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Knowledge, Attitude and Practice About the Use of Mobile Health Application in Diagnosis of Anemia Among Women Population

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Abstract

Background: Anemia is a debilitating illness of chronic nature, however commonly overlooked. Hence it is necessary to devise non-invasive methods for diagnosis and continuous monitoring of the disease for improved health outcomes. In this context, introduction of portable, easy to use health Apps would serve as valuable resources in producing faster and accurate results in the interests of the patient.

Aim: The present questionnaire study was conducted to assess the knowledge, attitude and practice among the women population about anemia and the use of mobile Application in it's diagnosis.

Methods: A cross-sectional questionnaire study was conducted among 400 women patients who visited the out patient and in patient of a Medical college for various health issues. A structured 20-item self-administered questionnaire covered knowledge, attitude and practice about the use of Mobile App in anemia diagnosis. Further the participants were stratified on the basis of socioeconomic status and age to evaluate it's impact in using a Mobile App in diagnosis of anemia. A Chi-square test was applied to assess the above mentioned outcomes.

Result: The results showcased a a statistically significant association between age group and awareness of anemia (Pearson Chi-Square = 28.195, df = 6, $p < 0.001$) and opinion on the usefulness of mobile health apps for anemia diagnosis (Pearson Chi-Square = 49.835, df = 6, $p < 0.001$) suggesting that perceptions about the role of health apps differ significantly across age groups. On exploring the impact of socioeconomic status, while awareness of anemia is consistent across different groups, acceptance and ease of using mobile health technology vary significantly with socioeconomic status.

Conclusion: People of older age and lower socioeconomic status are well- informed of the disorder of anemia and are willing to make use of mobile App which are designed to be user-friendly, faster, accurate and non-ambigious. Addressing these concerns is pivotal in developing a successful model.

Introduction

Globally, anemia is one of the most prevalent and widespread nutritional deficiency diseases, which is a cause of the major health concern in both children and women of reproductive age. It is found to be associated with several debilitating symptoms which adversely affect the quality of life of both women and children and in a broader scale affects the progress of the society and nation as a whole[1]. The WHO global estimates for anemia (2025) has recorded that the prevalence of anemia worldwide in women population from 15–49 years accounted to 30.7% In children of 6–59 years, it has been estimated to be 39.8%.[2]

Hence, newer and novel diagnostic strategies in addition to the existing conventional methods need to be formulated taking the data into account which would enhance the effectiveness in creating an awareness in the mind of the people about the nature and seriousness of the disease. In this context, making use of advancements in technologies in the form of Mobile Health care Apps would play a

strategic role in aiding in earlier diagnosis and management of the disorder more effectively[3]. These interventions can significantly boost existing health care facilities in terms of diagnosis and treatment approach, thereby reduce burden of the disease[4,5]. Considering the present setting of limited resources, intense labour demands and huge population in our country, leveraging technologies like mHealth can revolutionise health care, making services more efficient and available[6]. The term 'digital literacy' has gained significant momentum in recent days which includes utilizing gadgets in evaluating information in public health sectors[7]. In this regard, though mobile Health Apps are associated with potential benefits, the existing social and economic background imposes certain limitations on practical feasibility and implementation in routine health care diagnosis[8]. Hence, there is a need to identify the lacunae in this framework which lead to the development of the questionnaire to understand the existing knowledge, the attitude and practice among the women population about making use of a mobile App in diagnosis of anemia.

Materials and methods

STUDY DESIGN:

The study was designed as a cross-sectional questionnaire based descriptive survey to be conducted among women population to evaluate their knowledge, attitude and practice about the use of a mobile App in diagnosis of anemia. The study commenced after ethical approval obtained from the Institutional Ethical Committee for circulation among participants. (Ethical Clearance Number : **IEC-NI/25/11/111/221) .** Informed consent was obtained from all participants as per the Helsinki Declaration after assuring that the information collected was confidential and they were at will to withdraw from the study at any time.

STUDY SETTING:

The study was conducted among women population and attendees visiting the out patients and in patient of a Medical College to evaluate their knowledge, attitude and practice ablout use of mobile App in diagnosis of anaemia. The period of study was from December 2025- February 2026.

VARIABLES:

The primary outcome of interest was to evaluate the knowledge, attitude and practice about anemia and use of mobile App I initial diagnosis of anemia. The secondary outcomes were to analyse the impact of age, socioeconomic status in making use of the App and also to correlate the participant's knowledge of anemia and their attitude/ willingness to use the App in anemia diagnosis.

The primary exposure variables were based on the age group of the patients from 18-60 and the socioeconomic status. This grouping was done on the premise that both these factors have profound impact on making use of mobile App in health sector as per numerical data available in previous studies and research conducted.

Development of questionnaire

An introductory page was attached in the questionnaire to explain the purpose of the study. In the next page the identification details and background of the participants was obtained pertaining to their age, socioeconomic and literacy status. This study utilized a self-developed questionnaire to evaluate the knowledge, attitude and practice among women population on use of mobile health App in diagnosis of anemia. This study was cross-sectional and was initially prepared with a total of 25 questions, with 12 questions in the knowledge section, 7 in the attitude section and 6 in the practice section. The questionnaire was prepared and developed after a substantial literature search from various sources such as textbook, articles, guidance and discussion with experts in the concerned fields.

QUESTIONNAIRE VALIDITY:

The questionnaire underwent content validation and face validation to check for relevance, clarity and redundancy and adequacy of the questionnaire items to measure the variables that were intended to be studied, and the necessary modifications were discussed and made after validation. The questionnaire was translated to vernacular language (Tamil) prior to the pilot study. The linguistic validation was done by forward and backward translation method by an independent linguist, to improve the accuracy of the questionnaire.

FACE VALIDITY:

Face to face interview with 15 experts was conducted by the primary investigator to validate the questionnaire. The responses were compiled and the percentage of agreement for each of the 25 questions and over all agreement for all questions were calculated. The 3 items that had a percentage of agreement below 80% were restructured, 2 items between 80% to 90 % were revised and a 20 items above 90% were retained in the final tool. The over all percentage of agreement was calculated to be 88.9%.

CONTENT VALIDITY:

Following face validation, content validity for the questionnaire was done by using the Content validity Ratio given by Lawshe C.H in 1975.[9]The panel of 15 experts evaluated the level of relevance of each item for it's corresponding construct on a 4 point scale. (1= not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant). A minimum content validity ratio (CVR) of 0.49 was required to retain an item in the final test form, Of the total of 25 questions, twenty questions with a CVR of more than 0.49 were retained and the other 9 questions with a CVR of less than 0.49 were removed. The content validity of the revised, final questionnaire, with a I-CVI score of 1.00 indicated strong expert agreement.

