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Review

Educational Technologies aimed at promoting parental care of premature newborns at home: an integrative review

Tecnologias educacionais para promoção do cuidado parental do recém-nascido prematuro no domicílio: revisão integrativa

Tecnologías Educativas para la promoción del cuidado parental del recién nacido prematuro en el domicilio: revisión integradora

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Abstract

Objective: To identify scientific evidence about Educational Technologies aimed at promoting parental care of premature newborns at home. **Methods:** Integrative review based on primary studies published in full, in all languages, with no defined time frame, in the following databases: National Library of Medicine; Scopus, Web of Science, Embase and *Biblioteca Virtual em Saúde Brasil*. The articles were screened using the Rayyan application. The included studies were duly read and entered into the *Red Internacional de Enfermería en Salud Ocupacional* form, from which the following data were extracted: author, year of publication, country, language, specifications of the target group, study design, level of evidence, objective, type of technology and outcome. The analysis of the results was based on Merhy's classification of technologies. **Results:** Of the twenty-two studies included in the review, there was a predominance of educational technologies categorized as Smartphone apps, in addition to thematic educational approaches based on relationships. Twenty-one technologies met the needs of the study participants satisfactorily, and only one revealed insecurity among the target audience. **Conclusion:** Educational Technologies were vital to support the transition of premature babies from hospital to home and served as an instrument aimed at promoting care, with a high level of satisfaction among the participants.

Descriptors: Educational Technology; Infant, Premature; Caregivers; Home Care Services; Transitional Care.

Whats is already known on this?
Educational technologies play a significant complementary role in improving premature newborn care, including low-cost techniques that can be applied by parents and caregivers at home.

What this study adds?
It provides scientific evidence on the use of soft, soft-hard and hard technologies aimed at promoting the care of premature newborns in the home context.

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Resumo

Objetivo: *Identificar as evidências científicas acerca das Tecnologias Educacionais para promoção do cuidado parental do recém-nascido prematuro no domicílio.* ***Métodos:*** *Revisão Integrativa realizada a partir de estudos primários publicados na íntegra, em todos os idiomas, sem recorte temporal, nas bases de dados: National Library of Medicine; Scopus, Web of Science, Embase e Biblioteca Virtual em Saúde Brasil. Os artigos foram triados por meio do aplicativo Rayyan. Os estudos incluídos foram lidos e inseridos no formulário da Red Internacional de Enfermería en Salud Ocupacional, cujos dados extraídos foram: autor, ano da publicação, país, idioma, especificações do público, desenho do estudo, nível de evidência, objetivo, tipo de tecnologia e desfecho. A análise dos resultados foi embasada a partir da classificação das tecnologias de Merhy.* ***Resultados:*** *Dos vinte e dois estudos incluídos para a revisão, houve predomínio das Tecnologias Educacionais do tipo aplicativos de Smartphone e de abordagens educacionais temáticas baseadas nas relações. Vinte e uma tecnologias atenderam de forma satisfatória aos participantes dos estudos, apenas uma revelou insegurança pelo público-alvo.* ***Conclusão:*** *As Tecnologias Educacionais foram fundamentais para apoiar a transição de bebês prematuros do hospital para casa e serviram como instrumento de promoção dos cuidados, com elevado nível de satisfação dos participantes.*

Descritores: *Tecnologia Educacional; Recém-Nascido Prematuro; Cuidadores; Serviços de Assistência Domiciliar; Cuidado Transicional.*

Resumén

Objetivo: *Identificar evidencias científicas sobre Tecnologías Educativas para promover el cuidado parental del recién nacido prematuro en el domicilio.* ***Métodos:*** *Revisión integradora realizada a partir de estudios primarios publicados íntegramente, en todos los idiomas, sin marco temporal, en las bases de datos: National Library of Medicine; Scopus, Web of Science, Embase y Biblioteca Virtual em Saúde Brasil. La selección de los artículos se realizó a través de la aplicación Rayyan. Los estudios incluidos fueron leídos e insertados en el formulario de la Red Internacional de Enfermería en Salud Ocupacional, con extracción de los siguientes datos: autor, año de publicación, país, idioma, especificaciones del público, diseño del estudio, nivel de evidencia, objetivo, tipo de tecnología y resultado. El análisis de los resultados se basó en la clasificación de tecnologías de Merhy.* ***Resultados:*** *De los veintidós estudios incluidos para la revisión, hubo predominio de Tecnologías Educativas como aplicaciones para Smartphone y enfoques educativos temáticos basados en las relaciones. Veintiuna tecnologías sirvieron satisfactoriamente a los participantes del estudio, sólo una reveló inseguridad entre el público objetivo.* ***Conclusión:*** *Las Tecnologías Educativas fueron fundamentales para apoyar la transición de los bebés prematuros del hospital al domicilio y sirvieron como instrumento para promover el cuidado, con un alto nivel de satisfacción de los participantes.*

