THE UTILIZATION OF MOBILE-HEALTH INTERVENTION IN IMPROVING TREATMENT COMPLIANCE BEHAVIOR IN TUBERCULOSIS PATIENTS: A LITERATURE REVIEW

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THE UTILIZATION OF MOBILE-HEALTH INTERVENTION IN IMPROVING TREATMENT COMPLIANCE BEHAVIOR IN TUBERCULOSIS PATIENTS: A LITERATURE REVIEW

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Abstract

Background: Mobile-health assists health workers in monitoring and observing patient compliance behavior during TB treatment.

Objectives: The purpose of this review is to identify the use of mobile-health interventions in improving medication compliance behavior in tuberculosis patients.

Design: This research was conducted by following the scoping framework.

Data Sources: This study was conducted following a scoping review framework. This research literature search relied on data from PubMed, Scopus, and Science Direct databases. Using the keywords "mobile application", "Directly-Observed Treatment Short-course (DOTS)", "medication adherence", "tuberculosis patients", and "mobile-health". This scoping review uses data from 10 articles published between 2010-2019. Utilization of Mobile-Health in improving drug adherence of TB patients.

Review Methods: The particle screening method was used for the review and was guided by the PRISMA diagram. As well as an analysis of the articles reviewed.

Results: The m-health intervention has a positive impact on TB treatment. The benefits of m-health are increasing patient knowledge, providing social support, providing motivational support and increasing patient compliance behavior during treatment. The m-health application contains features such as short message service (SMS), video, telephone, and picture messages.

Conclusion: Mobile-health interventions can be applied independently with counseling, motivation and health education in improving medication compliance behavior. The advantages of mobile-health are that patients become more open, it saves time and distance, and also it strengthens communication between nurses and patients.

Keywords: *Directly-Observed Treatment Short-course (DOTS), Medication Adherence, Mobile Application; Mobile-Health, Tuberculosis Patients.*

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INTRODUCTION

Non-compliance behavior toward tuberculosis (TB) treatment is one of the main challenges in controlling TB. This condition is caused by the risk of prolonged disease transmission, treatment failure and the occurrence of drug resistance. Other factors are related to low density, bad weather conditions, long distances and lack of human resources which are obstacles in supervising the application of Directly Observed Therapy (DOT) (Wei X, Hicks JP, Pasang P, Zhang Z, Haldane V, 2019) (Kemenkes RI, 2015).

Tuberculosis is one of the major public health problems worldwide, especially found in developing countries with the highest prevalence rates. Tuberculosis control with the DOTS strategy has been implemented in many countries since 1995, but is still a global problem that is difficult to overcome (Adiutama NM, Amin M, 2018) (Nisar S, 2018). Indonesia is a country with the third largest tuberculosis in the world after India and China, which is comprising 10% of all patients in the world (WHO, 2018).

Tuberculosis cases in Semarang City are high. The number of cases of TB sufferers (all types) in Semarang City in 2019 was 3,438 cases, with the percentage of TB of all types in men as many as 1,875 cases (55%) greater than in women as many as 1,563 cases (45%) (Dinas Kesehatan Kota Semarang, 2018). Based on the qualitative fact, it happens because men are more intensely in contact with risk factors and are less concerned about aspects of individual health care compared to women. The prevalence of MDR-TB in Semarang City was 71 new cases of MDR-TB in 2018. A person can suffer from MDR-TB due to direct infection from other patients, or due to the treatment that is not up to standard and not complete (Dinas Kesehatan Kota Semarang, 2018) (Dinas Kesehatan Kota Semarang, 2019).

Successful management of TB treatment requires at least 6 months. The long duration of treatment, which even needs to be continued after clear clinical recovery, is one of the main reasons for patients not completing the treatment. To an extent, other explanations of factors contributing to incomplete treatment are fear of side effects, social stigmatization, illiteracy and the patient's inability to understand well about treatment. This condition emerges because the patient and family are not well informed about various things related to this disease, such as relapse, drug resistance, prolonged hospitalization or even death (Schwartzberg K, Adam A, Motara F, 2017) (Alqahtani S, Kashkary A, Asiri A, Kamal H, Binongo J, 2018).