FINAL QUESTIONNAIRE:

The final tool consisted of 20 items with 6 questions in the knowledge section, 8 questions in the attitude section and 6 questions in the practice section. (Supplementary table 1) Furthermore the

questionnaire consisted of closed ended questions with 7 questions consisting responses labeled as ‘Yes’, ‘No’, and ‘Not sure’. The remaining 13 questions had multiple choices from which participants had to choose responses in accordance with their priority and perceptions.

PILOT STUDY:

A pilot study was conducted before the main study on 25 participants to assess the feasibility and appropriateness of the main study and to check for the test-retest reliability of the questionnaire. The data from the pilot study was not included in the final study. The outcome of the pilot study suggested continuing the study with some modifications to the questionnaire.

Internal consistency (Reliability): The questionnaire was constructed in English and the complex words were changed into simpler terms so that every participant could understand the questions. The test-restest reliability was assessed by Cronbach’s alpha. The results of the pilot study showed good consistency with a value higher than 0.83.

SAMPLE SIZE:

The minimum sample size to carry out the study was estimated by experts as per the Goodness off fit tests. As per the input parameters, the effect size = 0.35, α error prob = 0.05, Power = 0.95 and Df = 5. The output results showed that Non centrality parameter λ = 19.8450000, Critical x^2 = 11.0704977, the actual power = 0.9507006 and the **total sample size = 162.** However the survey ultimately included 400 participants, far exceeding the minimum sample size required to carry out the study.

SAMPLING METHOD:

A Stratified random sampling method was followed in selecting the participants based on their age group and socio economic status.

INCLUSION CRITERIA:

1. Patients who were able to understand the contents asked in the questionnaire

2. Patients who were physically and mentally stable to answer the questionnaire

3. Patients who were willing to spend time in answering the questionnaire

4. Patients in the age group of 18- 60.

5. Patients who had given the consent to answer the questionnaire

EXCLUSION CRITERIA:

1. Patients with debilitating physical illness who could not answer the questionnaire

2. Patients who were not able to comprehend to the contents of the questionnaire

3. Patients who were not in a mental state to take part in the study

RECRUITMENT OF PARTICIPANTS:

The age group of the participants were in the range of 18 – 60, and they were divided into four categories based on the age group into 18 – 30, 31 – 40, 41-50 and 51 – 60. The socioeconomic status of the participants were categorized based on Modified Kuppuswamy scale updated for the year 2025.[10] (Upper, upper middle, lower middle, upper lower, lower)

SCORING METHODOLOGY:

The questionnaire was distributed as printed hard copies to participants who visited the outpatient of hospitals and were explained the purpose of the study. They were asked to choose responses as per their perception and understanding and in case they felt more than one response to be apt for the questions they were requested to rank the questions in order of their priority. Given the subjective nature of the questions, a uniform scoring criteria could not be followed and the response to each question were analysed descriptively to summarize the participants knowledge, attitude and practice regarding mobile App for diagnosis of anemia. For Yes/No/Not Sure questions, frequencies and percentages were calculated for each response. For multiple-choice questions frequencies and percentages were calculated for each option allowing for selection of the most suitable option.The data were summarized using tables and figures to highlight trends in perceptions and opinions. Analyses of results were done using Statistical product and service solution (SPSS) version 22 software. Descriptive statistics such as frequency and percentage were used. The p value was fixed at 0.05.

COLLECTION OF DATA:

Thequestionnaire in the form of a hard copy was distributed among the participants after obtaining informed consent. The age group of the participants were in the range of 18 – 60, and they were divided into four categories based on the age group into 18 – 30, 31 – 40, 41-50 and 51 – 60. Demographic data pertaining to age and socioeconomic status was collected in the introductory page and they were explained the purpose of the study. Each participant spent about 15-20 minutes in answering the questions. They were at will to withdraw from the study at any point of time. The results of each questionnaire were tabulated in an excel sheet and used for final scoring and calculation of results.

RESULTS

Questionnaire response:

A total of 400 questionnaires were distributed and all the participants gave valid responses, which resulted in a response rate of 100% (Supplementary able 2)

Back information and flow of participants:

This included women population in the age group of 18 – 60 years with the mean age group of 36 years. There were 39.5% of participants in the age group of 18-30, 22.3% in the age group of 31-40, 24.3% in the age group of 41-50 and 14% in the age group of 50 – 60. Based on Modified Kuppuswamy scale updated for the year 2025, our study had 11% of the population from the Upper socioeconomic status, 11.8% from the upper middle status, 18.3% from the lower middle status, 33.5% from the Upper Lower status and 25.5% from the lower socioeconomic status respectively. In terms of their locality, the participants were predominantly, women population residing in urban and semi-urban areas and they were predominantly occupied as domestic helps in nearby localities.

Performance of participants in the domain of knowledge about anemia and the use of moblile App in it's diagnosis.

On analysing the responses it was found that 95.8% of participants were aware of the medical condition of anemia, 2.5% were not aware and 1.8 % of the population were not sure of the nature of the disorder. Regarding the detection of anemia, 94.3 % of the participants have responded that it could be detected in blood, 5 % that it could be detected in saliva,

1. 8% that it could be detected in urine and 3.5% of them were not aware of how it could be detected in the body. In terms of knowledge about using a mobile App for diagnosis of anemia, 27.5% have responded positively, 21% have no opinion about using mobile phone in diagnosis and 55.25% have disagreed about the possibility of diagnosis using a mobile App. Concerning the well being of the patient, 63.25% have opined that anemia affects the physical well-being of the patient and 25.75% have responded that the over all quality of life is degraded because of anemia. Majority of the participants (85%) are aware that women are predominantly affected by anemia. Also, regarding the operational time of the App in delivering results, 55.3% of the responders are of the opinion that it would be quicker than blood examination and 7.5% of participants opine that both the methods give results on the same time. Among the various causative factors associated with anemia, 53.5% of the participants have suggested that all options, including lack of nutritional supplements, awareness, motivations and ability to identify the signs and symptoms together have contributed to the persistence of anemia in the society.

Performance of participants in the domain of attitude about anemia and the use of moblile App in it's diagnosis.

On making use of mobile phones in diagnosis of anemia, 50.7% of the participants were not sure of the adaptability to the new technology, 27.5% were positive about using the mobile App, however 21.8% have not agreed upon it's use. With regards to practical feasibility, 47% were not sure, if mobile Apps were an complete alternative option to diagnose anemia, whereas 38% of the respondents were positive about it's practical feasibilility and 15% of the participants did not consider it a viable alternative in routine use. In a situation that the App satisfies the expectations, 33.8% of participants have considered using it as

an alternative to blood examination for initial diagnosis and 9.8% have refused to make use of it in preference to blood examination. In the context of improving the contents of the App, 76% of the respondents have suggested that the App should be designed both in English and regional language, be supplemented with colourful images about nutritional supplements and provide information about signs, symptoms and complications associated with anemia.