Descriptores*: Tecnología Educativa; Recién Nacido Prematuro; Cuidadores; Servicios de Atención de Salud a Domicilio; Cuidado de Transición.*

INTRODUCTION

Declared to be a global public health problem, prematurity is the leading cause of neonatal deaths. Brazil ranks 10th among countries with the highest number of premature births. According to the Brazilian Unified Health System's Information Technology Department (Portuguese Acronym: DATASUS), there were 314,348 premature births in 2019 across the country. [1-3]

In turn, the birth of premature newborns has a variable incidence, resulting from social, biological, ethnic, behavioral factors, among others.[4] The arrival of premature newborns (PTN) is defined as a potentially stressful event for parents due to the long periods of hospitalization in neonatal units, leading to expectations and uncertainties about the home care that will be provided after hospital discharge.[5-6]

In view of the above, the hospital discharge planning process must be based on the provision of clear, concise and easy-to-understand guidelines regarding the continuity of care at home. In this perspective, educational technologies (ET) come into the picture, as they can contribute to complementing the information, simplifying the routine and reducing the insecurity of parents and family members.[7]

ET are techniques, processes and devices applied to generate knowledge and collaborate in the teaching-learning process. They act as a facilitating agent that provides reflections on new forms of education in the context of health education. They favor the development of safety and the practical application of scientific knowledge. They can be used in different formats: interviews, simulations, videos, counseling, slideshows, manuals, notebooks, educational games, websites, booklets, software, among others, providing innovative ways of exchanging knowledge.[8-9]

Given the importance attached to the maintenance of PTN's health and the quality of home care provided by parents and family members, technologies and health education activities must be combined in order to ensure effective follow up and support. However, given the gaps in knowledge related to the continuity of care at home, mediated by the use of educational technologies, the study aims to identify scientific evidence about educational technologies aimed at promoting parental care of PTN at home.

METHODS

Integrative review (IR) developed in six research stages: elaboration of the research question; definition of the databases and criteria for inclusion and exclusion of studies; definition of the information to be extracted; evaluation by two independent reviewers of the studies that make up the final sample; interpretation of the included studies; and presentation of the review or synthesis of knowledge.[10] The IR protocol is registered in the Open Science Framework (OSF), and can be accessed via the following link: https://doi.org/10.17605/OSF.IO/BUVG8 e DOI: 10.17605/OSF. IO/BUVG8.

To define the research, the PICo strategy[11] was considered, represented by: (P) patient – "*Pais*" (Parents), "*Cuidadores de Recém-Nascido Prematuro*" (Caregivers Infant, Premature); (I) intervention – "*Tecnologia Educacional*" (Educational Technology) e (Co) context – "*Serviços de Assistência Domiciliar*" (Home Care Services), which resulted in the following research question: "What are the healthcare educational technologies available to promote parental care of premature newborns at home?"

The construction of the search strategy of studies was carried out in the first stage, based on searches performed at the *Descritores em Ciências da Saúde* (DeCS) and the Medical Subject Heading (MeSH), through the *Biblioteca Virtual em Saúde* (BVS), combined with the use of the Boolean operators "OR" and "AND", according to the specificities of each database. Chart 1 shows the controlled and non-controlled descriptors used, as well as the replication of the search strategy used for each database consulted.

Chart 1. Controlled and non-controlled descriptors used, and search strategy applied in the databases. Teresina, PI, Brazil, 2023.

