

# Design and usability evaluation of nutritional counseling web app (virtual clinic) for pregnant women

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## Article Info

**Article type:**  
Research

### Article History:

Received: 2023-04-18  
Accepted: 2023-05-18  
Published: 2023-06-11

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### Keywords:

Nutrition  
Nutrition Consultation  
Virtual Clinic  
Nutritional Website  
Pregnant Women  
Online Therapy Regime  
Assessment  
User Interface  
Heuristic

## ABSTRACT

**Introduction:** Nutrition counseling web apps have the ability to improve the quality of health care. The purpose of this study is to design and evaluate the usability of a nutrition counseling web app (virtual clinic) for pregnant women.

**Material and Methods:** It was a descriptive-cross-sectional applied study that first designed and then examined the nutritional counseling web app (virtual clinic) for pregnant women using the heuristic evaluation method. The data was collected with a standard form designed based on the heuristic method. Data analysis was done with SPSS version 26.

**Results:** The number of known individual problems was 34. The highest number of problems was related to the flexibility and efficiency component and the lowest number was related to the component of helping users in diagnosing, identifying and correcting errors. In the end, all the problems identified in the web app were solved and it was given to the evaluators again, and in the end, a score of zero was assigned to all the components, meaning no problem.

**Conclusion:** Compliance with existing standards and rules in the design of web app user interfaces, such as the heuristics mentioned in this study, can reduce problems.

## Cite this paper as:

Dahri M, Zarei Shargh P, Sahebzamani A, Ghasemi R, Jahangir M, Moghbeli F. Design and usability evaluation of nutritional counseling web app (virtual clinic) for pregnant women. *Front Health Inform.* 2023; 12: 143. DOI: [10.30699/fhi.v12i0.433](https://doi.org/10.30699/fhi.v12i0.433)

## INTRODUCTION

In the new era, the type of mother's nutrition is very important in such a way that having nutrition counseling for pregnant women has a direct relationship with the growth and health of the fetus. In addition, proper nutrition can guarantee the mother's health during pregnancy and after childbirth. By giving, the right diet during pregnancy, the pregnancy nutrition consultant, in addition to maintaining the physical health of women, also controls her weight and prevents excess weight due to childbirth and after pregnancy [1-3].

For a physical examination, women need to go to a gynecologist's office and have an in-person visit with a doctor. However, nutrition counseling for pregnant

women can be done under the nutrition counseling web app when no physical examination is needed and the patient's questions can be answered [4-7].

According to the opinion of some experts in the field of nutrition, the best consultation between the client and the nutritionist occurs when they are in a suitable and comfortable position, so if a client is at home and texting is more suitable for him, that method is preferable. Virtual nutrition consultations can usually be implemented at any time and in any place, so it does not require specific planning and the person will have more time for other daily activities. Also, for women who are constantly traveling due to the type of work, they can contact their doctor according to the specific time that the individual wants [2, 8].

With the best and most skilled female nutritionists, the nutrition consultation web app (virtual clinic) provides the possibility of consulting with nutritionists, visiting a doctor online, and also providing nutrition counseling for pregnant women through the Internet such as Skyroom. At this time, there is no need to look for a nutritional consultant in the city traffic, pollution, and crowds and waste a few hours of time. Therefore, the purpose of this research is to design and evaluate a nutrition counseling web app (virtual clinic) for pregnant women during pregnancy [2-4].

These web-apps have the ability to improve consultation processes, speed up work and increase accuracy in documentation. Nevertheless, research has shown that the use of web apps has also brought many errors. Errors of web-apps can lead to disproportionate care, delays in treatment, problems in clinical research, increase in costs and finally putting patients' lives at risk. Many of these errors are related to the usability problems of these systems, which cause problems in the interaction of users with them. Therefore, solving usability problems seems very necessary. Considering the great effect of designing the user interface of web apps on the way users interact with the system and their level of satisfaction, the evaluation results of these web apps can be used for redesigning the user interface, accepted by users and solving their basic problems [9].

## MATERIAL AND METHODS

The first phase of this research is of the applied type, which includes the design of the online nutrition counseling web app. The second phase of the study included the usability evaluation of the nutrition counseling web app, which was a qualitative analytical study. The population studied in the first phase of the research includes the number of apps and studies available for remote nutrition counseling for pregnant women during pregnancy. To specify the necessary components in web app design, 2 nutrition web apps with the highest level of satisfaction were used. The second phase of the sample included 4 experts, consisting of two nutritionists and two medical informatics experts [10-12].

