Mobile health applications for pregnancy in Iran: Current state investigation

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Abstract:

BACKGROUND: The expansion of pregnancy-related mobile applications has led to an increase in the usage of these applications by Iranian women, which has the potential to have a long-term impact on women's pregnancy health and, as a result, community health. The goal of this research was to investigate the state of pregnancy-related mobile applications in Iran.

MATERIALS AND METHODS: This was a descriptive-applied research approach which was conducted in 2020. One hundred and fifty-seven pregnancy apps from different Iranian mobile app markets were installed and were examined in terms of the resources used and their validity, subject distribution, participation of obstetricians in the app development, apps volume, rank acquired by users and distribution of apps according to the developers. The relationship between the number of resources used and user rankings was also tested.

RESULTS: A total of 157 apps were categorized into 12 subject categories based on their content. Only 1.3% of the apps were developed with the participation of obstetricians. Only 5% of the apps had used reliable information resources. Furthermore, the number of resources referenced in the studied apps did not have a significant relationship with star ratings (r = 0.03, *P* = 0.64), according to the Pearson correlation test.

CONCLUSION: Iranian mobile applications in the field of pregnancy have grown significantly in terms of quantity, subject diversity, and user acceptance; however, the credibility of the information in these apps cannot be validated. This serves as a reminder to users to exercise caution while using such apps.

Keywords:

Applications, mobile health, obstetrics and gynecology, pregnancy

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Introduction

Mobile health apps are easily available and ubiquitous software that enable health and clinical information on smartphones and tablets. Because of the ease of use and cheap cost of these apps, women have turned to health apps for information on prenatal and maternity care.[1] The quality of such apps is critical since it may have an impact on the health of pregnant women and, as a result, the community's health. As a result, it is critical to assess the current state and quality of these apps. The state of mobile health apps has been studied in Iran and throughout the globe, including the following research: Ghazi-Saeedi on the validity of resources in mobile health applications available in the online store Cafe Bazaar.[2] Ershad Sarabi on the role of mobile phone use in health care in Iran,[3] Langarizadeh *et al.* and Kalhori *et al.*, on personal health record application for gestational diabetes,[4,5] Borjalilu *et al.* on the mobile applications in the delivery of mental health services,[6] Connor, on evaluating of prenatal mobile health apps,[7] Biviji, In assessing the quality of applications

How to cite this article: Shirvanian-Dehkordi M, Zare-Farashbandi F, Samouei R, Nouri R. Mobile health applications for pregnancy in Iran: Current state investigation. J Edu Health Promot 2022;11:338.

of maternal and child health,[8] Gyselaers to review health apps along with the pregnancy assessment and monitoring,[9] Bland *et al*. in assessing the coverage and nutrition information content of applications accessible to pregnant women,[10] Lee and Moon to review characteristics, contents and the validity of applications of pregnant women.[11] Furthermore, there are the reviews of mobile health apps on other topics such as obesity management,[12] pain management,[13] chronic kidney disease care management,[14] iPhone pregnancy apps[15] and Google Play,[16] physical activity in people with rheumatoid arthritis,[17] postpartum care, contraception, health behavior change,[18-20] weight management,[21] cancer diagnosis,[22] and establishment of ranking scales for mobile health applications[23] was conducted.

Iranian women now utilize Persian pregnancy health apps from online app stores such as Cafe Bazaar, Pars Hub, Iran Apps, Kandoo, Myket and Avval Market. As a result, the purpose of this research is to establish the state of these apps in terms of star rating (user opinion), app size, and resources referenced, amount of obstetrician engagement in the creation process, and subject distribution. Then, the relationship between the number of information resources referenced and user rankings was also tested.

Materials and Methods

The current research is an applied study that was done in 2020 using the descriptive approach. First, the most well-known Android app stores in Iran were discovered via an online search. In these stores, the keywords such as "prenatal care," "childbirth," and "pregnancy" were used to look for mobile apps. A total of 374 pregnancy-related apps were identified in six app stores, of which 157 were chosen for the research based on inclusion criteria, which included: 139 apps from Cafe Bazaar, 11 apps from Myket Market, 3 apps from Kandoo, 2 apps from Iran Apps, one app from Avval Market and also an app from Pars Hub. The following inclusion criteria were applied:[1] App availability in the Persian language,[2] relevance to pregnancy,[3] Availability for free or in-app payments[4] Getting at least 2.5 out of 5 stars by users. The apps was installed on the Xiaomi Redmi 6 pro phone and from different aspects such as information resources used and their validity, subject distribution, participation of obstetricians in the apps development, apps volume, star rank acquired by users, distribution of apps according to the developers and also relationship between the number of resources used and user rankings were examined.