MeSH		
P	Controlled	Infant, Premature, Preterm Infant, Neonatal Intensive Care, Infant Care.
	Non-controlled	Prematurity.
I	Controlled	Educational Technology, Methods, Patient Education, Mobile Apps, Instructional Technology, Digital Health, Health Informatics, Distance learning, Health Education,
	Non-controlled	Educational Material, Online Platforms, Technology-enhanced Learning, E-learning, Online Platforms,
Co	Controlled	Home Care, Home Health Care, Home Nursing, Nursing Care, Patient Education,
	Non-controlled	Caregiving, Patient Instruction, Patient Self-care, Health Coaching
DeCS		
P	Controlled	*Recém-nascido Prematuro, Bebê Prematuro.*
	Non-controlled	*Bebê pré-termo.*
I	Controlled	*Tecnologia Educacional, Telemedicina, Métodos, Educação em Saúde.*
	Non-controlled	*Material educativo*
Co	Controlled	*Serviços de Assistência Domiciliar, Assistência Domiciliar, Cuidados de Enfermagem.*
Search Strategy		
MEDLINE/Pubmed		
(("infant, premature" OR "prematurity" OR "Preterm Infant" OR "Intesive Care, Neonatal" OR "infant care") AND ("Educational Technology" OR "Educational Material" OR methods OR "Health Education")) AND ("home care" OR "home health care" OR "home nursing" OR "nursing care" OR "caregiving" OR "patient education" OR "patient instruction" OR "patient self-care" OR "health coaching")		
Scopus		
(TITLE-ABS-KEY ("Infant, Premature" OR "prematurity" OR "preterm infant" OR "neonatal intensive care" OR "infant care" AND TITLE ABS-KEY ("educational technology" OR "telemedicine" OR "mobile apps" OR "online platforms" OR "instructional technology" OR "digital health" OR " health informatics" OR "health education" AND TITLE-ABS-KEY ("home care" OR "home health care" OR "home nursing" OR "nursing care" OR "caregiving" OR "patient education" OR "patient instruction" OR "patient self-care OR "health coaching"**))**		
Web of Science		
((ALL= ("infant, premature" OR "prematurity" OR "preterm infant" OR "neonatal intensive care" OR "infant care")) AND ALL= ("Educational Technology" OR "Educational Material" OR "telemedicine" OR "Health Education")) AND ALL= (('home care' OR 'home health care' OR 'home nursing' OR 'nursing care' OR 'caregiving' OR 'patient education' OR 'patient instruction' OR 'patient self-care'))		
Embase		
('premature infant'/exp OR 'premature infant' OR 'prematurity'/exp OR 'prematurity' OR 'preterm infant'/exp OR 'preterm infant' OR 'neonatal intensive care'/exp OR 'neonatal intensive care' OR 'infant care'/exp OR 'infant care') AND ('educational technology' OR 'technology-enhanced learning' OR 'e-learning' OR 'telemedicine' OR 'mobile apps' OR 'online platforms' OR 'distance learning' OR 'instructional technology' OR 'digital health' OR 'health informatics' OR 'health education') AND ('home		

care' OR 'home health care' OR 'home nursing' OR 'nursing care' OR 'caregiving' OR 'patient education' OR 'patient instruction' OR 'patient self-care' OR 'health coaching')
BVS
("Recém-Nascido Prematuro" OR "Bebê Prematuro" OR "Bebê pré-termo") AND ("Tecnologia Educacional" OR "Material Educativo" OR Telemedicina OR Métodos OR "Educação em Saúde") AND ("Serviços de Assistência Domiciliar" OR "Assistência Domiciliar" OR "Cuidados de Enfermagem")

Key: MeSH - Medical Subject Headings; DeCS – *Descritores em Ciências da Saúde*; MEDLINE – National Library of Medicine; BVS – *Biblioteca Virtual em Saúde Brasil*.
Source: elaborated by the authors, 2023.

The search strategy was carried out on January 21, 2023, through the *Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES), with access via the *Comunidade Acadêmica Federada* (CAFe). The searches were carried out in the following information sources: Medical Literature Analysis and Retrieval System on-line (MEDLINE) via PubMed; Scopus (Elsevier); Web of Science and Excerpta Medica dataBASE (Embase); and the *Biblioteca Virtual de Saúde* (BVS).

Regarding the eligibility criteria, primary studies that presented ET aimed at the care of PTNs in the home context, without language or timeframe restrictions, were adopted. Editorials, theses, dissertations, review articles, and articles in which it was not possible to identify the educational technology were all excluded. The screening and selection of studies occurred from January to March 2023 with the use of the Rayyan QCRI software by two reviewers who worked independently and data masking was used during the screening process to ensure greater methodological rigor.[12]

To extract and synthetize information from the included studies, the *Red de Enfermería en Salud Ocupacional* (RedENSO Internacional) form[13] was adapted. Thus, the following information was extracted: author, year of publication, country, language, number of people covered, specification of people for whom the technology was intended, study design, level of evidence, objective, type of technology and outcome.

