Contributions of mobile applications on the breastfeeding practice: integrative review

Contribuições dos aplicativos móveis para a prática do aleitamento materno: revisão integrativa
Aportes de las aplicaciones móviles para la práctica de la lactancia materna: revisión integradora

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Abstract
Objective: To identify the contributions of mobile applications on the breastfeeding practice.
Methods: Integrative literature review of CINAHL, BDENF, Medline/PubMed, Scopus, LILACS, Web of Science, Cocharane and Scielo virtual libraries to answer the guiding question: What are the contributions of mobile applications to breastfeeding?. The searches occurred between September and November of 2017, using the descriptors "mobile applications", "breastfeeding", "postpartum period", "pregnant women", and "social support". After the combination of these descriptors, 530 articles were identified, and when applying the eligibility criteria, nine studies remained, which were assessed for methodological rigor and level of evidence. During data extraction, a validated and adapted instrument was used.
Results: Mobile applications that contributed to breastfeeding were informative. They provided guidance on the promotion of breastfeeding, infant feeding, use of alcohol during breastfeeding, and breastfeeding positions. Several applications were used to evaluate problems, experiences, and barriers to breastfeeding; frequency of breastfeeding; use of formula or complementary feeding. The applications that used the social network to support breastfeeding, and those which were subjected to the evaluation processes showed little expressiveness.
Conclusion: The applications were developed only with purpose of informative support in breastfeeding for the nursing mothers and their social network. However, some gaps were identified in the quality of information, usability, acceptability, and effectiveness of these applications, and it was not evident whether the development of these applications was supported by the scientific literature.

Resumo
Objetivo: Identificar as contribuições dos aplicativos móveis para a prática do aleitamento materno.
Métodos: Revisão integrativa da literatura, realizada nas bases de dados CINAHL, BDENF, Medline/PubMed, Scopus, LILACS, Web of Science e nas bibliotecas virtuais Cocharane e Scielo, para responder a questão norteadora: Quais as contribuições dos aplicativos móveis para a prática do aleitamento materno?. As buscas ocorreram entre setembro a novembro de 2017, utilizando os descritores "aplicativos móveis", "aleitamento materno", "período pós-parto", "gestante" e "apoio social". Após os cruzamentos desses descritores, identificou-se 530 artigos, que ao aplicar os critérios de elegibilidade, restaram nove estudos, avaliados quanto ao rigor metodológico e nível de evidência. Na extração dos dados empregou-se um instrumento validado e adaptado.
Resultados: Os aplicativos móveis que contribuíram para prática do aleitamento materno foram informacionais. Ofertaram orientações sobre promoção do aleitamento materno, alimentação infantil, uso de álcool na amamentação e posições para amamentar. Vários foram utilizados na coleta de dados referentes aos problemas, experiências e barreiras na amamentação; frequência da mamada; início do uso de fórmulas ou da alimentação complementar. Os aplicativos que continham a rede social de apoio na amamentação e os submetidos aos processos avaliativos tiveram pouca expressividade.
Conclusão: Os aplicativos foram direcionados apenas com objetivo de apoio informativo as nutrizes e sua rede social, na amamentação. Porém, apresentam lacunas quanto à qualidade de informações, usabilidade, aceitabilidade e eficácia desses aplicativos, como também não ficou evidenciado se a construção dos mesmos foi alicerçados na literatura científica.

Resumen
Objetivo: identificar los aportes de las aplicaciones móviles para la práctica de la lactancia materna.
Métodos: revisión integradora de la literatura, realizada en las bases de datos CINAHL, BDENF, Medline/PubMed, Scopus, LILACS, Web of Science y en las bibliotecas virtuales Cocharane y Scielo, para responder la pregunta orientadora: ¿cuáles son los aportes de las aplicaciones móviles para la práctica de la lactancia materna? Las búsquedas se llevaron a cabo de septiembre a noviembre de 2017, mediante la utilización de los descriptores "aplicaciones móviles", "lactancia materna", "período posparto", "embarazada" y "apoyo social". Después del cruce de los descriptores, se identificaron 530 artículos de los cuales, al aplicar los criterios de elegibilidad, quedaron nueve, evaluados con relación al rigor metodológico y nivel de evidencia. En la extracción de los datos se empleó un instrumento validado y adaptado.
Resultados: las aplicaciones móviles que contribuyeron a la práctica de la lactancia materna fueron informativas. Ofrecían instrucciones sobre promoción de la lactancia materna, alimentación infantil, uso de alcohol en la lactancia y posiciones para amamantar. Varias fueron utilizadas en la recolección de datos relacionados con los problemas, experiencias y barreras en la lactancia, frecuencia de las tomas, inicio de uso de leche de fórmula o de alimentación complementaria. Las aplicaciones que tenían una red social de apoyo en la lactancia y las que presentaban procesos de evaluación tuvieron poca expresividad.
Conclusión: las aplicaciones fueron orientadas solo con el objetivo de brindar apoyo informativo a las lactantes y su red social durante la lactancia. Sin embargo, presentan vacíos con relación a la calidad de la información, usabilidad, aceptación y eficacia de estas aplicaciones, así como tampoco quedó en evidencia si su elaboración estuvo fundamentada en la literatura científica.

