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Innovation Article

Development of medication reminder WhatsApp Bot application to improve medication adherence in pregnant women with hypertension

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A B S T R A C T

Background: Pregnant women's compliance with taking medication regularly is essential and supports the success of therapy. If pregnant women do not comply with taking medication, this can hurt the development of the disease and cause unexpected complications. Non-communicable diseases cause most cases of death in pregnant women. This is the basis for researchers to create a medication reminder system.

Purpose: This research aims to develop a WhatsApp Bot application, WhatsApp Bot, that reminds users when to take medication.

Method: This study employed Research and development, which consisted of four stages: Literature Study, Development Stage, Validity Expert, and Trial.

Results: A system that health workers can use in primary health facilities to remind them when to take medication has been successfully created. Performance test of the medication reminder system with a high % accuracy rate of 98% (MAPE value 9.05%).

Conclusion: This application is beneficial for pregnant women to remind them to take medication to increase compliance.

INTRODUCTION

Health development efforts ensure that every resident can achieve optimal health. Until now, these efforts are still an obstacle due to the high level of health problems, especially those related to non-communicable diseases, which can hamper a person's ability to live.[1] The use of drugs is very crucial in the treatment of disease. Therefore, medicine must be given correctly, whether it is the right disease, the right medicine, the correct dose, the right way to use it, and the right way for the patient; otherwise, the medicine will have unexpected effects and can even cause poisoning effects that endanger the patient's life.[1,2]

The duration of drug use varies when pregnant women undergo treatment. The success of treatment is not only determined by drug suitability but compliance with drug use as well. Non-compliance is influenced by several factors, such as non-compliance with the instructions written on the medication label, medication duplication, forgetting to take medication, and not taking medication at the proper interval.[2] Pregnant women who are undergoing treatment for chronic diseases such as hypertension, diabetes mellitus, heart disease, and so on will receive medication for an extended period and varying amounts of medication. Hence, they need tools to remind them of the right time to take medication.[2,3] Patient compliance influences the success of a treatment in achieving treatment targets and preventing complications effectively. Especially when giving medication and the distance between taking one medication and another.[4,5] In reality, in the field, pregnant women often receive poor understanding and explanations regarding the use of drugs during pregnancy, thus affecting their ability to consume drugs.[6,7] In fact, the Centers for Disease Control and Prevention (CDC) states that taking medication carelessly causes 30%-50% of treatment failures.

Therefore, following the doctor's rules for taking medication is very important, especially for people with chronic illnesses who should not skip even routine medication. Therefore, a system for reminding pregnant women to take medication is needed. Research on pregnant women states that using the Friends of Pregnant Women application increases compliance with taking Fe tablets and has the effect of significantly increasing the Hb levels of pregnant women.[8] This is in line with research, which states that a system of reminders, monitoring, and education on consuming blood supplement tablets increases pregnant women's compliance with consuming Fe tablets.[9] The

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weakness in previous research was that the reminder system only reminded one type of drug, Fe, for the same duration at night. Meanwhile, in this study, the system created was to remind pregnant women to take medication with more than one type of medication at different doses and times. This research aims to develop a WhatsApp Bot application, namely WhatsApp Bot, as a reminder media for when to take medication to increase medication adherence.

METHOD

The development model used in the research consists of Literature Study, Development Stage, Validity Expert, and Trials.[10]

Stage 1 Pre-Elementary Study

Researchers conducted literature studies and collected information data at 5 Community Health Centers as a pilot project, namely Cilongok Community Health Center 1, Sumbang Community Health Center 1, Sumbang Community Health Center 2, Baturaden Community Health Center 1, and Kalibagor Community Health Center to obtain data on the number of pregnant women with hypertension, and also conducted interviews with the coordinator midwives of the relevant community health centers—services provided to recommendations in the system to be built.

Stage 2 Application Development

The system was built using the Python programming language. The development system uses AI algorithms. Users enter data into the Form, integrated with the WhatsApp bot (WhatsaApp Robot). This WhatsApp bot was created using Google Apps Script and the WhatsApp web service to provide WhatsApp notifications to users who enter data. This robot is made to have a little "intelligence," which will read whether the user entering data is registered in the database. If the user is registered in this system, the input will be forwarded to the central database. The robot will read the database every hour. If the database finds a user who has entered the time to take medicine, then this robot will provide a WhatsApp notification to the number that has been entered.

Stage 3 Expert Validity

The expert validation test in this research used a system acceptance test by users. The system usability scale (SUS) questionnaire was completed to assess user acceptance of the system. The features tested in this study include the accuracy of medication reminders.

