KIA-CHAT: A QnA Chatbot for Postnatal and Newborn Care

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ABSTRACT

Background: Postnatal care information is relatively less provided than information about prenatal or pregnancy. Several causes of this is the mothers already delivered the baby safely, and soon after the baby's birth, mothers will be busy taking care of the newborns. They frequently miss their postnatal meeting with doctors because of these reasons. *Objective:* Therefore, this article aims to develop a chatbot in which the knowledge is taken from Buku KIA and focus group discussion. *Method:* The targeted users of the KIA chatbot are postpartum mothers with live newborns. Rapid Application Development method is used to develop the KIA chatbot. The KIA chatbot is constructed using Google DialogFlow with Telegram-based messenger. *Results:* The chatbot evaluation follows the Chatbot Usability Questionnaire with an overall score is 84.23 out of 100. Sixty-nine respondents confess that the KIA chatbot is easy to use and the knowledge is easy to comprehend. But, since the chatbot provides the answer options, the users feel some limitations. One of the limitations is they are unable to type their questions to the chatbot; only type the numerical order of the answer options. *Conclusion:* However, this limitation also brings another advantage to the mothers who have no time to type because of busy taking care of the newborns.

Keywords: chatbot, health, maternal, postnatal, newborn

INTRODUCTION

During the COVID-19 pandemic, mobile applications that aim to maintain health thrived (Mbunge *et al*., 2022). Finding reliable information during prenatal and postnatal periods is easy, however, given facts that much misinformation on the internet can cause confusion and bad decision-making (Montenegro *et al*., 2022). Several emerging technologies for maternal, neonatal, and child health services have already been implemented in Africa (e.g., JamboMama, Mum&Baby). Those technologies lie in Blockchain, Artificial Intelligence, Big Data Analytics, IoT, Virtual Clinics, and Telemedicine (Batani & Maharaj, 2022).

However, a study showed that chatbot is a relevant tool for providing primary health services in the context of maternal health (Silveira *et al*., 2023; Barreto et al., 2023). Moreover, studies about the application of chatbots in maternal health show that chatbots can educate patients about specific purposes (i.e., fertility problems) (Maeda *et al*., 2020). As long as the chatbot has clear language and shows comprehensive information, a chatbot can have a positive influence on pregnant women (Montenegro *et al*., 2022; Mane *et al*., 2023). Our preliminary research result shows that postpartum mothers only visit the doctor once out of four times, as per WHO standards (Vinarti *et al*., 2022). This is because the postpartum mothers

usually don't have enough time to take care of themselves; they more focused to their newborn babies. Therefore, in this article, postpartum mothers are the targeted chatbot users, instead of pregnant mothers. This condition makes the knowledge contained in the chatbot should not limited to the mother's health, but also how to take care newborn babies (Muklason *et al.*, 2022; Wong *et al.*, 2021). A randomized control trial study shows that the use of a chatbot is acceptable to postpartum mothers aged 18 and above (Suharwardy *et al.*, 2023).

This article aims to develop a chatbot that can help postpartum mothers to maintain both the newborn's and mother's health. In order to supply valid and reliable information in this chatbot, knowledge from both practitioner and established document are needed. An architecture for a conversational agent, HoPE Model, also used this kind of information retrieval from pregnancy guideline book written in Portuguese (Montenegro & da Costa, 2022). In Indonesia, knowledge for (pregnant) mothers is also documented as a guideline book, Buku KIA (Kementrian Kesehatan RI, 2023). This book contains the needed information for mothers during their pregnancy, perinatal, and postpartum. Therefore, the chatbot adopt information and knowledge from this book.

METHODS

The KIA chatbot aims to accompany postpartum mothers with valid information and knowledge during their first years become a mother. The validity was judged by medical experts: midwife, medical doctor, or OB/GYN specialist. The chatbot used Rapid Application Development (RAD). In RAD, there are four main stages: Requirements, User Design, Construction, Evaluation.

