The Impact and Response of Android Mobile Application Utilization of Health Consultations by Pregnant Women in Indonesia

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Abstract: The targets pertaining to Sustainable Development Goals for the period spanning from 2020 to 2021 have been revised downwards, notwithstanding a notable surge of 25 percent in the use of mobile-based health applications. Hence, the objective of this study is to create a mobile application called "Nutribid" that provides online counselling services for reproductive health and nutrition, specifically designed for Android devices. The participants of this research were 56 pregnant women residing in Purwadana Village, Indonesia, who utilised mobile devices equipped with the Android operating system. The findings indicate that a significant majority of the participants, above 90%, expressed agreement with the ease of identification, download, and use of the Nutribid application. Nevertheless, it is worth noting that a significant proportion, specifically 60.7% of the participants, expressed their dissatisfaction with the colour scheme employed in the application. Conversely, an overwhelming majority of the respondents concurred that the Nutribid application menu possesses commendable attributes such as ease of recognition, discoverability, legibility, and usability. The utilisation of mobile health applications has witnessed significant growth, yet, its integration into Indonesian society encounters many challenges attributed to the limited internet network infrastructure.

Keywords: android application; health; mobile consultation; mobile communication; tele-consultation.

1. BACKGROUND

The Covid-19 pandemic has exerted significant effects on the worldwide crises in various domains, including the economy, society, environment, and health. Furthermore, it has been observed that a significant reduction in the targets of the Sustainable Development Goals (SDGs) has occurred throughout the period of 2020 to 2021. This reduction can be attributed to the unequal distribution of vaccinations and healthcare resources, hence exacerbating the disparity between rich and poor nations (Sachs et al., 2021). The main objective of the Sustainable Development Goals (SDGs) is to mitigate the prevalence of poverty, a phenomenon that has experienced a significant decline in Southeast Asia as compared to Europe, Latin America, the Middle East, and Africa (Sachs et al., 2021).

Moreover, it is worth noting that poverty exerts a significant influence on the destabilisation of the health system, as outlined in Sustainable Development Goal 3 (Sachs et al., 2021)**.** This phenomenon is associated with a rise in the prevalence of anxiety and depression disorders among individuals, a heightened aversion to seeking direct medical care, a weakened healthcare support infrastructure, and a sense of confinement resulting from restrictions on mobility (OECD, 2021a, 2021b; World Health Organization, 2020).

The findings of a report from Indonesia indicate a decrease in several health indicators, particularly pertaining to women's reproductive health and nutrition services for the year 2020. Furthermore, there has been a temporary suspension of class activities specifically designed for pregnant women inside this nation. Additionally, there has been

a notable decrease in the frequency of fourth pregnancy visits, with a decline of 3.9%. Moreover, the coverage of tetanus toxoid immunisation has had a significant reduction of 10.18%, dropping from 64.88% to 54.7%. This event resulted in a decrease of 23.24% in the frequency of class activities specifically designed for pregnant women, which had a participation rate of just 69.9% in the preceding year. There was an increase in the number of maternal fatalities from 4,221 in 2019 to 4,627 in 2020. (Indonesia Ministry of Health, 2020).

Furthermore, with regard to child health, there was an observed rise in the incidence of neonatal mortality, with the number of fatalities among newborns increasing from 20,244 in 2019 to 20,266 in 2020. The percentage of coverage for the initial neonatal visit experienced a significant decrease of 12.88% from the previous year, resulting in a coverage rate of 81% in 2020. Moreover, it is noteworthy that the immunisation coverage rate of 82.6% observed in 2020 represents the lowest level recorded during the past decade. In the realm of nutrition, the data from 2020 indicates that merely 49.3% of toddlers were documented, with 1.1% classified as malnourished and 4.3% categorised as undernourished (Indonesian Ministry of Health, 2020).