Stage 4 Application Testing

Design here includes system design and software design. This research utilizes the Bot feature of WhatsApp, which is used to respond to messages. Application testing uses a pre-experimental design with a one-shot case study where one group (only the intervention group without a control group) is given one treatment and one measurement. The Population was all pregnant women with hypertension in 5 health centers. The sample size was determined, plus the possibility of dropping out was 40 samples (adjusting research time). Researchers limited the research time by limiting the use of specific samples with the criteria of pregnant women ≥ 16 weeks pregnant, pregnant women who regularly had prenatal check-up visits, and pregnant women who were willing to be respondents. The midwife collects data and enters it into the WhatsApp bot reminder system via the officer's user account. The data entered includes the name of the pregnant woman, WhatsApp number, type of medication given, date of medication administration, and recommended time to take medication via a spreadsheet integrated with WhatsApp bot (WhatsApp robot).

This WhatsApp bot was created using Google Apps Script and the WhatsApp web service to provide WhatsApp notifications to users who enter data. The robot will read the database every hour. If the database finds a user who has entered the time to take medicine, then this robot will provide a WhatsApp notification to the number that has been entered. The research carried out has received a Health Research Ethics Committee with No. 0894/EA/KEPK/2024.

RESULTS

Result of Stage 1 The Literature Review

Data was collected on 40 pregnant women with hypertension. Based on a literature review and interviews with midwives, the behavioral, social, and cultural patterns, as well as a lack of education regarding how to take medication as recommended (the time range for taking medication). Therefore, this reminder system is designed to make it easier for midwives and patients to monitor and evaluate drug consumption according to recommendations from health workers. In this system, midwives not only give reminders to pregnant women to take medication but also provide other information and reminders according to service needs.

Results of Stage 2 Application Development

The dataset from Stage 1 was grouped and cleaned to address imbalanced datasets. The dataset used is 40 with appropriate labels. The data collection is processed to test whether the reminder system performance meets patient targets. This system uses a WhatsApp bot to provide reminders to enter data via https://bit.ly/Pendataan-SEHAT. The first step in operating this is to fill out the Google form.

After that, the user (midwife/health worker) starts inputting data consisting of the patient's name, name of the medicine, duration of taking the medicine (days), time of taking the medicine, if taking the medicine three times, then write the time of taking the 1st to third medicine, health facility, the patient's WhatsApp number, the officer's ID and the date the medicine was given as in Figure 1.

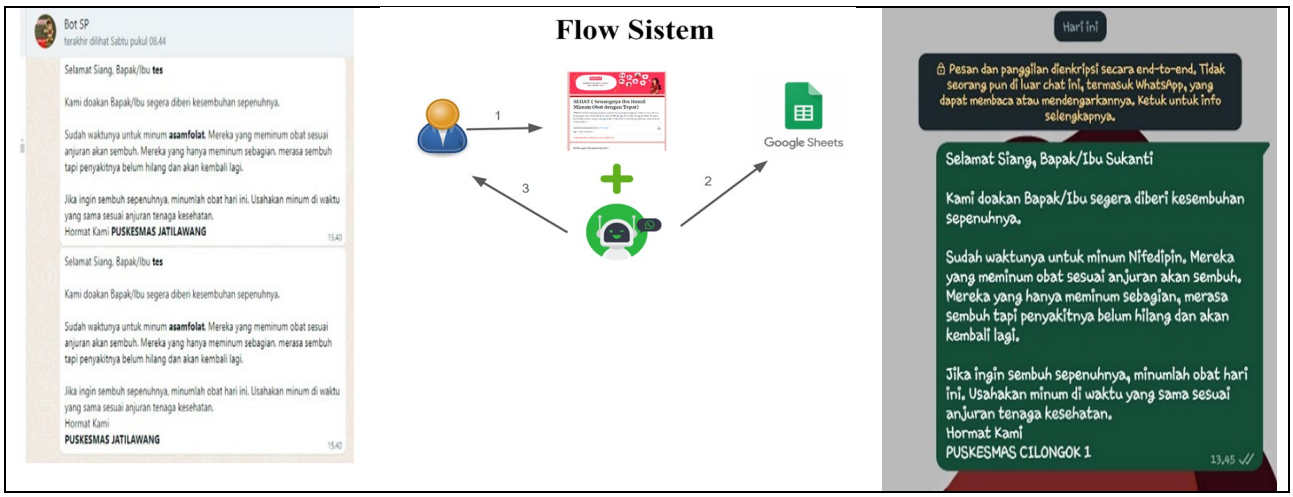

Figure 1. Flow System of The Medication Remainder

After the officer enters all the data, click start on the medication-taking server. Next, it contains data from reminders entered on pregnant women's WhatsApp. Users can save the admin's WhatsApp number to continue the consultation session if there is anything they want to convey. This robot is made to have a little "intelligence", where it will read whether the user entering data is a user registered in the database or not. If the user is registered in this system, then the input will be forwarded to the main database.

