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BRIEF REPORT

A review of pregnancy apps freely available in the Google Play Store

Abstract

Issue addressed: Smartphone apps have emerged as a mode for provision of information to women during pregnancy. More apps are available for pregnancy than for any other medical topic. This review aimed to assess the quality of Android pregnancy apps, including pregnancy-specific nutrition information.

Methods: A keyword search was conducted in the Google Play Store followed by the screening of app title, app store description and the downloaded app. To be included, apps needed to be free, in English, aimed at pregnant women and contain nutrition information. App quality was assessed using the Mobile Application Rating Scale (MARS) and the presence of nutrition topics was reported.

Results: A total of 76 apps were included in the analysis. Mean overall MARS quality score was 3.52 (max 5; SD: 0.58) ("1" = inadequate and "5" = excellent). The *functionality* subscale scored the highest (mean 4.06) and *information* scored the lowest (mean 3.23). The median number of pregnancy-specific nutrition topics per app was four (range: 0-6), with the most common related to caffeine consumption (n = 55, 72% of apps) and fish intake (n = 53, 69%), although the quality and quantity of nutrition information varied greatly between apps.

Conclusions: Although there are a large number of pregnancy apps available, few are of high quality and most contain only a small number of pregnancy-focused nutrition topics. It is important to be aware of the limitations of current apps in providing dietary advice during this key life stage.

So what? The current review does not support the use of freely available android apps currently on the market as an appropriate nutrition resource for pregnant women.

1 | INTRODUCTION

Smartphones apps have emerged as a popular resource to provide information to women during pregnancy, with more apps available for this condition than for any other medical topic.[1] An online survey of 410 Australian women who were pregnant or had given birth in the past 3 years found that almost three quarters had used at least one pregnancy app.[2] Further, a survey of 335 Chinese pregnant women reported that 88.7% used the internet to access health information, with foetal development and nutrition in pregnancy being the topics of most interest.[3] However, health professionals and researchers have raised concerns about the lack of regulation of pregnancy apps[1,4,5] as well as the misinformation contained in these resources, along with other online information sources (eg websites).[5,6] Further, some pregnancy apps have been found to have poor functionality[7] with some containing information that could be potentially harmful to pregnant women.[5]

Limited research has been conducted on the quality of freely available pregnancy apps and although the quality of pregnancy apps in the Australian iTunes App Store has been assessed,[5] android apps in the Google Play Store have not. This review therefore aimed to assess the quality of pregnancy apps freely available within the Australian Google Play Store using the Mobile Application Rating Scale (MARS) tool. This review also aimed to assess the inclusion of pregnancy-specific nutrition information in pregnancy android apps.

2 | METHODS

In October 2017, a keyword search for Android apps was conducted in the Australian Google Play Store using the keywords *Pregnancy*, *Pregnant*, *Pregnancy Diet*, *Pregnant Diet*, *Pregnancy Nutrition*, *Pregnant Nutrition*, *Pregnancy Food* and *Pregnant Food*.

Data for each app identified in the initial search were extracted including app name and version number, cost of the app (if applicable) and presence of in-app purchases. App store descriptions were then further screened for eligibility. Apps were considered eligible for inclusion in this review if they were in English, free (with or without containing in-app purchases), designed for pregnant women and contained nutrition or dietary information. If, from the Google Play Store description, it was uncertain whether an app met the inclusion criteria, it was included for further screening. Included apps were downloaded onto a Samsung Galaxy S5 for further evaluation and data extraction.

The quality of each app was assessed by one reviewer using the MARS tool.[8] Briefly, the MARS tool assesses the app's qualities across four subcategories: (i) Engagement (entertainment, interest, customisation, interactivity and target group), (ii) Functionality (performance, ease of use, navigation, gestural design), (iii) Aesthetics (layout, graphics, visual appeal) and (iv) Information quality (accuracy of app description, goals, quality and quantity of information, visual information, credibility, evidence base). Each item is marked on a 5-point Likert scale (1-Inadequate, 2-Poor, 3-Acceptable, 4-Good, 5-Excellent). The overall quality score was derived from the mean of the scores for the engagement, functionality, aesthetics and information quality subscales. More detail on the tool has been published elsewhere.[8]

Finally, the presence of pregnancy-specific nutrition information relevant to pregnant women in Australia was evaluated. A list of specified nutrition topics important in pregnancy was identified based on the expert opinion of the authors of this review. The topics included guidance to reduce caffeine consumption, guidance to reduce or abstain from alcohol, food safety in pregnancy (eg to reduce the risk of foodborne illness such as exposure to Listeria Monocytogenes), fish consumption in pregnancy (eg reducing exposure to mercury or other potential contaminants from fish consumption) and the Institute of Medicine's (IOM) pregnancy weight gain guidelines.

3 | RESULTS

In total, 283 app store descriptions were screened for inclusion, with 79 apps downloaded onto a Samsung Galaxy S5 and 76 included in the final analysis (see Supplementary File 1). Reasons for exclusion of the three apps post-download were that one app contained information that was not in English, one app was not pregnancy-specific and the other did not contain nutrition information.

