

EHealth technologies in parental care for preterm infants: an integrative review

1

ARTICLES
REVIEWS

Moisés Andrade dos Santos de Queiroz (<https://orcid.org/0000-0003-4887-1377>)¹
Christina César Praça Brasil (<https://orcid.org/0000-0002-7741-5349>)¹
Cláudia Belém Moura Cabral (<https://orcid.org/0000-0001-7235-261X>)¹
Andrea Cintia Laurindo Porto (<https://orcid.org/0000-0002-8608-1336>)¹
Priscilla Mayara Estrela Barbosa (<https://orcid.org/0000-0001-9611-1343>)²
Rachel Cassiano de Sousa (<https://orcid.org/0000-0002-4849-1502>)¹
Rita Feio da Gama Alegria (<https://orcid.org/0000-0001-6327-6088>)³
Vânia Peixoto (<https://orcid.org/0000-0002-8212-2137>)³

Abstract *The eHealth technologies promote parental care practices for preterm infants. Nonetheless, we should underscore the abundant information and available apps and disparities in these resources' quality, usability, and reliability. This article examines eHealth technologies directed at parents to care for preterm infants. An integrative review was conducted across the principal health databases (Capes, EBSCO, BVS, PubMed, Scholar, and SciELO), selecting works published from 2011 to 2022 in Portuguese and English, focusing on the use of eHealth technologies for the care of preterm infants. We identified 13 articles related to information and communication technologies in strategies for educating and promoting the health of preterm infants and their parents and the importance of evaluating and validating eHealth technologies in maternal and child health promotion. Properly validated eHealth technologies can be crucial in supporting parents in promoting health and providing care for preterm infants after hospital discharge, which, in turn, can drive the evolution of healthcare systems and improve clinical practices.*

Key words *Maternal-Child Health Services, Premature Newborn, eHealth Strategies, Public Health, Parenting*

¹ Programa de Pós-Graduação em Saúde Coletiva, Universidade de Fortaleza (UNIFOR). Av. Washington Soares 1321, Edson Queiroz. 60811-905 Fortaleza CE Brasil. fonomoises@outlook.com

² Programa de Pós-Graduação em Linguística Aplicada, Universidade Estadual do Ceará. Fortaleza CE Brasil.

³ Escola Superior de Saúde Fernando Pessoa. Porto Portugal.

Introduction

Preterm newborn (PTNB) development requires much care to promote their health and better quality of life. In this context, the essential speech therapy aspects to be observed involve orofacial functions, language, and hearing. The term “orofacial” refers to the set of stomatognathic functions of breathing, sucking, chewing, swallowing, and speech – articulation and voice¹. While the term “language” considers the distinctly human form of receptive (ability to understand) and expressive (ability to produce) communication that gathers social groups². “Hearing” appears in this process as a function for apprehending environmental sounds and a facilitator of language development and speech acquisition².

Premature birth occurs before 37 weeks of gestational age and can be subcategorized into extremely premature (<28 weeks), very premature (28 to <32 weeks), and moderate to late premature (32 to <37 weeks)³. Over the years, technological advances aimed at maternal and child health and neonatal care have enabled the survival of many preterm infants. However, preterm infants have an increased risk of neurological development sequelae, including cognitive and socio-communicative impairments⁴.

The neurocognitive and behavioral development of premature newborns can suffer losses resulting from neonatal characteristics and morbidities, mainly due to the need to remain in stressful environments, such as the Neonatal Intensive Care Unit (NICU), and adverse social factors that can influence their neurodevelopment. Recent studies state that eating disorders^{5,6} and language acquisition and development changes^{7,8} are observed more frequently in preterm babies than full-term. Such changes result in motor delays, global cognitive impairment, visual perception issues, executive functioning impairments, and learning difficulties⁹.

Preterm babies are prepared for discharge from the NICU and dehospitalization when they are physiologically stable, and their family members or caregivers have the necessary skills to provide essential care in their daily lives. Thus, successful follow-up programs for preterm babies begin during hospitalization and follow-up outpatient clinics. They aim to guarantee the care of the baby after dehospitalization, facilitating early diagnosis of possible health and development problems, early or prophylactic intervention, support for families, and the realization of studies on prematurity to ensure advances in treatments¹⁰.

Programs that encourage the bond between parents and babies through parental neonatal care practices positively influence the neuropsychomotor development of preterm babies¹¹. The family members of these babies have provenly lower effective interactions with them than their full-term peers, which can be justified by the following aspects: the PTNB's inability to focus and facial expressiveness during interactions¹²; stressful and emotionally exhausting experiences for parents¹³; separation from parents resulting from the extended stay of PTNBs in the NICU¹⁴; and parental susceptibility to Vulnerable Child Syndrome, in which preterm babies who were at risk of death at one point in their lives continue to be perceived as more vulnerable than their full-term peers, generating more significant anxiety in parents¹⁵.

