

Web-Based Telemidwifery for Consultation Between Midwives and Pregnant Women Using User-Centered Design

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ABSTRAK

The development of information technology has encouraged the transformation of healthcare services, including midwifery services through the concept of telemidwifery. This study aims to develop a web-based telemidwifery platform as a consultation medium between midwives and pregnant women using the User-Centered Design (UCD) approach. UCD was applied to ensure that the system was developed based on user needs, characteristics, and comfort. The research stages consisted of literature study, data collection, model design, model implementation, and testing and evaluation. The developed platform provides several main features, including online consultation, pregnancy education, examination schedules, pregnancy monitoring, and consultation history. Usability testing was conducted using the System Usability Scale (SUS) method involving 10 respondents. The results showed an average SUS score of 84.5, which is categorized as excellent. These findings indicate that the web-based telemidwifery platform is easy to use, has a clear workflow, and meets the needs of midwives and pregnant women. Therefore, this platform can serve as an alternative digital consultation medium to support communication, education, and maternal health monitoring more effectively.

Keywords : Telemidwifery; Online Consultation; Pregnant Women; User-Centered Design; System Usability Scale

Introduction

The advancement of information technology has driven the transformation of healthcare services toward systems that are more accessible, efficient, and responsive to user needs. One form of this transformation is the use of digital health applications, or mobile health (mHealth), which can support health monitoring, education, communication, and health information management more effectively. In the healthcare sector, User-Centered Design (UCD) has been widely adopted as a system development approach that places users' needs at the center of the design process. A literature review on the implementation of UCD in healthcare systems indicates that commonly used methods include interviews, questionnaires, think-aloud protocols, heuristic evaluation, focus group discussions, prototyping, and persona development [1]. These approaches have been shown to improve usability, service efficiency, and the quality of healthcare systems, while also reducing errors in system use.

In the context of midwifery services, digital technology can be utilized through the concept of telemidwifery, which refers to remote midwifery consultation services that enable midwives and pregnant women to communicate online without being constrained by distance or time. Midwifery services play an essential role in maintaining maternal and fetal health throughout pregnancy. Midwives are responsible for providing education, consultation, pregnancy monitoring, and early detection of potential pregnancy-related risks. However, several challenges remain in practice, including limited access to consultation services, insufficient communication between midwives and pregnant women, delays in the delivery of health information, and suboptimal periodic monitoring of pregnant women's conditions. These challenges indicate the need for a digital platform that can facilitate communication between midwives and pregnant women in a more accessible, structured, and continuous manner.

The development of digital health systems requires not only comprehensive features but also careful consideration of ease of use, interface convenience, information clarity, and users' trust in the system. A study on health applications for older adults in Thailand demonstrated that health applications developed by considering users' needs can improve user satisfaction and engagement. The study employed several stages, including context-of-use analysis, user requirement specification, user modeling, user interface design and prototyping, and usability testing in the development of a mobile-based health application [2]. These findings indicate that user involvement from the early stages of development is essential to ensure that the resulting system aligns with users' actual needs.

Another study on Carelinker, a health application designed to support older adult care in Indonesia, also demonstrated that digital health applications need to be developed comprehensively by integrating health monitoring, reminder, data recording, and user communication features. An evaluation using the System Usability Scale (SUS) produced a score of 82.4, which falls within the excellent category, indicating that a design that considers user needs can improve the usability quality of health applications [3]. SUS is a simple, rapid, and widely used usability evaluation instrument for measuring users' perceptions of a system's ease of use [4]. Furthermore, SUS evaluation results can be used to interpret the level of user acceptance of a system, including categories ranging from acceptable and good to excellent [5]. These findings are relevant to the development of a telemidwifery platform because the proposed

system also requires communication features, consultation history records, examination schedule reminders, and monitoring of pregnant women's health conditions.

In addition to functional aspects, digital health applications must also address user trust, security, and acceptance. A study on the development of artificial intelligence-based medical applications emphasized that the success of health applications is strongly influenced by the quality of the human-machine interface, usability, accessibility, trust, and user acceptance [6]. In the context of telemidwifery, these aspects are particularly important because the system will be used for health consultations related to the conditions of pregnant women. Therefore, the information presented in the system must be easy to understand, the features must be clear and easy to use, and interactions between midwives and pregnant women must be designed to be secure, convenient, and trustworthy.