**Design phase:** The design of the nutritional counseling web app was done in several stages. In the first step, a review of the available articles and web apps (Karafs, Lemomi) was conducted in the field of remote nutritional counseling for pregnant women during pregnancy and providing diet to pregnant women. In the next step, the variables related to pregnant women were identified and recorded in the data collection form for the design of the remote nutritional counseling web app, and finally, using Java and PHP programming languages, to design the remote nutrition clinic web app for Pregnant women

were paid [12-14].

**Evaluation phase:** In this phase, in order to make working with web apps comfortable, efficient and satisfactory for users, in the design of the user interface of this web app, a series of standard principles and rules related to the optimal design of the web app user interface must be observed. Evaluation of web apps based on these principles and rules is called heuristic evaluation.

One of the most well-known of these methods for evaluating the usability of the user interface was presented and explained for the first time in 1990 by Nielsen [14]. In this method, a group of evaluators (between 3 and 5 people) (four people were used in the present study) is used to examine the user interface and judge its compliance with predetermined standard principles (heuristics). In Nielsen's method, 10 main heuristic components are used to evaluate the web app, which are described below.

- Clarity of system status
- Compatibility between the system and the real world
- User freedom of action and control over the system
- Compliance with uniformity and standards
- Error prevention
- Recognizing instead of reminding
- Flexibility and efficiency of use
- Helping users in diagnosing, identifying and correcting errors
- Beautiful aspects of recognition and simple design
- Guidance and documentation

In this evaluation method, the evaluators independently examine the user interface and evaluate the compliance of the components mentioned in the system design. Non-observance of each of these components is recognized as a problem of applicability. These problems can prevent the successful interaction of the user with the system. This method has many advantages such as ease of use and identification of a large number of web app user interface problems. So far, the heuristic evaluation method has not been used to evaluate the usability of the online nutrition web app. Considering the importance of these web apps and the health of pregnant women and the necessity of using a suitable and desirable user interface, in this study, a web app was designed and evaluated with the heuristic evaluation method [15-18].

In this study, four evaluators independently evaluated the web app with Nielsen components. The evaluators consisted of two medical informatics specialists with full usability evaluation skills and 2

nutritionists who were trained in heuristic evaluation. Each of the evaluators examined different parts of the web app in terms of compliance with heuristics and entered the problems found in the data collection form. Data collection was done through a standard form based on the heuristic method proposed by Nielsen. Its content validity was confirmed by three medical informatics experts. This form consisted of a table containing columns (problem name, problem description, problem location, heuristic).

The data collected in independent evaluations were matched together, and from the total problems identified by the evaluators, repeated cases were removed and similar cases were determined. Also, the compliance of each problem with the considered heuristic was examined by each of the evaluators. Then the problems were entered in two separate lists according to the type of heuristic and the evaluated part of the system. For each of the problems found, the number of evaluators who found that problem was entered. Any disagreements about the problems found and their allocation to each of the heuristics were discussed and resolved in joint meetings. Finally, the severity and severity of the problems were scored based on a 5-point Likert scale. Then the data were analyzed using SPSS version 26 software.

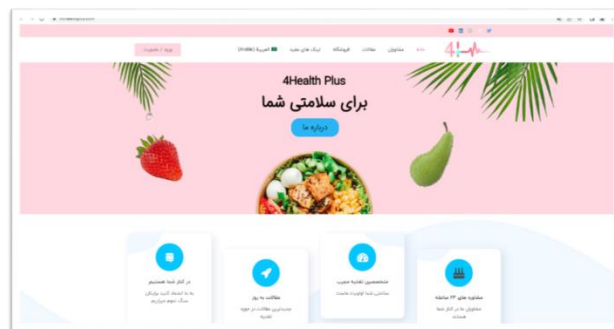


Fig 1: View of the main page of the site

Searching for a doctor

To search for a doctor, the user can enter the name of the specialist in the search field. Based on this, a list of nutrition consultants will be displayed (Fig 2).