The data were entered into Microsoft Excel spreadsheet and analyzed by descriptive statistics such as frequency and percentage. Furthermore, the association between the number of resources referenced in pregnancy apps and user star ratings was measured using the Pearson correlation test in IBM SPSS-21 software (IBM SPSS Statistics for Windows, version-21).

Results

Among 157 apps installed, 31 apps were available for in-app payment and 126 apps were available for free. These applications were obtained by 124 different developers. Among the developers, Maedeh Zamini had the most number of apps with 4 apps, followed by Taliam, Turk Droid, Abi, Ashk, and Ziba Khanum with 3 apps. The star rating was based on a predetermined criterion between 2.5 and 5 [Table 1].

"Calculating Pregnancy Overweight" from the Cafe Bazaar had the lowest volume, while the app "Pregnancy Music Collection" from the Miket store had the highest volume. The majority of the applications (49%) were between 1 and 3.9 megabytes in size [Table 2].

In addition, after evaluating the references of the studied apps [Table 3], it was discovered that the sources utilized are listed in the majority of them (125 apps, or 80%), but only 8 apps (5%) were used reliable and scientific information resources. In addition, just two apps (1.3%) were involved gynecologists and midwives to create the content ("Pregnancy and Child" app and "Delivery Date" app). The material for the majority of the apps was obtained from internal websites. From the application references list, the names of 13 separate websites were retrieved. In terms of citation rate, Beytoote site ranks top with 59 repetitions, followed by Aka-Iran site and Simorgh site in the second and third rank, respectively [Table 3]. A few scientific books and

Table 1: Frequency distribution of pregnancy-related applications based on star rating by users

Star rank	App number (%)
2.5-3	9 (5.7)
3.1-3.5	11 (7)
3.6-4	20 (12.7)
4.1-4.5	69 (43.9)
4.6-5	48 (30.6)
Total	157 (100)

Table 2: Frequency distribution of volume of applications associated with pregnancy

App volume	Number of apps (%)
<1 Mb	5 (3)
1-3.9 MB	77 (49)
4-6.9	34 (21.8)
7-9.9	25 (16)
10-12.9	7 (4.5)
13-15.9 MB	5 (3.2)
>16 MB	4 (2.5)
Total	157 (100)

articles were mentioned among the materials utilized in these apps. Only 8 apps (5%) of the apps had used reliable information resources such as textbooks and scientific articles.

The 12 subject areas were used to categorize the apps that were analyzed. Naturally, each app focused on one or more issues [Table 4]. In Table 4, "Pregnancy Information" refers to apps that present information about overweight, gestational age, and related tests, and the term "miscellaneous" refers to apps that sporadically and briefly address various topics related to pregnancy, such as pregnancy music.

In addition, the Pearson correlation test revealed that there was no significant relationship between the number of resources cited in pregnancy apps and user star ratings ($r = 0.03$, $P = 0.64$); in other words, there was

Table 3: References cited in pregnancy applications

Type of reference	Reference	Frequency of citations by the apps studied (%)
Websites	https://www.beytoote.com	59 (34)
	http://www.akairan.com	19 (11)
	https://seemorgh.com	18 (10.3)
	https://namnak.com	13 (7.5)
	https://www.ninisite.com	13 (7.5)
	https://persianv.com	10 (5.7)
	https://niniban.com	6 (3.4)
	https://www.tebyan.net	6 (3.4)
	https://www.bartarinha.ir	5 (2.9)
	https://madarsho.com	5 (2.9)
	https://www.aparat.com	4 (2.3)
	https://www.hidoctor.ir	3 (1.7)
	https://setare.com	3 (1.7)
Books and articles	Persian pregnancy book	3 (1.7)
	Religious book	2 (1.3)
	English pregnancy specialized book	1 (0.6)
	Specialized book on nutrition	1 (0.6)
	English article	1 (0.6)