The level of disruption in the health sector has witnessed a substantial increase during the Covid-19 pandemic, in contrast to the conditions observed in information and communication technology (ICT). Based on a survey conducted by the Indonesian Central Statistics Agency in 2020, it was found that 78.18% of the Indonesian population had internet connectivity. This figure represents a 5.03% rise compared to the previous year. In the year 2020, there was a notable gain of 5% in the computer proficiency of the Indonesian population, resulting in a total mastery rate of 18.83%, as compared to the preceding year. The number of cellular phone subscribers experienced a growth of 4.2% (Indonesian Central Statistics Agency, 2020).

Furthermore, as outlined in a report conducted by the Organisation for Economic Co-operation and Development OECD (2021b), it is imperative for a nation's policy to ensure that its citizens have unrestricted and convenient access to healthcare services, both in-person and through digital platforms. According to (Watt et al., 2020), there was a notable rise in the proportion of remote consultations in the United Kingdom during the pandemic. Similarly, (Mehrotra et al., 2020) reported an increase in online visits from 6% to 8% in the United States. According to Bestsennyy et al. (2021), it is suggested that online-based visits could persist beyond the Covid-19 epidemic due to their reduced obstacles in comparison to in-person visits, as noted by (Zachrison et al., 2021).

The utilisation of technology to address the disparity between the need for healthcare services and the numerous challenges posed by the Covid-19 pandemic is grounded in the evidence provided by (Bestsennyy et al., 2021; Mehrotra et al., 2020; OECD, 2021a).The prevalence of mobile health applications downloads experienced a 25% surge during the Covid-19 pandemic (Ramdurai, 2021). Furthermore, it has been shown that mobile-based applications exhibit a substantial level of utilisation and possess the potential to function as a pedagogical tool for those engaging with them (Muhamat et al., 2021).

Given the aforementioned context, the inquiry pertains to the feasibility of employing technology to establish seamless connectivity between patients and healthcare professionals during the recuperation phase of the Covid-19 pandemic. Also, if this technology may bridge the community's need for access to health services, which is typically delayed owing to patient worries around visiting health care facilities. Hence, the primary objective of this study is to create a mobile application called "Nutribid" that provides online counselling services for reproductive health and nutrition, specifically designed for the Android platform. This acronym, which represents nutrition and midwifery in the Bahasa language, is designed to facilitate patients' access to reliable and theoretically grounded reproductive health information provided by qualified healthcare professionals. Additionally, it is anticipated that this application will serve as a means to mitigate the dissemination of false information within the community pertaining to health-related matters.

2. METHODOLOGY

Overview of Research Locations

This research was conducted in one of the greatest industrial cities known as Karawang Regency, in West Java, Indonesia, with an area of 1,753.27 km, 30 Regencies, 309 Villages, and 4 large industrial zones. As a result, this circumstance generates curiosity among persons residing outside of Karawang, leading to a rise in the influx of individuals expressing a keen interest in seeking employment opportunities within this region. The veracity of this

statement is substantiated by the annual growth in population within the specified area, as reported by the Central Statistics Agency of Karawang Regency in 2020. The population of Karawang Regency has seen a consistent growth trend, increasing from 2,316,000 individuals in 2017 to 2,354,000 individuals in 2019. Moreover, according to data provided by the Central Statistics Agency of Karawang Regency (2020), the proportion of individuals living in poverty within this particular geographic area was recorded as 7.39% in the year 2019. Additionally, the unemployment rate for the same period was reported to be 9.61% (Central Statistics Agency of Karawang Regency, 2020).

The regency under consideration has a gender distribution, with females constituting 50.3% of the population and males accounting for 49.7%. Furthermore, the data reveals that there is a collective count of 333,017 women engaged in employment, 39,502 experiencing unemployment, 49,887 pursuing education, and 413,569 fulfilling domestic responsibilities as housewives. According to the data provided by the Central Statistics Agency of Karawang Regency in 2020, a significant portion of the female workforce is comprised of labourers, totaling 125,850 individuals. Additionally, there are 92,838 women working as entrepreneurs, 49,260 in temporary positions, 6,800 in permanent positions, 23,737 in unpaid family labour, and 34,532 in free employment (Central Statistics Agency of Karawang Regency, 2020).