TB treatment requires electronic monitors and automatic reminders attempting to improve the quality-of-care services as a form of supervision. This electronic monitoring is used to obtain accurate, real-time, and detailed dose information as well as provide a special communication channel between patients and healthcare workers to discuss their concerns. This device also has various functions such as a phone cellular, those are to communicate via text messaging (SMS), photo and video (MMS), telephone, and World Wide Web access. It also serves to multi-media playback and software application support. This application can be connected to mobile devices such as smart phones and PDA (Personal Digital Assistant) phones that are capable of performing high levels of performance with these various functions (Arnardottir NY, Oskarsdottir ND, Brychta RJ, Koster A, Domelen DR Van, 2017).

Online health interventions for patients such as TB have been designed to improve health behaviors, for example to monitor smoking cessation program or improve disease management. Disease management includes an effort to increase compliance behavior to prescribed drugs and drugs that need to be taken regularly. The intervention is given in the form of an application through the picture media and simple phrases to show each drug and its purpose, how much to take, and when to take it. This form of application will be easier to understand than the complex information and instructions that usually come with medicines (Nuryati, n.d.).

Interventions using reminders are mainly based on the principles of behavioral learning theory. The medication compliance mobile app is considered as an innovative and non-invasive approach to evaluate and improve compliance behavior in patients (Gauthier P, 2012). Mobile-health interventions have potential to consolidate all treatment-specific information for a patient that is always accessible, and thereby provide a systematic and efficient process for training patients about their disease care conditions.

Attempts to improve medication compliance in pulmonary TB patients require assistance, supervision or monitoring. One of them is by utilizing mobile health. The research conducted by Arjuna & Sukihananto (2018) found that Mobile Health is able to provide effective, efficient, and quality services for tuberculosis patients in several countries. Indonesia has great potential in implementing smartphone-based Mobile Health. However, the use of Mobile Health cannot be fully implemented in community nursing care because it is not yet comprehensive. In addition, the research done by Loriana et al., (2014) discovered that there was an effect of counseling and supervision in improving medication compliance in pulmonary TB patients.

Based on the explanation above, this scoping review aims to determine the use of mobile-health interventions in improving medication compliance behavior in tuberculosis patients.

METHODS

Design

The purpose of this article is to use Arksey and O'Malley's recommendations to synthesize current evidence and literature (2005). This scoping review uses a five-stage categorical technique, namely: 1) defining the research problem, 2) identifying the relevant literature 3) selecting related literature from articles and data extraction, 4) mapping or summarizing data 5) collecting, summarizing, and reporting findings for summarize the research comprehensively.

Search Method

The search for research articles started from June-August 2021. Data from PubMed, Scopus, and Science Direct. Using the keywords "mobile application", "Directly-Observed Treatment Short-course (DOTS)", "medication adherence", "tuberculosis patients", and "mobile-health". Year of publication (2010-2019) English.

Search result

Based on the literature search by the researcher, 193 articles of recognized literary works were obtained, the researcher reviewed 127 works based on titles and abstracts, all of the 32 texts were evaluated for feasibility. After complete analysis, 10 articles were omitted. Twelve studies did not meet the inclusion requirements, while five studies focused on patients with tuberculosis (TB), human immunodeficiency virus (HIV) and asthma. Ten articles were deemed relevant for this review.

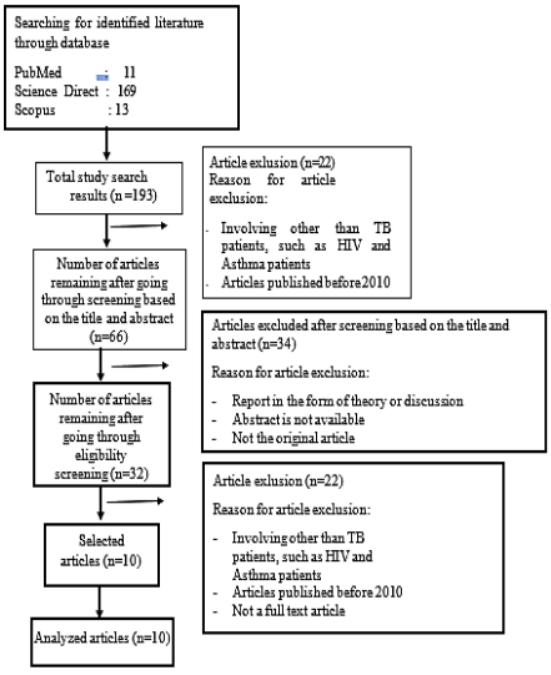

Figure 1. PRISMA diagrams and article search.