Table 4: Thematic coverage of applications associated with pregnancy

Row	Topic of the app	Number of app (%)
1	Pregnancy Calendar	59 (27.8)
2	Pregnancy and childbirth care	44 (20.8)
3	Nutrition	42 (19.8)
4	Pregnancy information	15 (7.1)
5	Exercise in pregnancy	13 (6.1)
6	Religious advice	9 (4.25)
7	Traditional medicine	7 (3.3)
8	Child care	3 (1.4)
9	Medical Information	2 (0.94)
10	Introducing medical centers	2 (0.94)
11	Psychology	2 (0.94)
12	Miscellaneous	14 (6.6)

no temporal relationship between the two variables in either direction or nondirection.

Discussion

Pregnancy is a significant time in a woman's life and it is particularly essential to pay attention to her information demands and ways of gathering information at this time. Given the interest of communities, particularly young mothers, in the use of new information technologies, pregnancy-related health apps may play an essential role in providing mothers with credible and practical information provided they meet the appropriate requirements.

According to the data, a large number of Iranian users awarded these applications a suitable star rating, with an average score of 4.25 out of 5, suggesting user satisfaction. Consumer reviews and rankings may be obtained in a variety of areas, such as forums, blogs, and user comments on websites.[24] User star rating is one of these methods, and it is crucial to the success of an app. This is because it is taken into consideration by both users and developers when deciding whether or not to use an app, and it provides developers with vital information for enhancing the app's quality. Poschenrieder observed that 77% of users would not download an app with a rating of <3 stars, preferring to follow the instructions of higher-rated apps.[25] According to Biviji, users in the Google Play Store awarded mother and child applications higher ratings than health and fitness apps. In-app payments resulted in increased downloads, whereas low-cost apps got higher star ratings.[8]

The information resources utilized in applications were one of the credit factors investigated in this research. The findings revealed that just a tiny percentage of citations went to books and scholarly journals, with the majority of citations going to internal websites. The findings of the Ghazi-Saeedi study also revealed that 20% of health apps lacked a resource list, and 69.5% relied on questionable information resources to create their content.[2] Fougerouse *et al.* in their study of the best US mobile health apps, discovered that even the best-rated apps lack certain fundamental app quality requirements.[26] Only 10% of cancer-related apps identified content sources in their app descriptions, and only 3% claimed that information was vetted by health care practitioners, according to Charbonneau's research.[27] Gong, found that the quality of Chinese mobile apps for diabetes self-management is much below what is wanted, and greater attention to the quality of information in these apps should be given via cooperation with researchers and public health experts.[28] In a review of stroke apps on Google Play and iTunes, however, Dubey *et al.* found that more than 60%

of the apps had accurate scientific content.[29] According to Haffy *et al.*, 48% of drug withdrawal applications relied on reputable and first-hand resources in this field.[30] Bohme also possessed reputable resources for accepting cancer-related applications, which ranked well. In contrast, there was no differentiation between scientific content and advertising in low-rated content apps.[31] All of the studies' conclusions imply that the results of this research that developers pay less attention to using credible resources in the development of mobile health apps are consistent with the findings of the other studies.

Evaluation is the critical phase involved in creating, producing, and deploying any related health application. This evaluation was done in the current study using user star ratings (which are generally utilized by the general public) and citations of scientific publications (which are mostly favored by scholars and experts), as well as the link between the two. However, the findings revealed that there was no link between the user's star rating and the number of scientific references cited by the apps under study. Furthermore, Knitza found an overall correlation between Mobile Application Ratting Scale scores and low user star ratings in German mobile rheumatology applications.[32] Distinct assessment techniques used for the same purpose should provide comparable findings; however, the two ways of assessing apps used in the current research had different aims, requirements, and features, and they did not agree significantly. This finding reveals that regular users of mobile health apps have different opinions than the app's health science content specialists, suggesting that the star rating should be used with care.

Another aspect of Pregnancy Apps that was investigated in this research was the app's theme coverage. The findings revealed that the topic variety of the pregnancy-related apps has increased dramatically. The most shows were under the heading "Pregnancy Calendar." The areas of "nutrition" and "prenatal care," respectively, are the next two topics of interest. While important issues such as "psychology" and "drug knowledge" were mostly ignored. Because pregnancy is more than simply a physical condition, and the physiological changes that occur during pregnancy have a significant impact on a woman's mental state,[33] it is vital to give users with more in-depth psychological information. Missing a vital problem like medication information for pregnant women, on the other hand, necessitates additional care in pregnancy-related apps. One cause for this topic dispersion and the omission of particular pregnancy concerns in the apps described may be due to the absence of engagement of specialists in this field in the content preparation of the apps.

