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The Effectiveness Of Using Text Messages Reminder On Adherence With Tuberculosis Patients: A Systematic Review

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ABSTRACT
Non-adherence is a factor that inhibits the completion of TB cases globally. Some studies suggest that the use of digital technology in the form of text message reminders can reduce the risk of non-adherence. The purpose of writing this article is to analyze the effectiveness of text message reminders on adherence to tuberculosis (TB) patients. The method in preparing this Systematic review is based on literature studies from various electronic databases, including Scopus, ScienceDirect, ProQuest, and Sage by conducting a comprehensive review using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes) guidelines. The keywords used are "Text Messaging" OR "Short Message Service" AND "medication adherence" AND "tuberculosis". There are 11 original articles with 9 articles using the Randomized Control Trials (RCTs) research method and 2 articles using the Quasy-experimental method that fits the inclusion criteria. The use of text message reminder interventions is effective and can be used as an optional method of increasing adherence to TB patients. This intervention is categorized as an easy, cheap, and flexible intervention. Further research can be carried out in the form of developing a technology-based reminder text message intervention method as an effort to increase adherence to TB patients in Indonesia.

Keywords : Text Messaging, Short Message Service, Medication adherence, Tuberculosis

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BACKGROUND

Pulmonary tuberculosis (TB) is a contagious disease that threatens the health and if it is not immediately treated regularly it can be fatal to death. This disease can attack various organs, especially the lungs which is caused by the bacteria Mycobacterium tuberculosis (CDC, 2016). Pulmonary TB cases are still a public health problem and are a global challenge to date with new tuberculosis cases of 6.4 million, equivalent to 64% of tuberculosis incidents (10.0 million) (WHO Global Tuberculosis Report, 2018). Pulmonary TB cases are increasing every year due to the indiscipline of treatment. The impact is that it results in increased transmission in the community, increased treatment costs, and an increase in the number of TB-MDR (Multi-Drug Resistant) cases(Alipanah et al., 2018). The risk that is accepted with the increasing number of MDR-TB cases, is estimated that by 2050 it can kill as many as 2.5 million people per year (Tuberculosis, 2018).

Non-adherence in TB patients is caused by several factors, namely lack of knowledge, feeling cured, drug side effects, long treatment duration, stigma, and lack of social support (Gebreweld et al., 2018). Prevention of non-compliance requires appropriate and effective strategies such as paying attention to social problems that are inhibiting factors for patients during the treatment process, establishing cooperation and effective communication between care workers and supervising clients directly and indirectly through PMOs, health workers, and families. which acts as a self-reminder in TB clients (Oren et al., 2017 ; Sholikhah et al., 2019). This strategy can be realized with innovation that is easy, accessible, comfortable, flexible, and able to empower clients. Innovation in this digitalization era has led to interventions using technology as an effort to change obedient behavior among TB patients.

Text message reminder is a form of intervention that utilizes digital technology with the use of cell phones. The contents of the text of this message can be in the form of information, motivation, reminders to take medication, reminders of visits to health services that are sent to patients according to the agreed schedule made with health workers. Text reminder messages have been widely applied in several areas of behavior change. The results of a study by Cele & Archary, (2019) on HIV patients in South Africa suggest that SMS-based mHealth interventions have the potential to improve adherence and viral suppression in adolescents living with HIV. This is in line with a study in type 2 diabetes mellitus patients in India which showed an increase in medication adherence and control of glycemia, blood pressure, and lipid profiles in diabetes after counseling the patient combined with a message reminder (Goruntala et al., 2019). Fang et al., (2017) stated that Short Message Service (SMS) is an effective therapeutic strategy for TB patients to improve TB patient treatment management, reduce missed drug doses, reduce the number of interrupted care and increase awareness of returning to health care control.

Evidence-based from some literature on text message reminder interventions, this systematic review was made with the aim of analyzing the effectiveness of using text message reminders to TB patients.

METHODS

The method used in the preparation of a systematic review is to use the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes) statement guidelines. Search for articles through the database Scopus, ScienceDirect, ProQuest, and Sage, using the keywords "Text Messaging" OR "Short Message Service" AND "medication adherence" AND "tuberculosis" OR "pulmonary tuberculosis". The articles

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chosen are original articles published in the last 5 years (2015-2020) with the Randomized Control Trial (RCTs) and Quasy-experimental research methods.
The criteria for the articles we entered in this systematic review were (1) articles related to TB patient compliance, (2) the criteria for the patient were tuberculosis patients, (3) the intervention carried out was the use of text message reminders, (4) The expected results of the study were TB patient compliance. The articles that we publish on this systematic review are (1) articles in the form of systematic reviews, dissertations, theses, and cross-sectional (2) articles that are not related to TB patient compliance.