Performance of participants in the domain of practice about anemia and the use of moblile App in it's diagnosis.

Of the total of 400 participants, 70% have felt the need for a nurse to guide them in using the App, 13% strongly felt that they will not be able to comprehend to the App even if the nurse guides them and 17% of the respondents were doubtful if they will follow the App even if a nurse guides them. 72.3% of the participants have agreed to recommend the App to neighbours and relatives if they find it informative, 12% are against recommendation and 15.8% are not sure of recommendation of the App. In the domain of practical challenges regarding the feasibility of using a mobile health App in diagnosis of anemia, as few as 4% have financial constraints in purchasing the mobile and 21.3 % of patients have had difficulty in understanding the App. However as many as 53.8% were not sure that the App will give accurate results and 21% of the participants have felt all the choices could be included as practical challenges in making use of a mobile App in anemia diagnosis. On taking into account, the insights of the participants on the role of Government agencies, 67.8% of them have suggested that government should use mass media for bringing awareness, conduct door to door screening and provide patient's with nutritional supplements as strategies to reduce the burden of anemia. A total of 52.5% of patients expect family member's support in purchasing a mobile, with constant support, guidance and motivation to use the App. In case the App gives an initial diagnosis of anemia, 68% of participants will follow-up treatment in hospital, 2.8% will not follow up treatment in hospital, 5.3% will follow up treatment, provided family members support them and 24% are not sure of treatment follow up under any circumstance.

The chi-square test showed a statistically significant association between age group and awareness of anemia (Pearson Chi-Square = 28.195, df = 6, $p < 0.001$). This indicates that awareness of anemia varies significantly across different age groups.

The chi-square test indicated a statistically significant association between age group and opinion on the usefulness of mobile health apps for anemia diagnosis (Pearson Chi-Square = 49.835, df = 6, $p < 0.001$). This suggests that perceptions about the role of health apps differ significantly across age groups.

The chi-square test indicated a statistically significant association between age group and comfort in using mobile apps for anemia diagnosis ($\chi^2 = 26.15$, $p = 0.0002$). This suggests that younger participants are more likely to feel comfortable using mobile health apps compared to older age groups.

The chi-square analysis shows that there is no statistically significant association between socioeconomic status and awareness of anemia, as the p-value (0.282) is greater than 0.05, indicating

that awareness levels are similar across all groups. However, there is a strong and statistically significant association between socioeconomic status and both the perceived usefulness of mobile health applications for diagnosing anemia ($p = 0.0001$) and the comfort in using such applications ($p = 0.0001$), as these p-values are much lower than 0.05. This suggests that individuals from higher socioeconomic groups are more likely to believe in the effectiveness of mobile apps and feel comfortable using them, whereas those from lower socioeconomic groups are more likely to be unsure or unwilling to use such technology. Overall, while awareness of anemia is consistent across different groups, acceptance and ease of using mobile health technology vary significantly with socioeconomic status.

The chi-square analysis shows varying levels of association between responses to anemia awareness and perceptions about mobile health applications. For the question on whether health apps could help in easier diagnosis of anemia, the association is statistically significant ($\chi^2 = 39.007$, $p < 0.0001$), indicating that awareness of anemia is strongly related to positive attitudes toward using mobile apps for diagnosis. In contrast, the need for guidance from a nurse in using such apps shows no significant association ($\chi^2 = 2.135$, $p = 0.711$), suggesting that there is no correlation between knowledge of anemia and attitude towards taking guidance from a nurse in making use of an App. Similarly, willingness to recommend the app to others is not statistically significant ($\chi^2 = 8.304$, $p = 0.081$), which indicates that there is insufficient evidence to conclude that knowledge of anemia is associated with recommending the App to others. Overall, while awareness of anemia significantly influences belief in the usefulness of mobile apps for diagnosis, it does not significantly affect the need for guidance or the likelihood of recommending the app.

DISCUSSION

The concept of ‘e’ health is the use of all forms of electronic media in information and technologies, especially in the health sector which delivers non-invasive, affordable, medical care based on the necessities of patients.[11] The judicious, prudent utilization of e-health services would assist in valuable saving of human resources, managing information data bases and bridging the existing gap in providing health benefits to patients.[12]. In this context our present questionnaire study was initiated to explore the possibility of introducing health care Apps in medical diagnosis which would fulfil the lacunae and create awareness in people about using scientific technology in their best interest.

The primary focus of our discussion is three fold:

1. To discuss results pertaining to key aspects of existing knowledge, changing attitude and prevailing practices among women population on the use of mobile health App in diagnosis of anemia/ health disorders on the whole

2. To analyse the key expectations in using the mobile health App, decipher the various challenges and barriers related to it and discuss the contents of the App based on the felt needs of the women

population.

3. To explore the influence of age and socioeconomic status of the participants and their inclination and interest in making use of scientific innovations such as Health Apps in medical diagnosis.

In connection with exploring the existing knowledge among the women population about anemia and their attitude in making use of mobile App in diagnosis , it has been found to be associated positively, with a significance of < 00001, indicating that greater the awareness, increased inclination to get the disorder diagnosed making use of the App which in the first place is a very encouraging sign to introduce digital technology in health sector. Our results also are in concordance of the results of the study conducted by **Abeer Alharbi**[13], who has conducted a cross-sectional questionnaire study to assess the correlation between knowledge of m-health Apps among participants and have obtained significant results as that of our study. In another qualitative study conducted to evaluate the user perceptions on mobile health Apps in medicine, conducted by **Wei Peng et al (2016)**[14], contradictory results were obtained were more than a quarter of patients considered the introduction of health App unnecessary, since they were comfortable with existing use of website information and they believed that they had already established healthy eating habits and a tool for was not needed for monitoring their health. However the fact is that in their studies the respondents were at a higher literacy level, already introduced to technological devices and were the privileged sections of the society. On the contrary, the most encouraging and noteworthy data from our study reveals the fact that though most of our participants were form lower socioeconomic strata and literacy level, still they were aware of the disorder of anemia and recognised the need to getting it diagnosed and treated at the earliest phase itself.

However on moving forward, though participants are aware of the disorder of anemia, the need for guidance from a nurse in using such apps shows no significant association ($\chi^2 = 2.135$, $p = 0.711$), suggesting that opinions on requiring assistance are independent of anemia awareness. Similarly, the results showcase that participant's knowledge of anemia has not influenced their attitude in recommending the App to others. The reason for this unconcerned attitude of the participants could be interlinked with the key barriers and challenges perceived by the participants at the individual level in making use of the App and hence are not confident to recommend it to others.

