DOI: 10.15253/2175-6783.20181933808
www.revistarene.ufc.br

Original Article

Construction and validation of behavioral technology to monitor child development milestones

Construção e validação de tecnologia comportamental para acompanhamento dos marcos do desenvolvimento infantil

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Objective: to describe the process of construction and validation of behavioral technology to follow child development milestones. **Methods:** methodological study, construction and validation of behavioral technology, in the form of reminders, through the Delphi Technique, with the participation of 10 judges specialized in the field of child health and in validation of technologies. In order to analyze the content validity of the reminders, the Content Validity Index was used, with agreement of at least 80.0% to guarantee the validation of the material. **Results:** most of the judges were nurses and had a doctorate degree. The items were validated, obtaining 90.0% approval by the expert judges. The overall agreement validation index was 0.87; thus, the technology was considered adequate. **Conclusion:** the construction and validation of the behavioral technology can favor professionals' adherence to the use of the Child Health Handbook to monitor child development.
Descriptors: Child Development; Primary Health Care; Validation Studies; Nursing.

Objetivo: descrever o processo de construção e validação de tecnologia comportamental para acompanhamento dos marcos do desenvolvimento infantil. **Métodos:** estudo metodológico, de construção e validação de tecnologia comportamental, na forma de lembretes, por meio da Técnica Delphi, com participação de 10 juízes especialistas na área de saúde da criança e em processos de validação de tecnologias. Para analisar a validade de conteúdo dos lembretes, utilizou-se o Índice de Validade de Conteúdo, com concordância de no mínimo 80,0%, para garantir a validação do material. **Resultados:** a maioria dos juízes era enfermeiro e possuía titulação de doutor. Os itens foram validados, obtendo-se 90,0% de aprovação pelos juízes especialistas. O índice de validação de concordância global foi 0,87, sendo considerada adequada a tecnologia. **Conclusão:** a construção e validação da tecnologia comportamental podem favorecer a adesão de profissionais à utilização da Caderneta de Saúde da Criança para acompanhamento do desenvolvimento infantil.
Descritores: Desenvolvimento Infantil; Atenção Primária à Saúde; Estudos de Validação; Enfermagem.

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Received: Sep. 25th 2018; Accepted: Nov. 28th 2018.

Introduction

Child development is a fundamental part of human development. It is an active and unique process of each child, expressed by continuity and changes in motor, cognitive, psychosocial and language skills, with progressively more complex acquisitions in the functions of daily life and in the exercise of the social role[1].

Adequate follow-up of children's growth and development, from zero to two years of age, enables the early identification of changes that require a timely approach by health professionals[2]. Therefore, it is essential to use instruments that assist professionals in detecting possible changes in child development[3].

In this perspective, the Brazilian Ministry of Health proposed that child growth and development be evaluated through a child's card, based on annotations, in order to systematize the follow-up and guarantee comprehensive care. Therefore, the Child Health Card was created in 1984 to subsidize the surveillance of basic child health actions. From 1984 to 2003, this card was revised and modified, and some milestones of child development were added, and it became known as the Child Health Handbook[4] and to be the main instrument for monitoring child health in primary care[5-7].

In order for the Child Health Handbook to serve as a guiding tool for health promotion, professionals must use it in an adequate manner, with correct and complete information[4-7]. In this perspective, a study points to the unsatisfactory use of the Child Health Handbook and the need for investment in the training of professionals for effective use thereof[6].

Therefore, a behavioral technology, of the reminder type, can contribute to improve this practice based on behavior change, since all human behavior is determined and that a stimulus produces a response, being possible to predict and control the behaviors of individuals through the contingency of human reinforcements[8]. Behavioral technology, understood as the systematic application of scientifically tested behavioral principles for problem solving in different areas, is based on Skinner's conception of human behavior, which presents reinforcement as a stimulus to increase the occurrence of a behavior[9].

In this way, the use of materials, such as posters, reminders, telephone and electronic communication, act as effective forms of professional awareness to improve the quality of work. These instruments can therefore be understood as behavioral technologies, thus favoring the professional's contact with the health service user, and resulting in improvements in the work process and assistance provided to the population[10]. Among the behavioral technologies, for this study, we decided to use reminders due to the low cost and applicability, contributing to the elaboration of new models of educational intervention[11].

