

## Breastfeeding mobile applications assistance in Brazil: a scoping review protocol

Iga Carnevalli Leal<sup>1</sup>   
Ester Florens Guerra Gouvêa<sup>1</sup>   
Larissa Melgaço Campos<sup>1</sup>   
Ana Júlia Delfim de Oliveira<sup>1</sup>   
Daiana Carola de Souza Teles<sup>1</sup>   
Teresa Raquel Moraes Silva<sup>1</sup>   
Joyce Marques Barroso<sup>2</sup>   
Andréa Rodrigues Motta<sup>3</sup>   
Renata Maria Moreira Moraes Furlan<sup>3</sup> 

<sup>1</sup> Universidade Federal de Minas Gerais - UFMG, Belo Horizonte, Minas Gerais, Brasil.

<sup>2</sup> Universidade Federal de Minas Gerais - UFMG, Programa de Pós-graduação em Ciências Fonoaudiológicas, Belo Horizonte, Minas Gerais, Brasil.

<sup>3</sup> Universidade Federal de Minas Gerais – UFMG, Departamento de Fonoaudiologia, Belo Horizonte, Minas Gerais, Brasil.

### ABSTRACT

**Purpose:** to present a scoping review protocol to identify and analyze free applications available for Android and iOS operating systems to assist nursing mothers in terms of breastfeeding.

**Methods:** the methodological structure of this scoping review has nine stages: developing the research question; defining descriptors; establishing application inclusion and exclusion criteria; locating applications; listing applications; selecting them by title and icon analysis; collecting application data; selecting them by application data analysis and quality assessment. The research question was developed based on the participants-concept-context strategy. Breastfeeding mobile applications assistance will be searched in Google Play and Apple Store. Two independent raters will select applications, collect data, and assess their quality. Quality assessment will use the Mobile App Rating Scale, which will be correlated with user ratings.

**Final Considerations:** this research presented a nine-stage scoping review protocol aimed at identifying and analyzing free applications available for Android and iOS operating systems to help nursing mothers in terms of breastfeeding. The protocol is ready to be implemented.

**Keywords:** Breast Feeding; Mobile Applications; Health Promotion

A study conducted at the Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.

**Financial support:** Nothing to declare.

**Conflict of interest:** Nonexistent.

### Corresponding author:

Renata Maria Moreira Moraes Furlan  
Universidade Federal de Minas Gerais -  
Faculdade de Medicina - Departamento  
de Fonoaudiologia  
Avenida Alfredo Balena, 190, Santa  
Efigênia  
CEP: 30.130-100 - Belo Horizonte,  
Minas Gerais, Brasil  
E-mail: renatamfurlan@gmail.com

**Received on:** August 31, 2023

**Accepted on:** October 9, 2023



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

The World Health Organization (WHO) recommends exclusive breastfeeding until 6 months old, then supplemented until the child is 2 years or older<sup>1</sup>. Breast milk has a complex and dynamic constitution that makes it ideal for newborns' nutritional, metabolic, and immunological needs<sup>2</sup>. Furthermore, breast milk has long-term benefits, as it increases the bond between the mother and her newborn/infant, prevents diseases such as diabetes and obesity, promotes the child's healthy development, and provides a higher quality of life for both the newborn/infant and the mother<sup>2</sup>.

Despite its known benefits, breastfeeding rates in Brazil are below those recommended by the Ministry of Health and the WHO<sup>1,3</sup>. There are various causes of early weaning. Misinformation, difficulties in latching, and returning to work are some of the reasons why babies are breastfed for less time than recommended<sup>4</sup>. In developing countries, nursing mothers face the challenge of less access to information and less support from institutions to breastfeed<sup>1</sup>. In this sense, measures should be taken to promote and protect breastfeeding.

The advancement of technologies worldwide and the increasing search for practicality and ease of access to services, in general, have led the population to a greater interest in mobile health<sup>5</sup>. This communication-changing process includes the integration of mobile applications, which provide information, help establish new forms of social and communication relationships, benefit nursing mothers and their social networks in terms of beginning and maintaining breastfeeding, and positively change their attitudes towards this practice<sup>6</sup>.

Technological mechanisms have been used to promote breastfeeding and increase adherence to it, as a large portion of the population has access to some form of technology, especially mobile applications<sup>6</sup>. Despite the increased number of mobile technology users and applications aimed at promoting the health of pregnant women and babies, assessment methods must be used to determine how effectively they improve the lives of this population.