The work of the multidisciplinary team is essential in organizing the follow-up. It can be coordinated by a neonatologist or pediatrician, with other professionals (neuropediatrician, ophthalmologist, otorhinolaryngologist, social worker, orthodontist, nurse, psychologist, nutritionist, physiotherapist, occupational therapist, and speech therapist¹⁶). Each stakeholder is a facilitator of rapprochement and interaction between the baby and their family members through health education strategies that promote bonding and the ability of family members to detect and respond to the preterm baby's behavioral signs daily, avoiding the deterioration of possible neurodevelopmental disorders¹⁷. Thus, the opportunity arises for developing new technologies that enable advances and perspectives in access to information that strengthen parents' knowledge and care for preterm babies.

Advances in technology have increased the population's life expectancy and quality, which includes maternal and child health¹⁸. In this setting, the World Health Organization (WHO) considers that eHealth technologies are tools applied to health that enable the implementation of therapeutic processes, learning, and health promotion, covering the following subcategories: mobile Health or mHealth; Health Information Systems or HIS; Distance healthcare (Telemedicine) and distance learning (Electronic Learning or eLearning)¹⁹.

With the use of the internet, the use of digital technology expands, enabling new ways of transmitting information to many people simultaneously. The e-Learning technologies, through distance learning (DL) tools, aim to expand people's knowledge on specific topics. They are

effective in the contemporary world due to the individual's learning practicality and autonomy. When these resources promote health, they bring knowledge to tackle issues, reduce illnesses, and foster positive behavioral changes¹⁹.

In recent years, it has become common for parents of preterm babies to search for information related to the health and care of their children on the internet, often before even consulting a healthcare professional. This process includes using search engines or social networks. Furthermore, these parents remain connected even after discharge from the NICU, searching for responsive platforms, distance learning courses, and mobile applications directly from their cell phones to obtain more information about the health and well-being of their babies²⁰.

While a wide variety of information and apps are available for parents of babies and children born prematurely, it is expected to see variable quality, usability, and credibility, with generally low scores in user reviews. Furthermore, few peer-reviewed or empirical studies relate to this content, which highlights the need for more attention to developing reliable, high-quality resources for parents of premature babies who remain in the NICU²¹.

Based on the facts presented, we ask: What topics are covered by the eHealth technologies available to alleviate the difficulties parents of preterm babies face in caring for their children after discharge from the NICU? What types of eHealth technologies geared to parents of preterm babies are mentioned in the studies? What are the contributions of eHealth technologies to equip these parents to care for their children?

The present study aimed to conduct an integrative review of eHealth technologies aimed at parents for the care of babies born prematurely.

Methods

Our integrative review revealed the scarcity of publications that directly address the design and validation of eHealth technologies aimed at parents of preterm babies, limiting the scientific evidence that supports their usability. However, this bibliographic gap also highlights the relevance of the topic under investigation and shows its relevance.

This integrative review was performed from August to December 2022 on the following healthcare portals and databases: Capes, EBSCO,

BVS, PubMed, Scholar, and SciELO. The time frame for the search included publications from 2011 to 2022 to include updated studies on the topic in Portuguese and English, aligned with the following guiding questions: What does the literature point out about the use of eHealth technologies to promote health education focused on the care of babies born prematurely? What does the literature point out about health promotion strategies and resources aimed at parents and families of babies born prematurely?

The integrative review is a careful research method that aims to provide and summarize the primary knowledge related to a given research problem so that it can be critically analyzed and incorporated into care practice. This information is provided in a systematic, orderly, and comprehensive manner, constituting the body of knowledge. Thus, the researcher can prepare an integrative review with different purposes, which may define concepts, review theories, or perform methodological analysis of studies on a given topic²².

The integrative review in the health field can help obtain a complete and relevant picture of complex concepts, theories, or care-related problems. The sample's varying composition and the integrative review's many purposes contribute to its scope and relevance. Ganong²³ proposes six steps to construct an integrative review: defining the theme and selecting the hypothesis or guiding question; establishing study/search inclusion and exclusion criteria; defining and categorizing information to be extracted from studies; evaluating included studies; interpreting results; and presenting the review/summary of knowledge. To this end, Medical Subject Headings (MeSH) descriptors or the following keywords were used, in English and Portuguese: "*saúde materno-infantil*" (maternal and child health); "*recém-nascido, prematuro*" (infant, premature); "*promoção da saúde*" (health promotion); "*educação a distância*" (education, distance); "*estratégias de eSaúde*" (eHealth strategies).

Two researchers identified and selected the studies, combining the abovementioned terms with Boolean operators "OR"/"AND". These were subject to quality assessment, with independent evaluations between two researchers, as per the Joanna Briggs International²⁴ approach. All articles included in the final sample met the quality criteria.

Initially, 1,571 studies were identified in the selection. Duplicate studies, those with titles that did not match the descriptors, studies without

elements relevant to the scope of the study, and those that did not use eHealth technologies were excluded. At the end of this process, the search identified 54 scientific productions, including articles and a dissertation, as shown in Table 1.