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Introduction

Scientific evidence highlights the benefits of breastfeeding and the establishment of initiatives to promote breastfeeding, however, breastfeeding rates, especially exclusive breastfeeding, remains low worldwide. The main reasons reported by mothers are: insecurity, inexperience, professional occupation, beliefs, influence of third parties, lack of support from relatives, friends and health professionals, and the lack of information.[1,2]

In order to contribute to this practice, digital technologies are emerging to complement the acquisition of new knowledge, as they are increasingly used and reach most social sets, reaching 5 billion mobile phone signatures worldwide, and 80.4 % of individuals in Brazil.[3,4]

With this growth, health services pursue the interest of mobile health by enabling benefits in several health specialties, offering information, storing clinical data, and supporting with decision-making. Also, they are able to follow the individual for 24 hours a day, through virtual space, without restrictions or physical limitations, representing an effective manner of reaching the desired target audience.[5-8]

In this process of transforming communication, the integration of mobile applications facilitates the acquisition of information, contributes to the establishment of new modes of social and communication relationships capable of integrating the mother and her social network in breastfeeding, collaborating on changes of positive attitudes in this practice. Thus, the present integrative review aims to identify the contributions of mobile applications on the breastfeeding practice.

Methods

This was an integrative review of the literature, that enabled a synthesize and analysis of the research developed by quantitative and qualitative methods, published on a given subject, providing the most comprehensive understanding of a given phenomenon, to support decision making based on scientific evidence.[9]

This review included the following stages: problem formulation; search in the literature for primary studies; evaluation of studies included in the review; data analysis; presentation of results.[9] The research question is: What are the contributions of mobile applications on the breastfeeding practice?

The search of the publications occurred between September and November of 2017, in the CINAHL, BDENF, Medline/PubMed, Scopus, LILACS, and Web of Science databases, and in the Cochrane and Scielo libraries. The Health Descriptors (DeSC) and Medical Subject Headings (MeSH) were used to facilitate the search. The descriptors used were "mobile applications", "breastfeeding", "postpartum period", "pregnant woman" and "social support", as well as their correspondents in Portuguese: "aplicativos móveis", "aleitamento materno", "período pós-parto", "gestante", and "apoio social".

The search strategy of the studies was performed by two researchers, with the intention of standardizing the sequence of the descriptors and combinations; and next, the same search was performed by these two researchers separately. The results of this search were compared to identify possible disagreements and correction of errors that might exist. All the combinations contained the descriptor, "mobile applications".

Initially, the descriptors were combined with each other, using the Boolean operator, AND; first in pairs, to understand the relationship between the mobile applications, with the other descriptors established. Then, combining was performed between the three descriptors, so that "mobile applications" and "breastfeeding" were maintained in association with the other words: "postpartum period", "pregnant woman" and "social support". All combinations were made equally, and in the same order, for each database and health library (Chart 1).

The primary studies were selected based on the inclusion criteria: original articles that addressed the theme of the study, available in their entirety, in Portuguese, English, and Spanish, published in the last ten years. This time delimitation was due the smartphone revolution in 2007, resulting in

Chart 1. Publications identified in databases and virtual health libraries, 2007-2017, focusing on the contributions of mobile applications for breastfeeding

| Combining keywords	Databases				Library	
	CINAHL	Medline/PubMed	Scopus	Web of Science	Cochrane	Total
Mobile applications and breastfeeding	4	9	21	18	3	55
Mobile applications and postpartum period	10	6	4	6	3	29
Mobile applications and pregnant woman	5	38	2	59	2	106
Mobile applications and social support	5	304	3	6	1	319
Mobile applications and breastfeeding and postpartum period	3	0	2	0	0	5
Mobile applications and breastfeeding and social support	1	1	2	3	2	9
Mobile applications and breastfeeding and pregnant woman	1	2	2	2	0	7
Total	29	360	36	94	11	530

the availability of several applications in virtual stores.[10] Letters to the reader, editorials, theses, dissertations, book, book chapters, newspaper articles, experiences, reflection studies, systematic or integrative literature reviews, and studies that did not answer the guiding question were excluded.