Thus, this study aimed to present a scoping review protocol to identify and analyze free applications available for Android and iOS operating systems to assist nursing mothers in terms of breastfeeding.

## METHODS

This research presents a scoping review protocol that will search mobile application stores (Google

Play Store and App Store), following the methodology proposed by Furlong and collaborators<sup>7</sup> to verify mobile applications to assist nursing mothers in terms of breastfeeding. The protocol was registered on the Open Science Framework (OSF) (DOI: 10.17605/OSF.IO/YUAQ5).

The methodological structure of the scoping review will have the following stages: (1) Developing the research question; (2) defining descriptors; (3) establishing application inclusion and exclusion criteria; (4) locating mobile applications to assist in breastfeeding; (5) listing applications by titles and icons; (6) selecting by title and icon analysis (broad screening); (7) collecting application data; (8) selecting applications through data analysis (focused screening); (9) assessing their quality.

The research question was developed based on the mnemonic PCC strategy, in which P (participants) refers to pregnant and nursing women, C (concept) refers to breastfeeding assistance, and C (context) refers to mobile applications. Hence, the research question for this study was defined as follows: "What mobile applications are available to assist pregnant and nursing women in breastfeeding and how is their quality classified?". The question was developed based on the need to find applications that help nursing mothers with breastfeeding.

Study descriptors were defined by consulting professionals who work with breastfeeding, including speech-language-hearing professors and pathologists. They included terms related to breastfeeding, adapted to the variety of consumers who access application stores, as follows: lactating, breastfeeding women, lactation, nursing mothers, and breastfeeding.

The eligibility criteria were defined according to the methodology proposed by Furlong and collaborators<sup>7</sup>. The inclusion criteria were applications with versions for Android or iOS and providing breastfeeding information or tips (e.g., about latch, breastfeeding schedule, correct mother and baby breastfeeding position, and techniques to facilitate sucking and stimulate the bond between the mother and the baby). The exclusion criteria were paid applications, applications in a foreign language, and those that malfunctioned when tested on three different days. It was decided to include only free applications to ensure support for families, especially those with socioeconomic difficulties.

The breastfeeding assistance mobile applications will be searched in Google Play Store and App Store because they are associated with the two most

used operating systems, Android and iOS. These two platforms were chosen due to their substantial share in the mobile application market. Two researchers will individually enter the predefined search terms in the web search fields in the application stores.

Search results will be listed in rows for each application store. The applications' titles and icons will be copied and pasted into Microsoft Word™, making them available for future visualization.

Applications will be analyzed according to the eligibility criteria in two stages: broad screening and focused screening.

Two researchers will broadly screen the applications, independently examining all titles and icons obtained in the search and judging whether to maintain or exclude them according to the eligibility criteria. Hence, they will enter a "yes" in a spreadsheet for applications meeting the eligibility criteria and a "no" for those not meeting

them. In cases of diverging opinions, a third researcher will be consulted. Applications selected at this stage will proceed to focused screening.

In the focused screening stage, the two reviewers will independently extract the applications' marketing information from both stores and apply the same inclusion and exclusion criteria based on such information. Then, the two researchers' agreement will be analyzed with Cohen's Kappa statistics<sup>8</sup>. Divergences will be resolved by discussion until a consensus is reached. The reasons for exclusions will be recorded.

One researcher will extract each application's information from the terms of service in Google Play and App Store. Then, the second researcher will extract 10% of the information and check for compatibility. Chart 1 presents the data to be extracted from each application and their respective definitions.

**Chart 1.** Application data and their respective definitions

Extracted information*	Definition
1. Version	The current application update.
2. Platform	The place where the application is available to be downloaded or accessed by users.
3. Release date	The day, month, and year when the application was made available on the platform.
4. Time since release	The number of days the application has been on the platform since its release.
5. Number of updates	The number of times the application underwent code changes to fix errors, optimize it, etc.
6. Mean update frequency	The mean time between two consecutive updates.
7. Time of the last update	The time when the application was last updated.
8. Evaluation of the current version	The number of recorded opinions on the application.
9. Number of evaluations of the current version	The number of people that rated the application.
10. Classification of the previous version	The performance evaluation of application versions previous to the current one.
11. Number of evaluations of the previous version	The number of users that rated the second last application version on the download platforms.
12. Device compatibility	The current version of the application must be compatible with the mobile phone configuration for it to run on the device.
13. Developer	The application designer, developer, and implementer.
14. Package option (yes/no)	Whether the application offers paid services as an option.

