analysis according to SAM, the general evaluation and that of each item separately revealed the material was considered “superior” (89.6%).

Six pregnant women and five puerperal women participated in the validation with the target audience. They evaluated the booklet positively and was achieved 100% concordance regarding clarity and relevance on all pages. When asked about the de-

**Table 1.** Distribution of the CVI, binomial distribution test of items and Cronbach’s alpha dimensions of language clarity, practical relevance and theoretical relevance of each page of the educational booklet

	Language clarity			Practical relevance			Theoretical relevance		
	CVI *	Binomial test (p-value)	Cronbach's alpha	CVI *	Binomial test (p-value)	Cronbach's alpha	CVI *	Binomial test (p-value)	Cronbach's alpha
Cover	0.91	0.154	.877	0.95	0.048	.904	0.95	0.048	.904
Presentation	0.95	0.048		0.91	0.154		0.95	0.048	
Page 7/Definition of syphilis	0.95	0.048		1	0.007		1	0.007	
Page 8/Signs and symptoms	0.95	0.048		1	0.007		1	0.007	
Page 9/Signs and symptoms	0.91	0.154		1	0.007		1	0.007	
Page 10/Definition of congenital syphilis	0.82	0.543		1	0.007		1	0.007	
Page 11/Diagnosis	1	0.007		1	0.007		1	0.007	
Page 12/Prevention	1	0.007		1	0.007		1	0.007	
Page 13/Prevention	0.95	0.048		0.95	0.048		0.95	0.048	
Page 14/Treatment	0.77	0.457		0.91	0.154		0.91	0.154	
Page 15/Partner treatment	0.86	0.332		1	0.007		1	0.007	
Page 16/Questions and answers	0.95	0.048		1	0.007		1	0.007	
Page 17/Questions and answers	0.91	0.154		1	0.007		1	0.007	
Page 18/Final word	0.95	0.048		0.95	0.048		0.95	0.048	

CVI\* = I-CVI

gree of relevance, all pages were classified as very relevant. Thus, the overall CVI value was 1.00.

The assessment of the instrument regarding understanding, attractiveness, self-efficacy, cultural acceptability and persuasion of educational material achieved excellent results according to the analysis of participants' responses, as shown in table 2.

**Table 2.** Distribution of responses obtained by the dissertation instrument applied to the target audience according to the evaluation domains of the educational booklet

Domains (n=11)	Yes n(%)	No n(%)
<b>Comprehension</b>		
Make comments on what the booklet says	11(100)	--
Can you mention what are the risks of syphilis during pregnancy?	11(100)	--
Can you mention the care that must be taken to avoid congenital syphilis?	11(100)	--
Are there parts of the booklet that you did not understand?	--	11(100)
<b>Attractiveness</b>		
Do you want to read the booklet until the end?	11(100)	--
<b>Self-efficacy</b>		
Do you believe you can follow what the booklet shows?	11(100)	--
Do you need to know anything else to follow the booklet's explanation?	1(9.1)	10(90.9)
<b>Cultural acceptability</b>		
Is there anything in this booklet that you found aggressive, bad or uncomfortable?	--	11(100)
<b>Persuasion</b>		
Do you intend to follow the information in the booklet to avoid syphilis during pregnancy and transmission to your baby?	11(100)	--
Do you think that if you had to inform a woman how to prevent the transmission of syphilis to the baby, you would inform as shown in the booklet?	11(100)	--

Therefore, this appears to be a reliable and validated educational material for application to pregnant women with the aim to prevent the vertical transmission of syphilis. Regarding the readability

index of the booklet text, the reading of its domains was classified as "easy" or "very easy", with FRE results varying between 59 and 78.

Finally, the effects on the KAP of pregnant women were evaluated after application of the educational booklet. As shown in table 3, a significant number of women, 10 (24.4%), had inappropriate knowledge in the pretest. However, after the educational intervention, the knowledge of all pregnant women increased both in the immediate posttest, 41 (100%), and the posttest on the 7<sup>th</sup> day, 38 (100%), and the difference between mean values of appropriateness of the level of knowledge was statistically significant.

Previously, most women had an appropriate attitude, but there was no statistically significant association with the practice before the intervention (p = 0.347). Although a predominance of women with an appropriate attitude towards the prevention of vertical transmission of syphilis was observed, not necessarily they present positive actions in practice.