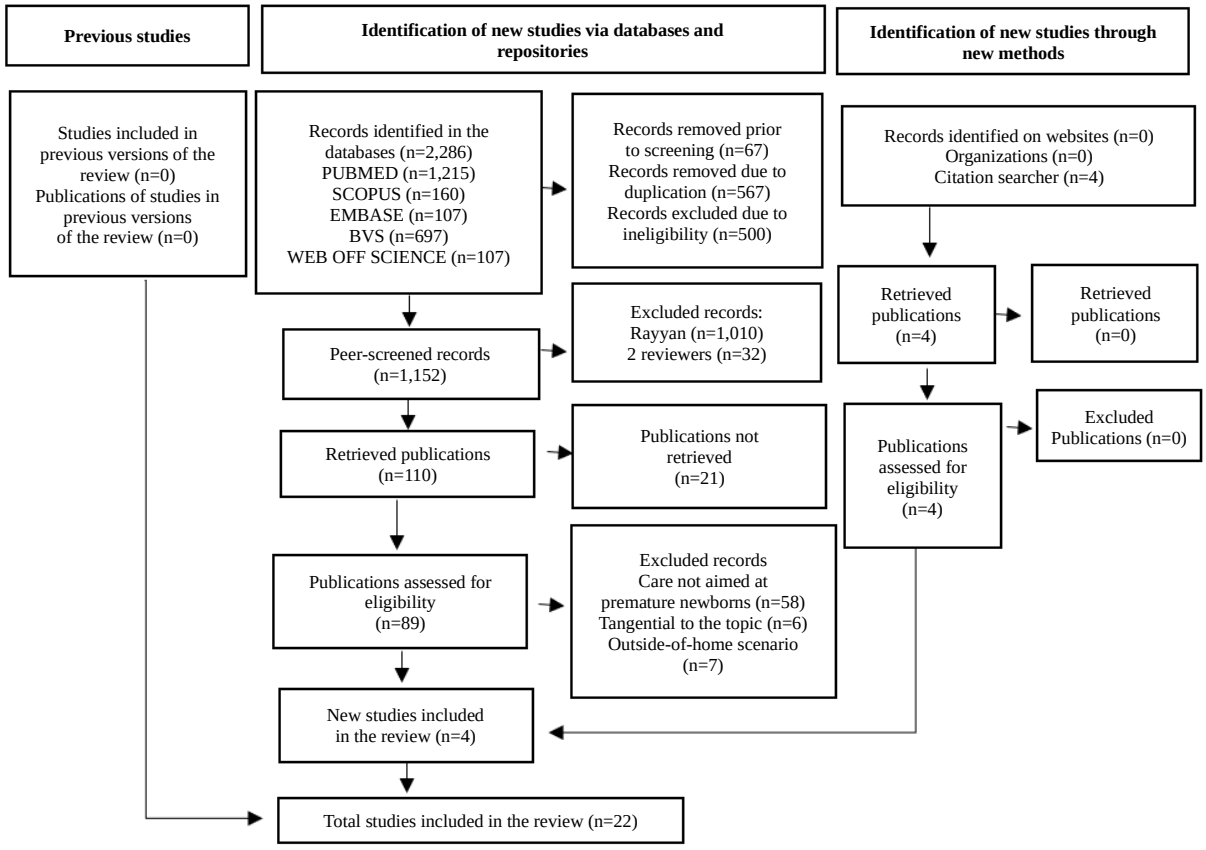
Aiming at the critical analysis and qualitative synthesis of the eligible studies, the classification of methodological quality was used by identifying the Level of Evidence (LE), based on the assumptions made by Melnyk and Fineout-Overholt, which covers six levels.[14]

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[15] flowchart was used to assess the eligibility and present the results of the review. With reference to the processes of critical analysis and description of the results, educational technologies were classified as hard, soft-hard and soft. Hard technologies refer to the use of material resources; soft-hard technologies refer to structured knowledge such as educational instruments; and soft technologies are the relationships based on actions that involve reception and humanization.[16-17]

RESULTS

A total of 2,286 studies were retrieved, of which 110 were selected and had their titles and abstracts read for meeting the inclusion criteria. In a second analysis, after reading the full text of 89 of these studies, 32 were excluded because they failed to answer the research question. There was a 25% disagreement rate among the reviewers during the selection of studies. Therefore, over the course of ten hours of asynchronous meetings, the disagreements were duly resolved, and they agreed that 22 studies should make up the final sample, as seen in Figure 1.