The robot will read the database every hour, if in the database it finds a user who has entered the time to take medicine, then this robot will provide a WhatsApp notification to the number that has been entered. Then the system will send a WhatsApp blast to the respondent according to the input results. Respondents will receive a message on WhatsApp according to the time of taking the medicine and the type of medicine based on the initial data input. WhatsApp number to continue the consultation session if there is anything they want to convey. Then the system will send a WhatsApp blast to the respondent according to the input results. Respondents will receive a message on WhatsApp according to the time of taking the medicine and the type of medicine based on the initial data.

Results of Stage 3 Expert Validity

There were five users, in this case, midwives, in this study. From the SUS questionnaire distribution results, one is deducted from the score for each odd question (X-1), while for even-numbered questions, the value is reduced from 5 (5-X). The result of adding ten questions is multiplied by 2.5 to obtain the SUS score for the reminder system that has been developed. The usefulness of the test results can be seen from the average SUS score, namely 81.5 (very good/acceptable), indicating that the user can understand the reminder system well and has fulfilled the standard usability that a system must meet.

Results of Stage 4 Application Testing

Based on the research results, there is a reminder system for taking medication, according to recommendations for taking medication (each pregnant woman gets a different reminder) in real-time. The weekly MAPE assessment counts the number of corrects and errors in the reminder system. Based on the results of calculations up to the fourth week (which were given by 40 respondents), the MAPE scale value from the system trial results was 9.02%, which means that the accuracy value is in the very accurate category (the MAPE value is less than 10%). The trial was carried out on 40 subjects. The assessment consists of several aspects, namely the functional aspects of the WhatsApp bot, the benefits, the effectiveness, and the overall assessment, as shown in Figure 2. The subjects rated the WhatsApp Bot as applicable (95.9%). As many as 90.8% of subjects rated WhatsApp Bot as effective for reminders. The subjects' overall assessment of the WhatsApp Bot was good (91.8%).

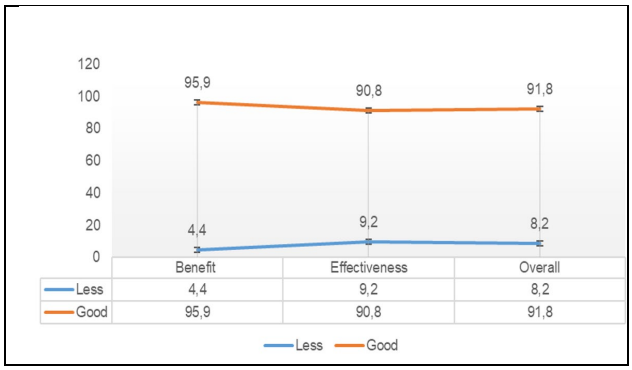

Figure 2. Subject ratings on WhatsApp Bot (%)

DISCUSSION

After testing the system in this research, it was found to run well in stable network conditions because the data captured and displayed are real-time data. So, every time a user accesses the WhatsApp chatbot, it will automatically make a request directly to the server so that it will display the information data that has been processed at that time. The use of this system increases the compliance of pregnant women to take medication according to the principles of drug administration. This research aligns with research that states that media use can increase pregnant women's compliance with consuming Fe tablets.[12,13] The system created functions according to the research objectives,

namely as a reminder to take medication for pregnant women by applying the principles of the right patient, time, drug, method, and dose. This aligns with research stating that the medication reminder system is intended for people who often take medication or vitamin supplements.[14] Nowadays, many people need to take medication several times a day at regular intervals. However, it is possible that forgetting will occur due to the large amount of medication. Therefore, a reminder system has been created to meet each person's needs.[15]

One factor that influences compliance is forgetting when to take medication. The medication reminder application will help people find the right time to take medication. This application is based on a WhatsApp bot that will send messages when people have to take medicine and display the name of the medicine people must take. Data from research on the use of alarms in patients receiving heart medication shows that alarms increase statin drug compliance, are relatively easy to implement, and are low-cost.[16,17] Therefore, we built a medication database by developing a medication reminder system. When one or two drugs can cause side effects if given simultaneously, intervals are given to avoid or reduce these effects.