The practice was evaluated only in the pretest and in the posttest on the 7<sup>th</sup> day, since it would not be feasible to investigate it right after the intervention, because there would not be enough time for the occurrence of changes. Thus, a significant number, 19 (46.3%), with inappropriate practice was identified in the pretest. After the educational intervention, there was a considerable improvement that was considered statistically significant (p = 0.01) and demonstrated the effectiveness of reading the educational booklet for the promotion of behavioral changes, especially regarding the adoption of healthy sexual practices.

**Table 3.** Distribution of the number of women and the average appropriateness of the KAP level on the prevention of vertical transmission of syphilis before the intervention with the reading of the educational booklet, immediately after the intervention and seven days after the intervention

	Pre-test n(%)	Immediate posttest n(%)	Difference between means	p-value*	Posttest on 7 <sup>th</sup> day n(%)	Difference between means	p-value*
<b>Knowledge</b>							
Appropriate	31(75.6)	41(100)	0.24	0.01	38(100)	0.18	0.005
Inappropriate	10(24.4)	--			--		
<b>Attitude</b>							
Appropriate	40(97.6)	41(100)	0.24	0.32	38(100)	0.26	0.32
Inappropriate	1(2.4)	--			--		
<b>Practice</b>							
Appropriate	22(53.6)	--			35(92.1)	0.31	0.01
Inappropriate	19(46.4)	--			3(7.9)		

\*Student's T test

## Discussion

Educational technologies are creative, reliable and useful tools for health education, contribute directly to the improvement of the teaching-learning process and encourage healthy practices.<sup>(24,25)</sup>

The ability to perform self-care depends, in part, on the ability to read and understand health information. In this context, written information has been used as a complementary strategy for health education.<sup>(26)</sup>

Educational interventions based on structured knowledge and information aimed at the clientele are made possible from the development of quality educational materials.<sup>(25)</sup> In a quasi-experimental study, a significant difference between the groups in the posttest was identified, with superior cognitive learning results for the experimental group that participated in an educational activity with the use of a booklet on care for premature babies.<sup>(27)</sup>

Health knowledge is a fundamental requirement for self-care, which depends on the empowerment of the individual, who needs to know the necessary actions for the prevention of a certain disease, consider these actions important and have awareness and motivation to acquire new habits of life. Hence the importance of knowledge, although it is not necessarily a predictor of self-care. In a study aimed at identifying the KAP of patients undergoing hemodialysis on self-care with arteriovenous fistula (AVF), it was found that knowledge and attitude can influence the client's practice related to the care of the fistula.<sup>(28)</sup>

In the context of syphilis during pregnancy, there is a deficit in the knowledge of pregnant women about the disease repercussions for maternal and fetal health. This demonstrates the need for new technologies that are effective in raising their awareness and improving the knowledge, attitude and practice of pregnant women about the prevention of vertical transmission of syphilis. By promoting their empowerment, enabling the modification of their perception of health and adoption of health promotion practices, it collab-

orates for greater control of this condition during pregnancy.

Knowledge is inherent to the prevention and adherence to the treatment of syphilis, and the lack of knowledge makes the problem of the disease even greater, causes feelings and attitudes that hinder its prevention and cure process.<sup>(29)</sup>

Furthermore, the use of educational booklets has been effective in promoting better knowledge, attitude and practice of readers. In a randomized clinical trial, pregnant women in the intervention group were compared to the control group, and they presented appropriate knowledge, attitude and practice regarding the use of regional food, with a higher prevalence of the appropriate level on the 7<sup>th</sup> and 30<sup>th</sup> day after the intervention.<sup>(2)</sup>

Limitations of this study were the sample size and the application of the educational intervention in only one health unit, therefore, not enough to generalize the findings and be representative of pregnant women in Brazil.

## Conclusion

The educational booklet proved to be a validated material in terms of face and content, demonstrating that the constructed material is reliable and validated for the application to pregnant women during prenatal care with the aim to prevent the vertical transmission of syphilis. Furthermore, the educational intervention based on the reading and availability has improved participants' knowledge and practice, and these changes remained after seven days of the intervention.

## Collaborations

Costa CC, Gomes LFS, Teles LMR, Mendes IC, Oriá MOB and Damasceno AKC contributed to the design of the project, analysis and interpretation of data, writing of the article, relevant critical review of the intellectual content and final approval of the version to be published.

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