

Peer Review File

Article information: <https://dx.doi.org/10.21037/mhealth-21-25>

Reviewer A

Comment 1: All analyses presented in the paper are based on user ratings of the apps, combined with data about numbers of downloads etc. This is understandable and practical, but it is totally unclear what user ratings actually mean: there is no (known) relationship with more objective quality criteria. It might very well be the case that a top-rated app is not effective, has serious issues regarding data security and privacy, or contains wrong or even dangerous information. I think it is important to emphasise this both in the introduction and the discussion sections.

Reply 1: We have addressed the above comment in the discussion section of our manuscript.

Changes in the text: We have added the following data in the discussion section of the manuscript.”Line 411 to 428 page 18 and 19”, “Nonevidence-based health and lifestyle apps should be carefully considered as they can lead to exposure to harmful content. Therefore, information on usability and effectiveness is crucial for the potential app consumers. Additionally, data security and privacy issues are not often addressed in the health apps. With increase in the advancement of the technology importance should be given to secure patients’ health data. App developers should guarantee security and privacy of the app used in tracking and recording the health data.

Potential users primarily rely on attributes such as the name of the app, its user ratings, ranking, and the reviews. This information plays an important role in the decision process of choosing an app to download. Additionally, apps with higher user ratings and ranks have high visibility and installs. User ratings and frequency of app download are a measure of acceptability and popularity of mobile app, indicating a favorable user experience , however, limited literature is available for evaluating the role of user ratings and quality of apps. Studies have also reported a bidirectional and contradictory relationship in this context, reporting higher user ratings implying higher app adherence and also poor correlation between user ratings and app quality. This context suggests an urgent need to expand the literature on correlation between app ratings and quality of mhealth apps”.

Note: References for the above text are added to the manuscript.

Comment 2: The title of the paper mentions the Indian context, but it is unclear in the paper what the Indian dimension of the study is. Only apps in English were included, most apps included are not Indian at all, so what is Indian? It would be good to explain

this and also to discuss what this means for generalisability of the findings.

Reply2: As per the google support policy our Google Play country determines what content we see in the play store. There is a variation in the apps, games and the content we see on the google play store from country to country. Additionally, any app not utilizing JNC-8, AHA or Indian hypertension guidelines were not included in the study. Additionally, based on the screenshot of the apps and the description apps focusing on the menu, diet and recipes based on ingredients not commonly used in India were also excluded from the analysis gave an Indian dimension to the study.

Changes in text: We have added the following after the exclusion criteria in the methodology section to justify the Indian context in the title. “Line 171 to 179 page 8”, “Country ‘India’ was by -default selected in the google play store. The Google Play country determines what content we get in the play store. There is a variation in the apps, games and the content we see on the google play store from country to country. Based on the country of search any app not utilizing JNC-8, AHA or Indian hypertension guidelines were not included in the study. Additionally, based on the screenshot of the apps and the description apps focusing on the menu, diet and recipes based on ingredients not commonly used in India settings were also excluded from the analysis giving the study the Indian context”.

Comment 3: In search strategy included dietary measures (DASH diet), but in the results all apps are treated as one group. I think monitoring and changing diet is very different from BP monitoring and would require very different functionalities of the apps. It would be great if in the results specific attention could be paid to diet-focused app as a specific sub-category. It now feels a bit like 'apples and pears' in the same basket.

Reply3: The study focused on identifying the diversity of intervention categories for hypertension self-management. Many apps included in the present study incorporated multiple functionalities such as diet, monitoring, physical activity etc. Apps that supported exclusively the component of DASH diet were only three. Considering this, the objective of the study was focused to assess the heterogeneity of features offered by apps focusing on self-management of hypertension at Google play store. To conclude, our review gives a snapshot and overview of the currently available apps of self-management of hypertension in the Indian scenario.

Changes in the text: None

Comment 4: In the conclusion the authors state that it would be important to develop one all-encompassing app that has all the possible functionalities. Although that is an interesting thought, I don't think the findings support that statement. I would have expected a bit different topic in the discussion and conclusions, saying something about the need to develop an evaluation framework for apps, the need for research into

usability, safety, effectiveness etc. I suggest the authors to reconsider the key messages they think the study supports.

Response 4: Additions have been made in the conclusion to address the above messages.

Changes in the text: Included the following lines to the conclusion section “Line 467 to 480 page 20 and 21”, “The review demonstrated an overload of hypertension apps on the google playstore. Due to overload of apps it becomes challenging for the users to determine and identify an appropriate app to make an informed selection. There is a need to develop disease specific tailored evaluation tool to aid in finding the appropriate app among the myriad of available health and lifestyle apps. Efficacy, effectiveness and usability of the app needs to be evaluated by both the healthcare providers and the potential users to guide in the selection of the most appropriate app”.