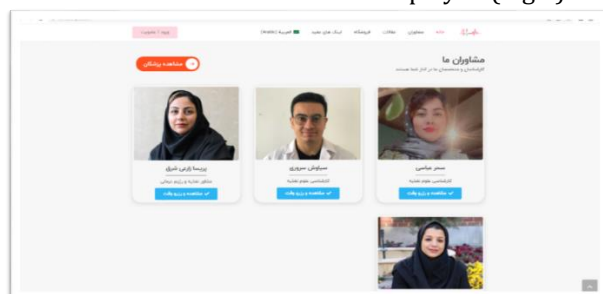


Fig 2: Doctor search view

RESULTS

Inferential Results

Phase 1: The site was designed based on PHP and Java language. At the beginning, the user sees the main page of the site, which includes 24-hour consultations, experienced nutritionists, up-to-date articles and blogs, as well as a number of links to other parts of the site.

Site components

There are two points of view about the system: user point of view and management point of view. From the user's point of view, a person first enters a page where he can see a list of nutritionist consultants on the site in different ways. Then, by choosing each one, he sees the details related to it and takes a visit from the relevant specialist.

Different parts of the site (Fig 1):

- Information bank of diet that should be sold online.
- A program that processes the doctor's search.
- A program that allows the user to log in/out to/from the site.
- Management interface.

Expert-based evaluation

Phase 2: In the evaluation of the nutrition counseling web app for pregnant women using the components provided by Nielsen (heuristic evaluation), 56 problems were found in different parts of this system. The number of known individual problems was 34. The sum of identified individual problems and the number of evaluators is specified in Table 1. These problems were identified in five main sections of the web app (home, consultants, articles, store, and useful links).

Table 1: Problems identified by evaluators

Number of problems identified by 4 evaluators (%)	Number of problems identified by 2 evaluators (%)	Number of problems identified by 1 evaluator (%)
15 (44.12)	13 (38.24)	6 (17.65)

The results showed that out of all the identified problems, the largest number of problems were related to the flexibility and efficiency component (23.5%) and then the components of aesthetic aspects and simple design and the clarity of the system status (14.8 %). Adherence to uniformity and standards (14.8 %), error prevention (11.8 %), diagnosis instead of reminders (8.8 %), guidance and documentation (8.8 %), consistency between the

system and the real world. (8.8 %), user freedom of action and system mastery (5.8 %) and the least number of errors was related to the component of helping users in diagnosing, identifying and correcting errors (2.9 %).

The degree of severity of the problems is determined based on Table 2.

**Table 2: The degree of severity and severity of problems**

Name	Intensity	Description
without problem	0	No problem
very little	1	It does not need to be modified unless there is extra time in the project
Low	2	Fixing this issue is a low priority.
Much	3	Its correction is important, so it should be given high priority
very much	4	Modification is required before releasing the product

- Clarity of the system status: problems related to non-observance of this component were scattered throughout the web app and were mostly seen in the consultants' section. Among these problems, we can refer to cases such as not selecting appropriate titles on the pages, the absence of a horizontal scroll bar in the display of consultant search information, not giving a message to the user when selecting items that do not apply to the patient (such as selecting incomplete answer tests). Did some of these problems, such as the first and second problems, were found by all four evaluators.

- Compatibility between the system and the real world: one of the problems related to this component, which causes more confusion for users and wastes their time; It was determined that graphic symbols are not the same as cultural signs.

- User's freedom of action and mastery of the system: the number of problems related to this component seems to be less than the problems related to other components. One of these problems is: lack of access to the previous or next page.

- Observance of uniformity and standards: problems related to non-observance of this component were observed in the entire web app. But most of the problems were related to the consultants. Among the problems related to non-observance of this component, the following can be mentioned: lack of a uniform standard for displaying window titles (Persian/English/untitled), heterogeneous use of attention-grabbing techniques (such as highlighting words), the difference in the way to display the appointment request information in the online and offline sections.

- Error prevention: problems related to non-observance of this component were scattered throughout the system and were mostly seen in the consultants' section. Some of these types of problems are described below. Failure to prevent the entry of inappropriate data (the birth year entry field has four characters, but only the two characters on the right are recorded during data entry), the possibility of entering numerical information in letter fields without receiving an error message.

- Recognizing instead of reminding: one of its problems is that mandatory fields to complete are not different from optional fields.

- Flexibility and efficiency of use: Among the problems of this section, the following can be mentioned: the difficulty of using the vertical scroll bar, the access level of expert and beginner users to the system is the same.

- Helping users in diagnosing, identifying and correcting errors: problems related to non-observance of this component among the 10 components presented by Nielsen, had the least number and related to the appointment request section in the consultants' section. Among these problems, we can mention the use of inappropriate messages in response to the user's action.