The substantial presence of employed women within the Karawang Regency exerts a significant impact on both maternal mortality rates and child nutrition outcomes, as both variables are closely intertwined with the health status of mothers during and post-pregnancy. (Indonesia Ministry of Health, 2018). Moreover, there was a significant surge in the prevalence of maternal mortality, with the number of deaths rising from 45 in 2019 to 90 in 2020. (Central Statistics Agency of Karawang Regency, 2020). Moreover, the correlation between working women and malnutrition in children resulting in stunting has been observed. A child is considered to be stunted if their body length or height falls below the average range for children of the same age (Indonesia Ministry of Health, 2018; National Team for the Acceleration of Poverty Reduction, 2017). In the year 2019, Indonesia attained the third position among Southeast Asian countries in terms of the prevalence of stunting. Moreover, it is worth noting that in the year 2018, a total of 4,109 children falling within the age range of 0 to 59 months experienced stunting in Karawang Regency. This number witnessed an increase to 4,408 by the year 2020 (Central Statistics Agency of Karawang Regency, 2020; Indonesia Ministry of Health, 2018). Hence, the present study centres on pregnant individuals residing in Purwadana Village, Karawang Regency, who use Android-based mobile devices into their routine tasks.

Application Development Method

An engineering method with a prototype model approach was used in the development of this application. This model was employed because it provides the best approach for defining the rules of the game at the beginning. Specifically, the customer and the developer must agree that the prototype serves as a requirement definition mechanism. Figure 1 depicts the sequential stages involved in the development of the prototype approach.

Identification of Needs

The development of efficient communication between researchers and stakeholders necessitates the completion of many tasks. The term "stakeholders" is used in this study to refer to health workers who are employed as dietitians and midwives. At this stage, interviews are performed with stakeholders or relevant parties to gather information regarding the design and implementation of the application. The objective of this phase is to get a first depiction, so enabling the developer to commence work on the programme. The current level of this inquiry necessitates the identification of specific needs.

a. the identification of problems.

The process of problem definition plays a crucial role in addressing the challenges that frequently arise within the domain of reproductive health and nutrition. The aforementioned procedure involved the extraction of data from the Indonesia 2020 health profile report.

b. Proposed Troubleshooting Solution

The present study employs an object-based system approach, incorporating use cases, activities, sequences, and class diagrams, to propose solutions for addressing challenges in the implementation of reproductive health and nutrition interventions.

c. Requirements for Application

At this stage, the development of the environmental design of a system include the utilisation of software, hardware, and operating systems.

Once the application's need has been identified, it is possible to form conclusions regarding the requirements that must be met throughout its development. The subsequent phase entails the acquisition of data, with the subsequent step below.

A. Data collection

Various methods can be employed to gather secondary and primary data, which are essential components of data gathering in research, such as:

a. **Interviews** are conducted in order to gather input and supporting data for this research. These interviews involve questioning an expert in the relevant field or engaging in a discussion with an individual who possesses a comprehensive understanding of the subject matter. This approach is employed due to its several advantages in data retrieval, including its straightforward applicability and implementation, cost-effectiveness, and capacity to directly ascertain user requirements.

b. **Library research** involves the systematic gathering of data and sources from diverse references pertaining to the fields of midwifery and nutrition. Additionally, it encompasses the creation of user-friendly interface designs that can facilitate the research team's efforts in developing applications.

B. Application Design

The design of the application in this stage necessitates the completion of the following tasks:

a. Application design, the objective of this phase is to develop the application design from the perspective of the user, utilising the unified modelling language (UML) notation as a case tool within the scope of this research.

b. Database design, the objective during this phase is to create a database by utilising a class diagram, which delineates the current entities, employing UML as the preferred tool.

c. The interface design, this process of interface design involves the creation of the interface following the completion of the normalisation form, incorporating the desired input and output. The tool employed in this level is a pencil.