Reviewer B

Comment 1: Were the included apps downloaded? It appears that the apps were not actually downloaded for this review. It is preferable that features be based on actual review of the app rather than the description of features and functions from the Google Play store. If the review was based only on app descriptions only without full app download, the results are potentially misleading and this is a significant limitation.

Reply1: The included apps were not downloaded. The features, description and general information provided by the developer were used to review the app. Along with that; the screenshots of the app provided were taken into the consideration. The included apps will further be utilized and downloaded for usability analysis study.

Changes in the text: This is added in the limitation section as “Line 440 to 454, page 19 and 20”, : Fourthly, to assess the features of the included apps we only reviewed the short description, general information, features, new updates and the screenshot of the app provided by the app developer. None of the included app was downloaded to evaluate the usability and effectiveness of apps from the perspective of healthcare professionals and hypertensive or at-risk patients. Since, it is preliminary study to assess the features and the gaps in apps for hypertension, screenshots and the description can solve the purpose. As per the preview assets and content guidelines of google, app developers should add screenshots and short descriptions for their apps. Screenshots must focus on the main functions and the content and demonstrate the actual in-app experience to the potential users. The screenshots aids in conveying capabilities for better decision- making. In addition, the short description should highlight any characteristics that make the app unique and written in a way that the potential app users can quickly understand the core purpose of the app. We intend to address some of the mentioned limitations by exploring hypertension apps on iTunes, along with conducting a follow-up study to assess the effectiveness and usability of the apps by using it for few months.

Comment 2: “Indian Context” Given that the search was conducted in India, I expected the review would be more tailored to the South Asian context, which was not the case. Specifically, I expected

Comment 2a: The introduction to provide more context about the prevalence of hypertension and cardiovascular disease in India or South Asian countries. It is my understanding that cardiovascular disease and Diabetes are highly prevalent.

Reply2a: We have added the prevalence of hypertension and CVD in India.

Changes in the text: We have added the following in the introduction section of the manuscript “Line 72 to 82, page 4”, “Hypertension or “silent killer” is one of the major causes of premature deaths worldwide, affecting approximately 1.13 billion people. The prevalence of hypertension has proliferated globally during the past decades, specifically in low-and middle-income countries. Additionally, some of the Southeast Asian countries have also reported significantly higher rate of uncontrolled hypertension. As with other LMICs, the prevalence of hypertension is high in India, and is also a leading risk factor attributable to premature deaths, chronic diseases and

disability. Literature also reports that hypertension attributes to 10.8% of all deaths in the country. The prevalence of hypertension in Indian context is 30.7%, which affects 25-30% of middle aged individuals in urban settings and 15-20% in rural settings of the country, on the other hand it is also reported that these individuals have low hypertension awareness, treatment and control.

Note: References are added in the manuscript.

Comment 2b: The introduction to provide more India specific information on mobile device and app use for health

Reply2b: We have added the prevalence of mobile device and app use for health in India.

Changes in the text: We have added the following in the introduction section of the manuscript “Line 111 to 116, page 5 and 6”, “India is fast on the route of digitization and is predicted to reach 829 million smartphone users by 2022. Android is the dominating OS in India accounting for 95.23% of the mobile operating systems. In 2019 India also became the leading market in term of app downloads. Additionally the number of medical apps downloaded increased by 90% in India during 2020, owing to COVID-19.

Comment 2c: The review to have included apps that were available in languages other than English. I wonder how many apps were available in Punjabi, Hindi, Urdu etc. and what the functionalities of these apps are. Is it common for individuals in India to use English language apps? I would expect a comment on whether or not there is a need for non-English language apps.

Reply2c: Of the apps meeting our criteria but were excluded due to the language included 2 Hindi apps and one in Urdu language. We have added the literature to support the need for non-English apps in India.

Changes in the text: We have added the number of apps in Hindi and Urdu language in the excluded apps box in the figure1. We have added the following in the discussion section of the manuscript “Line 388 to 400, page 17 and 18”, “In this review, two apps in Hindi language and one app in Urdu language were focusing on self-management of hypertension but they were excluded from the study on the basis of non-English language exclusion criteria. None of the app was present in other languages frequently used in India such as Punjabi, Marathi, Tamilian etc. At the moment, there is a dearth of apps tailored for the language needs of Indian population to address the high prevalence of hypertension. As per the study by KPMG in India and Google in April 2017, by 2021 Indian language internet users are expected to account for nearly 75% of India’s internet user base. By 2021, Hindi internet user along with few other Indian languages is likely to outgrow English user base. Besides, in next 5 years nine out of every 10 new internet users are likely to be Indian language users. To address the language barrier, increase the reliability of the content and for higher visibility of the app where English is not the main language, app developers should try

to incorporate bilingual or multilingual app content.”