Quality Rating

The researcher analyzed every incoming literature that met the criteria. Data were analyzed by summarizing the main results selected to obtain topics and subtopics. After that, the researcher combined the data analysis and analyzed it to find sub-themes. To achieve the objectives of this scoping review, the literature on TB patient adherence was thoroughly reviewed. Using the PRISMA technique, the researcher selected 10 articles for review.

Data Abstraction

The selection of articles uses a selection process that is guided by the PRISMA diagram. To identify findings that meet the study's questions and objectives. To include information from selected studies, samples, objectives, design, year of publication, instruments and results of each study for each article.

Data Analysis and Synthesis

This study uses a descriptive analysis that describes the results of the study through a narrative method in mapping, compiling, and summarizing the selected literature. To include information from the selected literature, samples, objectives, design, year of publication, instruments, conclusions and results of each research article.

Table 1. Summary of Articles Obtained.

No.	Article	Purpose	Method	Findings
1.	Mobile Health Technologies May Be Acceptable Tools for Providing Social Support to Tuberculosis Patients in Rural Uganda: A Parallel Mixed Method Study usual care in Tibet (Musiimenta et al., 2020)	To explore the effect of TB patient access through social support and perceptions of involving a compliance monitoring intervention using mobile health on medication compliance	It used a parallel mixed-method study, with 53 respondents, using interviews	Interventions using cell phones can provide an alternative approach in providing social support for medication compliance in TB patients who do not live with their social environment. Social support can be in the form of instrumental support, emotional support, and information support from health care providers
2.	Change in Patient Comfort Using Mobile Phones Following the Use of an App to Monitor Tuberculosis Treatment Adherence: Longitudinal Study (Do et al., 2019)	To find out whether tuberculosis sufferers who use the mHealth application in the form of Video Directly Observed Therapy (VDOT) to monitor their tuberculosis treatment become more comfortable and to identify factors associated with changes in comfort.	It used a questionnaire and interviews with a quantitative approach to 120 respondents	After the use of VDOTS patients became more comfortable, the use of VDOTS by recording and sending videos of every drug consumption event, and we found there was a positive and significant change in the convenience of using a mobile phone to take videos and photos. Patients gain the skills and confidence to adapt more quickly by using the mHealth app for other conditions.

3.	Analysis of the Effect Telephone Counseling by Nurses on the Compliance of the Control of DOTS Poly Tuberculosis Patients at Dungus Madiun Lung Hospital (Winarto & Bintoro, 2018)	To prove the effect of providing counseling telephones by nurses on control compliance in DOTS poly TB at the Pulmonary Hospital Dungus Madiun.	It used Pre-Experiment method, and the research design being used is a one-shot case design study using a random sampling involving15 respondents	Counseling by telephone can improve treatment compliance of TB patients, as well as improve communication between patients and nurses and increase the motivation of TB patients. Changes are found in patients who are late for control become obedient on time and it can motivate TB patients during treatment. The advantages of telephone communication make patients become more open, and create easier communication.
4.	Development of a Mobile Image-Based Reminder Application to Support Tuberculosis Treatmentin Africa (Haji et al., 2015)	To evaluate the effect of a prototype application in which participants are given a mobile phone on which a reminder system is installed to remind medication compliance	Qualitative study, 38 respondents using interviews. The study was conducted for 8 days; the reminders were adjusted according to the patient's medication schedule. For example: every 7 o'clock on a regular basis	Picture-based telephone reminders are useful in supporting TB treatment, where participants understand more easily and interpret the desired meaning of each picture. Comparison of image-based phone reminders with text messages and phone calls: does not have literacy and language barriers; and does not require the mobile operator to control the service (no operating costs).
5.	Mobile Health Treatment Support Intervention for HIV And Tuberculosis in Mozambique: Perspectives of Patients and Healthcare Workers (Nhavoto et al., 2017)	To support retention in antiretroviral (ART) and tuberculosis (TB) treatment in Mozambique by using the mhelath program which includes automated SMS	It used randomized controlled trial (RCT), the study was conducted in five health centers in Mozambique with 141 respondents and 40 nurses.	Both patients and health workers find the SMS system useful and reliable. Effectively reduces the number of failures in taking medication and avoids control schedule. Patient confidence in the system is high. Most of them consider the ability of the system to improve communication between healthcare providers and patients and assist in health education and motivation.