Following the completion of the system's application design, a prototype is subsequently developed.

C. Developing Prototype

The production of a prototype necessitates the creation of a comprehensive documentation or blueprint outlining the concept of the application.

D. Stakeholder Evaluation

The evaluation of the system prototype is undertaken during this stage to obtain consensus from stakeholders regarding the design of the application. This evaluation encompasses an assessment of both the managerial and technical aspects of the application. The design and improvement of the application are also undertaken at this stage. The subsequent phase involves the implementation of a coding system without the need for re-evaluation. Subsequently, the subsequent course of action entails the reconfiguration of the application, contingent upon an assessment of the prototype design.

E. System Coding

This stage encompasses the execution of necessary actions to convert a prototype design, which has undergone evaluation by relevant parties and been transformed into an appropriate programming language. The programming language employed in this study is Java, which was created via the Android Studio software development environment.

F. Application Testing

The activities undertaken during this phase encompass the construction, testing, installation, and provision of services to the end customer. In addition, the system undergoes coding and transformation into an application, followed by testing using two distinct methods, which include:

White box testing is a software testing technique that involves examining the internal structure and implementation of a software system. It is also known as clear box testing, structural testing, or glass box testing. The purpose of this application programme test is to analyse the flow of data from its initiation to its completion, in order to ascertain its alignment with the anticipated objective outcome.

Black box testing refers to a method of software testing where the internal structure, design, and implementation details of the system being tested are not known to the tester. Instead, the tester focuses on the inputs and outputs black box testing is a method of system application testing that involves the active participation of the user and is designed to identify any deficiencies or limitations inside the produced application system.

G. Application Trial

The activities conducted during this phase entail acquiring valuable feedback from stakeholders, derived from the assessment of the application representation that was created throughout the system testing phase. Furthermore, a total of 56 pregnant women residing in Purwadana Village, located in Karawang Regency, actively engaged in this particular phase as participants. This step additionally evaluates the extent to which the application aligns with the preferences and interests of stakeholders. As a result, participants were requested to complete a questionnaire encompassing an evaluation of the system, user, and interaction components subsequent to the testing phase.

H. Application Documentation

The next stage entails the documentation of the survey after the evaluation has been done and the application indicated to be in line with the stakeholders' expectations.

3. RESULT

A. Participants

Nutribid is an Android-based online health consulting application originating from Indonesia. It provides users with the capability to determine their daily calorie requirements and assess their nutritional status through the utilisation of the health calculator feature. One of the health consultations that can be conducted pertains to women's reproductive health issues, encompassing topics such as pregnancy, childbirth, postpartum care, adolescent reproductive health, as well as consultations on nutrition and dietary concerns. Table 1 presents the characteristics of the 56 pregnant women who took part in the Nutribid application trials.

Table 1 Demographic Data of Research Respondents

Variable	Frequency	
	n	%
Age		
≤35 years old	41	73.2
>35 years old	15	26.8
Total	56	100
Mean	32,.3	
Median	30.5	
Minimum	20	
Maximum	49	
Education		
Elementary School/Junior High School	29	51.8
Senior High School/Higher Education	27	48.2

Table 1 additionally demonstrates that a significant proportion of the participants in the study are aged 35 years or younger, accounting for 73.2% of the total sample. The age range of the responses spans from 20 to 49 years, with the youngest participant being 20 years old and the oldest participant being 49 years old. The prevailing educational attainment among the respondents, comprising 51.8% of the sample, was Elementary School/Junior High School.

B. System Aspect

Table 2. Frequency Distribution of Nutribid Application System Aspects

Variable	Yes		No	
	N	%	n	%
Easy-to-recognize Application Display	55	98.2	1	1.8
Easy Download Application	56	100	0	0
Easy to Use Application	56	100	0	0
Color Apps Not Boring	34	60.7	22	39.3

Based on the data shown in Table 2, it can be observed that a significant majority of the participants, above 90%, expressed agreement with the notion that the Nutribid application possesses qualities that make it easily identifiable, downloadable, and usable. However, it is worth noting that a significant proportion of respondents, specifically around 60.7%, expressed the opinion that the colours used in the application are perceived as dull or uninteresting.