Comment2d: That the paper would comment on cultural appropriateness of any dietary or lifestyle advice provided by the apps, specifically for the South Asian context.

Reply 2d: Following literature is added to the text to address the comment.

Changes in the text: We have added the following in the discussion section of the manuscript “Line 368 to 387, page 16 and 17”, “In our review 34 apps were not excluded in the analysis because they were not appropriate for the Indian population. Only 20 of the included apps focused on the dietary component to manage the hypertension by incorporating Indian based diets. Dietary modifications are regarded as a cost-effective strategy with high potential to prevent hypertension. Availability of widespread technology can motivate healthy eating. Nevertheless, such technological applications usually adopt a “one-size-fits-all” approach. These approaches are usually biased towards specific cultures, ethnic groups or population. Empirical studies suggest that diet and health promotion messages, tailored according to culture, ethnicity, and language are perceived as relevant and likely to address the needs of individuals, and encourage them to engage in health promoting behaviours. Besides tailored culturally appropriate diets can aid in reducing burden of preventable diseases as they can be easily incorporated in the daily diet instead of a one-size-fits-all approach. Personalized nutrition advice and messaging should include varied suggestions for meals and recipes according to what person eat in daily diet and foods that her affordable and easily accessible in addition to information about recommended amounts of nutrients or nutrients that should be avoided. It would be important to study whether the apps aimed at improving the blood pressure levels through diet delivers a tailored cultural messaging or utilizes size-fits-all approach. More emphasis is needed to develop apps utilizing tailored, cultural and behavioural approaches that will best encourage and promote sustained dietary changes in individual and different cultural and regional group”.

Note: the references are added to the manuscript.

Comment2e: For apps created in India, that the paper would comment on the appropriateness of the educational information and the “medical quality” of the apps. Specifically, I am interested to know if alternative therapies or natural products are more highly emphasized in these apps.

Reply2e: The present study focused on feature analysis of the apps according to the information present on the home page of each app at google play store. Further investigations into the presence of alternative therapies or natural products would be possible only after downloading the app and assessing the content present. For this study we wanted to evaluate the content that a primary consumer would go through before deciding whether to download a particular app. It would be interesting to see in the follow up study whether these apps are advocating any alternative therapy or natural

products which may or may not be harmful or scientifically proven.

Changes in the text: We have incorporated the following to the discussion section of the manuscript, “Line 401 to 411, page 18”, “One of the vital recommendations to the app developer is that while curating the content for the app targeting any health condition, they should involve medical professional. The involvement of medical professional in developing the app will enhance the quality, accountability, accuracy and transparency of the content. Besides, it will protect the users from getting exposed to the content, therapies or commercial products which are scientifically not proven and can be potentially harmful. Nonetheless, there is a need to regulate and investigate the medical conditions apps for the safety of the potential app users”.

Comment 3: Lack of Review of iOS apps: Only focussing on Android apps limits the comprehensiveness of the study. While I realize this significantly increases the scope of the work, at minimum this should be listed as a limitation.

Reply3: We have added lack of review of iOS apps as the limitation.

Changes in the text: It has been stated in the strengths and limitation paragraph of the manuscript, “Line 431 to 455 page 19 and 20”, “Thirdly, apps extracted were only from the Google Play Store and apps from other operating systems such as iOS were not taken into consideration. Inclusion of only android-based apps limits the comprehensiveness of the study but including apps from these additional app stores was beyond the scope of this preliminary research. Besides, in the year 2020, Android held a share of 95.23% of the mobile operating system market followed by Apple's iOS, a with market share of 3.2% in India”.

Comment 4: Statistical analysis: Means & medians are reported in the text, but the standard deviation or interquartile ranges are missing.

Reply4: We have added standard deviation and interquartile ranges where applicable.

Changes in the text: We have added the SD and range for the number of ratings and number of reviews in the table 1.

Comment 5: JNC7: In the introduction, the authors use the 2003 JNC 7 guidelines to support the benefit of self-management recommendations for hypertension. There are more contemporary guidelines that could be referenced. Also, I suggest referring to any India specific hypertension guidelines if they exist.