6.	Mobile Direct Observation Treatmentfor Tuberculosis Patients: A Technical Feasibility Pilot Using Mobile Phones in Nairobi, Kenya (Hoffman et al., 2010)	To summarize a concept trial designed to provide phone for Mobile Direct Observation Treatment (MDOT) toward TB patients	The method is a quantitative study involving 13 respondents and 3 nurses using a questionnaire. The study was conducted for 4 weeks, the video is 5-8 seconds long	Both patients and health professionals are able to work together through receptive communication with each other even at long distances, so that MDOT through health messages via mobile phones can improve patient compliance behavior to treatment.
7.	Tuberculosis Treatment with Mobile-phone Medication Remindersin Northern Thailand (Kunawararak et al., 2011)	To study the effect of mobile reminders toward MDR-TB control in Northern Thailand	It is a quantitative study involving 98 respondents using a questionnaire	Mobile phones help improve treatment of MDR-TB patients by reminding them to take medication, reminding them to submit sputum specimens, answering patient questions, increasing medication compliance, and supporting as well as maintaining patient confidentiality
8.	SMS Reminders to Improve Adherence and Cure of Tuberculosis Patients in Cameroon (TB-SMS Cameroon): A Randomized Controlled Trial (Bediang et al., 2018)	To evaluate the effectiveness of daily reminder SMS to improve the healing process of adult patients newly diagnosed with sputum positive pulmonary TB (SS + PTB) and treated at Treatment and Diagnostic Center (TDC) in Yaoundé, Cameroon	It is Randomized Controlled Multicenter (RCM) study toward 279 respondents use a questionnaire	This study showed that SMS reminders statistically significantly increased the proportion of treatment and success at 5 months and cure at 6 months.
9.	Effectiveness of a reminder card system versus a mobile application to improve medication adherence among asthma patients in a tertiary care hospital (Mohan et al., 2018)	To assess and compare the effectiveness of the reminder card system with a mobile application to improve patient medication adherence	It is a quantitative study, involving 100 respondents using a questionnaire	Giving interventions using a mobile application is more effective in improving medication adherence than medication reminder cards.

10.	A Study on the Role of Mobile Phone Communication in Tuberculosis DOTS Treatment (Elangovan & Arulchelvan, 2013)	To analyze the use of cell phones and their effectiveness in TB DOTS treatment	It is a quantitative study, involving 150 respondents using a questionnaire	The majority of patients use cell phones to connect with health workers to clarify their doubts about the side effects, diet, and symptoms of this disease. Mobile phone ownership is 68% of all TB patients. Reminder phones have widespread connectivity, low cost, and growing popularity. Health and communication will reach a larger audience if via SMS it is available in local languages. Mobile phone also helps health workers in advising family members of patients by telephone and educating families about prevention and the importance of treatment.

DISCUSSION

Theme 1: Mobile Health Application

There are 3 researches that discuss text messaging or short message services (SMS) that have been applied to various mobile phones regarding health-based intervention (mHealth). One of many strategies to increase compliance is with short message service (SMS) because this media is inexpensive and can reach a large number of people as mobile phones are common in most countries (Bediang et al., 2018) (Mohan et al., 2018) (Elangovan & Arulchelvan, 2013). Patients received SMS reminders every day for 6 months. The point of the m-health intervention is to explore motivational messages that are adjusted in relation to the patient profile at the beginning of the special attention to towards the end of treatment. Motivational messages will target several features of medication adherence: invite, motivate, encourage and appointment dates reminders, or even to reward healing steps that have been achieved. Furthermore, SMS content should consider the information-motivation-behavioral skills (IMB) model including contextual elements such as culture, language, beliefs, and factors affecting access to health care (Kunawararak et al., 2011). Image-based mobile applications using visual communication can be useful in helping TB patients adhere to their treatment. This application has the potential benefit of supporting illiterate TB patients in understanding their treatment process using these visual aid (Haji et al., 2015).