Figure 1. Flowchart identifying the selection process of studies included in the integrative review, as recommended (PRISMA). Teresina, PI, Brazil, 2023.



Source: elaborated by the authors, 2023.

Of the 22 studies included in the review, 15 (68.20%) were indexed in the MEDLINE/PubMed database, five (22.70%) in the Embase (Elsevier) database and two (9.10%) were retrieved from the *Biblioteca Virtual em Saúde* (BVS).

The selected studies were written in English and Portuguese between 2000 and 2022. Regarding the study design, six (27.26%) were controlled and randomized studies; six (27.26%) were observational and participatory studies; three (13.65%) were quasi-experimental studies; one (4.55%) was an experimental study; four (18.18%) were validation studies; one (4.55%) was field research; and one (4.55%) was a descriptive reflective study.

Regarding the level of evidence, six (27.26%) studies were classified as level I, one (4.55%) study as level II, four (18.18%) studies as level III, seven (31.83%) studies as level IV, and four (18.18%) studies as level VI. Chart 2 presents the description of the studies as well as the characterization of the respective results found, which seeks to answer the research question.

Chart 2. Synthesis of the studies included in the review. Teresina, PI, Brazil, 2023.

Author, year, country, language	*No. of participants/ Sample*	*Study design/LE*	*Objective*	*Technology*	*Outcome*
Gray, et al. 2000.[18] USA, English	56/ Families with premature babies	Randomized clinical trial/ LEVEL I	To evaluate a telemedicine program designed to reduce the costs of care and provide medical, informational, and emotional support to families with premature infants.	Multifaceted telemedicine program (Baby Carelink)	It improved family satisfaction, supported their emotional needs, reduced hospital transfer costs, and contributed to early discharge home.
Tessier, et al. 2009.[19] Canada, English	194/ Families in the KMC group; 144/ Families in the Traditional Care group	Randomized controlled trial/ LEVEL I	To test the hypothesis that the KMC method improves infants' performance on the developmental quotient scale.	Kangaroo Method	It had a positive impact on the home environment, suggesting that parents be involved as direct caregivers.
Araújo, et al. 2010.[01] Brazil, Portuguese	30/ Parents and grandparents of low-birth-weight NB and premature NB who were discharged from the Kangaroo Mother Method	Descriptive exploratory field research with a quantitative approach/ LEVEL IV	To understand the home care practices of the KMC method and the aspects that influence its implementation.	Kangaroo Method	It supported both the healthcare team and the family members, making them feel safe, well-guided and able to return home and care for the Newborn in the home environment.
Isetta, et al 2013.[21] Spain, English	90/Late preterm babies, babies weighing between 2.2kg and 2.5kg, babies weighing between 2.5kg and 3kg and babies weighing more than 3kg	Retrospective cohort study/ LEVEL III	To evaluate an online post-discharge monitoring care strategy for premature babies that provides educational information.	Internet-based Monitoring System (Babies at Home)	There was a reduction in the use of hospital resources such as emergency room visits after discharge and a high level of parental satisfaction.
Garne, et al. 2016.[22] Sweden, English	09/Parents with premature babies in home care; 10/Parents with premature babies in the NICU	Observational study with qualitative method/ LEVEL IV	To identify parents' needs regarding the provision of neonatal care at home with telemedicine support.	Telemedicine	It supported families in their self-efficacy, giving them a sense of security when combined with nursing guidance.
Peyrovi, et al. 2016.[23] Irâ, Inglês	80/Mothers and premature babies	Quasi-experimental study/ LEVEL III	To examine the effect of the empowerment program on the "perception of discharge readiness" among mothers of premature babies.	Empowerment Program (perceived readiness for discharge)	It was an effective strategy to promote the sense of readiness on mothers of premature newborns at the time of discharge.
Sgandurra et al. 2017.[24] Italy, English	82/Babies born between 28 weeks; 32 weeks and 6 days of gestational age and babies between 3 and 9 months of age	Randomized clinical trial/ LEVEL I	To evaluate the effects of the CareToy intervention on early motor and visual development of premature infants.	Care Toy Training	It provided an early and effective individualized intervention to premature infants without serious medical complications.