The key expectations include accuracy of results, faster results, user friendliness and support of family members

KEY CHALLENGES RELATING TO USING A MOBILE APP

1. Doubtful about accuracy of results
2. Difficulty in understanding the app
3. Unsure if it will give quicker results

From the above graphical representations, it may be deciphered that key expectations and challenges reflect each other precisely and focusing on these aspects while developing the App will influence the practical feasibility of using the App among the common population. In the qualitative study conducted by **Wei Peng et al (2016)[14],** nine themes were identified, some of them aligned with the results of our study. Additionally newer perceptions were identified, which included lower awareness of health Apps, lack of digital literacy, lack of time, effort, motivation and discipline. In a similar KAP study conducted by **Gajendra Singh et al (2019)[15],** among medical students, the results show that 6.2% of them did not know how to obtain them, 36.9% of them have not trusted them, 40% of the users felt that they were not necessary and 16.9% of participants have not specified any reason in particular. In a complete contrast, in a university study conducted by **Prince Peprah et et al (2019)[16]**, the respondents showed positive attitude and perception about the use of Apps in medical health systems contradictory to the results of our study. This infers that even among medical students differences of opinion and conflicts exist regarding the acceptance and practical application of mobile App in health sector.

On exploring the design and contents of the App as expressed by the participants, the following could be elucidated:

EXPECTATIONS RELATED TO CONTENT AND DESIGN OF APP

1. Contents both in English and regional language
2. Colourful images of natural food products and nutritional supplements
3. Provide information related to complications of anaemia

It should be reiterated that our study was conducted among participants predominantly in lower socioeconomic status and literacy level and hence preferred description in regionl languages also for better understanding. Most of the partcicpants were keen on obtaining information about food supplements which could help managing anemia rather then medications. Also, they felt, rather then going through long texts, images of food supplements, if displayed in the App would be a motivating factor for them in consuming the App consistently. In the review of literature conducted by **Uwe Radtke et al (2025)[17]** , in analysing the patient expectations and factors influencing the use of mobile health Apps in health sector, specific expectations from the users were identified as personalization, data entry and tracking, reminder and alerting, source of information and education, data sharing, connectivity and security which is in concordance with the results of our study. However, as already documented our respondents had lower level of digital literacy and hence they were not concerned about issues of privacy, data sharing, connectivity and security. In fact, such domains were not included in the purview of our study and respondents were compeletely ignorant of such issues in a health App. In a qualitative analysis conducted by **Astrid Torbjørnsen et al [18],** participants have emphasized on inclusion of features of automated tracking, data entry, flexibility and freedom of choice in the App to enhance it's utility in daily routine. In similar terms with the results of our study, the respondents in this study also required

support in interpretation of results, to make them understand what the numerical value in the displayed in the App, suggests about their health status. Furthermore, the respondents in this research also have sought for educational content in the app, such as a manageable menu and more detailed feedback to improve their health.

On evaluating the age related perspectives in connection with using mobile Apps in diagnosing and monitoring of disease, it is found that our studies have delivered results which suggests that perceptions about the role of health apps differ significantly across age groups and younger age groups are more comfortable in adapting to technological innovations for various reasons including growing up with technology, comfortness with data tracking and faster adaptation to new technology and interface. However there is a lacunae in promoting the use of mobile technology among older adults. In systematic review conducted by **Elahe Amouzadeh et al**[19] in optimizing mobile App design among older aspect the key themes which were identified included simple operational design, easy to navigate, readable through large fonts, audio connect and feedback with users coupled with touch friendly elements. The challenges among older age group in accepting a mobile App included difficulties in congnizance, lack of memory and difficulty in articulating the various steps in operating the App [20, 21]. Regarding the technical barriers, lack of prior exposure, limited technical skills and unfamiliarity in handling gadgets may create a negative attitude and reluctance among older aged population in opting for a mobile App in health diagnosis.[22,23,24]

Furthermore, physical barriers like impairment in visual, hearing and motor skills and psychosocial barriers like trust, motivation and privacy concerns could also be factors in reduced adoption to technology among older age group.[25,26,27,28]

Subsequent to the in-depth analysis of the barrier factors, several factors were suggested for improving the accessability and usability of mobile App among the older age groups, some of which included:

1. Integration of helping tools in AI such as voice enabled tool and predictive text

2. Designing inclusive apps that are culture adaptive and context sensitive[19]

3. Incorporation of age –friendly features like, ergonomic handles, enhanced visual contrast, larger font size and screen reader compatibility.[29]

Our study has also evaluated the correlation between socioeconomic status and the attitude to use mobile App in diagnosis and monitoring of disease. The results showcase the fact that though the awareness of anemia is not found to significantly vary among participants of different socioeconomic status, the willingness and comfort in using the App is found to be higher in participants of higher socioeconomic status. In a similar questionnaire study conducted by **Bushra Batool Zahra et al [30](2025), it** has been found that the perception score and feasibility score are increased in people with better family income compared to those in a lower economic status, in concordance with our study. However, in a study conducted by **Jainam Shah et al [31]** to evaluate the impact of Socioeconomic status

on usage of DiabetesXceL App usage in adults, contrasting results were obtained were participants who were socioeconomically underprivileged showed higher digital literacy. This explains that e - health solutions can efficiently serve the disadvantaged populations and highlights the complexity of the relationship between resource deprivation and digital literacy . The rationale behind this could be the fact that personalized features of the App in their study, content customization, simple, patient-friendly language with minimal medical vocabulary, design of the App with sensitivity to cultural contexts would have improved the patient usability and engagement. At this point the complex social structure needs to be understood where the lower socioeconomic corresponds with the lower literacy status due to their lack of access to higher level of education. Hence a simple App design has improved patient usability in the above mentioned study**.**

KEY ASPECTS OBTAINED FROM THE STUDY:

1. At the first place our study was conducted among participants who represented the extremely marginalised sections of the society and even to narrow it down, to the women population. However most of the available literature and studies currently have been conducted among people who already were introduced to technological platforms.

2. Hence it is understood form our study, that disproportionate barrier to use mobile App exists among both the groups. In the section of people who are technologically informed the barriers are, they already avail health information from other social media platforms like instagram, facebook or various other websites and not felt the necessity of personalized health apps. Also, they are apprehensive about the confidentiality and privacy issues in handling the App. They also feel the existing health Apps are not efficient in data handling and routine tracking of their health status. Furthermore some section of people feel they are already healthy and are not in need for health Apps.