\*Furlong et al. (2016)<sup>13</sup>

The applications selected in the previous stage will be downloaded to assess their quality, using an Android device manufactured by Motorola™, model MotoG8 PLUS, and an iPhone 7 plus. Hence, the comparison will only consider mobile phones. Application quality will be assessed with the Mobile App Rating Scale (MARS)<sup>9</sup>. Developed by a multidisciplinary team, this tool evaluates applications using a 5-point scale, on which 1 means inadequate and 5 means excellent, in the following six indicators: 1) engagement (five items), 2) functionality (four items), 3) aesthetics (three items), 4) information (seven items), 5) subjective quality (four items), and 6) perceived impact (six items)<sup>9</sup>. MARS was designed so that the total mean score can be converted directly into a star rating for comparison with the star ratings in the app store. Two reviewers will independently test the mobile applications included for quality assessment. The intraclass correlation coefficient (ICC) will be calculated to verify the consistency between the two reviewers' responses. An ICC above 0.75 will be considered indicative of good agreement<sup>10</sup>. If the ICC is below 0.75, a third reviewer will be consulted.

Pearson's correlation coefficient will be calculated to determine whether the MARS scores given by the reviewers are correlated with the star ratings ascribed by App Store and Google Play users.

The applications' descriptive and technical information and quality assessment results will be presented in tables and summarized in the text. The applications' scores will be compared in charts regarding their engagement, functionality, aesthetics, and quality of information. The 10 mobile applications with the highest mean quality score will be highlighted.

## DISCUSSION

Scoping reviews are developed to map evidence that supports a certain area of knowledge<sup>11,12</sup>. They are generally carried out in scientific article databases and the grey literature (theses, dissertations, monographs, and other such documents). This protocol innovates by proposing a scoping review that addresses mobile applications.

A study conducted by Furlong and collaborators<sup>13</sup> systematically searched for speech-language therapy applications for children in mobile application stores for 6 months. They used 12 previously defined search terms and identified 5,076 applications. The systematic screening process reduced the list to 132 exclusive applications, which two raters thoroughly assessed with MARS<sup>13</sup>. The authors found 25 high-quality, 105

medium-quality, and two poor or very poor-quality applications<sup>13</sup>. This type of review has been gaining strength recently, given the widespread use of mobile applications<sup>7,13</sup> and the need to help the population make choices among the many applications offered in stores.

This review is structured according to traditional scoping reviews, guided by the Preferred Reporting Items for Systematic Reviews and Meta-analyses – Extension for Scoping Reviews (PRISMA-ScR)<sup>12</sup>, and adapted to the search for mobile applications. MARS<sup>9</sup>, which assesses the quality of applications, is validated<sup>14</sup> and widely used in application analysis. It has been adapted to various languages<sup>15-17</sup>, including Brazilian Portuguese<sup>18</sup>.

This protocol study will hopefully encourage further research to analyze applications in other health and speech-language therapy topics. The results of the final research are expected to help nursing mothers choose breastfeeding assistance applications that provide guidance based on scientific evidence and solid recommendations and that are accessible to the entire population of mobile users.

## FINAL CONSIDERATIONS

This research presented a scoping review protocol aimed at identifying and analyzing free applications available for Android and iOS operating systems to help nursing mothers in terms of breastfeeding. It will have nine stages: developing the research question; defining descriptors; establishing application eligibility criteria; locating mobile applications to assist in breastfeeding; listing applications by titles and icons; broad screening; focused screening; and quality assessment. The protocol is ready to be implemented.

## REFERENCES

- Victora CG, Bahl R, Barros AJD, França GVA, Horton S, Krusevec J et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *The Lancet*. 2016;387:475-90. [https://doi.org/10.1016/S0140-6736\(15\)01024-7](https://doi.org/10.1016/S0140-6736(15)01024-7) PMID: 26869575.
- Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Saúde da criança: nutrição infantil: aleitamento materno e alimentação complementar / Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Atenção Básica. – Brasília: Editora do Ministério da Saúde, 2009. 112 p: il. – (Série A. Normas e Manuais Técnicos) (Cadernos de Atenção Básica, n. 23).
- Boccolini CS, Boccolini PMM, Monteiro FR, Venâncio SI, Giugliani ERJ. Breastfeeding indicators trends in Brazil for three decades. *Rev Saude Publica*. 2017;51:108. <https://doi.org/10.11606/S1518-8787.2017051000029> PMID: 29166437. PMCID: PMC5697916.