Pinto, et al. 2018.[25] Brazil, English	22/Expert judges (health professionals)	Content validation study / LEVEL VI	To develop and validate an educational animation on home care aimed at premature newborns.	Educational animation	The validation showed that cartoons are pertinent and valid content instruments that demonstrate relevance and credibility.
Nourani et al. 2019.[26] Iran, English	20/ Premature babies; 20/Neonatal Nurses; 20/Mothers	Experimental study/ LEVEL II	To develop a mobile application to educate mothers of premature babies.	Smartphone App	It increased the mothers' knowledge about the needs of their premature babies at home.
Holm, et al. 2019.[27] Denmark English	96/Premature babies requiring tube feeding	Randomized clinical trial/ LEVEL I	To compare growth and breastfeeding rates between babies cared for in the NICU (conventional care) and through neonatal telecare.	Neonatal telecare	Considered a model of care suitable for dealing with premature babies outside the hospital environment; with the additional benefit of achieving higher breastfeeding rates.
D'Agostini, et al. 2020[28] Brazil, English	08/Parents of Premature Newborns	Participatory design study with a qualitative approach/ LEVEL IV	To develop and evaluate an educational game called *Serious Game e-Baby*, together with parents of premature babies.	Educational game *(Serious Game e-Baby)*	It promoted learning among parents, clearing up doubts and sparking reflections on the continuity of care in the home context.
Hägi-Pedersen, et al. 2020.[29] Denmark English	05/Families in video appointments in a home-based neonatal care program with Neonatal Nurses	Qualitative study based on participative observation/ LEVEL IV	To examine communication between nurses and families through video appointments in a home-based neonatal care program.	Video appointment	It provided an easy and enjoyable access for families but requires a communication-focused approach as well as confidence in using video-service tools.
Khosravan, et al. 2020.[30] Iran, English	20/Mothers of premature babies with gestational ages from 26 to 32 weeks	Controlled clinical trial/ LEVEL I	To study the effects of the NIDCAP home monitoring program on the levels of stress and anxiety felt by the mothers.	Home Monitoring Program (NIDCAP)	It was effective in reducing stress and anxiety levels among mothers and families with premature babies.
Fernandes, et al. 2021.[31] Brazil, English	13/Expert judges (neonatal nurses); 20/Caregivers of premature babies	Content validation/ LEVEL VI	To create and validate an educational booklet for parents on NB care during the NICU discharge process.	Educational booklet	It provided support for health professionals, parents and caregivers, clearing up doubts and addressing difficulties related to post-discharge care.
McKelvey, et al. 2021.[32] USA, English	498/High-risk, low-birth-weight premature infants after discharge from a NICU	Quasi-experimental prospective cross-sectional study/ LEVEL III	To work with parents to educate and support them as they care for their medically fragile infants in the home setting.	Home visiting program (Follow Baby Back Home – FBBH)	Health education and support were key factors for delivering proper child health care during the infant's first year of life.
Gomes, et al. 2021.[33] Brazil, English	15/Mothers who had premature NB admitted to a CoNICU and KaNICU	Qualitative descriptive study/ LEVEL IV	To identify mothers' knowledge about care for premature newborns and the application of the KMC method in the home context.	Kangaroo Method	Even with the knowledge and guidance acquired with the KMC method, fear, anxiety and difficulties were revealed, showing the need for better clarification upon hospital discharge.

Guimarães et al. 2021.[34] Brazil, English	06/Expert judges (neonatal nurses)	Content production and validation/ LEVEL VI	To develop and validate an ET on baby bathtub at home aimed at family members of PTNs and low-birth weight infants.	Baby Bathtub Technique	A digital illustrated book was obtained with valid ET aimed at preparing family members for neonatal care after discharge, with knowledge-sharing potential.
Garfield, et al. 2022.[35] USA, English	142/Mothers; 114/Fathers of premature babies	Non-randomized quasi-experimental study/ LEVEL III	To test parental self-efficacy in the NICU from admission to home, through a mobile application.	Smartphone App (NICU2HOME)	It allowed for the continuation of greater parental self-efficacy after hospital discharge to home.
Galeano, et al. 2022.[36] Colombia, English	207/ Mothers of premature babies	Cross-sectional validation study carried out in two stages/ LEVEL VI	To determine the validity and reliability of the CUIDAR instrument among mothers of premature infants.	Scale to measure mothers' skills in caring for premature babies (CUIDAR-MaPre)	It allowed for a valid and reliable assessment of the level of competence of mothers in caring for their premature babies.
Phagdol et al. 2022.[37] India, English	160/ Mothers of premature babies	Randomized controlled trial/ LEVEL 1	To improve mothers' knowledge about home care practices, using a mobile application.	Mobile Health App (mHealth)	It effectively improved mothers' knowledge regarding newborn care practices after discharge from the NICU to home.
Strand, et al. 2022.[38] Sweden, English	03/Families; 06/Mothers; 02/Fathers; 03/Nurses in charge of home-based neonatal care for babies born between the 24th-34th gestational week	Complex intervention trial with participatory design/ LEVEL IV	To develop an eHealth application that supports the transition from hospital to home aimed at parents with premature infants.	eHealth application (app) for Android tablet devices, with participatory design.	eHealth can replace appointments, is easy to use, and can be a supportive practice for parents as they transition their premature babies from hospital to home.
Sarik, et al. 2022.[39] USA, English	378/Premature babies in the first 18 months of life	Reflective intervention study with descriptive approach/ LEVEL IV	To support caregivers and babies during the difficult transition period from the neonatal intensive care unit (NICU) to home.	Telehealth intervention (Baby Steps project)	Considered viable and satisfactory to improve NICU patient outcomes and support caregivers during the transition home, in addition to contributing to the reduction of readmissions and the use of emergency care services.