The development of health applications for women also needs to consider users' specific needs. A study on an mHealth framework for menopause management demonstrated that women's health applications should address personalization, information credibility, privacy, ease of navigation, comfortable text size, appropriate visual contrast, and emotional support for users [7]. Although the study focused on menopausal women, the principles applied are also relevant to telemidwifery development because pregnant women similarly require reliable health information, empathetic communication, and an easy-to-use system interface.

A previous study conducted by the authors, entitled "Design of a Web-Based Information System for the Mandeh Tourism Area Using a User-Centered Design Approach," demonstrated that the UCD approach can be applied to the development of web-based systems oriented toward user needs and experiences [8]. In that study, the development process involved a literature review, data collection, model design, model implementation, as well as testing and evaluation. The results showed that UCD contributed to the development of a website that was more informative, easy to use, equipped with simple navigation, relevant content, and visually appealing elements for users [8]. The experience gained from that study provides the methodological foundation for the present research, particularly in adapting the UCD approach from the tourism information system domain to the digital health domain, specifically telemidwifery.

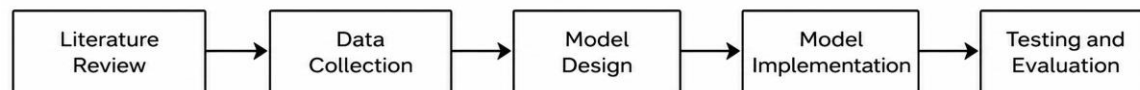
Based on the findings of these previous studies, it can be concluded that the development of digital systems using a UCD approach can improve the quality of user interaction, ease of use, and the alignment of system features with user needs. However, studies specifically focusing on the development of web-based telemidwifery systems to support consultations between midwives and pregnant women using a User-Centered Design approach remain limited. Midwifery services involve two distinct user groups: midwives as healthcare professionals and pregnant women as service recipients who require continuous access to health information, consultation, education, and health monitoring.

Therefore, this study proposes the development of a web-based telemidwifery platform for consultations between midwives and pregnant women using a User-Centered Design approach. The UCD approach is employed to ensure that the developed system meets user needs, is easy to use, and effectively supports two-way communication between midwives and pregnant women.

The platform is expected to provide features such as online consultations, pregnancy education, consultation history, examination schedule reminders, and pregnancy condition monitoring. Through the implementation of this web-based telemidwifery platform, midwifery consultations are expected to become more effective, reliable, and accessible for both pregnant women and midwives.

Research Methods

This study employed the User-Centered Design (UCD) approach. UCD is a system development approach that focuses on users' needs and preferences [9], [10]. This approach actively involves users throughout the design process, from system design to evaluation, to ensure that the developed system is not only functional but also convenient and easy to use. The following are the stages applied in the development of the web-based system using the UCD approach.



Web development stage diagram

The figure above illustrates the systematic stages of the model development process, which consists of five main steps. The process begins with a literature review, during which the researchers collect relevant theories and references as the foundation for the system design. This is followed by data collection through observations, interviews, or questionnaires to directly identify users' needs and problems. The collected data are then used in the model design stage, where an initial design or prototype is developed in accordance with the research objectives. The design is subsequently implemented during the model implementation stage, transforming it into a functional system that can be directly tested. Finally, testing and evaluation are conducted to assess the extent to which the developed model functions effectively and meets user needs. These stages reflect a structured, user-centered, and outcome-oriented development approach.

2.1. Literature Review

The literature review stage was conducted to examine theories and previous studies related to telemedicine, telemidwifery, maternal healthcare services, digital midwifery consultations, and the User-Centered Design method. At this stage, previous studies applying UCD to various digital applications were also reviewed to understand how the approach has been used to design systems that are easy to use and aligned with user needs. The findings of the literature review served as the basis for determining the system requirements, key features, and development direction of the telemidwifery platform.