3. However our study is conducted in an entirely different background and the insights obtained from participants through our questionnaire seems to be markedly different. Almost all the participants are aware of the health disorder of anemia and are willing to accept a technological innovation to improve their health status. The impeding barriers seem to exist in terms of their apprehension in understanding the App, lack of the basic knowledge about an App existing on the mobile at the baseline level, lack of support and motivations from family members, trust issues regarding the accuracy of results obtained from the App. Our study participants are not concerned about privacy of data and are also unaware of existence of other social media platforms like facebook , instagram or health websites. Continuous support from government, non- governmental organisations , healthcare providers and family members is deemed absolutely necessary to instill a sense of confidence in the mind of the women population in adopting to the new technology.

4. Though our study included most of the population from a lower socioeconomic strata, 70% of them did not have financial constraints in purchasing a mobile. They have opinined that mobile phones have become a routine use gadget in daily life and a necessity. Hence the above mentioned actual challenges have to be considered to encourage usability of App among the women population.

5. Although personalization is prime factor in designing a mobile App, it has the ability to connect people to address health disparities on a larger scale and to leverage the resources and abilities of a community to make sustainable changes on a population level. Hence we must understand the complex interplay of the community, ecological, social and cultural aspects embedded in minds of the people which influences their attitude in making use of the App. Developers of the App should be social scientists as well before attempting to design an App.

KEY RECCOMENDATION TO THE GOVERNMENT AND NON-GOVERNMENTAL AGENCIES IN PROMOTING A MOBILE APP IN HEALTH DIAGNOSIS:

1. It should be emphasized that anemia being a very common, but overlooked health disorder is to be addressed with concern. Here the women population are affected in majority and form the apex of the treatment triangle with both the government and non-government organisations expected to reach out to them, to reduce it's prevalence.

3. At present there are various pitfalls in the area of implementing a newer technology such as a mobile health App, including, limited geographic access to mobile Apps across the country with under-representation of remote and rural areas, lacunae in validation on a clinical setting, uncertainty about their reliability and non-availability of plans to collaborate m-Health into existing health sector or Digital India to name a few.

4. To begin with, steps should be taken towards first re-structuring the existing guidelines and frame a new regulatory policy and develop a m-health regulatory framework for ensuring quality of care in the interest of the users.

5. Funding should be made available for ensuring robust and scientific evaluation of effectiveness of m-Health solutions and for studies that use technology with appropriate human and sociological interventions specifically for the vulnerable population.

6. Multi-sectorial partnership between health care and technological organizations should be encouraged to ensure a wider health system approach, to increase the quality and reach of m-Health innovations and use of various m-Health functionalities to produce holistic solutions that support various domains of the Indian health system.

7. Academic organisations should form associations and amalgamations with organisations in government sector for exchange of knowledge , management of resources and advocacy.[32]

8. Strengthen primary healthcare: Enhance awareness among the common people of the disorder of anemia, through regular outreach progrmmes planned in each taluk as per the population, deployment of medical service personal exclusively devoted on this project.

9. .Train healthcare workers on innovations and scientific advancements in anemia diagnosis and prevention, which will reduce their laborious work burden.

10. .Integrate Mobile – App with healthcare system : An exclusive policy on linking mobile App to national healthcare system for seamless referrals and follow up. Use App data to inform policy decisions and track progress.

11. Offer financial incentives to women to access healthcare, to use App and complete follow up screenings. Also creating employment oppurtunities for women to ensure their economic stability.

12. . Evaluate the impact of policy changes and mobile App on anemia reduction, make data-driven adjustments in policies and programs as needed.

STRENGTH:

The core strength of the study lies in the demographics of the participants , in that they represent the population all strata of the society. More so, this study has focussed primarily on obtaining the insights from the most underprivileged sections of the society who were introduced to the concept of an “App” in medical field through our study only. Hence the outputs from the participants reflect the most raw and original data which gives us the understanding that improving digital literacy is the key factor to be considered immediately for ensuring a healthy population through technological solutions. Also the output of our questionnaire has proved that participants are willing to receive technological options in health diagnosis, provided their key expectations like accuracy, simplicity , user-friendly and faster results from the App are effectively addressed. If the results from this study are considered as factors while developing an App it would indeed foster designing a “patient centric” App based on their felt needs.

LIMITATIONS:

Our study has some limitations that though we have considered the age and socioeconomic status of the patient’s as factors, the literacy level also has a huge play in consuming App among the participants which needs to be addressed in future. The second limitation is that the study needs to be expanded by increasing the number of participants in order to have results which are more reliable and generalizable. Our study has given a ‘bird’s eye view’ about the mindscape of the population, however could also be elaborated by including many specific factors , like analysing sub-groups within each category, for a better understanding.

FUTURE PROSPECTS:

A qualitative research could be conducted among participants through focus group discussions or interviews to obtain deeper insights about experiences, emotions and contexts and enhance our understanding about the actual expectations of people.

CONCLUSION

This study demonstrates that participants form an urbanized background with higher scale of socioeconomic status and younger age group were more likely to use mHealth apps, although concerns were raised on reliability and understanding of the App. Hence future research should be based on the understanding the impact of cultural, social and economic challenges in making use of the App. To improve the practical usability of people living with anemia utilizing the mHealth apps, it is pivotal to conduct training programs and digital literacy sessions for both users and health care providers, focused on enhancing the functionality and effectiveness of mHealth apps.

Declarations

Ethics approval and consent to participate: Ethical approval for the study was obtained from the Institutional Ethics Committee, Sri Ramachandra Institute of Higher Education and Research (Deemed to be University), Chennai, Tamil Nadu, India (DHR/ICMR Registration No: EC/NEW/INST/2023/TN/0293; Ethical Clearance Number: IEC-NI/25/11/111/221). Informed consent was obtained from all participants in accordance with the Helsinki Declaration.

Consent for publication: Not applicable

Data availability: All data generated or analysed during this study are included in this published article and its supplementary information files.

Competing Interests: The authors declare that they do not have any competing interests.

Funding: Not applicable

Author's contribution:

First author: Niveditha .B : Has conceptualized the study, prepared the self-structured questionnaire, conducted the study and written the manuscript

Second author: Naveena S S : Has contributed in the data analysis and statistical part of the study

Third author: Akila Ganesh: Has developed the questionnaire and contributed in enhancing the content validity and face validity of the questionnaire to be presented to experts for final approval. Overviewed the manuscript.

Fourth author: Nanda Balan. I, Has developed the questionnaire and contributed in enhancing the content validity and face validity of the questionnaire to be presented to experts for final approval. Overviewed the manuscript.

Corresponding author : Divyambika C V, Conducted the questionnaire study and overview of the final version of the manuscript.