- Beautiful aspects of recognition and simple design: problems related to not observing this component can be seen in all parts of the web app. The most important of them are the smallness of the fonts, the use of inappropriate colors (the color of the texts being too soft), the density of information on the pages of the articles, the confusion of the page titles.

- Guidance and documentation: the problems related to non-observance of this component were related to the entire web app and especially the consultants' section. Among the identified problems, we can mention the cases of non-existence and access to the web app guide (including auxiliary keys, descriptive, trending, interpretive, navigational information), anonymity of the list of articles.

In the end, all the identified problems were solved and it was given to the evaluators again, and in the end, a score of zero was assigned to all the components, which means there is no problem. The usability problems of the web app according to their sharing among the evaluators, their average and their severity status are given in Table 3.

According to Ttable 3, the average degree of severity detected in users in system clarity and freedom of action of the user, mastery of the system is low (2.3) and the average and degree of severity related to the characteristics of recognition instead of recall (2.9) is estimated as a high problem.

**Table 3: Web app usability problems by their share among the evaluators, their average and severity level**

Title	Severity of the problem	Average degree of intensity	Total	Common	Evaluator 4	Evaluator 3	Evaluator 2	Evaluator 1
Clarity of system status	Low	2.3	2	2	0	1	1	2
Consonance between the system and the real world	Much	2.6	5	3	1	3	2	2
Freedom of user action and mastery of the system	Low	2.3	4	2	0	1	1	2
Observance of uniformity and standards	Much	2.7	7	5	1	3	5	3
Error prevention	Much	2.6	7	4	2	3	4	2
Diagnosis instead of reminder	Much	2.9	5	3	2	1	3	2
Flexibility and efficiency of use	medium	2.5	12	8	2	3	7	8
Helping users in diagnosing, identifying and	Much	2.7	2	1	0	1	1	1
Correct errors	Much	2.6	7	3	2	2	3	3
Aesthetic aspects and simple design	Much	2.7	5	3	2	1	3	2
Guidance and documentation	Much	2.59	56	34	12	19	30	27

## DISCUSSION

In this research, to design a web app, the available articles and web apps were reviewed in the field of remote nutrition counseling for expectant women during pregnancy. After reviewing the articles and web apps available in the field of online nutrition counseling for pregnant women, the variables related to pregnant women such as age, sex, weight, blood type, as well as the online appointment sections that are available in the web app in the counselors section, the articles section, the store section was designed to sell the products needed by pregnant women such as nutrition and home (about the web app) and finally useful links. Based on the comparison made in the studies for the design of the web app for nutrition advice for pregnant women, the existence of these sections is sufficient and meets the needs of the users [19, 20].

In the existing studies and the famous web apps of Karafs and Lemomi [19, 20], the diet is considered for all groups of patients, but the present study was designed only for pregnant women and authentic materials were collected specifically for this group of people. It has been updated. Due to the specific conditions of pregnant women, the existence of a dedicated panel for them that has the ability to provide online and offline counseling and follow-up continuously was not available in similar cases, and this case was solved in the web app designed.

In Table 4, the Karafs, Lemomi site is compared with the virtual nutrition clinic for pregnant women.

The results of the heuristic evaluation of the virtual nutrition clinic web app for pregnant women showed that this web app and similar cases; although it is used in the country, it has a large number of applicability problems. Some of these problems, if continued, can have negative effects on the performance of users (such as fatigue, confusion, waste of time) [21-23]. This can cause errors and, as a result, damage the quality of treatment and ultimately the patient's health. According to the review of scientific sources and studies conducted, the evaluation method in this article is one of the new methods that have not been used to evaluate web apps [24, 25].

Studies have shown that having expertise both in the field of evaluation and in the field of the studied web app, causes better identification of problems. According to Nielsen's studies about increasing the usability of the user environment, user environments that are constantly subject to change and transformation need to be reviewed and updated every once in a while. The update should be based on adding new facilities and facilities and correcting and solving existing problems, which has a great effect on optimal user interaction and increasing users' understanding of the system environment [17, 26].