The mHealth application is also useful in providing social support to TB sufferers, especially TB patients who do not live in the same home environment, so a long-distance communication tool in the form of the mHealth application is needed to support and monitor adherence to medication (Musiimenta et al., 2020).

In addition, other intervention is given by using video-DOT to summarize the material, as well as using the capabilities of Skype and WhatsApp mobile technology to visually observe the process of remote patient treatment. The VDOT system works by recording and sending videos of every drug consumption event (Do et al., 2019). Phone calls can be used to conduct counseling. The advantages of phone counseling services can be seen from the patients who become more prepared and open in sharing their problem comparing to face-to-face communication, and it also facilitate in doing long distance scheduled activities (Winarto & Bintoro, 2018).

Counseling is the process of providing assistance by an expert (called as counselor) to an individual who is experiencing a problem (called as counselee) that leads to the problems faced by the client. Counseling is a form of communication that aims to change the current situation to a better state (Winarto & Bintoro, 2018). In researcher's opinion, in the respondent group which is a group of TB sufferers who take a long time at least for 6 months duration of treatment, it is necessary to get counseling in addition to increasing motivation to undergo treatment, as well as providing solutions when there are obstacles during treatment.

Mobile-health reminders help patients feel better, feel less alone in treatment and less socially isolated. Their comfort using mobile applications can determine whether these applications improve patient skills in using technology (Kunawararak et al., 2011).

Theme 2: Intervention Component

The basis for developing mobile-health in TB health programs is to increase patient involvement in their treatment. Knowledge and understanding of patients regarding their disease is very important, wherein the health education received is still less for patients during diagnosis and treatment. In this sense, education is one of the important components in intervention. Education toward patient can be adjusted to suit the patient's needs and culture.

Some educational content is prioritized regarding the information provided to patients. Providing education about: (a) nutrition during

treatment, (b) what to do when you feel bad (for example, side effects - seek help from a provider), (c) effects of treatment over time (for example, side effects often get through and get easier), and (d) acknowledgment that the treatment is challenging (for example, there are many pills that must be taken every day and for a long time).

In addition to providing health education, mobile applications can be used to provide social support, emotional support (counseling) and informational support (e.g., drug side effects) as well as motivational support focusing on the patient's beliefs and attitudes. At the duration of 4-6 weeks treatment after the patient felt the effects of the treatment, many patients tended to despair regarding the treatment process. In such condition, patient must remain motivated to complete the treatment process. Patients can be motivated to adhere to treatment and eliminate their doubts. Social support as well as motivational support is needed by patients during their treatment.

Theme 3: Implementation of Mobile Health

The implementation of mobile-health in health services has a positive impact. Mobile-health assists health services in controlling, monitoring, and evaluating TB patient treatment. It also includes the identification of patient needs, operational procedures, and anticipatory guidance. Patient needs include patient expectations, telephone numbers of health workers, and examples of how to send patient daily medication reports. Operational procedures were developed regarding the steps to start using the mobile-health application, the time specified for message reminders, and documentation. Evaluation toward the patients who do not respond for 2 days will be called and asked several questions by the health workers. If there is still no reply, then health workers and the community will contact the service center close to the patient to evaluate the obstacles of using mobile-health.

This type of mobile-health system prioritizes the use of mobile phone networks, which in many countries are growing rapidly with an increasing number of users, and increasingly affordable costs. The increasing the number and types of mobile phone applications on the technology side can provide various types of innovations for the development of public health service applications. The main keys to developing this mHealth system are: a good understanding of health services and their problems, the availability of technology and network infrastructure features, a synergistic collaboration with various parties, as well as innovations that are developed consistently and sustainably (Hoffman et al., 2010).

Implications for Nursing

Technological developments in the health sector, such as mobile-health can provide support in increasing compliance behavior of TB patient treatment. Utilization of mobile applications and services that can be used includes SMS, video, telephone, and picture messages. Those can be applied in empowering patient treatment independence. Nurses can evaluate and monitor patient treatment by collaborating DOTS program. A collaborative approach involving both the professional nurse and the patient during the treatment process may take more time, but resulted in responsive interventions that are suitable with patient needs and in accordance with the culture at large.