4. Lima APC, Nascimento DS, Martins MMF. A prática do aleitamento materno e os fatores que levam ao desmame precoce: uma revisão integrativa. *J. Health Biol Sci.* 2018;6(2):189-96. <https://doi.org/10.12662/2317-3076jhbs.v6i2.1633.p.189-196.2018>
5. Singh K, Drouin K, Newmark LP, Rozenblum R, Lee J, Landman A et al. Developing a framework for evaluating the patient engagement, quality, and safety of mobile health applications. *Issue Brief (Commonw Fund)*. 2016 Feb;5:1-11. PMID: 26934758.
6. Costa CC, Santos LN dos, Andrade JS de. A tecnologia dos aplicativos móveis na promoção ao aleitamento materno: revisão integrativa. *Res Soc Develop*. 2022;11(6):e7111628688. <http://dx.doi.org/10.33448/rsd-v11i6.28688>
7. Furlong L, Morris M, Serry T, Erickson S. Mobile apps for treatment of speech disorders in children: An evidence-based analysis of quality and efficacy. *PLoS ONE*. 2018;13(8):e0201513. <https://doi.org/10.1371/journal.pone.0201513> PMID: 30092095. PMCID: PMC6084897.
8. Altman DG. Estatísticas práticas para pesquisas médicas. Londres: Chapman e Hall; 1990.
9. Stoyanov SR, Hides L, Kavanagh DJ, Zelenko O, Tjondronegoro D, Mani M. Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR Mhealth Uhealth*. 2015;3(1):e27. <https://doi.org/10.2196/mhealth.3422> PMID: 25760773. PMCID: PMC4376132.
10. Portney L, Watkins M. Statistical measures of reliability. In: Foundations of clinical research: applications to practice. Upper Saddle River, NJ: Pearson/Prentice Hall; 2009. p.585-658.
11. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8(1):19-32.
12. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. 2018;169(7):467-73. <https://doi.org/10.7326/M18-0850> PMID: 30178033.
13. Furlong LM, Morris ME, Erickson S, Serry TA. Quality of mobile phone and tablet mobile apps for speech sound disorders: Protocol for an evidence-based appraisal. *JMIR Res Protoc* 2016;5(4):e233. <https://doi.org/10.2196/resprot.6505> PMID: 27899341. PMCID: PMC5155082.
14. Stoyanov SR, Hides L, Kavanagh DJ, Wilson H. Development and validation of the user version of the Mobile Application Rating Scale (uMARS). *JMIR Mhealth Uhealth* 2016;4(2):e72. <https://doi.org/10.2196/mhealth.5849> PMID: 27287964. PMCID: 4920963.
15. Yamamoto K, Ito M, Sakata M, Koizumi S, Hashisako M, Sato M et al. Japanese version of the Mobile App Rating Scale (MARS): development and validation. *JMIR Mhealth Uhealth*. 2022;10(4):e33725. <https://doi.org/10.2196/33725> PMID: 35197241. PMCID: 9052018.
16. Barzegari S, Sharifi Kia A, Bardus M, Stoyanov S, GhaziSaeedi M, Rafizadeh M. The Persian version of the Mobile Application Rating Scale (MARS-Fa): translation and validation study. *JMIR Form Res*. 2022;6(12):e42225. <https://doi.org/10.2196/42225> PMID: 36469402. PMCID: PMC9764158.
17. Bardus M, Awada N, Ghandour L, Fares E, Gherbal T, Al-Zanati T et al. The Arabic version of the Mobile App Rating Scale: development and validation study. *JMIR Mhealth Uhealth* 2020;8(3):e16956. <https://doi.org/10.2196/16956> PMID: 32130183. PMCID: PMC7078658.
18. Gralha SR, Bittencourt ONS. Portuguese translation and validation of the user rating scale for mobile applications in the health area (uMARS). *Res Soc Develop*. 2023;12(6):e8912642056. <http://dx.doi.org/10.33448/rsd-v12i6.42056>

#### Authors' contributions:

ICL, EFGG: conceptualization, data collection and analysis, writing – original draft, methodology, project administration, review, and approval of the final version;  
 LMC, AJDO, DCST, TRMS: data collection and analysis, review, and approval of the final version;  
 JMB: writing – original draft, review, and approval of the final version;  
 ARM: development of the methodology, supervision of research stages, review of the manuscript, and approval of the final version;  
 RMMMF: conceptualization, development of the methodology, supervision of research stages, review of the manuscript, and approval of the final version.