2.2. Data Collection

The data collection stage was conducted to obtain direct information regarding user needs, particularly from midwives and pregnant women as the prospective primary users of the platform. Data were collected through observation, interviews, questionnaires, or document analysis related to midwifery consultation processes, pregnancy monitoring, health education, and communication barriers between midwives and pregnant women. This stage is essential in the UCD approach because the developed system must be based on the actual needs of its users.

2.3. Model Design

The model design stage was conducted by developing the system design based on the results of the user needs analysis. At this stage, the platform workflow, menu structure, key features, user interface design, and interaction model between midwives and pregnant women were developed. The proposed features may include online consultations, pregnancy education, examination schedule reminders, monitoring of pregnant women's health conditions, and early detection of pregnancy-related risks. The design process was carried out by considering UCD principles, ensuring that the system is simple, easy to understand, convenient to use, and appropriate for the characteristics of its users.

2.4. Model Implementation

The model implementation stage was carried out by transforming the previously developed design into a prototype or telemidwifery platform application. The implementation process included the development of the user interface, consultation features, pregnant women's data management, educational information services, and other supporting functions. At this stage, the UCD-based design was realized as a functional system that could be used and evaluated by users.

2.5. Testing and Evaluation

The testing and evaluation stage was conducted to assess whether the developed telemidwifery platform met user needs. The testing process involved midwives and pregnant women as users who directly interacted with the system. The evaluation focused on ease of use, interface convenience, feature suitability, clarity of the user flow, and user satisfaction. The evaluation methods included the System Usability Scale (SUS) or other usability assessment instruments. The evaluation results were used as the basis for system improvements to ensure that the platform became more effective, user-friendly, and aligned with User-Centered Design principles.

Results and Discussion

3.1 User Needs Analysis

The user requirements analysis was conducted to identify the primary needs of midwives and pregnant women as users of the telemidwifery platform. Based on the identified problems,

midwifery services continue to face several challenges, including limited access to healthcare services, low consultation frequency, suboptimal communication between midwives and pregnant women, and delays in detecting pregnancy-related risks. These conditions indicate the need for a digital platform that can support health consultations, education, monitoring, and communication in a more accessible and structured manner.

From the perspective of pregnant women, the primary needs include easy access to consultations with midwives, valid and reliable pregnancy-related information, examination schedule reminders, and the ability to report health complaints promptly. Meanwhile, midwives require a platform that enables them to monitor the condition of pregnant women, record consultation histories, provide health education, and detect potential pregnancy risks at an earlier stage.

Based on the analysis, the key features required in the platform include online consultations, pregnancy education, examination schedule reminders, monitoring of pregnant women's health conditions, consultation history, and early detection of pregnancy-related risks. In addition, the platform should be designed with a simple interface, a clear user flow, and easily understandable language to ensure alignment with User-Centered Design (UCD) principles.