The integrative review evidenced a lack of publications that addressed the use of eHealth technologies for the health education of parents of babies born prematurely, primarily related to oral and language development. The fifty-four publications initially selected were reviewed, and we excluded those that did not address the topic of interest, leaving only 13 publications (Chart 1).

After the selection, we performed in-depth reading of the material, followed by content analysis in thematic modality²⁵, resulting in two themes presented in the results of this article. The partial results of this review were shown under a simple summary at the 11th Ibero-American Congress on Qualitative Research (CIAIQ 2022)²⁶ and published in *New Trends in Qualitative Research (NTQR)*²⁷.

Results and discussion

The themes emerging from the literature review are information and communication technologies (ICT) in education and health promotion strategies for preterm babies and their parents and the importance of evaluating and validating eHealth technologies in promoting maternal and child health.

We found that, among the resources and strategies used to promote the health of parents and families of babies born prematurely, most do not involve eHealth technologies and include parental intervention programs, multi-professional guidance, telephone-based screening, booklets,

and leaflets. However, the 13 selected studies address using eHealth technologies in this context, such as Telemedicine, websites, mHealth, gamification, and eLearning.

Based on the first guiding question, the studies presented in Chart 1 present eHealth technologies to promote health education aimed at caring for premature babies. Only two adopted a mixed approach (quantitative and qualitative), emphasizing the complementarity of results obtained through statistical analyses and participants' perceptions. Breastfeeding, an orofacial function, was the most recurring theme among the studies.

Information and Communication Technologies (ICT) in health education and promotion strategies for premature babies and their parents

With the advancement of technology and the popularization of the internet and mobile devices, the dissemination and use of eHealth tools have become a viable option to provide maternal and child support and exchange information and knowledge with different target audiences, favoring the continuity of care for the baby after hospital discharge, follow-up by the multidisciplinary team and monitoring of child development^{30,36,37}.

The eHealth technologies aimed at maternal and child health effectively promote health promotion and education, transforming health systems. Its clinical and scientific relevance is based on its possibilities of application at all care levels, overcoming the barriers imposed by physical distance and respecting the fragility and individuality of parents and family members³⁵. However, before being adopted by the target audience, these tools must be evaluated regarding their applicability, advantages and limitations. In this sense, the internet has been increasingly used as a source of maternal and child health information, and social networks enable the exchange of experiences and parental support¹⁹.

Information and Communication Technologies (ICT) can guide parents and family members regarding the baby's health pre- and postnatal periods. These technological tools effectively sensitize and encourage family participation in monitoring and stimulating the neuropsychomotor development of babies and children, contributing to maternal and child health and well-being. Furthermore, these health education resources can curb the risks of mortality and child development disorders³⁸.

Table 1. Result of the literature review.

Databases/ Electronic Portals	Type	N
EBSCO	Article	12
PubMed	Article	22
Scholar	Article	9
CAPES	Article	5
SciELO	Article	5
Scholar	Dissertation	1
Total		54

Source: Authors (2023).

Chart 1. Selected studies that address eHealth technologies in feeding and communication care for babies born prematurely.

	Authors	Year	Title	Objective	Study type
1	Ferecini ²⁸	2011	<i>Desenvolvimento e avaliação do objeto digital de aprendizagem sobre o aleitamento materno do prematuro.</i>	Develop a website aimed at family members of PTNBs about BF and evaluate this digital learning object with nursing and IT professionals.	Quantitative
3	Cervantes Guijarro <i>et al.</i> ²⁹	2014	Use of the new technologies and Telemedicine, in the healthy newborn follow up.	Show the effect of the eHealth tool in monitoring healthy babies in the first six months of life in a Primary Health Care service.	Quantitative
3	Jiménez-Serrano <i>et al.</i> ³⁰	2015	A mobile health application to predict postpartum depression based on machine learning.	Develop a mHealth app to early detect the risk of postpartum depression and improve maternal care performance	Mixed
4	Letourneau <i>et al.</i> ³¹	2015	Quasi-experimental evaluation of a telephone-based peer support intervention for maternal depression.	Assess the effect of telephone peer support on maternal depression and social support.	Quantitative
5	Ahmed <i>et al.</i> ³²	2016	The effect of interactive web-based monitoring on breastfeeding exclusivity, intensity, and duration in healthy, term infants after hospital discharge.	Determine whether an interactive web-based BF monitoring system promotes EBF and reduces postpartum depression.	Quantitative
6	Posmontier <i>et al.</i> ³³	2016	Telephone-administered interpersonal psychotherapy by nurse-midwives for postpartum depression.	Test the feasibility, effectiveness, and acceptability of interpersonal psychotherapy via telephone by certified nurse-midwives in the treatment of postpartum depression.	Mixed
7	White <i>et al.</i> ³⁴	2016	Theory-based design and development of a socially connected, gamified mobile app for men about breastfeeding (milkman).	Develop the first evidence-based breastfeeding app aimed at men.	Mixed

it continues

The maternal and child well-being provided by eHealth tools depends on the ability to implement programs that allow the exchange of knowledge and experiences between the target audience and developers. These actions should have a clear and differentiated language for parents and family members, meeting individual demands and contributing to baby care-related decision-making³⁹. Using technologies aimed at maternal and child audiences can potentially strengthen family ties and contribute to monitoring child development⁴⁰. When developing eHealth technologies, it is necessary to understand the concerns and

challenges of the target audience to meet their specific educational needs⁴¹.