The Nutribid application can be acquired by accessing the Play Store on an Android mobile device. Furthermore, the programme is visually characterised by a blue interface and features a logo that is predominantly white in colour (see Figure 1). Based on the analysis of the users' test results, it can be inferred that the incorporation of colours in the application aligns with the preferences of the users, hence facilitating ease of recognition.

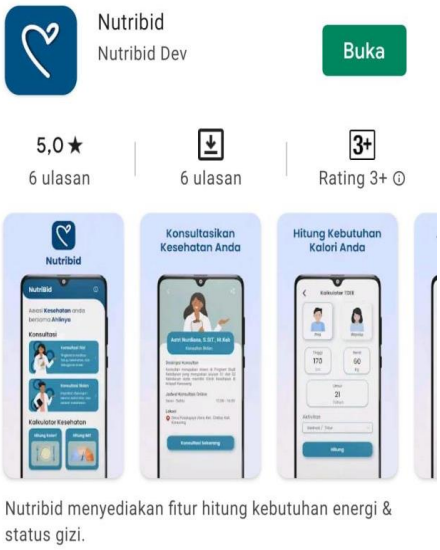

Figure 1. Nutribid Application Display

C. User Aspect

According to Figure 2, while launching the Nutribid application, users will be presented with the display layer. This layer encompasses many features such as a menu offering nutritional and midwife consultations, a Health calculator for determining daily energy requirements, and a nutritional status indicator.

During the initial phase, the user is guided to access the online consultation menu and health calculator (Figure 3). Following this, the users are presented with the option to either engage in an online consultation or utilise a health calculator. With respect to the online consultation, the customer has the option to select either a consultation pertaining to nutrition or reproductive health. The operators will subsequently be routed to an email delivery menu specifically designed for nutritionists to facilitate dietary nutrition counselling. In the interim, individuals will be guided

to a designated menu facilitating the transmission of electronic correspondence to midwives, so enabling consultations pertaining to reproductive health.

The user has the option to conclude the consultation if the issue has been remedied or the query has been addressed satisfactorily during the online interaction. Nevertheless, the consultant may recommend that the user seek medical attention or undergo an examination directly at the healthcare facility in the event that unresolved issues arise.

Moreover, individuals are prompted to select between calculating energy requirements or assessing nutritional status when opting to utilise a health calculator. Users have the option to either terminate the application's usage or seek further guidance from healthcare professionals once they have obtained the results of the energy calculation or assessed their nutritional state.