In the selection stage of the primary studies, the titles of the 530 publications were read. A total of 300 articles were excluded because they did not address the topic of study in the titles. Among the 230 left, the eligibility criterion was applied, and 177 were excluded because they did not meet the established criteria. The abstracts were read of the remaining 44 publications, and 35 were exclud-

ed because they did not address applications and breastfeeding. Nine publications remained for analysis and discussion (Figure 1). Articles found in more than one database were cataloged only once, according to the order of identification in the first database searched.

The data extraction was guided by a validated and adapted instrument, which includes information about the authors, objective, methodological characteristics, and main results of the study.[12] To evaluate the methodological rigor, the instrument adapted from the Critical Appraisal Skills Program (CASP) was used, which classifies the studies as: good methodological quality and reduced bias (category A - 6 to 10 points), and satisfactory methodological quality (category B - at least 5 points);[13] however, all the articles were included.

The level of evidence was evaluated according to the hierarchical classification, as: level 1, meta-analysis of multiple controlled studies; level 2, an individual experimental study; level 3, quasi-experimental studies, study with experimental design, non-randomized controlled single group, pre and post-test; level 4, non-experimental design, such as descriptive, correlational, qualitative, or case studies; level 5, case reports or systematically obtained, verifiable quality improvement program evaluation or quality analysis; and level 6, opinion of known authorities, based on their experience or the opinions of an expert committee, including the interpretation of non-research-based information; regulato-
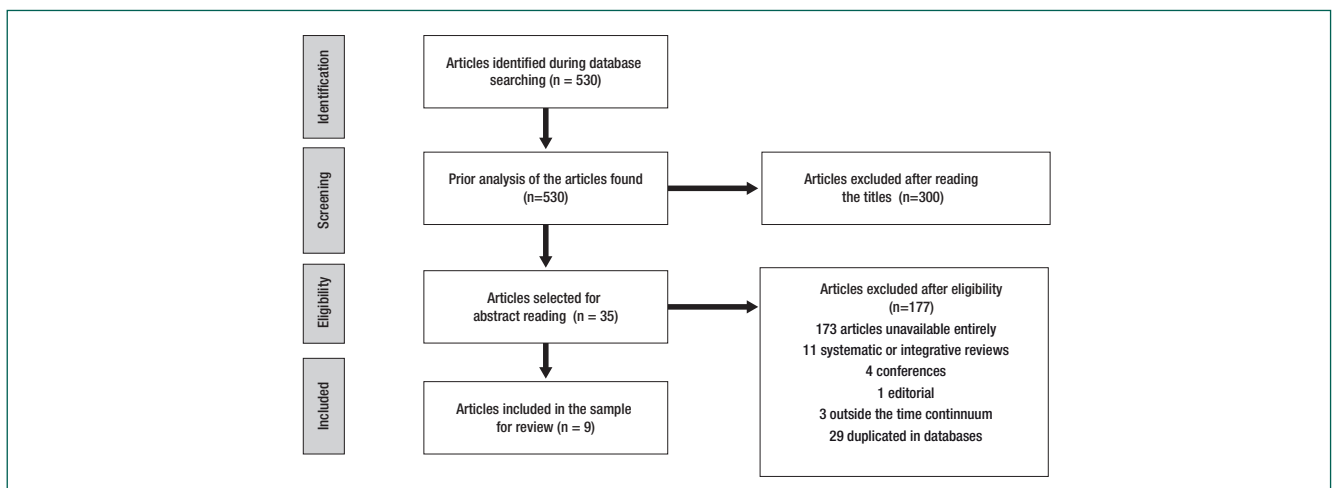
Source: Adapted from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, the PRISMA.[11]

Figure 1. Study selection process based on the contributions of mobile applications to breastfeeding

ry or legal opinions.[14] The results were discussed in light of Sanicola Social Network Theory,[15] and the scientific literature.

Results

Among the nine articles selected, three were found in Medline/PubMed, two in Scopus, two in CINAHL, and two in the Web of Science.[16-25] With regards to the research design, five were descriptive,[17,20-23] one qualitative,[18] one methodological,[19] one experimental without randomization,[25] and the other experimental with randomization.[24] The predominant level of evidence was four,[17-23] followed by three,[25] and two.[24] The methodological analysis of rigor focused on level A,[18-25] and only one on B.[17]