The proposed behavioral technology has the potential to improve the adherence of primary health care nurses to the use of the Child Health Handbook to monitor child development. Thus, the objective was to describe the process of construction and validation of a behavioral technology to follow child development milestones.

Methods

This is a methodological study carried out between January and June 2018, using the Delphi Technique, according to which the selection of the sample of judges is considered non-random and intentional and is justified by the interest in selecting specialists in the subject under study. These are pre-selected according to the engagement with the subject in question. The search for the expert judges was done through the Lattes Platform, based on the production profile of the researchers and the areas of knowledge. In a complementary way, the snowball sampling method was used.

In order to participate in the validation process, the judge should obtain a score equal to or higher than

five points, according to a study[12] that considers academic qualifications, professional experience, published articles and guidelines in the area of interest.

For the definition of the number of judges, for this study, we observed the recommendation[13] that proposes a minimum of 5 and a maximum of 10 judges. As for the selection of judges, initially, an invitation was sent for fifteen participants, via electronic mail, with information of the study, the Informed Consent Form and the validation instrument. However, due to the absence of responses after 15 days, ten new invitations were made, totaling 25 invited judges. A period of 14 days was stipulated for the return of the material forwarded. At the end, ten judges answered within the established period, composing the sample of this study, totaling seven nurses and three physicians, of whom four professionals worked with healthcare and three, in the teaching area.

The Delphi Technique was applied in three rounds. The first one started after acceptance of the judges and was composed of two open questions, whose answers enabled the judges to express their opinions on the issues they considered important to approach in the reminders. Thus, the responses of the first stage contributed to the construction of the reminders.

Subsequently, a literature review was carried out in the databases: Latin American and Caribbean Literature in Health Sciences, Scientific Electronic Library Online and Medical Literature Analysis and Retrieval System online, using a combination of controlled descriptors, terms contained in the structured vocabulary Descriptors in Health Sciences. The descriptors were: *atenção primária à saúde/*primary health care, *puericultura/*child care, *desenvolvimento infantil/*child development. After completing this process, the content of the reminders was elaborated.

The images used are under CC0 Public Domain license, being totally free of copyrights, being taken from a bank of free images. The graphic design of the reminders was divided into subtitle, a short text that referred to the importance of assessing the milestones of child development and images with high level of attraction.

The validity of the content was evaluated by the Delphi Technique, a procedure capable of seeking opinions from a group of experts regarding future events and when there is incomplete knowledge about the nature or components of a given situation. Agreement level was set at 80.0%, according to studies on consensus[14-15]. For the use of this technique, the judges were asked to express judgment regarding each of the proposed items, this being the second round of the study. The options were I strongly disagree, I disagree, I do not agree nor disagree, I agree, I strongly agree.

In the validation instrument, a blank space was provided for criticisms, suggestions or modifications in each item. The instrument was composed of eight topics, distributed in objectives, content, language, relevance, illustration, layout, motivation for reading and culture. With the instruments in hand, the data obtained were compiled in the Statistical Package for the Social Sciences, version 20.0.

Statistical analysis of concordance was performed by adjusting the proportions of the judges who agreed with the pertinence of the reminders. The data were presented by means of proportions and means. Therefore, in the first round of application of the Delphi Technique, through the opinion of the judges, the construction of the reminders began. In the second round, three items obtained agreement less than 80.0%, requiring, therefore, a new appreciation by the judges, which occurred through the third round of validation, with the participation of all the judges. The total period between the first and third rounds of the Technique, with the completion of the construction of the reminders, was six months.

In order to analyze the validity of the content of the reminders, we used the Content Validity Index (CVI), calculated on the basis of two mathematical equations, namely the I-CVI (item-level content validity index) and the S-CVI/Ave (scale-level content validity index). This index measures the judges' agreement on certain aspects of the instrument and its items[16]. In

this study, I-CVI was defined as the content validity index of the individual items, calculated from the division between the number of positive responses to a given criterion of validation of the reminders and the total number of responses to the item. The S-CVI/Ave is understood as the average content validation indexes for a given set of criteria for validating reminders. Finally, the S-CVI Global (overall content validity index) was also calculated, which represents the mean I-CVI for the criteria for validation of the reminders, according to the evaluations of the ten specialists.