In the Requirements stage, there is only one type of users: postpartum mothers with live baby. Therefore, the requirements were gathered from 69 participants through Focus Group Discussion (FGD). All participants are either pregnant mothers or mothers with babies. The FGD was led by an expert in midwifery, an expert in knowledge modelling, and an expert in information systems. FGD was held in a health care center (Puskesmas Paciran) in Lamongan city, East Java, Indonesia.

In the User Design stage, knowledge taken from Buku KIA is categorized into two urgency levels. User with high-level urgency will have direct and actionable information based on their current problem. Meanwhile, user with low-level urgency will have descriptive and nested information based on the depth of details they want to know.

In the Construction stage, Google DialogFlow is used to build this QnA-based chatbot. Google DialogFlow facilitate chatbot making by expressing dialog as an intent. There is generic intent pattern in Google DialogFlow: Welcoming – Main Content – Closing – Out-of-Scope Intent. In Welcoming and Closing intent, the default greeting and parting sentence are displayed. The urgency-based categorization gathered in previous FGD activity is constructed in Main Content intent. In the Out-of-Scope intent, an expert contact is attached to help mothers out of the problem.

In the Evaluation stage, a questionnaire is used to measure the usability of chatbot, Chatbot Usability Questionnaire (CUQ) (Holmes *et al.*, 2019). The CUQ contains sixteen questions that are scored using a five-point Likert scale. Odd questions represent positive questions, and vice versa. To make sure that the resulted chatbot meets the needs of the mothers, respondents for the CUQ are the same as FGD participants in Requirements stage.

RESULTS AND DISCUSSION

The result of FGD in this Requirements stage is mothers need different category based on urgency. Urgency here means that whether they are in a rush to get the answer, advice, consultation from the medical experts (high-level urgency). Or they just need to find relevant information at any time (low-level urgency).

From FGD activity, mothers usually categorized sickness as an urgent moment. Sickness here is divided into two parts: physical and emotional. This sickness covers both baby and the mother. Therefore, the actionable information will be arranged specifically to the body parts (for physical sickness). Also, the information is delivered in a step-by-step instruction, so the mothers

can implement the instruction carefully and correctly in order. Meanwhile, in their spare time, mothers sometimes learning about their baby development or their parturition period. This requirement will be categorized as less urgent. Hence, information about baby growth and development, immunization, and breastfeeding will be written in declarative form. However, some knowledge will be suitable for nested information like what-if cases. For example, how to store compressed breast milk based on the refrigerator type of the mothers. Some other information will be given with pictures, in order to have better understanding of the details instead of using narration. For example, baby ability to hold and tilt their head to right and left by stimulating them with red or bright object.

A Telegram-based chatbot is resulted in Construction Stage. Default intents are shown by Figure 1. In the Main Content intent (Figure 2 and Figure 3), there are two intent options: Learning (for low-level urgency) and Sickness (for high-level urgency). Nested information is also constructed; see Figure 4 for the example in the breastfeeding topic for storage of compressed milk.

After deployed in the Telegram messenger environment, the chatbot will have the same structure as the modelled intent. The KIA chatbot can be accessed in http://t.me/kia_ibu_chatbot. See Figure 5 and Figure 6 to see the greeting message and content of Sickness category.
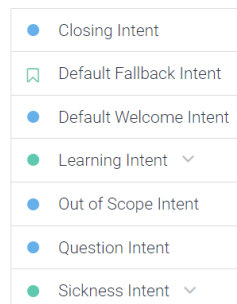

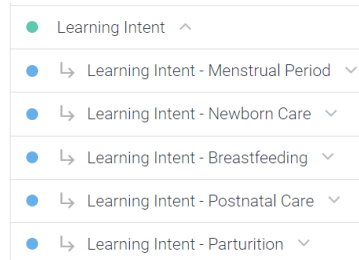**Figure 1.** Default intent categorization in Google DialogFlow

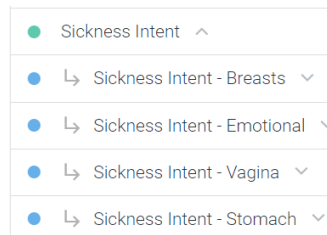**Figure 2.** Learning intent categorization