3.2 Model Design

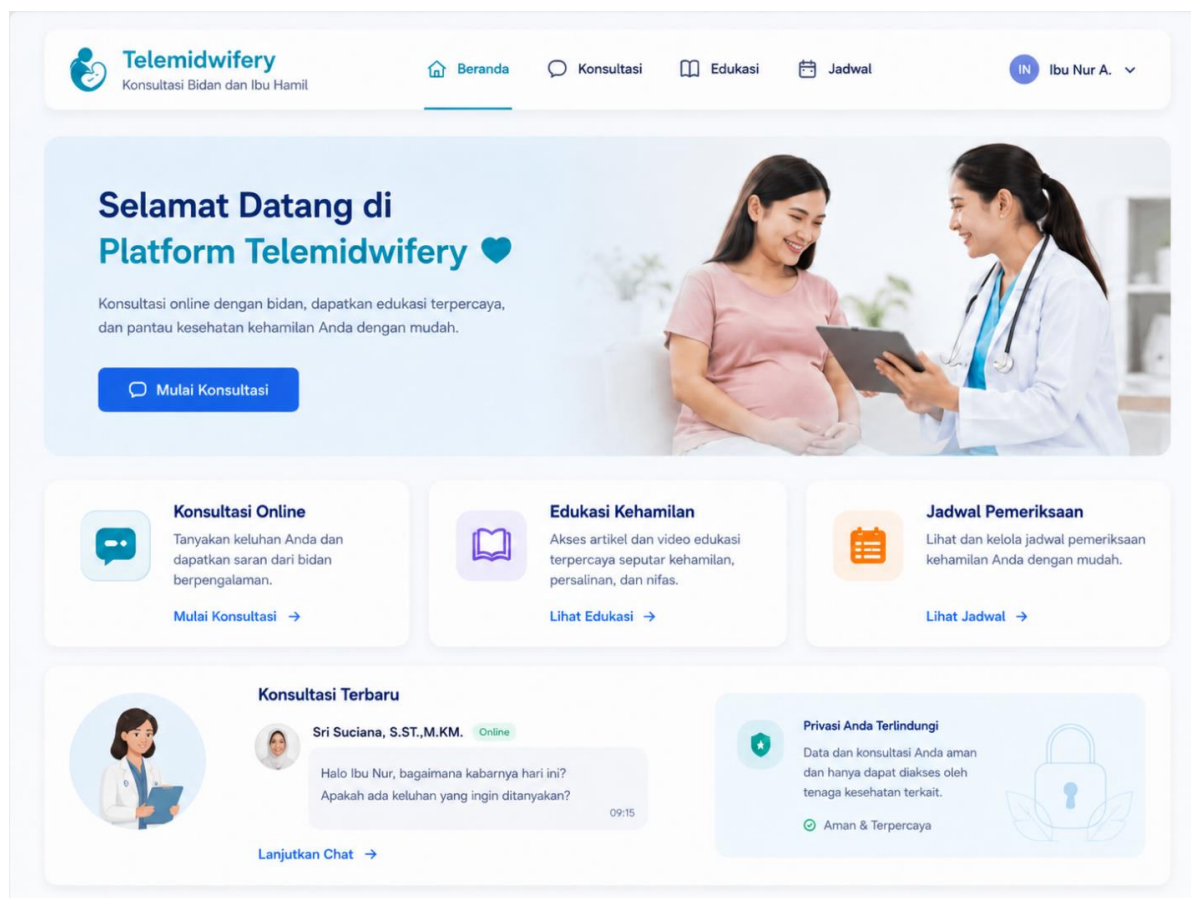


Figure 3.2.1 Model Design

The model was designed based on the results of the user requirements analysis, particularly the needs of pregnant women and midwives for a telemidwifery platform that is easy to use, informative, and capable of supporting digital health communication. The figure illustrates the main interface design of the telemidwifery platform, which serves as the initial page for users, particularly pregnant women, to access midwifery consultation services.

At the top of the interface, the application logo, platform name, and main navigation menu are displayed. The navigation menu consists of Home, Consultation, Education, and Schedule. These menus were designed in a simple manner so that users can quickly understand the system's primary functions. The interface also displays the user's identity in the upper-right corner, indicating that the system is personalized and can be accessed through individual user accounts.

The main section of the page displays a welcoming message stating, "Welcome to the Telemidwifery Platform," accompanied by a Start Consultation button. This element was designed to provide pregnant women with quick access to consultation services with midwives. The illustration of a pregnant woman and a midwife in the main section further reinforces the system's identity as a digital midwifery service platform.

The model design also presents three main features: Online Consultation, Pregnancy Education, and Examination Schedule. The online consultation feature was designed to enable pregnant women to easily communicate their concerns or questions to midwives. The pregnancy education feature provides reliable information related to pregnancy, childbirth, and the postpartum period. Meanwhile, the examination schedule feature helps pregnant women view and manage their antenatal care appointments.

At the bottom of the page, a Recent Consultations component displays the latest interactions between pregnant women and midwives. This component indicates that the system is designed to support continuous two-way communication. In addition, the "Your Privacy Is Protected" notice emphasizes that consultation data are securely maintained and can only be accessed by authorized healthcare professionals.

Overall, the model was designed based on User-Centered Design principles by prioritizing ease of access, a clear user flow, a simple interface, and features that align with user needs. Through this design, the telemidwifery platform is expected to serve as a practical, secure, and user-friendly medium for consultations, health education, and the management of antenatal examination schedules.