Thirty-eight of the 76 apps included in the final analysis declared their country of origin, with most being produced in India (n = 9), the United States (n = 6) and the United Kingdom (n = 4), followed by Australia (n = 2), Germany (n = 2), Indonesia (n = 2), Nigeria (n = 2), Belize (n = 2) and one app each from Pakistan, Canada, Kuwait, Estonia, Ghana, Italy, Romania, Russia and Sweden.

Many of the apps (n = 29, 38.2%) required internet access to function and 13 (17.11%) contained in-app purchases. Only eight apps declared their affiliations, which included limited liability companies (n = 3), universities (n = 2) and one app each for a private company, a health company and a non-government organisation. Some of the apps had 10 or more user ratings for the current app version (n = 29, 38.16%) and of these ratings, all were higher than 3 out of 5.

The mean overall MARS quality score (mean score of the four subscales) across all apps was 3.52 (SD: 0.58) out of 5 ("1" = inadequate and "5" = excellent). The apps scored as being of the highest quality were *My Pregnancy & Baby Today* (4.95), *Ovia Pregnancy Tracker & Baby Countdown Calendar* (4.92), *Pregnancy* (4.68) and *Pregnancy Tips-Week by Week* (4.67).

The apps that had the lowest quality scores were *TheFitMomProject Pregnancy App* (2.18), *Healthy Eating for a Great Diet* (2.41), *Pregnancy Week by Week* (2.45) and *Pregnancy Guide-Tips for Fitness and Nutrition* (2.49).

Overall, the MARS subscale Functionality was rated the highest (mean: 4.06, SD: 0.67), followed by Aesthetics (mean: 3.50, SD: 0.72), Engagement (mean: 3.29, SD: 0.79) and Information was the lowest scoring subscale (mean: 3.23, SD: 0.67). Two apps scored the highest for all four MARS subscales: *My Pregnancy & Baby Today* and *Ovia Pregnancy Tracker & Baby Countdown Calender*.

The median number of pre-determined nutrition information topics per app was four and ranged from 0 to 6 per app (six topics: n = 13 apps, 0 topics: n = 12 apps). The two apps that scored highest for all four MARS subscales, *My Pregnancy & Baby Today* and *Ovia Pregnancy Tracker & Baby Countdown Calender*, also included six nutrition information topics each. Twelve apps did not contain any information related to the pre-determined nutrition topics; however, they may have included more general nutrition and/or food facts, and/or recipes. The most common pregnancy nutrition topics were related to caffeine consumption (n = 55, 72.4% of apps), fish intake (n = 53, 69.74%), food safety guidelines (n = 52, 68.42%) and alcohol consumption (n = 50, 65.79%). Information related to the recommended number of food group serves to consume each day was present in 27 apps (35.53%), with weight gain guidelines present in 24 apps (31.58%).

4 | DISCUSSION

This is the first comprehensive review of commercially available nutrition and pregnancy Android apps that are free to download from the Google Play Store. It is also the first to independently evaluate the app quality using the MARS tool in conjunction with the identification of pregnancy-specific nutrition information included in the apps.

Overall, the included apps were of moderate quality and scored the highest in terms of functionality and aesthetics using the MARS tool. These findings are in line with the recent review of apps available in the Australian iTunes App Store, in which functionality was also the highest scoring subscale[5] as well as reviews assessing the quality of apps for weight management[9] and health apps aimed at children and adolescents.[10] "Information" was the lowest scoring subscale, which also reflects findings of other app reviews.[9,10] Further, 12 apps included in the current review contained no pregnancy nutrition information related to the pre-determined nutrition topics deemed very important in pregnancy, which is also in line with previous reviews identifying that health apps commonly lack evidence-based content.[11–16] This is important to highlight as a recent review found that pregnancy apps are commonly used to access health information.[17] Of further concern is the apps available in the online app stores are not regulated and so the responsibility of including evidence-based content lies solely with the app developers.[1] However, there are currently no standards as to what can or cannot be included in these apps, thereby potentially exposing pregnant women to risks due to inaccurate information, with no consequence for the app content developers.[1]

Strengths of this review include the systematic process carried out to select the included apps as well as the use of the MARS, which is a reliable tool for assessing the quality of mHealth apps.[8] A limitation was that only one reviewer assessed the quality of the apps; however, any ambiguity was clarified with a second reviewer.

5 | CONCLUSION

The results of the current review support recommendations made in a recent review of apps available in the Australian iPhone App Store for prenatal health professionals, health researchers and app developers to co-design pregnancy nutrition apps that are high quality and contain evidence-based nutrition information.[5] Further,

the authors of the current review recommend that there should be some regulation of health and medical apps available in the Google Play Store in order to remove the large number of poor quality apps currently available on the app market and to help protect pregnant women from exposure to unsound nutrition advice.[5,17]

In line with the recent review of iPhone apps available in the Australian iTunes Store, the current review does not support the use of apps currently on the market as an appropriate nutrition resource for pregnant women. While this review provided an overall snapshot of the current Android pregnancy app landscape in Australia, more in-depth analysis of the content of apps, including readability and information accuracy, is needed to further determine quality.

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CONFLICT OF INTEREST

None of the authors or affiliated institutions associated with this manuscript submission has any financial or personal relationship or affiliation that could influence the present work.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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