Reply 5: We have incorporated recent guidelines on hypertension. Additionally, we have added Indian based guidelines for hypertension.

Changes in the text: We have added the following lines in the introduction section of the manuscript “Line 83 to 98 page 4 and 5”, “The Eighth Joint National Committee (JNC 8) recommends pharmacologic treatment should be begun among adults younger than 60 years when blood pressure is 140/90 mm Hg or higher. In 2018, European guidelines retained the earlier definition of hypertension (ie, BP >140/90 mmHg). As per the European hypertension guidelines South Asians are at the highest risk and most vulnerable to high BP levels along with the growing risk of diabetes mellitus. The latest revised American guidelines lowered the threshold to define hypertension as blood

pressure of >130/90 mmHg. The fourth edition of the Indian Guidelines on Hypertension (IGH-IV) came out in the year 2019. The guidelines incorporated the recent changes in the diagnosis and management of hypertension and the changes in the target BP by the American College of Cardiology/American Heart Association (ACC/AHA). As per the guidelines the diagnosis of hypertension should be based on clinic blood pressure reading of >140/90. For people at risk or patient having hypertension the guidelines recommend frequent monitoring of blood pressure and tracking of non-pharmacologic measures such as following of DASH diet, restriction of tobacco intake and alcohol intake, and reduction of body weight if needed, adherence to medication, practicing of yoga and meditation”.

Note: References are added to the manuscript

Comment 6: English Language editing: There is use of some colloquial or non-standard English expressions which require cleaning up. For example: on Page 5, line 132 and 138 the paper refers to “inclusive criteria” and “exclusive criteria” rather than inclusion and exclusion criteria. Another example is “the number of installs was centered on 30,000.” Rather than the mean (or median) number of installs was 30,000. Another example: Page 13 Line 388: “there is essential to develop...”

Reply 6: The non-Standard English expressions are cleaned and the words have been modified.

Changes in the text:

- a. Both “inclusive criteria” and “exclusive criteria” modified to “Inclusion criteria” and “Exclusion criteria”.
- b. “the number of installs was centered on 30,000.” is replaced with " On average the apps in the ‘Entertainment category has 30,000 installs”.
- c. “There is essential to develop” modified to “It is essential to develop”.

Comment 7: Discussion - I suggest that the paper would benefit from a more robust comparison of the current findings to the previously published Hypertension app reviews.

Reply 7: We have elaborated the comparison of the current findings to the previously published Hypertension app reviews in the discussion section of the manuscript.

Changes in the text: We have added the following in the discussion section of our manuscript “Line 353 to 367 page 16”, “ Another study conducted on the content analysis of hypertension apps available in on Apple Store and Google Play Store in 2018 in United-Kingdom found the most common self-management educational information about hypertension (59.1%) to be the most common self-management functionality which was commonly seen in our study as well. Self-monitoring (53.2%) was seen to be the second most common functionality to be present where the majority of these apps (n=94) aided in BP tracking. Other common functionality was provision of automatic feedback (28%), and BP measurements reminder (21%). Similar to be our study, few apps included the component of stress management (2.7%), BP goal

setting (5.4%) and had a provision for tracking medication compliance, potassium intake, or sodium intake.

In our review Out of the 14 self-management support components of the PRISMS taxonomy three components were not provided by any of the included apps. None of the apps had all the 14 PRISMS taxonomy components. Our findings are similar to a study conducted in 2018 for hypertension apps available in the United Kingdom. The apps which were reviewed by the authors rarely incorporated the components of self-management support”.

Note: References are added to the manuscript

Comment 8: Simulation & Game apps: I see in Figure 5 that there were a large number of simulation apps. I am unfamiliar with what a simulation app is. I also wonder if there were any misleading apps that claimed you could measure BP just using the smartphone itself.

Reply 8: It is recommended to the app developers to choose the appropriate type of the category to represent the app to enhance the ranking the visibility. One such category is Stimulation and game app. Google uses tags to group apps together and determine which apps should be recommended to users. Choosing a category is subjective to the developer. Any app which enhances the user activity can be classified as a stimulation app. In terms of hypertension, app having the capability to track, provide feedback or measure BP may be categorized as stimulation and game app.

Since, the apps were not downloaded it would be difficult to know about the misleading apps claiming to measure the BP just by the smartphone itself. We do intend to address this limitation in the further studies.

Changes in the text: None

Minor Comments

Comment 1: Page 3 Line 70 – “once a year” seems out of place.

Reply1: We have modified the line.

Changes in the text: Replaced “once a year” with every year.