An adequate approach to parents of preterm babies requires consideration of their fragility and individuality. Furthermore, health professionals working in the NICU must be trained in communicative skills to support parents in making decisions about the baby's health³⁹. Lack of awareness about the importance of monitoring and stimulating children after hospital discharge can affect parents' adherence to intervention programs. Therefore, it is essential to raise awareness among this population through health commu-

Chart 1. Selected studies that address eHealth technologies in feeding and communication care for babies born prematurely.

	Authors	Year	Title	Objective	Study type
8	Alam et al. ³⁵	2017	The impact of mobile phone based messages on maternal and child healthcare behaviour: A retrospective cross-sectional survey in Bangladesh	Assess the association between Aponjon mobile messaging services and practices regarding childbirth and maternal and newborn care in selected areas in Bangladesh.	Quantitative
9	Flax et al. ³⁶	2017	Group cell phones are feasible and acceptable for promoting optimal breastfeeding practices in a women's microcredit program in Nigeria.	Examine the feasibility and acceptability of using cell phone messaging groups within a multi-component BF promotion intervention.	Qualitative
10	Martinez-Brockman et al. ³⁷	2018	Impact of the lactation advice through texting can help (LATCH) trial on time to first contact and exclusive breastfeeding among WIC participants.	Test the effectiveness of a two-way text messaging intervention encouraging EBF among low-income women enrolled in EBF counseling programs.	Quantitative
11	Wang et al. ³⁸	2018	A breastfeed-promoting mobile app intervention: Usability and usefulness study.	To evaluate the usability and usefulness of MoomMae, a mobile application developed to support breastfeeding women.	Qualitative
12	D'Agostini et al. ³⁹	2020	<i>Serious Game e-Baby Família: tecnologia educacional para o cuidado do recém-nascido premature.</i>	Develop and evaluate the Serious Game e-Baby Família based on the needs of parents of preterm babies.	Qualitative
13	Kim ⁴⁰	2020	Information and Communications Technology and Education Customized for Fathers of Preterm Infants.	Understand the concerns and needs of parents of premature babies and seek ICT opportunities to support them.	Qualitative

Source: Authors (2022).

nication strategies and other actions about the relevance of postnatal care in reducing changes in the child's neuropsychomotor development⁴².

The quality of communication between health professionals and the assisted population is directly linked to how knowledge and experiences are shared. Thus, communication strategies and health technologies can promote differentiated work, contributing to the growth, learning, and well-being of the parents-baby relationship⁴³.

New systems can be offered to improve the activities of people and health services with technological progress and the emergence of mobile devices with greater processing power and advanced technical resources, as in the case of maternal and child health. However, there is a lack of published studies evaluating the use of mHealth technologies in postnatal interventions¹⁹.

Studies investigating eHealth technologies' effects on maternal and child health cover different aspects, such as user profiles, criteria for developing actions, quality of the information provided, contributions of these tools to health services, and adherence of the target audience³². The results indicate positive effects of these technologies on maternal and child health and well-being, including managing gestational diabetes, mental health, self-care of pregnant women, and empowerment and participation of parents and family members in the care of the baby in low- and middle-income countries³⁴. Moreover, Telemedicine interventions have been presented as high-quality care models with low risk and cost for health services⁴⁴.

According to Wallwiener et al.⁴⁵, the predominant profile of users who use eHealth tech-

nologies to search for maternal and child health information consists of young women of reproductive age who frequently use the internet, social networks, and smartphone applications. Using applications and websites on maternal and child health is highly applicable and accepted and promotes health education and the participation of young women. Furthermore, these tools provide benefits such as increasing knowledge about maternal and child health and reducing maternal anxiety and depression²⁸. In a systematic review of 15 studies with users of eHealth resources, Heuvel *et al.*¹⁹ highlight that most who seek information online are pregnant women, regardless of age, education, or socioeconomic profile. Furthermore, around 88% of this population uses smartphones, and 50% to 98% access maternal and child health information through websites and applications.

Telemedicine-based eHealth interventions represent a trend that aims to curb healthcare costs without compromising the quality of services, becoming an effective alternative for health plans by offering low-risk and low-cost care models. Studies on the impact of eHealth technologies on maternal and child health include the evaluation of parameters such as quality standards, target audience adherence, and increased provision of care. Using these technologies suggests positive effects regarding lifestyle, management of gestational diabetes, mental health, self-care of pregnant women, empowerment, and parental participation in baby care in middle and low-income countries⁴⁴.