Mobile-health can help to overcome obstacles such as stigma, loss of privacy, and limited transportation. It is an easy and cost-effective way to communicate and monitor patients. In addition, mobile-health develops a strong professional relationship between patient and health workers through supervision and giving support. These have been identified as critical things as the efforts to control TB which could potentially be achieved through telecommunication tools, such as mobile-health.

CONCLUSION

Mobile-health interventions can be applied independently with counseling,

motivation and health education in improving medication compliance behavior. The advantages of mobile-health are that patients become more open, save time and distance flexibility, strengthen communication between nurses and patients. TB sufferers need to be invited to communicate with health workers about their problems and provide insight to family members, using mobile-health as a strategy to control the disease.

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Related to conflict of interest that arise when conducting article.

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AUTHOR CONTRIBUTION

Eko Budi Laksono: Collecting data, analyzing data, compiling research results, conducting discussions, compiling manuscripts.

Andrew Johan: Assisting in the interpretation of research results, directing deeper discussions related to research results, directing the preparation of manuscripts.

Meira Erawati: Assisting in the interpretation of research results, directing deeper discussions related to research results, directing the preparation of manuscripts.

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REFERENCES

Adiutama NM, Amin M, B. A. (2018). An Evaluation of Medication Adherence in Tuberculosis Patients Based on Theory of Planned Behavior An Evaluation of Medication Adherence in Tuberculosis Patients Based on Theory of Planned Behavior. *(August 2019)*.

Alqahtani S, Kashkary A, Asiri A, Kamal H, Binongo J, C. K. (2018). Journal of Epidemiology and Global Health Impact of mobile teams on tuberculosis treatment outcomes , Riyadh Region , Kingdom of Saudi Arabia , 2013 – 2015. *J Epidemiol Glob Health*. https://doi.org/10.1016/j.jegh.2017.09%0A.005%0A

Arjuna, & Sukihananto. (2018). Mobile Health Upaya Dalam Meningkatkan Keberhasilan Pengobatan Pasien Tuberkulosis (TB) Paru: Kajian Literatur. *Keperawatan*, 1–7.

Arnardottir NY, Oskarsdottir ND, Brychta RJ, Koster A, Domelen DR Van, C. P. (2017). Comparison of Summer and Winter Objectively Measured Physical Activity and Sedentary Behavior in Older Adults : Age , Gene / Environment. *Susceptibility Reykjavik Study*.

Bediang, G., Stoll, B., Elia, N., Abena, J. L., & Geissbuhler, A. (2018). SMS reminders to improve adherence and cure of tuberculosis patients in Cameroon (TB-SMS Cameroon): A randomised controlled trial. *BMC Public Health*, *18*(1), 1–15. https://doi.org/10.1186/s12889-018-5502-x

Dinas Kesehatan Kota Semarang. (2018). *Profil kesehatan kota semarang 2018*.

Dinas Kesehatan Kota Semarang. (2019). *Profil kesehatan kota semarang 2019*.

Do, D., Garfein, R. S., Jazmine, C. M., Collins, K., & Liu, L. (2019). Change in patient comfort using mobile phones following the use of an app to monitor tuberculosis treatment adherence: Longitudinal study.

In *JMIR mHealth and uHealth* (Vol. 7, Issue 2). https://doi.org/10.2196/11638

Elangovan, R., & Arulchelvan, S. (2013). A study on the role of mobile phone communication in tuberculosis DOTS treatment. *Indian Journal of Community Medicine*, *38*(4), 229–233. https://doi.org/10.4103/0970-0218.120158

Gauthier P, C. J. (2012). Personalized Medicine Teenagers as a Moving Target : How Can Teenagers Be Encouraged to Accept Treatment ? *277–86*.

Haji, H. A., Suleman, H., & Rivett, U. (2015). Development of a Mobile Image-Based Reminder Application to Support Tuberculosis Treatment in Africa. *International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering*, *9*(8), 522–529. https://www.researchgate.net/publication/303460126

Hoffman, J. A., Cunningham, J. R., Suleh, A. J., Sundsmo, A., Dekker, D., Vago, F., Munly, K., Igonya, E. K., & Hunt-Glassman, J. (2010). Mobile Direct Observation Treatment for Tuberculosis Patients. A Technical Feasibility Pilot Using Mobile Phones in Nairobi, Kenya. *American Journal of Preventive Medicine*, *39*(1), 78–80. https://doi.org/10.1016/j.amepre.2010.02.018