The research was conducted in accordance with ethical standards and approved by the Research Ethics Committee of the Regional University of Cariri, according to nº 2388778 and Certificate of Presentation for Ethical Appreciation nº 79718317200005055.

Results

The reminders were built with the participation of ten professionals working in the area of child health, who were female, being seven nurses and three physicians. Among them, there were five PhDs, three masters and two specialists. With regard to the current occupation, four worked in the area of healthcare, three engaged in healthcare and teaching activities and three worked in the teaching area. It is noteworthy that, of the total number of judges, three had experience in the process of elaboration and validation of health technologies.

Figure 1 presents the results related to the first round of the Delphi Technique, corresponding to the survey, with the judges, of the content to be addressed in the reminders.

First round responses	**n (%)**
Importance of the Child Health Handbook for follow-up of child development milestones	
It is important to guide the practitioner during the evaluation and conduction of childcare consultations, helping to identify delays in child development	8 (80.0)
It is an instrument that favors communication, health education, surveillance, child health promotion	1 (10.0)
It is essential for monitoring child development and serves as support for the diagnosis of child development	4 (40.0)
It is possible to identify changes in the anthropometric measures of the child that reflect in the growth and development	5 (50.0)
Excellent tool in the process of child care, which helps and directs the practitioner, helping to prevent diseases related to growth and development	1 (10.0)
Main complications it can identify	
Motor, neurological and endocrine problems	2 (20.0)
Malnutrition, occurrence of immunological and preventable diseases, delayed growth and autism	5 (50.0)
It may show early developmental disorders	8 (80.0)
Disorders related to changes in weight (low weight, malnutrition, obesity), cephalic perimeter (microcephaly, hydrocephaly)	6 (60.0)
Cognitive and motor deficits	4 (40.0)

Figure 1 – Distribution of the judges' responses to the first round of the Delphi Technique

Figure 2 presents the results of the second round of application of the Delphi Technique, with eight topics, of which five presented agreement above 80.0%, and only three topics had a low agreement index, namely Language, Illustration and Layout.

The reminders (Figure 3) were developed from the following aspects observed by the judges: importance of early diagnosis of changes in child development; role of practitioners in assessing child development; verification and annotation of data in the Child Health Handbook; and role of primary health care professionals in monitoring the child's growth and development.

Topics	n (%)
Objectives	
Is the information/content consistent with the daily needs of the target audience?	10 (100.0)
Is the information/content important to the work of the target audience?	10 (100.0)
Does the technology invite and/or instigate behavior and attitude change?	8 (80.0)
Is it a tool that can be used by the scientific milieu of the area?	10 (100.0)
Can it promote reflection on the importance of evaluating child development?	9 (90.0)
Does the information in the reminders encourage behavior change?	8 (80.0)
Can it be introduced as support or supplementary material during the childcare consultation?	10 (100.0)
Content	
Is it suitable for nurses who work in childcare?	9 (90.0)
Does it provide information on the importance of evaluating child development?	10 (100.0)
Is the text clear and objective?	10 (100.0)
Is the information scientifically accurate?	10 (100.0)
Are the contents varied and sufficient to achieve the goals of the reminders?	8 (80.0)
Language	
Is the information clear and understandable when considering the level of experience of the target audience?	10 (100.0)
Does the style of the text match the level of knowledge of the target audience?	10 (100.0)
Is the information in agreement with the spelling norms?	7 (70.0)
Is the information well structured?	10 (100.0)
Is the writing attractive?	10 (100.0)
Relevance	
Do the sentences portray key aspects that should be reinforced during childcare consultations?	8 (80.0)
Do the reminders encourage the nurse to improve practice in childcare consultations?	8 (80.0)
Are the reminders suitable for use with nurses working in childcare?	10 (100.0)
Are the reminders adequate and can they be used as a mediating instrument in health education?	10 (100.0)
Is the theme current and relevant?	10 (100.0)
Illustration	
Are the illustrations relevant to the content of the reminders?	7 (70.0)
Do the illustrations express the information intended to be transmitted, being easy to understand?	8 (80.0)
Do the illustrations remind the target audience of the purpose of the reminders?	9 (90.0)
Layout	
Is the presentation of reminders attractive?	9 (90.0)
Is the content presented in letter size and font suitable for reading?	6 (60.0)
Does the font make it easier to read the material?	7 (70.0)
Is the text layout adequate?	10 (100.0)
Motivation	
Does the content arouse interest for reading?	10 (100.0)
Is the content motivating and encourages the reader to improve the practice?	9 (90.0)
Culture	
Is the material appropriate to the socio-cultural level of the target audience?	10 (100.0)