Studies that evaluated the level of satisfaction of young, primiparous women with higher education who used maternal and child health applications suggested by health professionals describe high acceptance rates, convenience, education, and co-participation^{46,47}. The benefits of eHealth interventions in increasing mothers' knowledge about their baby's health are related to reducing maternal anxiety and visits to clinics due to insecurities and excessive concerns. The user satisfaction rate with the technologies analyzed ranges from 86% to 95% in studies that address mental health and 90% in research on mothers of babies monitored at home because these tools allow them to stay home caring for their children for a longer period^{48,49}.

Ferecini²⁸ developed a website on breastfeeding for preterm babies for families and evaluated this technology with nurses and IT professionals. The technology was well accepted among nurses (96%) and IT professionals (92%), concluding

that the instrument is valid for health education for parents of these babies, encouraging breastfeeding.

Kim⁴⁰ investigated the concerns and needs of 18 parents (ten mothers and eight fathers of preterm babies) to develop an eLearning technology to strengthen the parent-baby bond and support parents in caring for their children after hospital discharge. Respondents highlighted the importance of personalized education and argued that an eLearning system could meet their educational needs.

The eHealth technologies are also used as care and health promotion strategies for premature parents and babies. An example of this is the effectiveness of these tools in managing the mental health of mothers with postpartum depression, which affects 3% to 15% of the cases⁵⁰. Also, telephone calls and applications for screening and detecting postpartum depression are viable and practical tools for tackling this issue^{30,51}. Mitchell *et al.*⁵² affirm that mothers with postpartum depression may be afraid to seek specialized help due to fear of losing their children. The eHealth technologies can help overcome this barrier, as they allow online psychotherapy, reducing depressive symptoms according to studies, especially when compared to groups on a waiting list³³. Furthermore, eHealth interventions have revealed significant improvements in social and peer support perception, related to fewer depressive symptoms³¹.

The eHealth technologies have also proven to be a viable alternative for health insurers due to the good results obtained in health interventions with their use, besides contributing to cost reduction. For this reason, ICTs can be a suitable option to transform traditional health education and offer support in a free and widely accessible way⁵³.

The relevance of evaluating and validating eHealth technologies in promoting maternal and child health

Few studies address the perceptions of maternal and child health professionals regarding the use of eHealth technologies. A qualitative study conducted by Goetz *et al.*⁵⁴ presented the results of interviews with twelve healthcare professionals in obstetrics departments who expressed concerns regarding the implementation barriers and potential legal risks of eHealth interventions. Some participants reported little familiarity and skill with adopting these technologies, which

limited their involvement and understanding of the possibilities they could offer perinatal care. These professionals generally considered Telemedicine an additional parallel service rather than integrating it into the prenatal care model.

Despite the increasing number of studies investigating interventions with eHealth technologies, there is a strong need to evaluate their impacts¹⁹. Identifying measurable and reliable indicators is the principal barrier to this assessment. Furthermore, methodological obstacles exist, such as establishing a clear causal relationship between the eHealth technology intervention and outcomes, which confounding factors may influence. Identifying these indicators is complex, as the time interval between the intervention and the result is often long, and the relevance of the indicators may be context-dependent. However, the availability of (direct and indirect) outcome indicators can facilitate consistent measurement and comparability of studies⁴⁴.

Based on the above, there is a need to conduct more studies with a qualitative approach to using eHealth technologies in maternal and child health and greater interdisciplinarity in developing these technologies. We suggest applying the Interdisciplinary Method for the Development of Health Technologies (IMDHT) in designing more reliable eHealth technologies, following the stages of development, validation, and evaluation of research tools and strategies. This method aligns with the nature of the methodological study and qualitative approach, drawing the researcher nearer to the topic investigated for a better understanding of the facts. It enables the definition of the principal issue, the formulation of precise hypotheses, and the discovery of relevant results, which are not always evident⁴¹.

Adopting a qualitative approach, in turn, is a crucial tool for identifying the perceptions, feelings, and needs of parents of preterm babies. This information is essential for designing and validating more effective eHealth technologies, allowing a broader understanding of the setting and characteristics of the target audience and measuring the participants' level of satisfaction. The current trend is gathering quantitative and qualitative approaches, following the IMDHT model, which seeks the complementarity of objective and subjective perspectives to obtain different perspectives, analyses, and interpretations of the objects of study^{41,55}.

Final considerations

The themes covered in this study highlight the relevance of this integrative review and encourage more specific qualitative research on the use of eHealth technologies by parents of preterm babies to improve these children's health conditions and global development. Although these technologies are recognized for strengthening health education and communication actions, enabling parents to care for their babies after hospital discharge, it is vital to hear the perspectives of both parents and health professionals about the meaning and contribution of these technologies so that they can be improved and widely used.

The studies show concern about developing consistent and systematic strategies to provide educational interventions for developing and caring for preterm babies. In this context, maternal and child health professionals use eHealth technologies to boost health education programs, obtaining significant results in the knowledge of parents and baby development. The eLearning resources are considered critical pedagogical resources for rapid and expanded content availability, providing education opportunities for people in remote locations with difficulties in in-person access. However, we recommend more qualitative studies to obtain greater consistency regarding parents' experiences using eHealth technologies, including topics related to the development of feeding and language in preterm babies.