RESULT

The results of the article search found 280 articles consisting of 24 Scopus articles, 53 Science Direct articles, 112 Proquest articles, and 91 Sage articles. The process of reviewing selected articles consists of three stages, namely reviewing the title, reviewing the abstract, and reviewing the research content. 32 were selected for review from the content of the study, and 12 of the 32 articles were excluded because they were not original articles, in the form of a systematic review, cross-sectional, did not use the RCTs or Quasy-experiment method, and the respondents were not TB patients. 11 articles that matched the inclusion and exclusion criteria were retained. The process of excavating and filtering articles is summarized in Figure 1.

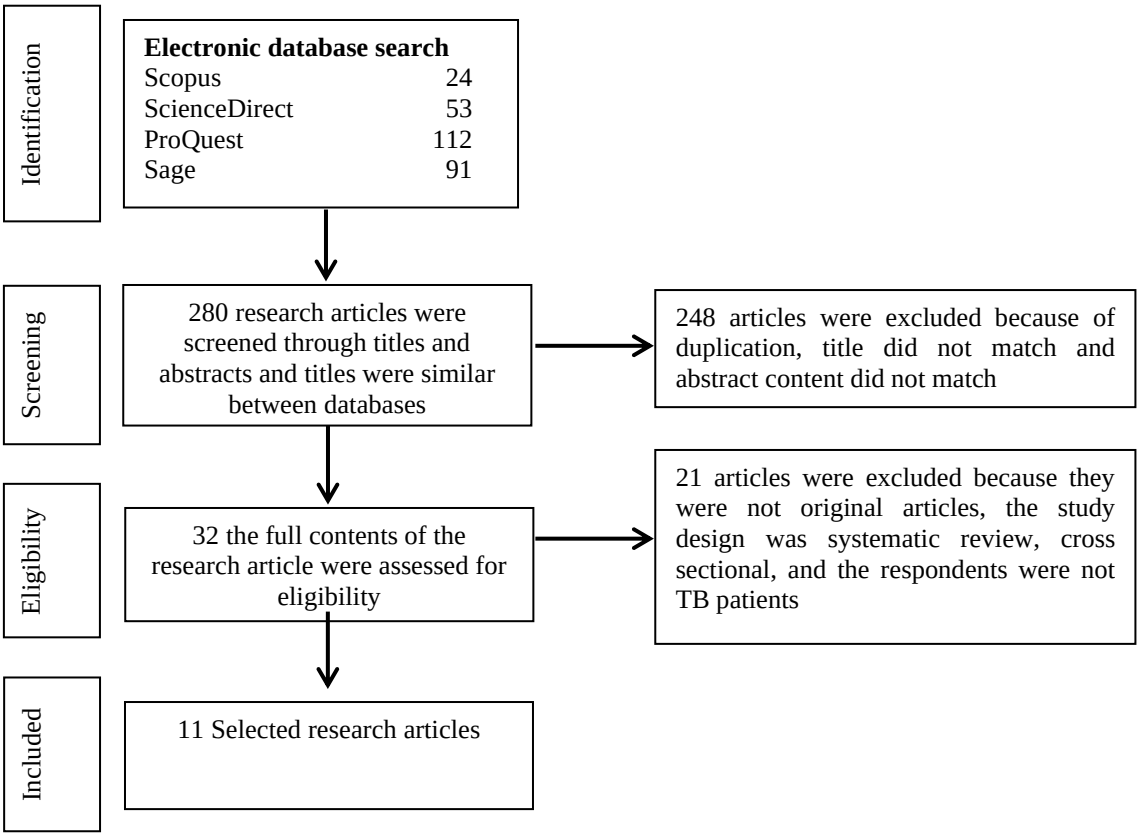

Figure 1. Flow diagram and article selection

The research articles are limited from 2015 to 2020. 1 article was published in 2016, 5 articles were published in 2017, 1 article was published in 2018 and 3 articles were published in 2019. The study design used was 8 articles using the RCTs design and 2 articles using Quasy-experimental. The population in this study was 90-2207 respondents.