Figure 2 – Distribution of the agreement index of judges in evaluating objectives, content, language, relevance, illustration, layout, motivation and culture of reminders

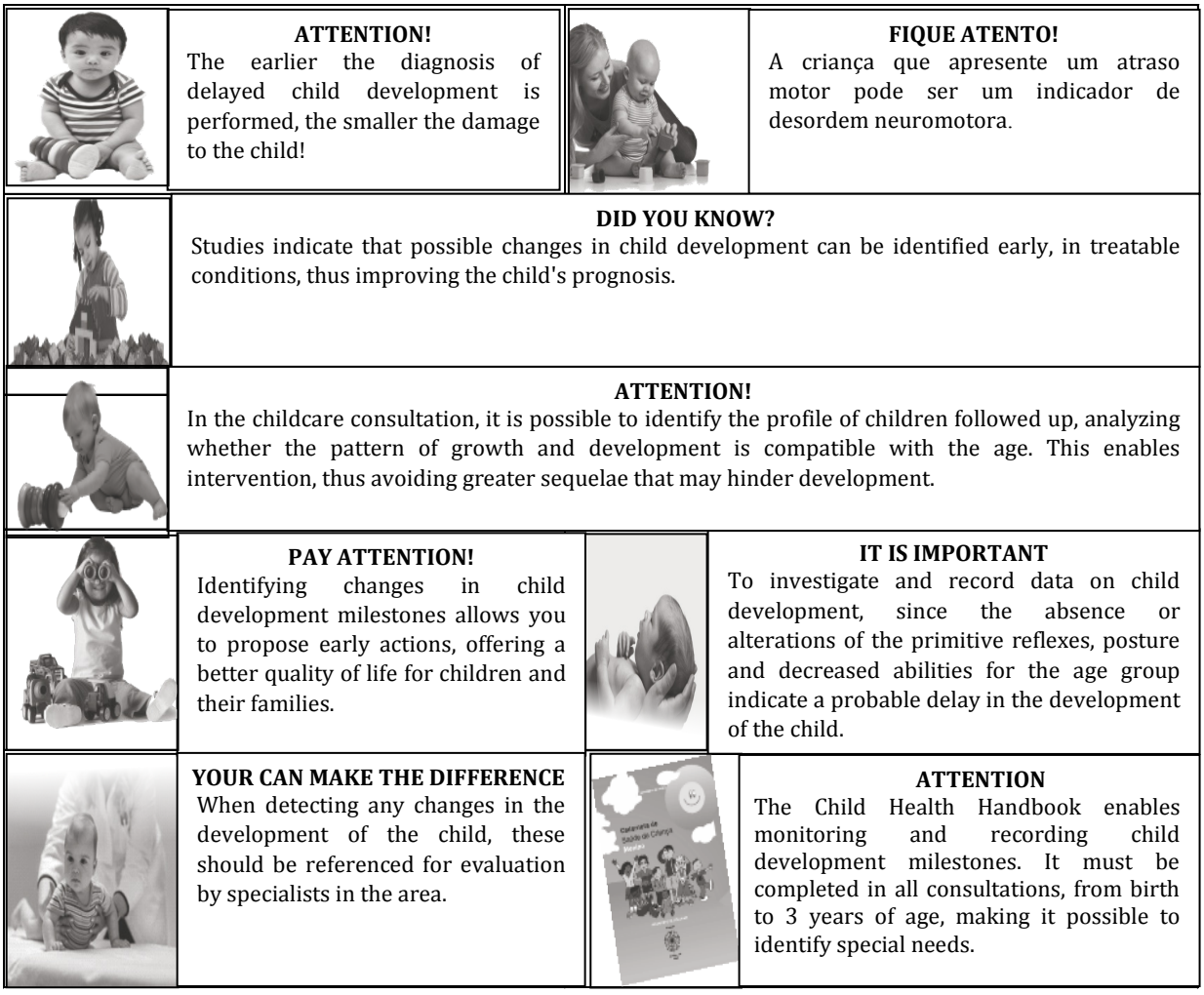

Figura 3 – Lembretes para adesão de enfermeiros da atenção primária à saúde para utilização da Caderneta de Saúde da Criança para acompanhamento dos marcos do desenvolvimento infantil

In relation to the distribution of content validity indexes (CVI) of each topic, based on the judges' analysis, CVI was below 80.0% in language (0.73), illustration (0.79) and layout (0.73). So, the third round of the Delphi Technique was performed for the necessary adjustments. After improvement of the material, the reminders were approved by 90.0% of the judges. The overall CVI, which in the second round was 0.83, reached 0.87 in the third round, thus obtaining gold standard at the end of the validation with judges, and the behavioral technology of reminder type was considered to be validated. Regarding the CVI of each topic evaluated in the material, it was observed an increase of the aspects, with values greater than 0.85, in the third round of evaluation, after the corrections. The changes suggested by the judges were adopted, which improved the quality of the material. With the modification of the requested phrases, inclusion of new contents and reformulation of the design of the reminders, the material was sent again for appreciation of the content by judges, obtaining a satisfactory result in the final version.

Discussion

A limitation of the study was the non-validation of reminders by specialists in the area of graphic design. However, the validated behavioral technology, based on scientific criteria, has proved to be a strategy with the potential to support adequate professional practices in the context of child development surveillance.

The literature points to the unsatisfactory use of the Child Health Handbook, as well as the need for qualification of health professionals for adequate use thereof[6]. A study carried out in the northeast region of Brazil showed underutilization of the Child Health Handbook and lack of motivation of primary care professionals in using it[17].

Study has been carried out from the use of behavioral technologies to change professional behavior[18]. In this perspective, the technology constructed and validated in this study has an innovative character in nursing, and may constitute a potential instrument for changing attitudes regarding the evaluation of child development by primary health care professionals.