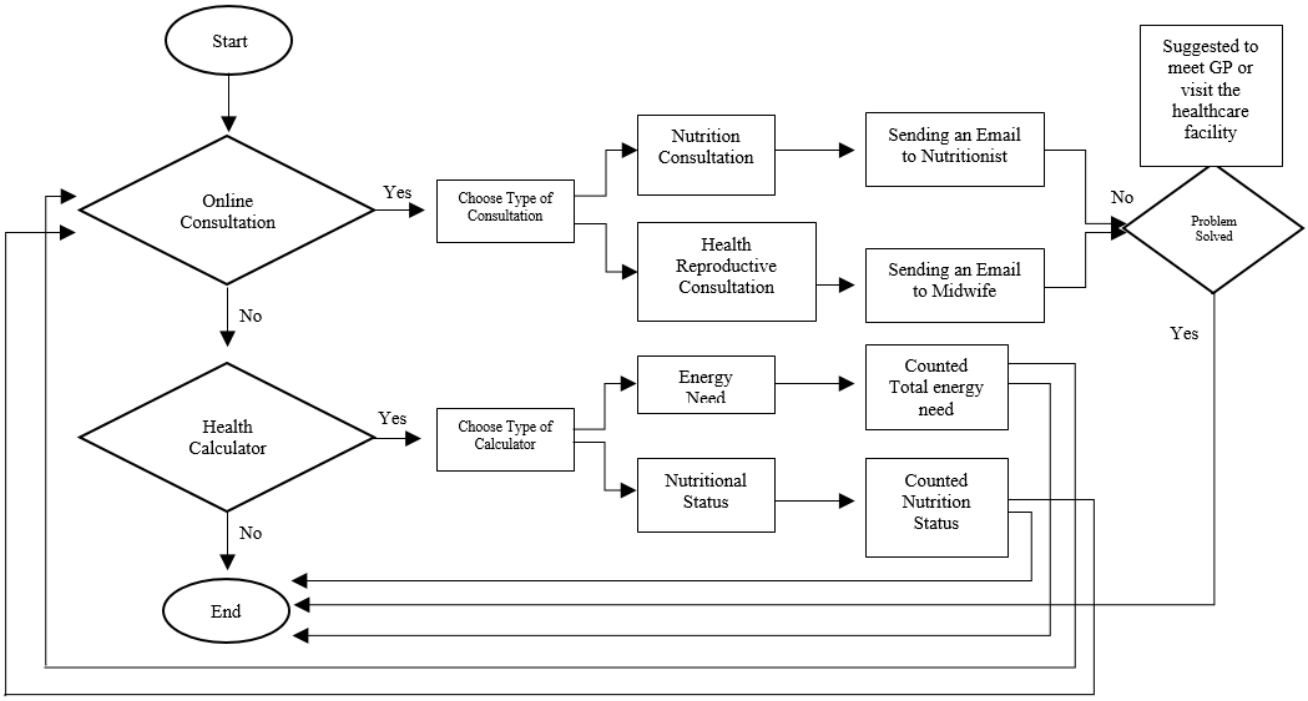

Figure 2 System Flowchart

Figure 3. Nutribid Application Menu

The objective of this study is to assess the level of user-friendliness in terms of recognition, searchability, readability, and usability of the application menu. The analysis findings are presented in Table 3.

Table 3. Frequency Distribution of Nutribid Application User Aspects

Variable	Yes		No	
	n	%	n	%
Easy to Recognize Menu	54	96.4%	2	3.6%
Easy to Find Menu	55	98.2%	1	1.8%
Easy to Read Menu	55	98.2%	1	1.8%
Easy to Use Menu	55	98.2%	1	1.8%

According to the findings presented in Table 3, a significant majority of the participants express agreement with the notion that the Nutribid application menu possesses attributes of ease in terms of recognition, locating, legibility, and use. The advent of the digital revolution and the emergence of Industry 4.0 have profound implications for the transformation of the design of the healthcare system and the management of health services. The occurrence of this revolution coincides with the process of structural reconstruction inside an organisation, hence necessitating health resources to deliver health services that are both efficient and of high quality. The current trend in health services has likewise transitioned towards a patient-centered approach. This phenomena enhances the capacity to oversee and regulate all operations conducted by healthcare professionals, provide medications in accordance with patient requirements, and advance information pertaining to the healthcare industry (Buchelt et al., 2020).

Furthermore, the advancement of mobile-centric health applications offers numerous advantages for diverse stakeholders, encompassing patients, physicians, chemists, and other healthcare practitioners. The model of providing and financing health services undergoes many modifications (Ramdurai, 2021). The ongoing Covid-19 pandemic has led to a heightened emphasis on the advancement of mobile-based applications, as indicated by market experts projecting a 25.5% growth in market development from 2020 to 2027. (Ramdurai, 2021).

The use of mobile-based applications in low-income nations offers numerous advantages and is hypothesised to mitigate the occurrence of reproductive-related fatalities among women, infants, children, and adolescents (Astri Nurdiana, 2020; Ronchi et al., 2016). Additionally, these nations encounter challenges pertaining to subpar human resources, limited access to healthcare facilities, inadequate policy frameworks, and insufficient organisational support. The utilisation of this application has the potential to enhance the calibre of healthcare services, serve as a platform for clinical diagnostic information, and contribute to the prevention of unsuitable therapy (Ronchi et al., 2016).