Acknowledgement: Not applicable

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Tables

Tables 1 to 4 are available in the supplementary files section

Figures

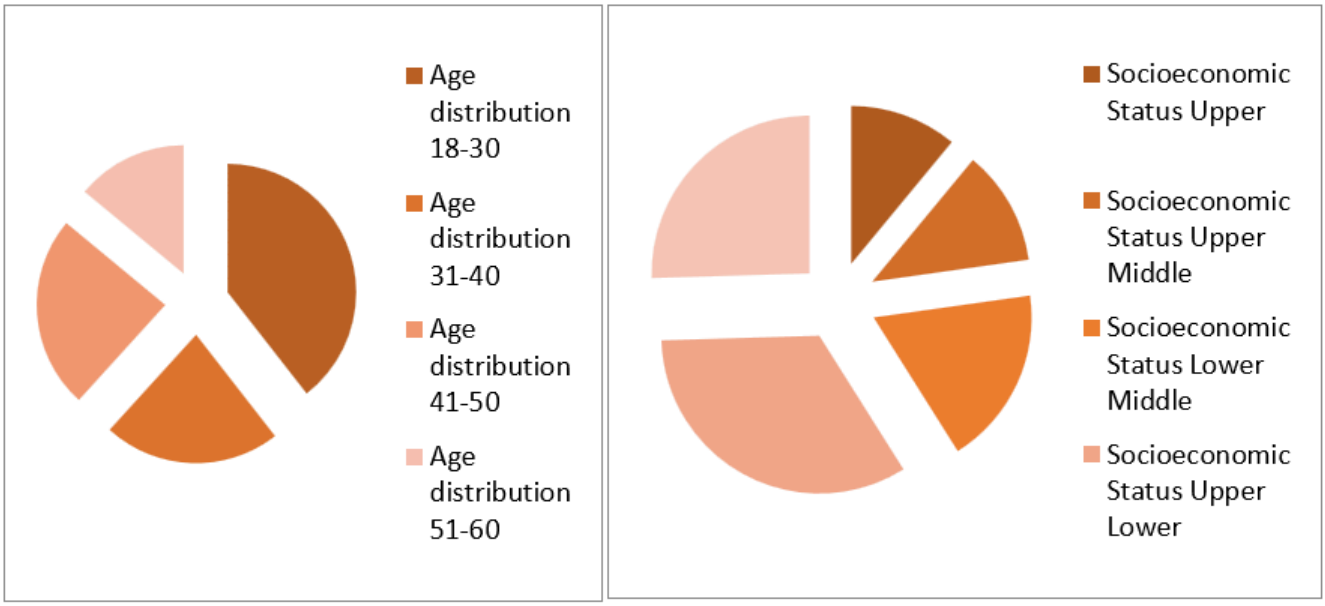


Figure 1

GRAPHICAL REPRESENTATION OF PARTCIPANTS ACCORDING TO AGE AND SOCIOECONOMIC STATUS

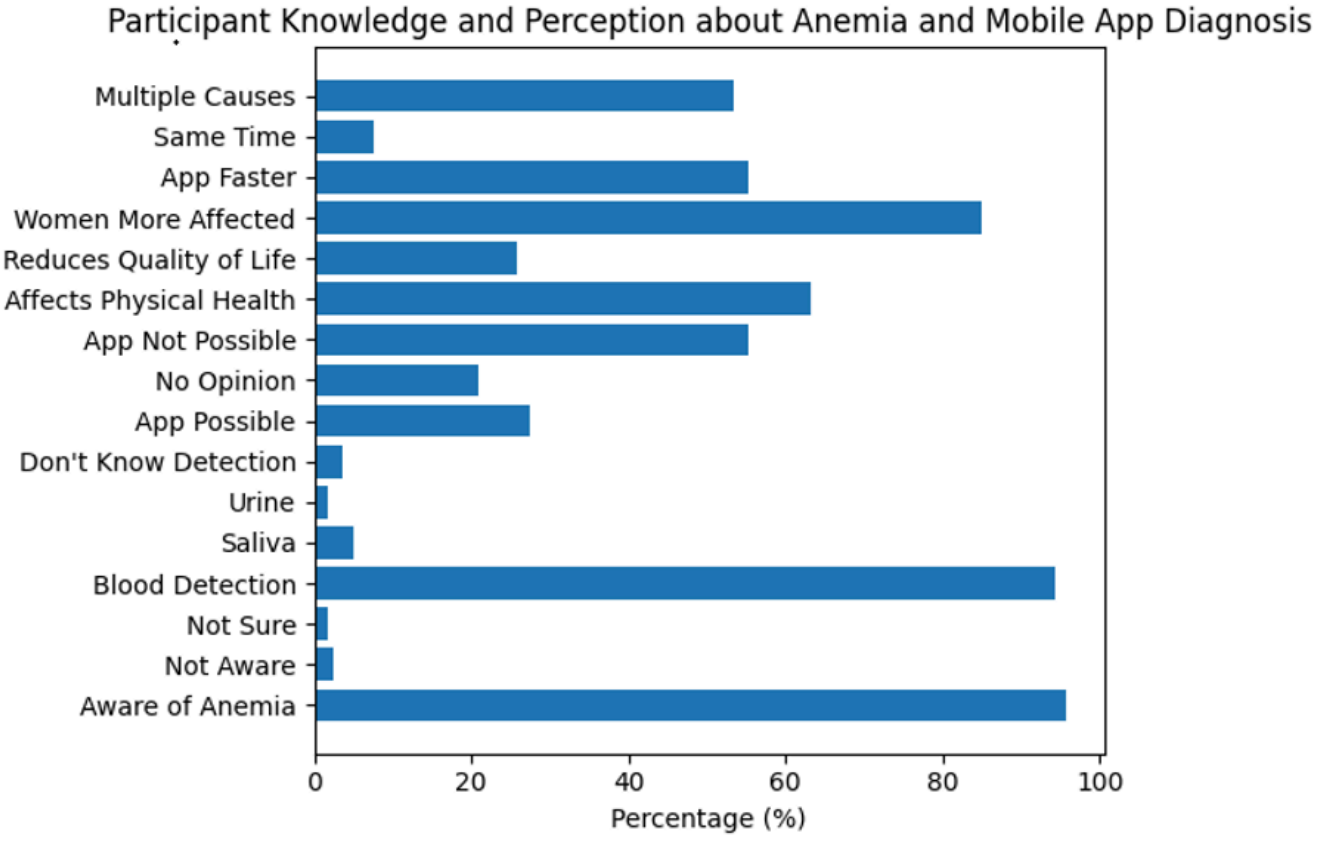


Figure 2

Participant knowledge and perception about Anemia and Mobile app Diagnois