We identified that eHealth technologies are also used to promote and care for the health of preterm babies after hospital discharge, thus transforming health systems and increasing the practice resolutivity. From this perspective, we observe an increase in the survival rates of preterm babies in neonatal care using actions combining technologies, humanization, and quality control.

The strategies identified in the literature emphasize respect for individuality and guaranteed access to technologies that provide security and care for newborns and their families, facilitating the bond between parents and babies. Furthermore, health professionals can also benefit from eHealth technologies, as they increase the engagement of parents and family members in baby care, reducing the impacts of prematurity on the development and quality of life before and after hospital discharge.

Despite advances in eHealth technologies and their contributions to improving the quality of life of preterm babies, many challenges and innovations are still necessary, such as the need to evaluate and validate these resources by developing studies that evaluate their usability, validity, effectiveness, and efficiency.

Collaborations

MAS Queiroz contributed to the conception and design of the study, bibliographic research, data analysis and interpretation, and the work's drafting and formatting. CCP Brasil contributed to the conception and design of the study, the work's critical review and approval of the version to be published. CBM Cabral and ACL Porto contributed to data analysis and interpretation and the work's drafting and formatting. PME Barbosa and RC Sousa contributed to data analysis and interpretation. RFG Alegria and V Peixoto contributed to the work's critical review and approval of the version to be published.

References

1. Schmid KM, Kugler R, Nalabothu P, Bosch C, Verna C. The effect of pacifier sucking on orofacial structures: a systematic literature review. *Prog Orthod* 2018; 19(1):8.
2. Feldman HM. The importance of language-learning environments to child language outcomes. *Pediatrics* 2019; 144(4):2019-2022.
3. Vogel JP, Chawanpaiboon S, Moller AB, Watananirun K, Bonet M, Lumbiganon P. The global epidemiology of preterm birth. *Best Pract Res Clin Obstet Gynaecol* 2018; 52:3-12.
4. Abbott A. The brain, interrupted. *Nature* 2015; 518:24.
5. Mayerl CJ, Gould FDH, Bond LE, Stricklen BM, Buddington RK, German RZ. Preterm birth disrupts the development of feeding and breathing coordination. *J Appl Physiol* (1985) 2019; 126(6):1681-1686.
6. Mayerl CJ, Myrta AM, Bond LE, Stricklen BM, German RZ, Gould FDH. Premature birth impacts bolus size and shape through nursing in infant pigs. *Pediatr Res* 2020; 87(4):656-661.
7. Vandormael C, Schoenhals L, Hüppi PS, Filippa M, Borradori TC. Language in preterm born children: atypical development and effects of early interventions on neuroplasticity. *Neural Plast* 2019; 25:6873270.
8. Antinmaa J, Lapinleimu H, Salonen J, Stolt S, Kaljonen A, Jäskeläinen S. Neonatal brainstem auditory function associates with early receptive language development in preterm children. *Acta Paediatr* 2020; 109(7):1387-1393.
9. Johnson S, Marlow N. Early and long-term outcome of infants born extremely preterm. *Arch Dis Child* 2017; 102(1):97-102.
10. Myrhaug HT, Brurberg KG, Hov L, Håvelsrud K, Reinart LM. *Prognosis and follow-up of extreme preterm infants: a systematic review*. Oslo: Norwegian Institute of Public Health; 2017.
11. Meins E, Bureau JF, Fernyhough C. Mother-child attachment from infancy to the preschool years: predicting security and stability. *Child Dev* 2017; 89(3):1022-1038.
12. Bozzette M. A review of research on premature infant-mother interaction. *Newborn Infant Nursing Rev* 2007; 7:49-55.