3.3 Model Implementation



Figure 3.2 Online Consultation Process

1) Selecting the Consultation Menu

Users first access the main page of the telemidwifery platform. Pregnant women then select the Consultation menu from the main navigation bar. This menu directs users to the online consultation service page, where they can communicate with a midwife.

2) Starting a Consultation

After accessing the consultation page, the user selects the Start Consultation button. The system then displays a consultation room that connects the pregnant woman with an available midwife.

3) Filing a Complaint

At this stage, the pregnant woman enters the complaints or questions she wishes to communicate to the midwife. These may include lower back pain, nausea, dizziness, contractions, reduced fetal movement, or other pregnancy-related concerns. The user may also attach additional information when necessary.

4) Completing Pregnancy Data

Before sending the message, the user can complete relevant pregnancy data, such as gestational age, most recent blood pressure, body weight, primary complaint, and fetal movement condition. This information helps the midwife gain a more accurate understanding of the pregnant woman's condition before providing a response.

5) Sending a Consultation Message

After completing the complaint details and pregnancy-related information, the user selects the Send Message button. The system then forwards the message to the midwife for review. At this stage, the message status may be displayed as sent or awaiting a response.

6) The midwife provides a response

The midwife reviews the complaints and pregnancy-related data submitted by the pregnant woman. The midwife then provides a response in the form of an explanation, health advice, educational information, or a recommendation for further examination when necessary.

7) Pregnant Woman Reading Midwife's Advice

The pregnant woman receives and reviews the midwife's response. The advice may include recommendations to rest, maintain a healthy diet, drink adequate amounts of water, monitor symptoms, or immediately visit a healthcare facility if any pregnancy-related warning signs are present.

8) Pregnant Woman Reading Midwife's Advice

If the midwife recommends further examination, the user can view or arrange an examination appointment through the Schedule menu. If only ongoing observation is required, the pregnant woman can continue monitoring her daily condition through the pregnancy monitoring feature.

9) Consultation Completed

The consultation is considered complete after the pregnant woman has received the midwife's response and understood the recommendations provided. The consultation history is stored in the system so that it can be reviewed by both the pregnant woman and the midwife whenever necessary.

3.4. System testing

System testing was conducted to determine the usability level of the developed telemidwifery platform. The evaluation involved 10 respondents representing prospective system users, including pregnant women and/or healthcare professionals. The System Usability Scale (SUS) method was employed to assess ease of use, interface convenience, feature clarity, and overall user satisfaction with the system.

The testing was conducted after the respondents had used the main features of the system, including Online Consultation, Pregnancy Education, Examination Schedule, Pregnancy Monitoring, and Consultation History. Based on the testing results, all features functioned properly and met user requirements. The respondents were able to access the consultation menu, submit complaints, complete pregnancy-related data, receive responses from midwives, and review their consultation history.

The following table presents the usability testing results obtained using the System Usability Scale (SUS).

Respondents	Score SUS
R1	80
R2	85
R3	82,5
R4	87,5
R5	80
R6	85
R7	90
R8	82,5
R9	85
R10	87,5
Average	84,5

Table 3.1 User test results table

Based on the calculation results, an average SUS score of 84.5 was obtained. This score falls within the excellent and acceptable categories, indicating that the telemidwifery platform has a high level of usability and is suitable for use by its intended users.

The testing results showed that the system interface was easy to understand, the user flow was straightforward, and the main features could be accessed clearly. The respondents were also able to understand the functions of the available menus without experiencing significant difficulties. These findings indicate that the system design is consistent with User-Centered Design (UCD)

principles, which prioritize users' needs, convenience, and ease of use when interacting with a digital platform.

Therefore, the developed telemidwifery system was found to function effectively and support digital consultation processes between midwives and pregnant women. The SUS evaluation results also demonstrated that the system was acceptable to users and has the potential to be utilized as a platform for consultation, education, pregnancy monitoring, and the management of antenatal examination schedules.

Conclusion

This study developed a web-based telemidwifery platform to support consultations between midwives and pregnant women using a User-Centered Design approach. The UCD approach was implemented through several stages, including a literature review, data collection, model design, model implementation, testing, and evaluation. Through this approach, the system was designed based on the primary needs of its users. Pregnant women require access to consultation services, pregnancy education, examination schedules, pregnancy monitoring, and consultation histories, while midwives require a platform for providing responses, health education, and monitoring the conditions of pregnant women.