The studies were published between 2015-2017, in the English language, in periodicals of the United States,[16,17,20-22] United Kingdom,[23,24] and Australia.[18,19] Among the studied population, three were from the United States,[17,20,21]

two from Australia,[18,19] one in Liberia,[22] one from Denmark,[23] and one from India.[24] One of the articles[16] did not have the location identified. Three were published in the maternal and child area,[16,20,21] two in informatics,[18,24] two in the multidisciplinary area,[19,22] one in the medical area,[23] and one in the nursing area.[17]

One study shared information about the characteristics of the applications available in the virtual stores, related to breastfeeding,[16] however, the most commonly used applications aimed at collecting data on maternal and child health, such as breastfeeding problems, breastfeeding frequency, initiation of formula or complementary feeding, experiences and barriers with breastfeeding, and alcohol use in breastfeeding.[16,17-23] Only two studies focused, exclusively, on tracking breastfeeding practices,[20, 21] two integrated the social network of nursing support in their studies,[17,18] one article was evaluated by means of a opinion survey and evaluation scale of the prototype.[18] The synthesis of the articles found is presented in chart 2.

Chart 2. Summary of articles on the contributions of mobile applications to breastfeeding

Authors/Year/Database	Objective	Methods/Level of evidence	Description of applications	Contributions of mobile applications to breastfeeding
Mohrbacher N et al.[16] 2015 Web of Science	To evaluate the mobile applications developed for breastfeeding, available in virtual stores.	Descriptive study, performed in searches of the characteristics of mobile applications in the virtual stores. Level of evidence-4	Most applications are about general baby care and places for breast milk collection; only the breastfeeding solutions explain the dynamics of breastfeeding.	Breastfeeding information support; screening for breastfeeding, including problems with breastfeeding; identification of location for breast milk pumping.
Asiodu IV et al.[17] 2015 CINAHL	To describe the use of social media and mobile applications during the pre- and post-partum periods, in African-American primiparous women and their social network.	Qualitative study, with interviews and observations of 43 primiparous women and their social support network. Level of evidence- 4	The applications showed little information about breastfeeding. The focus is on pre- and post-partum care, growth and development content.	Information on the practice of breastfeeding in the postpartum period
White BK et al.[18] 2016 Medline/ PubMed	To develop an application with information about breastfeeding for parents.	Methodological study, with the development and assessment of an application based on the Social Cognitive Theory. Level of evidence- 4	Contains a digital library with information focused on breastfeeding and infant feeding, sends notifications with messages about breastfeeding, and enables connectivity among mothers.	Providing, sharing information and discussions on breastfeeding, having the parents as the focus
White BK et al.[19] 2016 CINAHL	To describe a multidisciplinary partnership to develop and promote a health promotion application.	A descriptive study about mobile applications developed with information on breastfeeding and alcohol use. Level of evidence- 4	The main resource is a chronometer that indicates when breast milk is free of alcohol.	Sharing the application enabled women who use alcohol access to information on alcohol consumption and breastfeeding.
Demirci JR et al.[20] 2017 Medline/PubMed	To describe the feasibility and acceptability of a mobile application to track breastfeeding	Descriptive study, from the observation of the behavior and thinking of primiparous women about breastfeeding, over 8 weeks. Level of evidence- 4	Data collection on feeding and breastfeeding, such as: time, duration, volume, comments, thoughts and experiences (success, problems, and unexpected events).	Information about breastfeeding and problems experienced by postpartum participants. Development of a text message program to support those who are breastfeeding.
Demirci JR et al.[21] 2017 Scopus	To track real-time behavior and experiences of breastfeeding.	Observational, descriptive study, performed by downloading the BabyConnect application, and use of an ecological momentary assessment tool (EMA). Level of evidence - 4	Extensive amount of information and possibility of sharing, about infant feeding and breastfeeding.	Obtaining data on breastfeeding time, last breast used, duration, milk volume and pumping intervals, experiences, problems, concerns and barriers with breastfeeding.

Continuation.

Authors/Year/ Database	Objective	Methods/Level of evidence	Description of applications	Contributions of mobile applications to breastfeeding
Guyon A et al.[22] 2016 Scopus	To describe the health and nutrition monitoring system based on a mobile application.	A descriptive study in which a digital data collection platform was used. Level of evidence - 4	Ability to receive, store, and transfer data information, through a storage cloud for download and analysis.	Information on breastfeeding promotion and initiation of complementary feeding.
Hägi-Pedersen MB et al.[23] 2017 Web of Science	To test the effects of video assessment using the application program (PreHomeCare) compared to the effect of hospital visits	A quantitative and randomized controlled trial, in which 80 participants received one application and one infant scale, and 80 received standardized hospital visits. Level of evidence- 2	Addressed knowledge about breastfeeding, position for breastfeeding, participatory videos, data recording, message sending, access to history, and sharing.	The application provides access to guidance 24 hours a day, addressing three components, including breastfeeding and breastfeeding positions.
Balakrishnan B et al.[24] 2016 Medline/Pubmed	To evaluate the effectiveness of the mHealth Continuity of Care Services (CCS) platform for strengthening maternal and child services.	Experimental quantitative study based on the CCS application, by means of providing health services and obtaining information; among them, the early initiation of breastfeeding and complementary feeding, compared to other castes of India. Level of evidence - 3	The application has specific units for registration of pregnancy, puerperium, the practice of exclusive breastfeeding, among others. It has a home-visit planner, a feature that helps with data collection, and real-time transmission to the central database.	The early initiation of breastfeeding was higher in the intervention group than in the control group, and approximately 41% of the children began complementary feeding at an opportune time.