13. Ionio C, Lista G, Mascheroni E, Olivari MG, Confalonieri E, Mastrangelo M, Brazzoduro V, Balestriero MA, Banfi A, Bonanomi A, Bova S, Castoldi F, Colombo C, Introvini P, Scelsa B. Premature birth: complexities and difficulties in building the mother-child relationship. *J Reprod Infant Psychol* 2017; 35(5):509-523.
14. Vasa R, Eldeirawi K, Kuriakose VG, Nair GJ, Newson C, Bates J. Postpartum depression in mothers of infants in neonatal intensive care unit: risk factors and management strategies. *Am J Perinatol* 2014; 31(5):425-434.
15. Horwitz SM, Storfer-Isser A, Kerker BD, Lilo E, Leibovitz A, ST John N, Shaw RJ. A model for the development of mothers' perceived vulnerability of preterm infants. *J Dev Behav Pediatr* 2015; 36:371-380.
16. Silveira RC. Como organizar o seguimento do prematuro. In: Silveira RC. *Manual de seguimento ambulatorial do prematuro*. São Paulo: Sociedade Brasileira de Pediatria; 2012. p. 3-7.
17. Feldman R, Rosenthal Z, Eidelman AI. Maternal-preterm skin-to-skin contact enhances child physiologic organization and cognitive control across the first 10 years of life. *Biol Psychiatry* 2014; 75(1):56-64.
18. Facundo SHBC, Silva RM., Gonçalves JL, Borba Netto FC, Queiroz MVO, Brasil CCP. Communication technologies used by nurses in prenatal care. *Rev Bras Promo Saude* 2020; 33:1-9.
19. Heuvel JFM, Groenhof TK, Veerbeek JHW, Solinge WW, Lely MD, Franx AMD, Bekker MN. Ehealth as the next-generation perinatal care: an overview of the literature. *J Med Internet Res* 2018; 20(6):e202.
20. Størksen H, Haga S, Slinning K, Drozd F. Health personnel's perceived usefulness of internet-based interventions for parents of children younger than 5 years: cross-sectional web-based survey study. *JMIR Ment Health* 2020; 7(11):e15149.
21. Richardson B, Dol J, Rutledge K, Monaghan J, Orovec A, Howie K, Boates T, Smit M, Campbell-Yeo M. Evaluation of mobile apps targeted to parents of infants in the neonatal intensive care unit: systematic app review. *JMIR Mhealth Uhealth* 2019; 7(4):e11620.
22. Galvão CM, Sawada NO, Trevizan MA. Revisão sistemática: recurso que proporciona a incorporação das evidências na prática da enfermagem. *Rev Latino-Am Enferm* 2004; 12(3):549-556.
23. Ganong LH. Integrative reviews of nursing research. *Res Nurs Health* 1987; 10(1):1-11.
24. Lockwood C, Munn Z, Porritt K. Qualitative research synthesis: methodological guidance for systematic reviewers utilizing meta-aggregation. *Int J Evid Based Healthc* 2015; 13(3):179-187.
25. Gomes R. Análise e interpretação de dados em Pesquisa Qualitativa. In: Minayo MCS, Deslandes SF, Gomes R, organizadores. *Pesquisa social: teoria, método e criatividade*. Petrópolis: Vozes; 2016. p.79-108.
26. Queiroz MAS, Brasil CCP, Cabral CBM, Porto ACL, Barbosa PME. Tecnologias eHealth direcionadas aos pais para o cuidado de bebês prematuros: revisão integrativa. In: *Libro de resúmenes del 11º congreso iberoamericano en investigación cualitativa*. Coruña; 2022 jul 12-15.
27. Queiroz MAS, Brasil CCP, Cabral CBM, Porto ACL, Barbosa PME, Sousa RC. Parent-targeted eHealth technologies for premature babies' care: An integrative review. *Investig Qualitativa Saude Avancos Desafios* 2022; 13:e693.
28. Ferecini GM. *Desenvolvimento e avaliação do objeto digital de aprendizagem sobre o aleitamento materno do prematuro* [tese]. Ribeirão Preto: Universidade de São Paulo; 2011.
29. Cervantes Guijarro CM, Sánchez Luna M, Bazán Fernández P. Uso de las nuevas tecnologías y telemedicina en el seguimiento del recién nacido sano. *Pediatr Atención Primaria* 2014; 16(64):305-310.
30. Jiménez-Serrano S, Tortajada S, García-Gómez JM. A mobile health application to predict postpartum depression based on machine learning. *Telemed J E-health* 2015; 21(7):567-574.
31. Letourneau N, Secco L, Colpitts J, Aldous S, Stewart M, Dennis CL. Quasi-experimental evaluation of a telephone-based peer support intervention for maternal depression. *J Adv Nurs* 2015; 71(7):1587-1599.