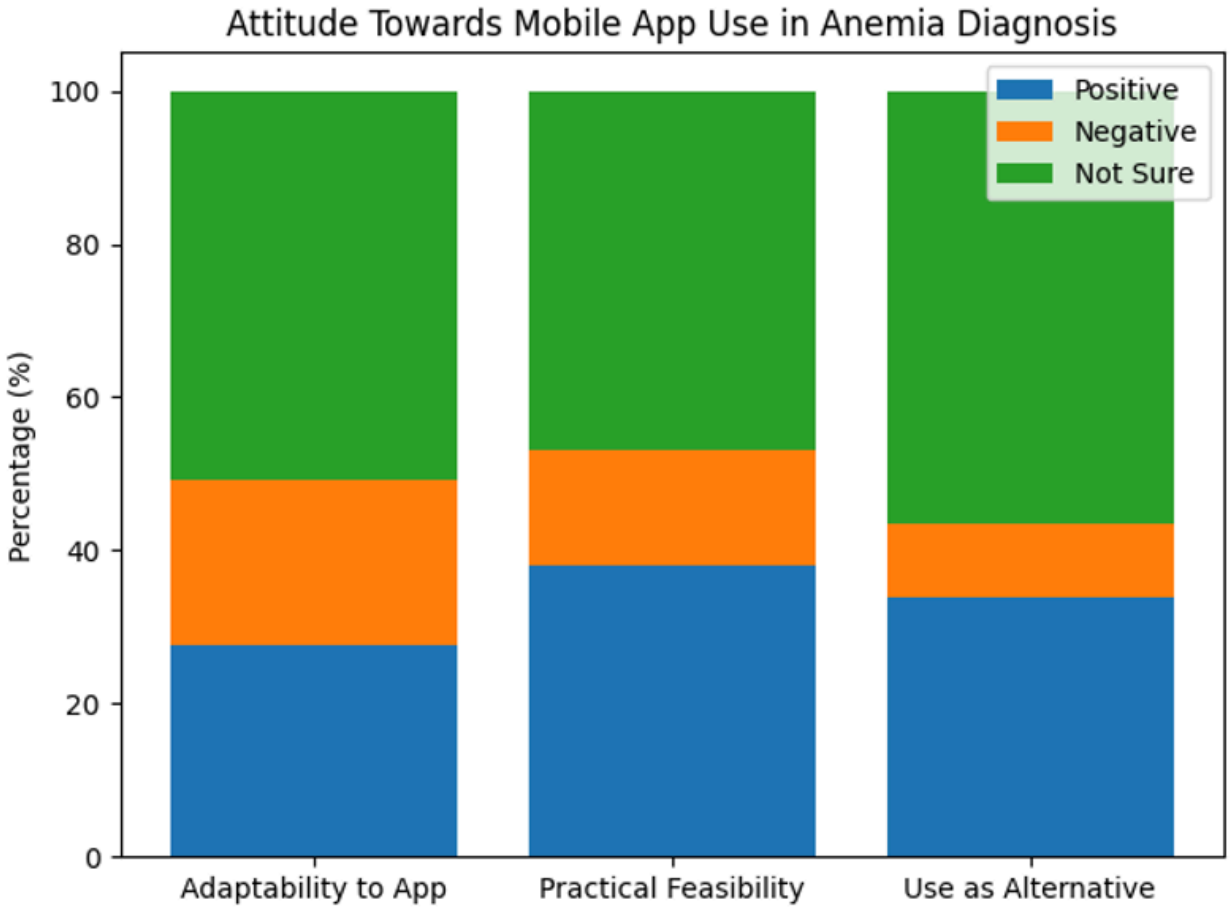


Figure 3

Attitude towards Mobile app use in Anemia Diagnosis

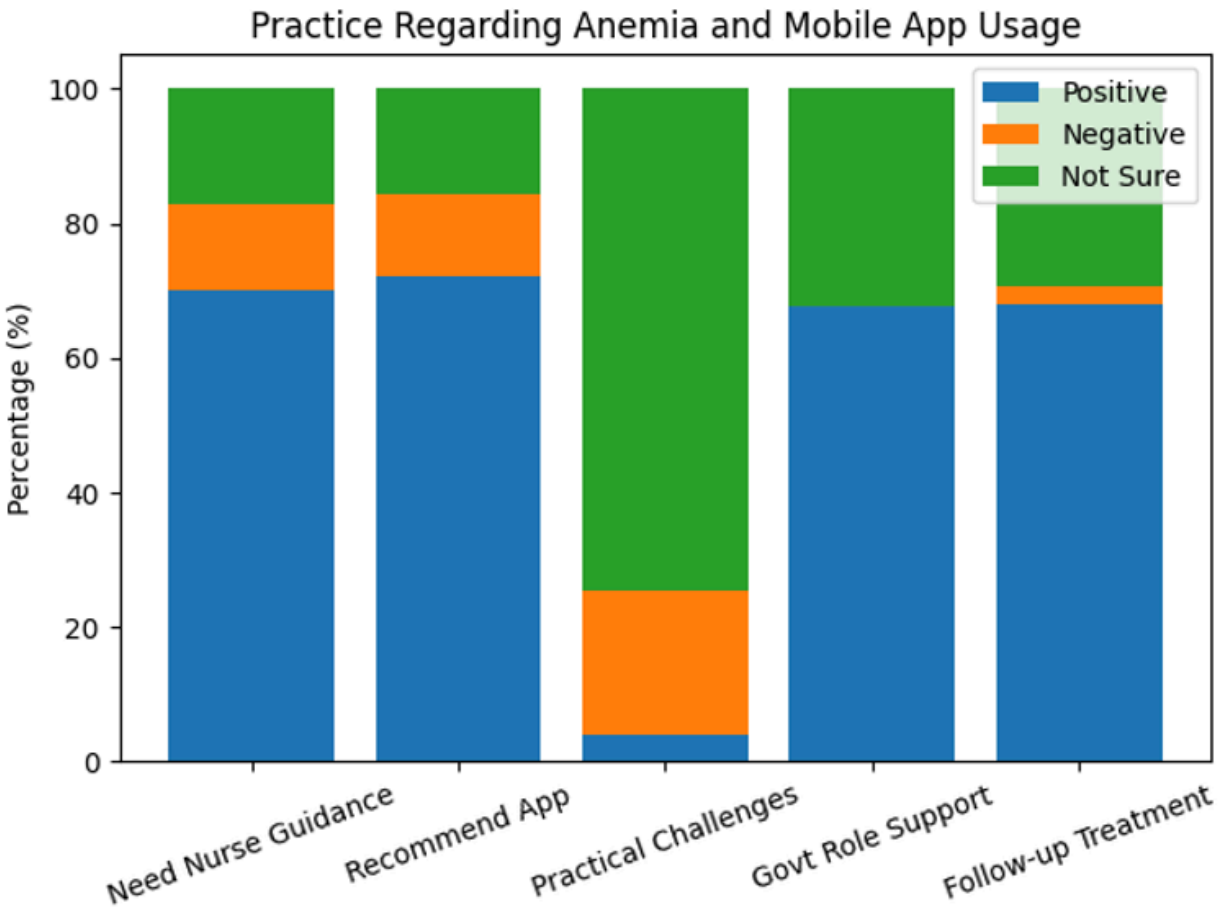


Figure 4

Practice regarding Anemia and Mobile app usage



Figure 5

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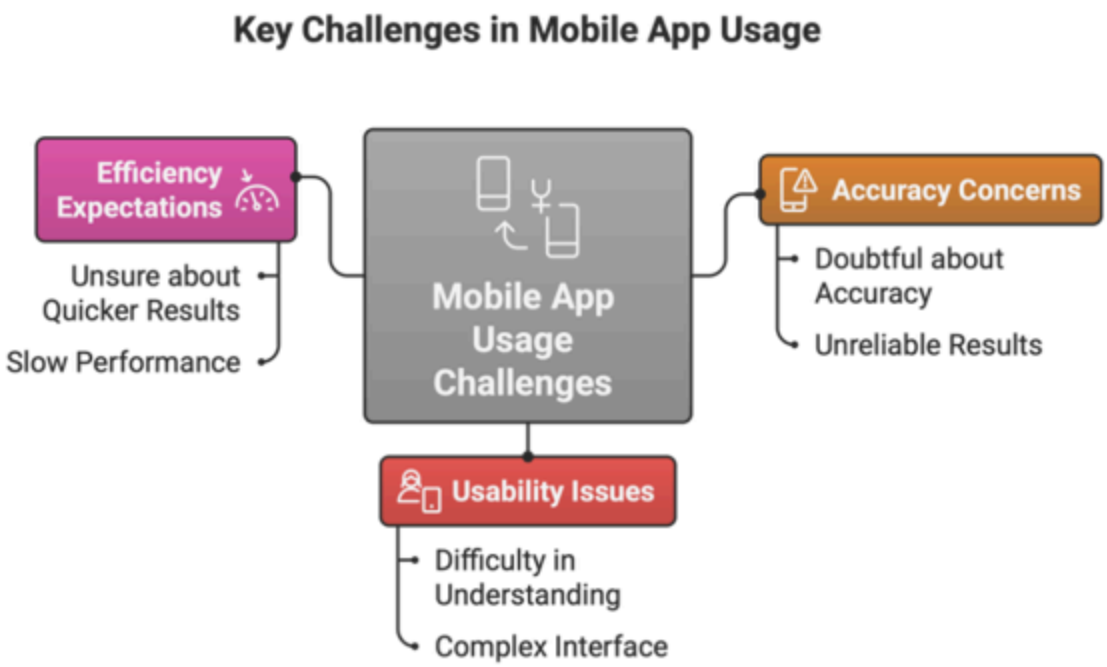


Figure 6

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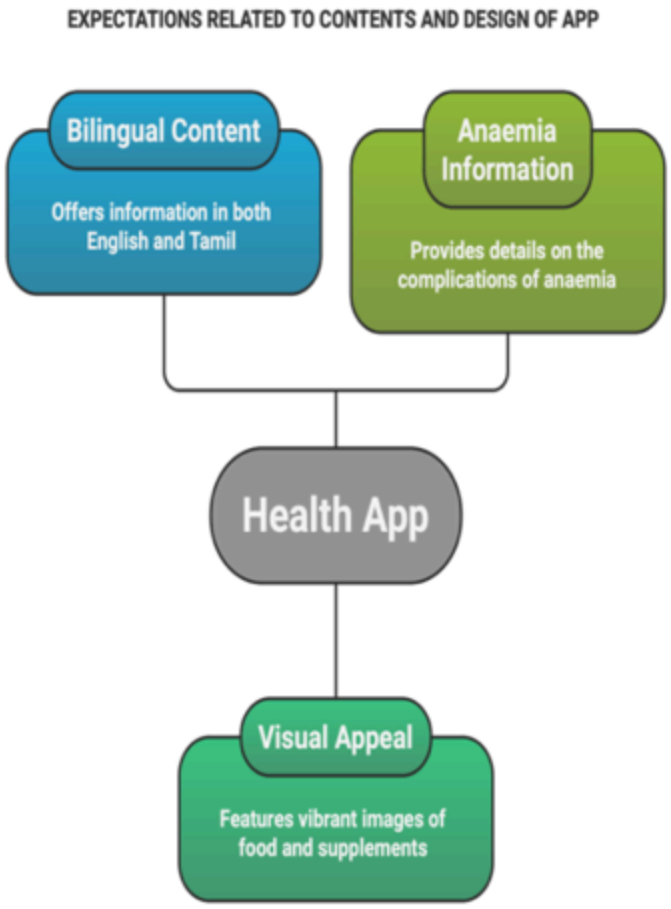