This is in line with research that states that reminder models must consider managing drug interactions that can be detrimental or cause side effects. In this study, medication reminders were generated using UMS artificial intelligence to help remind patients to take medication as recommended.[18,19] A study shows that the coverage of pharmaceutical services in health services in health services is still rare with the use of software.[20] In facing the challenges of patient needs in the 21st century, artificial intelligence can help pharmacists provide more effective medication counseling. Meanwhile, this artificial intelligence can reduce repetitive tasks, help patients take medication as prescribed, and organize relevant data through a data-driven approach in the Health System.[20,21]

The medication reminder system facilitates patients regarding medication schedules and improves their medication compliance. This system increases the efficacy of therapy for chronic diseases and reduces the occurrence of drug resistance.[22–24] The use of technology in the health sector in the technology 5.0 era is proliferating. In Korea, for example, it has promoted a change from medical care-oriented services to a paradigm centered on the 4Ps, which are preventive, predictive, personal, and participatory based on technology.[11] This medication reminder system helps patients in home care, ensuring they take their medication on time to reduce medication errors resulting in complications.[25]

The success of therapy in pregnant women with hypertension is not only due to regular drug consumption but also to non-pharmacological therapy factors that pregnant women undergo. Things that influence this include not smoking, reducing sugar and salt consumption, engaging in physical activity as recommended, getting enough rest, and eating nutritious food.[26]

CONCLUSIONS AND RECOMMENDATION

A WhatsApp Bot application, WhatsApp Bot, has been built. This application can be used to remind pregnant women to take medication, which is essential to increasing their compliance. To support technology-based service transformation, this application will be socialized to other health centers and collaborate with related agencies in the future. Hopefully, future researchers can develop this system not only as a reminder to take medication but also as an educational medium for pregnant women with non-communicable diseases

REFERENCES

1. Irjayanto S, Chamim ANN. Prototipe Kotak Pengingat Minum Obat. *J Ilm Semesta Tek*. 2015;18(2):183. doi:https://doi.org/10.18196/st.v18i2.1820
2. Mardianto R. Aplikasi Pengingat Minum Obat Di Desa Sumbersuko Kecamatan Wagir Kabupaten Malang. *J ABM Mengabdi*. 2021;8(2):33. doi:10.31966/jam.v8i2.951
3. Shinde S, Bange N, Kumbhar M, Patil S. Smart Medication Dispenser. *nternational J Adv Res Electron Commun Eng*. 2017;6(4):200-204.
4. Alfian R. Korelasi Antara Kepatuhan Minum Obat dengan Kadar Gula Darah pada Pasien Diabetes Melitus Rawat Jalan di RSUD Dr. H. Moch. Ansari Saleh Banjarmasin. *J Pharmascience*. 2019;2(2):15-23. doi:http://dx.doi.org/10.20527/jps.v2i2.5818
5. Nanda O, Wiryanto B, Triyono E. Hubungan Kepatuhan Minum Obat Anti Diabetik dengan Regulasi Kadar Gula Darah pada Pasien Perempuan Diabetes Mellitus. *J Amerta Nutr*. 2018;2(4):340-348. doi:https://doi.org/10.20473/amnt.v2i4.2018.340-348
6. Eldalo AS, Siraj N, Yousif M. Pregnant Women's Awareness and Perception About Medicines. *Lat Am J Pharm*. 2015;34(5):869-874.
7. Handayani EY. Hubungan Kepatuhan Mengkonsumsi Tablet Fe Terhadap Kejadian Anemia Pada Ibu hamil Trimester III Di Puskesmas Rambah Hilir I Kabupaten Rokan Hulu. *J Matern Neonatal*. 2020;3(2):125-131.
8. Krismawati E, Widjanarko B, Rahfiludin MZ. Pengaruh Aplikasi Sahabat Ibu Hamil (ASIH) terhadap Kepatuhan Minum Tablet Fe dan Kadar Hb Ibu Hamil. *J Keperawatan*. 2022;14(1):121-128. doi:10.32583/keperawatan.v14i1.44
9. Falah YF, Alamsyah SS, Sari AADP, Sari NASA, Priyambudi ZS, Arifah I. Anedoc APP: Sistem Pengingat, Pemantau, dan Edukasi Konsumsi Tablet Tambah Darah Ibu Hamil di Puskesmas Sangkrah Kota Surakarta. *War LPM*. 2022;25(3):300-310. doi:10.23917/warta.v25i3.1025
10. Sugiyono. *Metode Penelitian & Pengembangan Research and Development*. Alfabeta; 2017.
11. Tian S et al. Smart Healthcare: Making Medical Care More Intelligent. *J Glob Health*. 2019;3(3):62-65. doi:10.1016/j.glohj.2019.07.001.
12. Fertimah AR, Widyawati W, Mulyani S. Efektifitas Penggunaan Media Audiovisual Dan Aplikasi Permitasi