Conclusion

While some mobile health applications in the field of pregnancy have received positive user feedback and a high star rating, it remains to be seen whether this type of evaluation is conducted by experts and using standard tools, and whether health applications have the necessary compatibility and correlation. The citation status and subject distribution of these applications, on the other hand, revealed that these apps need qualitative evaluation by health professionals, particularly gynecologists and obstetricians. Some crucial topics, such as psychology and drug information during pregnancy, have gotten relatively little attention due to the topical distribution of these apps, indicating the apps' content and citation status, as well as the likely absence of expert involvement. The disparity between the citations' status and credibility of the pregnancy applications examined with past research also urges users of such apps to be cautious while using them. Given the increasing growth in the production and usage of pregnancy apps, and the fact that these apps may have a significant influence on the health of mothers and their children, assessing the quality of their content is critical.

Finally, health care practitioners and obstetricians should consider measures to analyze, manage, and monitor mobile health applications in this field, as well as actively engage in the development of these apps to enhance their quality.

Conflicts of interest
There are no conflicts of interest.

References

1. English CL. Evaluation of Health Information Websites on Labor and Birth [D.N.P.]. Ann Arbor: The University of North Carolina at Chapel Hill; 2017.
2. Saeedi MG, Kalhori SR, Nouri R, Yasini M. Persian mHealth apps: A cross sectional study based on use case classification. Stud Health Technol Inform 2016;228:230-4.
3. Sarabi RE, Sadoughi F, Orak RJ, Bahaadinbeigy K. Role of mobile technology in Iran healthcare system: A review study. J Health Biomed Inform 2018;4:313-26.
4. Langarizadeh M, Samimi M, Behzadian H. Development of personal health record application for gestational diabetes, based on smart phone. J Urmia Nurs Midwifery Fac 2016;14:714-27.

5. Kalhori SR, Hemmat M, Noori T, Heydarian S, Katigari MR. Quality evaluation of English mobile applications for gestational diabetes: App review using mobile application rating scale (MARS). Curr Diabetes Rev 2021;17:161-8.

6. Borjalilu S, Mazaheri MA, Talebpor A. The role of mobile applications in delivery of mental health services: A review study. J Health Biomed Inform 2016;3:132-44.

7. Connor K. Perinatal mHealth Apps: An Evaluation of Content and the Perceptions of Women Who Use Them: University of Kansas; 2018.

8. Biviji R. Evaluating the Quality of Mobile Health Apps for Maternal and Child Health (MCH). Indiana University-Purdue University Indianapolis; 2018.

9. Gyselaers W, Lanssens D, Perry H, Khalil A. Mobile health applications for prenatal assessment and monitoring. Curr Pharm Des 2019;25:615-23.

10. Bland C, Dalrymple KV, White SL, Moore A, Poston L, Flynn AC. Smartphone applications available to pregnant women in the United Kingdom: An assessment of nutritional information. Matern Child Nutr 2020;16:e12918.

11. Lee Y, Moon M. Utilization and content evaluation of mobile applications for pregnancy, birth, and child care. Healthc Inform Res 2016;22:73-80.

12. Jeon E, Park HA, Min YH, Kim HY. Analysis of the information quality of Korean obesity-management smartphone applications. Healthc Inform Res 2014;20:23-9.

13. Salazar A, de Sola H, Failde I, Moral-Munoz JA. Measuring the quality of mobile apps for the management of pain: Systematic search and evaluation using the mobile app rating scale. JMIR Mhealth Uhealth 2018;6:e10718.

14. Siddique AB, Krebs M, Alvarez S, Greenspan I, Patel A, Kinsolving J, *et al.* Mobile apps for the care management of chronic kidney and end-stage renal diseases: Systematic search in app stores and evaluation. JMIR Mhealth Uhealth 2019;7:e12604.

15. Brown HM, Bucher T, Collins CE, Rollo ME. A review of pregnancy iPhone apps assessing their quality, inclusion of behaviour change techniques, and nutrition information. Matern Child Nutr 2019;15:e12768.