## CONCLUSION

Carrying out usability evaluation, as shown in this study, can identify the root and cause of problems that may cause new errors, users' fear of working with the system and their resistance to the system, and on the other hand, harm to patients. Do these types of problems arise because of not following accepted standards and principles (such as heuristics) in the design of web apps, which can cause problems for human interaction with web apps? The result of a defective or unsuccessful interaction can cause an unpleasant experience of working with the system and cause errors in the results of the work process, that is, in the care of patients. By using the results of this research, the problems identified in the system can be solved and it can be redesigned. In addition to solving the problems in the next versions of the system, it is possible to prevent the problems identified in the design of similar systems. According

to the mentioned cases, heuristic evaluation is an important and effective method for diagnosing problems and defects in health web apps, which increases the quality of treatment and patient safety by providing more accurate results and helping to identify real problems.

Among the limitations, we can mention the design of the site during the covid-19 pandemic, which limited the possibility of face-to-face communication in the design.

It is suggested that the team members undertake the design by increasing their knowledge of IT and programming.

It is suggested that the above site be used for other specialists, including psychologists, as well as the possibility of providing services in Arabic

**Table 4: Summary and comparison of the Karafs, Lemomi website and the virtual nutrition clinic for pregnant women**

Website	Satisfaction rate	Start year	Scope	Comparison
Karafs	4.5	2015	It is suitable for those who are at their ideal weight and just want to maintain their current weight. Karafs users so far: 5100000 people	Providing products in the form of Android-IOS site applications
Lemomi	4.5	2016	All people who need to receive diet From childhood to middle age	Artificial intelligence Weight loss, weight gain Food information Report based on BMI information virtual doctor Food value with camera, report and graph
Virtual clinic for pregnant women	4.5	2021	Nutrition for pregnant women	- Website design and implementation under the supervision of nutritionists and health information technology experts And that this web app was designed and implemented at the suggestion of nutritionists. But karafs, Lemomi are guided by nutrition experts. - Bilingual website design in both Farsi and Arabic

**AUTHOR'S CONTRIBUTION**

All authors contributed to the literature review, design, data collection and analysis, drafting the manuscript, read and approved the final manuscript.

**CONFLICTS OF INTEREST**

The authors declare no conflicts of interest regarding the publication of this study.

**FINANCIAL DISCLOSURE**

No financial interests related to the material of this manuscript have been declared.

**REFERENCES**

1. Sajjad UU, Shahid S. Baby+: A mobile application to support pregnant women in Pakistan. International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct. ACM; 2016.

2. 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. *Mater Child Nutr.* 2019; 15(3): e12768. PMID: 30569549 DOI: 10.1111/mcn.12768 [PubMed]