Discussion

Globalization and the advent of the internet have contributed to more space for mobile application use in the population. This technology enables the development of entertainment solutions and a enormous network of communication, provides independent and autonomous knowledge, as it facilitates women and their social networks to surf in their own interest, but also enables sharing and obtaining of relevant information in an attempt to contribute to the maintenance of breastfeeding.

This versatility contributed to the recognition by the World Health Organization, in 2011, of the potential of mobile health as a strategy for health practices, favoring the incorporation of this increasingly frequent device.[6] As a result, studies on mobile applications used to help the breastfeeding practice[16-24] have been published. However, they are still relatively recent, between 2015-2017, as identified in this review.

Among the populations studied in the investigations identified for this review, Brazilian studies were not identified, although this country has around 245 million mobile devices connected to the Internet, 71% of which are smartphones.[25] However, this technology is shown as an alternative supporter of information, for offering different manners of disseminating knowledge, and transmitting information about breastfeeding, to remote places, reaching pregnant women, puerperal women and their social network. This information diffusion should occur especially in the puerperal period, because at this stage a greater need for support and guidance on breastfeeding is identified, due to the insecurity with nurturing,[26] and because it constitutes a period where beliefs, myths, and customs about breastfeeding are more present. This information, when offered, is responsible for increasing exclusive breastfeeding by up to 49%, and breastfeeding by 66%.[27] This fact was well evidenced in a study included in this review.

This information support should also be offered to family members, neighbors, and friends, because they are considered important to guaranteeing the adherence and maintenance of breastfeeding.[28] Nursing mothers, in the midst of numerous puerperal transformations, are susceptible to external influences, and their social network may or may not have a positive impact on breastfeeding.

At birth, the father's feelings of fear and uncertainty about his new family situation create insecurities and doubts about the care of the baby and his wife. Thus, the father must be included as well, guiding him about the importance of his participation in the breastfeeding process, because the more he knows about the benefits for the child and the woman, the greater the chances of success. However, the analysis of the articles showed that the father was not very well represented in the social network.

However, it is not enough to only offer information, but also to track actions to promote, protect, and support breastfeeding, in order to provide support for directing the practice of the guidelines conducted by health professionals and institutions. Data collection using mobile applications promotes greater agility to obtain, record, store and send infor-

mation with organization, speed and convenience, resulting in rapid and effective intervention.[30]

Mobile applications, for the most part, are about general care with newborns and locations for breast milk collection[16] in addition to there being little information about the quality of these contents. These applications are launched in virtual stores without any type of monitoring, possibly because they are not associated to research, but to private developers, making it difficult to assess the quality of the information content.[31]

The evaluation guarantees the application of methodological procedures to determine, from proposed objectives, the relevance, effectiveness, and impact of certain activities for the purpose of decision-making. This process was identified in one article of this review, occurring by formative evaluation of content, credibility test and assessment of functionality, comprehensibility, and usability.[18]

Conclusion

In this age of the great propagation of the Internet and smartphones, applications emerge as an educational proposal, capable of distributing information in several contexts. However, it is necessary to reflect on the importance of this tool for breastfeeding support, with regards to providing information to the mother and her social network. The studies demonstrated that information was offered on breastfeeding to puerperal women, and informative support was provided to mothers and their social network. However, they indicate that gaps need to be filled with quality information that is usable, acceptable and effective, as they did not mention whether the construction of mobile applications was based on the scientific literature. It should be noted that no experimental studies were found for breastfeeding, which would enable the specific description of evidence in the subject studied. Thus, mobile applications exclusively on breastfeeding, focused on promoting breastfeeding throughout the pregnancy-puerperal cycle, must be developed.

Devices should be developed that recognize the mothers' needs, which include their social network

of breastfeeding support, and which are coherent and adequate, according to specific demands, submitted to an assessment process and research that can evaluate their efficiency.

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