Figure 7

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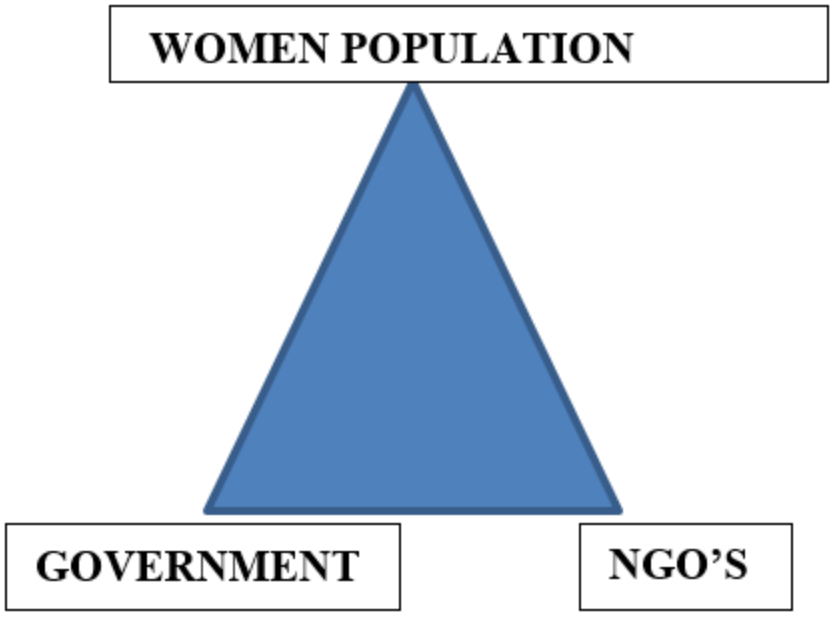


Figure 8

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Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- TABLE.docx
- Supplementarytable1Modifiedfinalquestionnaire1.docx
- Supplementarytable2KAPresults.doc
- Supplementary3Dataavailability.xlsx