Key: LE – Level of evidence**;** KMC – Kangaroo Mother Care; NIDCAP - Newborn Individualized Developmental Care and Assessment Program; PTN – Premature Newborn; NICU – Neonatal Intensive Care Unit.
Source: elaborated by the authors, 2023.

Six technologies (27.26%) were classified as soft,[20,21,24,31,33,34] four technologies (18.18%) as soft-hard[25,32,35,37] and 12 (54.56%) as hard technologies,[19,22-23,26-30,36,38-40] as shown in Chart 3. Regarding the technologies addressed, it was observed that technologies based on relationships, reception and humanization for home-based care of premature newborns were present in 16 studies (63.70%) and that only one study failed to positively meet the parents' needs.

Chart 3. Classification of educational technologies for home-based care of preterm newborns. Teresina, PI, Brazil, 2023.

Classification of technologies	*Results*
Soft technology	Kangaroo Method, Empowerment Program, Home Monitoring Program, Home Visiting Program.
Soft-hard technology	Care Toy Training, Educational Booklet, Baby Bathtub Technique, Scale to measure skills.
Hard technology	Telemedicine, Telehealth, Neonatal telecare, Video appointment, Smartphone/Tablet applications, Monitoring system, Educational animation, Educational game.

Source: elaborated by the authors, 2023.

DISCUSSION

Based on the analysis of the articles, different educational technologies that enable the promotion of care for premature newborns in the home context were identified. Therefore, these were grouped according to their classification to facilitate the reader's understanding.

Soft technology

According to Merhy, the adoption of soft technologies in health work permeates the processes of reception, bonding and comprehensive care as managers of health actions. From this perspective, the Kangaroo Method (KM), the Empowerment and Home Monitoring Programs and the Home Visiting Program (HV) were interventions based on relationships that contributed to increase knowledge aimed at newborn care.[40]

The KM has innovative actions that can be applied to improve bonding, promote breastfeeding, reduce stress and pain in newborns, in addition to increasing parental confidence in the care provided to their children.[41-42] It is an effective, evidence-based intervention that can be implemented on a large scale, helping to reduce the incidence of complications in preterm births and neonatal mortality.[43-44]

Empowerment programs are strategies used by health professionals to create empowered people who are aware of their problems and concerns, making them capable of expressing their emotions; they are also effective in promoting mothers' skills so that they are able to care for their children in a valid and reliable way after hospital discharge.[45-46]

Among the programs developed, the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) is based on systems that help assess, construct and change the delivery of individualized care and support for both the baby and their family, in addition to favoring human, caring and brain-supporting experiences, consequently avoiding physical and emotional trauma in the face of the complexity of parental care for the newborn in the home context. NIDCAP has a positive impact on both the baby's well-being and on the way parents care for their newborns.[47-49]

As a soft technology, the Home Visiting Program encourages the promotion of different types of knowledge, as it is considered a tool that provides health education through informational and emotional support and is also linked to other health services. Home Visits enable parents to understand their babies' special medical needs, in addition to providing support during the transition from the neonatal unit to home.[50] Studies conducted by the Council on Community Pediatrics, the Early Childhood Council, and the Committee on Child Abuse and Neglect demonstrate that home visits lead to improvements in maternal mortality rates and provide benefits for the health and development of newborns.[51]

Soft-hard technology

Regarding soft-hard technologies, educational tools stand out, which, in addition to clarifying doubts, also spark reflections on the care practices that may be performed in the home context after hospital discharge. This category includes training-based interventions, use of booklets, scales and care techniques.