3. Brug J, Oenema A, Campbell M. Past, present, and

- future of computer-tailored nutrition education. *Am J Clin Nutr.* 2003; 77(4 Suppl): 1028S-34S. PMID: 12663313 DOI: 10.1093/ajcn/77.4.1028S [[PubMed](#)]
4. Octovia LI, Manikam NRM, Witjaksono F, Sutanto K, Koesoema AP, Soegijoko S, et al. mHealth for mother and child health nutrition: A review and proposed design for Indonesia focus on early life nutrition in Indonesia. International Conference on Instrumentation, Communications, Information Technology, and Biomedical Engineering. IEEE; 2017.
  5. Zhu C, Zeng R, Zhang W, Evans R, He R. Pregnancy-related information seeking and sharing in the social media era among expectant women: Qualitative study. *J Med Internet Res.* 2019; 21(12): e13694. PMID: 31799939 DOI: 10.2196/13694 [[PubMed](#)]
  6. Knight-Agarwal C, Davis DL, Williams L, Davey R, Cox R, Clarke A. Development and pilot testing of the Eating4two mobile phone app to monitor gestational weight gain. *JMIR Mhealth Uhealth.* 2015; 3(2): e44. PMID: 26048313 DOI: 10.2196/mhealth.4071 [[PubMed](#)]
  7. Ahmad M, Khan MA, Bibi M, Ullah Z, Shah ST. Mobile apps for human nutrition: A review. In: Umair S. Mobile devices and smart gadgets in medical sciences. IGI Global; 2020.
  8. Bhalekar NS, Chandna S. A smart fitness application for pregnancy that recommends workout plans based on health conditions. World Congress on Electrical Engineering and Computer Systems and Sciences. MHCI; 2022.
  9. Moulaei K, Sheikhtaheri A, Ghafaripour Z, Bahaadinbeigy K. The development and usability assessment of an mHealth application to encourage self-care in pregnant women against COVID-19. *J Healthc Eng.* 2021; 2021: 9968451. PMID: 34336175 DOI: 10.1155/2021/9968451 [[PubMed](#)]
  10. Kundu S, Kabir A, Islam MN. Evaluating usability of pregnancy tracker applications in Bangladesh: A heuristic and semiotic evaluation. Humanitarian Technology Conference. IEEE; 2020.
  11. Jennings A, Powell J, Armstrong N, Sturt J, Dale J. A virtual clinic for diabetes self-management: Pilot study. *J Med Internet Res.* 2009; 11(1): e10. PMID: 21821504 DOI: 10.2196/jmir.1111 [[PubMed](#)]
  12. Almeida LB, Segurado AC, Duran ACF, Jaime PC. Impact of a nutritional counseling program on prevention of HAART-related metabolic and morphologic abnormalities. *AIDS Care.* 2011; 23(6): 755-63. PMID: 21287417 DOI: 10.1080/09540121.2010.525789 [[PubMed](#)]
  13. Nielsen J. How to conduct a heuristic evaluation. Nielsen Norman Group. 1995; 1(1): 8.
  14. Nielsen J, Molich R. Heuristic evaluation of user interfaces. The SIGCHI Conference on Human Factors in Computing Systems. IEEE; 1990.
  15. Jalilian N. Designing and building intelligent software for the health of pregnant women at risk. *Journal of Kermanshah University of Medical Sciences.* 2012; 16(2): e79775.
  16. Meshki M, Seyedi Sani K, Shafaqi K. Effectiveness of training programs on nutritional status during pregnancy: Comparison of group discussion method and multi-media package. *Iranian Journal of Women, Obstetrics and Infertility.* 2014; 17(128): 18-27.
  17. Montazerifar F. Evaluation of nutritional status in pregnant women referring to health centers in Iranshahr, Iran. *Medical - Surgical Nursing Journal.* 2014; 3(2): e87909.
  18. Arabi E, Salehi S, Najafpoor Bushehri N. Investigating the effect of an educational program based on the Bezenf model on the nutritional performance of pregnant women referring to Meraj Bushehr Health Center in 2013. *Iranian South Medical Journal.* 2016; 19(3): 435-45.
  19. Karafs [Internet]. 2019 [Cited: 10 Mar 2023]. Available from: <https://karafsapp.com/>
  20. Limomi [Internet]. 2021 [Cited: 10 Mar 2023]. Available from: <https://limoome.com/>
  21. Lupton D, Pedersen S. An Australian survey of women's use of pregnancy and parenting apps. *Women Birth.* 2016; 29(4): 368-75. PMID: 26874938 DOI: 10.1016/j.wombi.2016.01.008 [[PubMed](#)]
  22. Caballero-Ruiz E, García-Sáez G, Rigla M, Villaplana M, Pons B, Hernando ME. A web-based clinical decision support system for gestational diabetes: Automatic diet prescription and detection of insulin needs. *Int J Med Inform.* 2017; 102: 35-49. PMID: 28495347 DOI: 10.1016/j.ijmedinf.2017.02.014 [[PubMed](#)]
  23. Garnweidner-Holme LM, Borgen I, Garitano I, Noll J, Lukasse M. Designing and developing a mobile smartphone application for women with gestational diabetes mellitus followed-up at diabetes outpatient clinics in Norway. *Healthcare (Basel).* 2015; 3(2): 310-23. PMID: 27417764 DOI: 10.3390/healthcare3020310 [[PubMed](#)]
  24. Islam MN, Karim M, Inan TT, Islam A. Investigating usability of mobile health applications in Bangladesh. *BMC Med Inform Decis Mak.* 2020; 20(1): 19. PMID: 32013965 DOI: 10.1186/s12911-020-1033-3 [[PubMed](#)]
  25. Vélez O, Okyere PB, Kanter AS, Bakken S. A usability study of a mobile health application for rural Ghanaian midwives. *J Midwifery Womens Health.* 2014; 59(2): 184-91. PMID: 24400748 DOI: 10.1111/jmwh.12071 [[PubMed](#)]
  26. Derksen ME, Jaspers MW, van Strijp S, Fransen MP. Mobile health for smoking cessation among disadvantaged young women during and after pregnancy: user-centered design and usability study. *JMIR Form Res.* 2021; 5(8): e24112. PMID: 34346895 DOI: 10.2196/24112 [[PubMed](#)]