Validation of content by judges has been carried out by researchers in the evaluation of technologies, being this process relevant for improvement and reformulation of information, replacement of terms and illustrations[19-20]. As for the illustrations, they should be attractive and enable objective communication[17]. In addition, the layout should reach high level of attention, so that it arouses interest of reading the proposed material[18]. In relation to the language used in materials subjected to validation, should be clear and understandable by the target audience and may be of practical relevance[19].

Research that validated printed material have also used the CVI to validate the content of the study material and had to undergo adjustments until the validated final version was reached, which demonstrates the importance of performing this step for the elaboration of a quality material[16-19]. This process of adapting behavioral technology to the judges' suggestions is also referred to in other studies, in which reformulations of information, terms and illustrations have also been carried out, as established in the literature[17-20].

From the premise that human behavior can undergo changes through stimulus and reinforcement[9], we believe in the potential of the behavioral technology developed in this study, since it can modify the professional practice of primary health care nurses regarding the use of the Child Health Handbook for the monitoring of child development.

Conclusion

The construction and validation of behavioral technology of reminder type with a view to favoring the adherence of professionals to the use of the Child Health Handbook met the criteria established in the Delphi Technique, resulting in a relevant instrument for behavior change in the evaluation of child developmental milestones.

Collaborations

Souza MAF and Damasceno SS collaborated in the writing of the article, critical review of the intellectual content and final approval of the version to be published. Cruz RSBLC and Viana MCA contributed to data analysis and interpretation, and article writing. Silva AVS assisted in the relevant critical review of the intellectual content and final approval of the version to be published. Oliveira DR collaborated in design, data analysis and interpretation.

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