D. Interaction Aspect

The Nutribid programme facilitates online user engagement with health advisors through email correspondence. The selection of this medium in the design of the programme was motivated by the desire to enable consultations to be conducted in a concentrated way, free from the disruptions caused by incoming calls or the accumulation of conversations in online messaging services. According to Assing Hvidt et al., (2021), The utilisation of email communication enables the analysis of patients' psychological and emotional states through written correspondence (Assing Hvidt et al., 2021). Email is a valuable tool for viewing photographs with a high level of clarity and resolution (Madi et al., 2020).

The present study aimed to assess the convenience of engaging in online consultation activities and examine the alignment between the type of consultation and the patients' specific demands. Furthermore, the purpose of this study was to evaluate the efficacy of the Nutribid application in terms of its interaction capabilities. The findings shown in Table 4 indicate a high level of consensus among the respondents, since the majority agree that the Nutribid application is user-friendly for online consultation and aligns well with their specific requirements.

Table 4. Frequency Distribution of Nutribid Application Interaction Aspects

Variable	Yes		No	
	n	%	n	%
Easy-to-Use Online Consulting Activities	55	98.2%	1	1.8%
Type of Consultation As Needed	55	98.2%	1	1.8%

The health service The process of digitization is a valuable chance to save expenses and deliver efficient and convenient services to all stakeholders, with a particular focus on patients (Aceto et al., 2020). The implementation of this procedure may provide challenges, necessitating the collaboration and cooperation of all involved parties. This is crucial in light of the ongoing transition from physical to digital platforms, alongside the need for regulatory adjustments. In addition, it is imperative for healthcare professionals to deliver healthcare services from an alternative standpoint (Aceto et al., 2020).

Numerous mobile health applications have been created to serve diverse purposes, encompassing clinical applications and diagnostics, remote monitoring, promotion of healthy lifestyles, and provision of health references (Ramdurai, 2021; Ronchi et al., 2016). The Nutribid programme serves as a diagnostic tool for assessing an individual's nutritional health and determining their energy requirements. Additionally, this platform functions as a valuable health resource by facilitating email-based consultations and exchanges between consumers and healthcare professionals. Furthermore, the use of mobile health applications encounters some obstacles, including inadequate internet signal coverage, delayed message delivery, the financial burden of acquiring internet data packages, reliance on electricity supply, evolving user requirements, and insufficient regulatory frameworks (Ajmera & Jain, 2019; Rehamm et al., 2019; Ronchi et al., 2016).

4. CONCLUSION

The utilisation of mobile health applications has undergone significant and swift advancement, including many functionalities such as clinical and diagnostic procedures, remote monitoring, promotion of healthy lifestyles, and access to health-related information. As a result, the Nutribid application was created with the intention of tackling issues related to reproductive health and nutrition in Indonesia. The aforementioned programme serves as a diagnostic tool to assess an individual's nutritional health and determine their energy requirements. Additionally, this programme functions as a health reference tool, facilitating communication between users and healthcare professionals through email correspondence. The findings from the user application trials indicate that a majority of the participants, above 90%, expressed agreement with the notion that the application possesses attributes of being easily identifiable, downloadable, and user-friendly. Furthermore, a significant majority of the participants expressed unanimous agreement about the ease of identification, location, legibility, and usability of the menu within the Nutribid application. The programme can be utilised as an online consultation platform, offering ease of use and flexibility through the development of numerous types tailored to meet the specific requirements of users.

Application Development Plan

A consultation type menu, specifically sports and medicine consultation will be developed into the Nutribid application. Furthermore, a menu will be added to calculate gestational age on the health calculator.

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Conflict of Interest

The author ensures that there is no conflict of interest in this research

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