32. Ahmed AH, Roumani AM, Szucs K, Zhang L, King D. The effect of interactive web-based monitoring on breastfeeding exclusivity, intensity, and duration in healthy, term infants after hospital discharge. *J Obstet Gynecol Neonatal Nurs* 2016; 45(2):143-154.
33. Posmontier B, Neugebauer R, Stuart S, Chittams J, Shaughnessy R. Telephone-administered interpersonal psychotherapy by nurse-midwives for postpartum depression. *J Midwifery Womens Health* 2016; 61(4):456-466.
34. White BK, Martin A, White JA, Burns SK, Maycock BR, Giglia RC, Scott JA. Theory-based design and development of a socially connected, gamified mobile app for men about breastfeeding (Milk Man). *JMIR Mhealth Uhealth* 2016; 4(2):e81.
35. Alam M, D'Este C, Banwell C, Lokuge K. The impact of mobile phone-based messages on maternal and child healthcare behaviour: a retrospective cross-sectional survey in Bangladesh. *BMC Health Services Res* 2017; 17(1):434.
36. Flax VL, Ibrahim AU, Negerie M, Yakubu D, Leatherman S, Bentley ME. Group cell phones are feasible and acceptable for promoting optimal breastfeeding practices in a women's microcredit program in Nigeria. *Matern Child Nutr* 2016; 13(1):10.1111/mcn.12261.
37. Martinez-Brockman JL, Harari N, Segura-Pérez S, Goeschel L, Bozzi V, Pérez-Escamilla R. Impact of the Lactation Advice Through Texting Can Help (LATCH) trial on time to first contact and exclusive breastfeeding among WIC Participants. *J Nutr Educ Behav* 2018; 50(1):33-42.
38. Wang C-J, Chaovalit P, Pongnumkul S. A breastfed-promoting mobile app intervention: usability and usefulness study. *JMIR Mhealth Uhealth* 2018; 6(1):e27.
39. D'Agostini MM, Aredes NDA, Campbell SH, Fonseca LMM. Serious Game e-Baby Família: an educational technology for premature infant care. *Reben* 2020; 73(4):e20190116.
40. Kim HN. Information and communications technology and education customized for fathers of preterm infants. *Neonatal Network* 2020; 39(2):66-74.
41. Vasconcelos Filho JE, Brasil CCP, Rolim KMC, Silva Junior GB, Silva RM. MIDTS: método interdisciplinar para o desenvolvimento de tecnologias em saúde. In: Jorge MSB, Vergara CMAC, Sampaio HAC, Moreira TMM, organizadores. *Tecnologias eHealth em gestão em saúde: fundamentos para seu desenvolvimento e avaliação*. Curitiba: CRV; 2021. p. 49-66.
42. Silva CS, Carneiro MNF. Pais pela primeira vez: aquisição de competências parentais. *Acta Paul Enferm* 2018; 31(4):366-376.
43. Pilecco JC, Backes DS. Mother-baby binding in a neonatal intensive care unit: Interactive care technology. *Res Soc Develop* 2020; 9(8):e198985610.
44. Schwamm LH, Chumbler N, Brown E, Fonarow GC, Berube D, Nystrom K, Suter R, Zavala M, Polsky D, Radhakrishnan K, Lactman N, Horton K, Malcarney M-B, Halamka J, Tiner AC, American Heart Association Advocacy Coordinating Committee. Recommendations for the implementation of telehealth in cardiovascular and stroke care: a policy statement from the American Heart Association. *Circulation* 2017; 135(7):e24-e44.
45. Wallwiener S, Müller M, Doster A, Laserer W, Reck C, Pauluschke-Fröhlich J, Brucker SY, Wallwiener CW, Wallwiener M. Pregnancy eHealth and mHealth: user proportions and characteristics of pregnant women using Web-based information sources-a cross-sectional study. *Arch Gynecol Obstet* 2016; 294(5):937-944.
46. Wade VK, Karnon J, Elshaug AG, Hiller JE. A systematic review of economic analyses of telehealth services using real time video communication. *BMC Health Serv Res* 2010; 10:233.
47. Walker MG, Windrim C, Ellul KN, Kingdom JCP. Web-Based Education for Placental Complications of Pregnancy. *J Obstets Gynaecol Canada* 2013; 35(4):334-339.
48. Rauf Z, O'Brien E, Stampalija T, Ilioniu FP, Lavender T, Alfirevic Z. Home labour induction with retrievable prostaglandin pessary and continuous telemetric trans-abdominal fetal ECG monitoring. *PLoS One* 2011; 6(11):e28129.
49. O'Brien K, Bracht M, Macdonell K, McBride T, Robson K, O'Leary L, Christie K, Galarza M, Dicky T, Levin A, Lee SK. A pilot cohort analytic study of Family integrated care in a Canadian neonatal intensive care unit. *BMC Pregnancy Childbirth* 2013; 13(Supl. 1):S12.
50. Andrews G, Cuijpers P, Craske MG, Mcevoy P, Titov N. Computer therapy for the anxiety and depressive disorders is effective, acceptable and practical health care: a meta-analysis. *PLoS One* 2010; 5(10):e13196.
51. Kingston D. Pregnant women's views on the feasibility and acceptability of web-based mental health e-screening versus paper-based screening: a randomized controlled trial. *J Medical Internet Res* 2017; 19(4):e88.
52. Mitchell AM, Mittelstaedt ME, Schott-Baer D. Postpartum depression: the reliability of telephone screening. *MCN Am J Matern Child Nurs* 2006; 31(6):382-387.
53. Queiroz FFSN, Brasil CCP, Silva RM, Bezerra IC, Collares PMC, Vasconcelos Filho JE. Avaliação do aplicativo "Gestação" na perspectiva da semiótica: o olhar das gestantes. *Cien Saude Colet* 2021; 26(2):485-492.
54. Goetz M, Müller M, Matthies LM, Hansen J, Doster A, Szabo A, Pauluschke-Fröhlich J, Abele H, Sohn C, Wallwiener M, Wallwiener S. Perceptions of patient engagement applications during pregnancy: a qualitative assessment of the patient's perspective. *JMIR Mhealth Uhealth* 2017; 5(5):e73.
55. Minayo MCS, Costa AP. Fundamentos teóricos das técnicas de investigação qualitativa. *Rev Lusofona Educ* 2018; 40(40):139-153.

Article submitted 10/10/2023

Approved 10/04/2024

Final version submitted 12/04/2024

Chief editors: Maria Cecília de Souza Minayo, Romeu Gomes, Antônio Augusto Moura da Silva