16. Brown HM, Bucher T, Collins CE, Rollo ME. A review of pregnancy apps freely available in the Google Play Store. Health Promot J Austr 2020;31:340-2.

17. Bearne LM, Sekhon M, Grainger R, La A, Shamali M, Amirova A, *et al.* Smartphone apps targeting physical activity in people with rheumatoid arthritis: Systematic quality appraisal and content analysis. JMIR Mhealth Uhealth 2020;8:e18495.

18. Sardi L, Idri A, Redman LM, Alami H, Bezad R, Fernández-Alemán JL. Mobile health applications for postnatal care: Review and analysis of functionalities and technical features. Comput Methods Programs Biomed 2020;184:105114.

19. Rousseau F, Da Silva Godineau SM, De Casabianca C, Begue C, Tessier-Cazeneuve C, Legendre G. State of knowledge on smartphone applications concerning contraception: A systematic review. J Gynecol Obstet Hum Reprod 2019;48:83-9.

20. McKay FH, Cheng C, Wright A, Shill J, Stephens H, Uccellini M. Evaluating mobile phone applications for health behaviour change: A systematic review. J Telemed Telecare 2018;24:22-30.

21. Bardus M, van Beurden SB, Smith JR, Abraham C. A review and content analysis of engagement, functionality, aesthetics, information quality, and change techniques in the most popular commercial apps for weight management. Int J Behav Nutr Phys Act 2016;13:35.

22. Kong FW, Horsham C, Ngoo A, Soyer HP, Janda M. Review of smartphone mobile applications for skin cancer detection: What are the changes in availability, functionality, and costs to users over time? Int J Dermatol 2021;60:289-308.

23. Azad-Khaneghah P, Neubauer N, Miguel Cruz A, Liu L. Mobile health app usability and quality rating scales: A systematic review. Disabil Rehabil Assist Technol 2021;16:712-21.

24. Hyrynsalmi S, Seppanen M, Aarikka-Stenroos L, Suominen A, Jarvelainen J, Harkke V. Busting myths of electronic word of mouth: The relationship between customer ratings and the sales of mobile applications. J Theor Appl Electron Commer Res 2015;10:1-18.

25. Hu H, Bezemer CP, Hassan AE. Studying the consistency of star ratings and the complaints in 1 & 2-star user reviews for top free cross-platform Android and iOS apps. Empir Softw Eng 2018;23:3442-75.

26. Fougerouse PA, Yasini M, Marchand G, Aalami OO. A cross-sectional study of prominent US mobile health applications: Evaluating the current landscape. AMIA Annu Symp Proc 2017;2017:715-23.

27. Charbonneau DH, Hightower S, Katz A, Zhang K, Abrams J, Senft N, *et al.* Smartphone apps for cancer: A content analysis of the digital health marketplace. Digit Health 2020;6:1-7.

28. Gong E, Zhang Z, Jin X, Liu Y, Zhong L, Wu Y, *et al.* Quality, functionality, and features of Chinese mobile apps for diabetes self-management: Systematic search and evaluation of mobile apps. JMIR Mhealth Uhealth 2020;8:e14836.

29. Dubey D, Amritphale A, Sawhney A, Amritphale N, Dubey P, Pandey A. Smart phone applications as a source of information on stroke. J Stroke 2014;16:86-90.

30. Haffey F, Brady RR, Maxwell S. A comparison of the reliability of smartphone apps for opioid conversion. Drug Saf 2013;36:111-7.

31. Böhme C, von Osthoff MB, Frey K, Hübner J. Development of a rating tool for mobile cancer apps: Information analysis and formal and content-related evaluation of selected cancer apps. J Cancer Educ 2019;34:105-10.

32. Knitza J, Tascilar K, Messner EM, Meyer M, Vossen D, Pulla A, *et al.* German mobile apps in rheumatology: Review and analysis using the mobile application rating scale (MARS). JMIR Mhealth Uhealth 2019;7:e14991.

33. Neshat R, Majlesi F, Rahimi A, Shariat M, Pourreza A. Investigation the relationship between preterm delivery and prevalence of anxiety, stress and depression in pregnant women of Dorrod Health Center, Iran in 2010. Iran J Obstet Gynecol Infertil 2013;16:16-24.