Kemenkes RI. (2015). *Pedoman Nasional Pelayanan Kedokteran Tata Laksana Tuberkulosis*. i–100. https://rspmanguharjo.jatimprov.go.id/wp-content/uploads/2020/02/10.-Pedoman-Nasional-Pelayanan-Kedokteran-Tatalaksana-Tuberkulosis-2013-Dokternida.com_.pdf

Kunawararak, P., Pongpanich, S., Chantawong, S., Pokaew, P., Traisathit, P., Srithanaviboonchai, K., & Plipat, T. (2011). Tuberculosis treatment with mobile-phone medication reminders in northern Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health*, *42*(6), 1444–1451.

Loriana, R., Thaha, R. M., & Ramdan, I. M. (2014). Efek konseling terhadap pengetahuan, sikap dan kepatuhan berobat penderita tuberkulosis paru di wilayah kerja Dinas Kesehatan Kota Samarinda. *Univeristas Hasanudin*, 1–13. http://pasca.unhas.ac.id/jurnal/files/1445b949d295c9486aeb541ca379aefb.pdf

Mohan, P. L., Shaji, S., Ashraf, T., Anas, V. U., & Basheer, B. (2018). Effectiveness of a reminder card system versus a mobile application to improve medication adherence among asthma patients in a tertiary care hospital. *Journal of Taibah University Medical Sciences*, *13*(6), 541–546. https://doi.org/10.1016/j.jtumed.2018.10.001

Musiimenta, A., Tumuhimbise, W., Atukunda, E. C., Mugaba, A. T., Muzoora, C., Armstrong-hough, M., Bangsberg, D., Davis, J. L., & Haberer, J. E. (2020). *Mobile Health Technologies May Be Acceptable Tools for Providing Social Support to Tuberculosis Patients in Rural Uganda : A Parallel Mixed-Method Study*. *2020*.

Nhavoto, J. A., Grönlund, Å., & Klein, G. O. (2017). Mobile health treatment support intervention for HIV and tuberculosis in Mozambique: Perspectives of patients and healthcare workers. *PLoS ONE*, *12*(4), 1–13. https://doi.org/10.1371/journal.pone.0176051

Nisar S, K. P. (2018). Predicting Intentions to Take Medication in Patients with Pulmonary Tuberculosis : Moderating Role of Subjective Norms. *2(9):2–7*.

Nuryati. (n.d.). *Bahan Ajar Rekam Medis dan Informasi Kesehatan: Farmakologi* (Vol. 148). Kementerian Kesehtahatan Republik Indonesia.

Swartzberg K, Adam A, Motara F, L. A. (2017). Case Report A Case of Female Acute Urinary Retention Presenting to the

ED. *2017:2–5*.

Wei X, Hicks JP, Pasang P, Zhang Z, Haldane V, L. X. (2019). Protocol for a randomised controlled trial to evaluate the effectiveness of improving tuberculosis patients ' treatment adherence via electronic monitors and an app versus usual care in Tibet. *1-12*.

WHO. (2018). *WHO: Kasus TBC Indonesia 2017 Terbesar Ketiga Dunia*. https://databoks.katadata.co.id/datapublish/2019/10/09/who-kasus-tbc-indonesia-2017-terbesar-ketiga-dunia

Winarto, A., & Bintoro, T. (2018). Analysis Of The Effect Telephone Counseling By Nurses On The Compliance Of The Control Of DOTS Poly Tuberculosis Patients at Dungus Madiun Lung Hospital. *Journal Of Nursing Practice*, *1*(2), 47–52. https://doi.org/10.30994/jnp.v1i2.33.

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THE UTILIZATION OF MOBILE-HEALTH INTERVENTION IN IMPROVING TREATMENT COMPLIANCE BEHAVIOR IN TUBERCULOSIS PATIENTS: A LITERATURE REVIEW

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32 Erlina Wijayanti, Adang Bachtiar, Anhari Achadi, Ummi Azizah Rachmawati et al. "Mobile application development for improving medication safety in tuberculosis patients: A quasi-experimental study protocol", PLOS ONE, 2022
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Crossref
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tuberculosis treatment: A systematic review with meta-analysis", PLOS ONE, 2019
Crossref

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