The implementation results showed that the telemidwifery platform was capable of providing key features that support two-way digital communication between midwives and pregnant women. The online consultation feature enables pregnant women to communicate their complaints or questions more easily, while midwives can provide advice, health education, and recommendations for further examinations based on the user's condition. In addition, the pregnancy education, examination schedule, pregnancy monitoring, and consultation history features can support a more structured process of monitoring pregnant women's health.

Based on the System Usability Scale evaluation involving 10 respondents, the platform achieved an average SUS score of 84.5. This score falls within the excellent category, indicating that the web-based telemidwifery platform has a high level of usability, is easy to use, and is well accepted by users. Therefore, the platform is considered suitable for use as a digital consultation medium to support midwifery services, particularly by improving access to consultations, education, communication, and maternal health monitoring.

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Bibliography:

- [1] S. Chandran, A. Al-Sa'di, and E. Ahmad, "Exploring User Centered Design in Healthcare: A Literature Review," in *Proc. IEEE Conference*, 2020.
- [2] S. Chopvitayakun, M. Rattanasiriwongwut, and M. Ketcham, "An Integration of User-Centered Design and Design Thinking Principles for Developing a Mobile Application for Nutritional Tracking for Thai Elderly: A Mixed-Method Study," in *Proc. 2025 IEEE International Conference on Cybernetics and Innovations (ICCI)*, 2025, doi: 10.1109/ICCI64209.2025.10987228.
- [3] K. Wong, L. D. Pamudji, J. A. Loekito, B. B. Hansel, M. Rexana, E. Wianto, and A. Oktavina, "Design and Evaluation of Carelinker: A Mobile Health Application for Elderly Care in Indonesia," in *Proc. 2025 13th International Conference on Orange Technology (ICOT)*, 2025, doi: 10.1109/ICOT68409.2025.11425133.
- [4] J. Brooke, "SUS: A quick and dirty usability scale," in *Usability Evaluation in Industry*, P. W. Jordan, B. Thomas, B. A. Weerdmeester, and I. L. McClelland, Eds. London, U.K.: Taylor & Francis, 1996, pp. 189–194.
- [5] A. Bangor, P. T. Kortum, and J. T. Miller, "An empirical evaluation of the System Usability Scale," *International Journal of Human-Computer Interaction*, vol. 24, no. 6, pp. 574–594, 2008, doi: 10.1080/10447310802205776.
- [6] L. Wiebelitz, P. Schmid, T. Maier, and M. Volkwein, "Designing User-friendly Medical AI Applications: Methodical Development of User-centered Design Guidelines," in *Proc. 2022 IEEE International Conference on Digital Health (ICDH)*, 2022, doi: 10.1109/ICDH55609.2022.00011.
- [7] N. I. A. M. Jasni, N. Ibrahim, N. Abdul Wahab, A. Abu Seman, A. Osman, and A. H. Mohammed, "Empowering Aging Women: A User-Centered M-Health Framework for Menopause Management," in *Proc. 2025 International Conference on Cognitive Systems and Computer Interaction (ICoSCI)*, 2025, doi: 10.1109/ICoSCI66700.2026.11447570.
- [8] L. R. Azmi, S. 'A. Ramadhani, V. M. Putri, and W. Azhar, "Perancangan Sistem Informasi Kawasan Wisata Mandeh Berbasis Web dengan Pendekatan User-Centered Design," *Jurnal Pengembangan Sistem Informasi dan Informatika*, vol. 6, no. 4, pp. 109–116, Oct. 2025.
- [9] J. Brooke, "SUS: A quick and dirty usability scale," in *Usability Evaluation in Industry*, P. W. Jordan, B. Thomas, B. A. Weerdmeester, and I. L. McClelland, Eds. London, U.K.: Taylor & Francis, 1996, pp. 189–194.

- [10] A. Bangor, P. T. Kortum, and J. T. Miller, “An empirical evaluation of the System Usability Scale,” *International Journal of Human-Computer Interaction*, vol. 24, no. 6, pp. 574–594, 2008, doi: 10.1080/10447310802205776.