Figure 3. Sickness intent categorization

Based on the calculated results, the average overall CUQ score is 84.23/100. This value shows that the usability of the system is reliable.
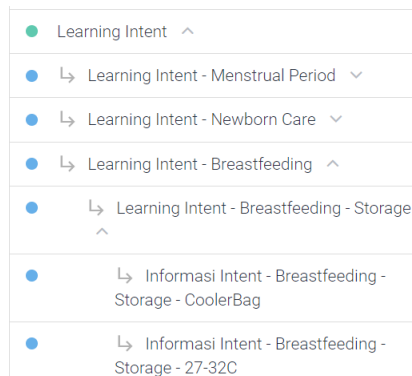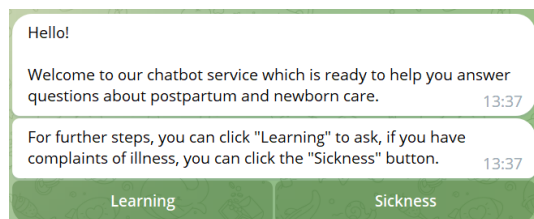

Figure 4. Nested information

Figure 5. Greeting message in Welcoming intent

What area do you feel sick right now?
a. Vagina
b. Stomach
c. Breasts
d. Emotional

Please type in the part number you are complaining about.
(Example: a)

If you still have questions that are not listed in the options above,
you can contact Mrs. Rizki Amalia, S.ST., MPH on the following link
https://msng.link/o?RizkiAmalia24=tg

msng.link
Message me to Telegram
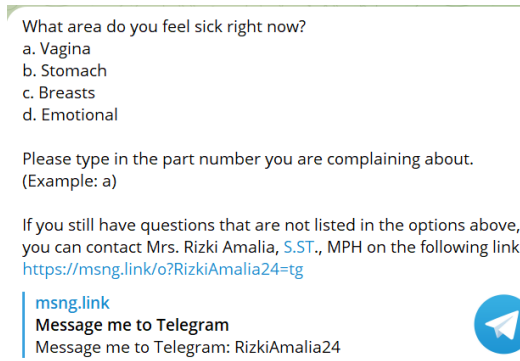Message me to Telegram: RizkiAmalia24

Figure 6. Content message in Sickness intent

This value passed the acceptability average score (68/100) (Larbi et al., 2022). In the CUQ evaluation, it was found that the chatbot had good evaluation result with average value greater than 4.5/5. Those are (1) Welcoming at the start (4.6/5), (2) Easy to navigate (4.6/5), (3) Chatbot responses are helpful, appropriate, and informative (4.6/5), (4) Very easy to use (4.7/5).

Participants confessed that using the chatbot was very easy because the flow and sentence of the questions led to the needed information (i.e., direct). So, participants could respond correctly to the chatbot, and the displayed knowledge is easy to understand. However, improvements are also needed on the chatbot in that it appears too robotic (2.8/5) and fails to recognize inputs that are not provided in the option list (1.8/5). Participants felt the chatbot was too robotic because the options are already provided. They are not required to type their own questions. However, the answer options are provided because of the other participants' requirements, since they are too busy taking care of their newborns, they are unable to type longer questions.

CONCLUSION

This article aims to develop and evaluate a chatbot that built based on a written knowledge and focus group discussion (i.e., Buku KIA). The chatbot will help postpartum mothers to seek information about themselves and newborns. In order to develop the chatbot, a rapid application development is used. There are two types of users in this chatbot: user with high-level urgency and user with low-level urgency. Therefore, information gathered from knowledge book is arranged based on those two urgency levels. The chatbot is developed using Google DialogFlow and Telegram-based messenger. After developing the chatbot, an evaluation was conducted using chatbot usability questionnaire. The questionnaire results show that the KIA chatbot is easy to use and understand, meanwhile some improvements need to be made for questions that are out of scope. This limitation may lead to the chatbot further research that employs machine learning and natural language processing to recognize the typed questions.

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