Terhadap Pengetahuan Dan Kepatuhan Ibu Meminum Tablet Besi. *J Keperawatan Klin dan Komunitas*. 2021;5(3):134-145. doi:https://doi.org/10.22146/jkkk.44276

13. Rusnayani R, Syafar M, Rifai M. Pengaruh Media Audiovisual (Youtube) Terhadap Kepatuhan Konsumsi Tablet Tambah Darah Dalam Mencegah Anemia Dan Tiwu KabupatenKolaka Utara. *J Ilm Obs*. 2021;12(2):50-55. doi:https://doi.org/10.36089/job.v13i3.416
14. Paul LC, Ahmed SS, Rani T, et al. A smart medicine reminder kit with mobile phone calls and some health monitoring features for senior citizens. *Heliyon*. 2024;10(4):e26308. doi:10.1016/j.heliyon.2024.e26308
15. Kumar SB, Goh WW, Balakrishnan S. Smart Medicine Reminder Device for The Elderly. In: *Conference: 2018 Fourth International Conference on Advances in Computing, Communication & Automation (ICACCA)*. ; 2018:168. doi:http://dx.doi.org/10.1109/ICACCAF.2018.8776734
16. Reddy A, Huseman TL, Canamucio A, Marcus SC, Asch DA, Volpp K, Long JA. Patient and Partner Feedback Reports to Improve Statin Medication Adherence: A Randomized Control Trial. *J Gen Intern Med*. 2017;32(3):256-261. doi://doi.org/10.1007/s11606-016-3858-0
17. Sevriani S. *Hubungan Pola Asuh Ibu Dalam Pemberian Makan Dengan Kejadian Stunting Pada Balita Di Desa Ajmberejo Kec Kedungadem Kab Bojonegoro*. ITSKes Insan Cendekia Medika; 2022.
18. Nyamabo AK, Yu H, Shi JY. SSI-DDI: substructure-substructure interactions for drug-drug interaction prediction. *Br Bioinform*. 2021;22(6). doi:https://doi.org/10.1093/bib/bbab133
19. Zheng Y, Peng H, Zhang X, Zhao Z, Gao X LJ. DDI-PULearn: a positive-unlabeled learning method for large-scale prediction of drug-drug interactions. *BMC Bioinformatics*. 2019;20(19):661. doi:https://doi.org/10.1186/s12859-019-3214-6
20. Corrigan BW. Artificial Intelligence and Machine Learning: Will Clinical Pharmacologists be needed in the Next Decade? The John Henry Question. *Clin Pharmacol Ther*. 2020;107(4):679-9. doi:10.1002/cpt.1792
21. Eggerth A, Hayn D, Schreier G. Medication management needs information and communications technology-based approaches, including telehealth and artificial intelligence. *J Clin Pharmacol*. 2020;86(10):2000-2007. doi:https://doi.org/10.1111/bcp.14045
22. Zhao BW, Wang L, Hu PW, et al. Fusing higher and lower-Order Biological Information for Drug Repositioning via graph representation learning. *IEEE Trans Emerg Top Comput*. 2024;12(1):163-176. doi:10.1109/TETC.2023.3239949
23. Zhao BW, Su XR, Hu PW, Huang YA, You ZH HL. iGRLDTI: an improved graph representation learning method for predicting drug-target interactions over heterogeneous biological information network. *Bioinformatics*. 2023;39(8). doi:https://doi.org/10.1093/bioinformatics/btad451
24. Lianlian Wu, Wen Y, Leng D, et al. Machine learning methods, databases and tools for drug combination prediction. *Brief Bioinform*. 2022;23(1). doi:https://doi.org/10.1093/bib/bbab355
25. Ciampi M, Coronato A, Naeem M, Silvestri S. An intelligent environment for preventing medication errors in home treatment. *Elsevier Ltd*. 2022;193:116434. doi:https://doi.org/10.1016/j.eswa.2021.116434
26. Sumiasih H, Trilestari, Utami W. Hubungan Kepatuhan Minum Obat terhadap Keberhasilan Terapi pada Pasien Hipertensi di Puskesmas Prambanan Sleman Bulan Januari – Februari 2020. *CERATA J Ilmu Farm*. 2020;11(1):21-27. doi:10.61902/cerata.v11i1.95