Training-based interventions aim to provide early, intensive, individualized, family-centered intervention. In this sense, these trainings contribute, through the multidisciplinary services provided to children, to promoting child health and well-being, improving their skills and reducing developmental delays. Early interventions are extremely important for identifying damage that can be caused by prematurity and that can lead to even greater complications.[52] For example, the CareToy training included in this research is an early intervention system with a therapeutic approach whose main objective is to stimulate motor development in premature infants, helping them acquire skills such as rolling over, sitting up, crawling and walking.[53]

Studies indicate that, after the premature Newborn (PTN) is discharged from hospital, doubts and feelings can directly affect the role of parents in providing home-based care to the newborn. This is the context in which booklets come into play, which are printed educational materials used by health professionals as a tool to improve knowledge, satisfaction, adherence to treatment and self-care. They are basic and continuous learning tools that contain information that is accessible to all audiences, using visual elements as a practical way of conveying knowledge.[54-55]

Care scales are instruments developed to measure the capacity, skill and level of preparation of the caregiver. They are fundamental indicators that guarantee the continuity and safety of care for the individual. Measurement scales are available to measure a wide range of phenomena. The accuracy and quality of the scales are determined by their level of reliability, which in turn relates to the true values of the feature.[56]

Among the neonatal care techniques aimed at the PTN's well-being, the research highlights the Baby Bathtub Technique (BBT), also known as "bucket bath", which consists of immersing the newborn in a bucket filled with heated water for five minutes, simulating the intrauterine environment, promoting a feeling of safety and relaxation, and helping with extrauterine adaptation. This is a care technology that helps reduce stress and pain.[57-58]

Hard technology

Telemedicine, Telehealth, Neonatal Telecare programs and Video appointments (eHealth/mHealth), as hard technologies, are perceived as tools that support the daily practice of health professionals in caring for PTNs in the home environment. The study highlights the provision of specialized information on care and the roles and skills expected of parents and family members, reducing the need for repeated trips to the hospital.[59]

Given the importance of providing effective care for premature babies, the mHealth/eHealth-based application approach helps to improve the parent-baby interaction and the growth and development of these babies.[60-61]

Educational animations are tools that facilitate the teaching-learning process through involvement, participation and exchange of experiences between parents/caregivers and nursing professionals. The main goal of the animations and simulations is not to replace the experience or take the place of reality, but rather to allow the rapid formulation and exploration of various hypotheses related to a specific experiment. In this way, these educational resources contribute to the creation of new cognitive connections.[62-63]

Furthermore, it is worth noting that only three technologies were developed in Brazil, showing the fragility of the production of studies involving the use of educational technologies in the country, especially soft technologies. [25,28,31] Moreover, it should be noted that even though the largest percentage of the included studies are prone to bias, all technologies bring specific contributions to each dimension of parental care aimed at premature newborns. Therefore, the findings fail to identify the most effective care technology, and new clinical studies are needed to evaluate and compare the effects of these technologies cited here.

Furthermore, it was observed that the topic 'discharge of the newborn from the neonatal unit' was present in all studies, making it relevant to develop and evaluate educational tools that can improve the knowledge of parents and families from the discharge planning process.

The study limitations refer to the inclusion of articles that are only available for free, as well as studies with completed results, which may restrict the identification of other types of technologies that are being implemented, which, however, have only had partial results published.

CONCLUSION

The scientific evidence found in the studies indicates that ET aimed at the home-based care of premature newborns covered important areas of care such as family empowerment, promotion of breastfeeding and nutrition, as well as basic care practices. It is noted that, regarding the use of ET aimed at the education of parents and caregivers of premature newborns, there was a predominance of hard technologies. Thus, the technologies identified as having the highest level of evidence are the CareToy training, the Kangaroo Method, the Neonatal Telecare, the Home Monitoring Program and the mHealth/eHealth-based applications.

Therefore, the geographical scope of the studies stands out as knowledge gaps given that most of them were developed in an international context, further inferring the fragility of the technology production in Brazil.

Furthermore, the study highlights the importance of using ET to promote improved care practices and safety for parents and family members caring for preterm infants at home. And, finally, it is suggested that new studies on ET be conducted in Brazil focused on home-based care provided to premature babies, given that few studies on the subject have been developed in the country.

CONTRIBUITIONS

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