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The mean age of the respondents was 18 - 65 years and over. The locations in this study are multi-regional or various countries, namely China, Africa, Pakistan, Saudi Arabia, and Indonesia. The results of the review showed that 5 articles stated that there were significant differences and 5 articles showed no significant effect between text message reminder intervention and conventional DOT intervention on TB patient compliance. The results of this study can be seen in Table 1

Table 1 Characteristics of research articles

Title and Author	Method	Result
Mobile health to improve adherence to tuberculosis treatment in Khartoum state, Sudan (Ali & Prins, 2019) Sudan, Saudi arab	**Design :** RCT **Sample:** 148 patient **Sampling Technique:** *consecutive sampling* **Variabels:** **variable Independent:** SMS reminder **variable Dependent :** TB patient treatment adherence **Analysis:** 1. *Chi-square tests* 2. *logistic regression analysis*	The use of mhealth can increase knowledge, reminders for drug taking, improve medication adherence and increase social support from health workers to patients through two-way communication between patients and health workers.
SMS nudges as a tool to reduce tuberculosis treatment delay and pretreatment loss to follow-up. A randomized controlled trial (Wagstaff et al., 2019) Afrika	**Design :** RCT **Samples:** 649 patient **Variables:** **Variables Independent:** SMS **variable Dependent :** 1. Reducing delays in TB treatment 2. Reducing Loss Follow Up (LFU) **analysis :** 1. *Pearson's χ2 test ofequal proportions* 2. *t-test ofequal mean*	The results showed that SMS can increase and remind TB patients to make visits to the clinic (62%) compared to the control group, namely the results of the analysis were 51% of patients returned to visit the clinic.
The Role Of Mobile SMS-Reminders In Improving Drugs Compliance In Patients Receiving Anti-TB Treatment From Dots Program (Farooqi et al., 2017) Pakistan	**Design :** RCT **Sample:** 148 paient **Sampling Technique:** *consecutive sampling* **Variables:** **Variable Independent:** Mobile *SMS-Reminders* **variable Dependent :** TB patient treatment adherence **analysis :** Chi-square test.	The number of cases of default treatment was lower in the "intervention group" than in the "control group", Treatment-default was found in 7 (4.7%) patients, of these 3 patients (4.1%) were in the "intervention group" and 4 patients (5.4%) were in the "control group", both groups were comparable with no statistically significant difference (p = 0.983).
Impact of a daily SMS	**Design :** RCT	The results of this study

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Title and Author	Method	Result
medication reminder system on tuberculosis treatment outcomes: A randomized controlled trial (Mohammed et al., 2016) Karachi, Pakistan	**Sample:** 2.207 patient **Sampling Technique:** *Simple random sampling* **Variables:** **Variable Independent:** *daily SMS medication reminder system* **variable Dependent :** TB patient treatment adherence **analysis:** 1. *Intention- To-Treat* 2. *the χ2 test* 3. *Least Squares Regressions* 4. *The Bonferroni Correction* 5. *The Less Conservativewestfall And Young Free Step-Down Resampling Method*	indicate that there is no significant difference between the intervention group of SMS recipients and the control group in increasing treatment adherence. With p value = <0.05 1. SMS group p = 0.782 2. Control group p = 0.782
SMS reminders to improve adherence and cure of tuberculosis patients in Cameroon (TB-SMS Cameroon): A randomised controlled trial (Bediang et al., 2018) Cameroon-Afrika	**Design :** RCT **Sample:** 279 **Sampling Technique:** randomised **Variables:** **Variable Independent:** *SMS reminder* **Variable Dependent :** TB patient treatment adherence **Analysis** 1. *T-test and Mann-Whitney tests* 2. *Chi-square* 3. *Fisher's exact tests*	There was no significant difference between the control group and the intervention group with the final outcome, namely at 6 months of treatment, there were 87 patients recovered (63.5%) in the intervention group and 88 (62%) in the control group. With p value = <0.005 The p value of the control group and the intervention group = 0.791 with a value (OR = 1.06 [0.65, 1.73]; p = 0.791).
Effect of Short Message Service on Management of Pulmonary Tuberculosis Patients in Anhui Province, China: A Prospective, Randomized Controlled Study (Fang et al., 2017) China	**Design :** RCT **Sample:** 350 patient **Sampling Technique:** *stratified cluster sampling method* **Variables:** **Variable Independent:** *SMS* **variable Dependent :** Pulmonary TB Management **analysis:** 1. *Shapiro-Wilk test* 2. *t-test or Mann-Whitney U test* 3. *chi-square test*	SMS is an effective therapeutic strategy to improve TB patient treatment management, reduce missed drug doses, reduce the number of interrupted care and raise awareness for return to health care. Complete treatment = the SMS group (96.25%) was

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Title and Author	Method	Result
		significantly higher than that in the control group (86.84%) (c2 = 9.52, P = 0.002). The rate of interrupted treatment and missed dose = SMS group was significantly lower than that in the control group (c2 = 10.41, P = 0.001; c2 = 28.54, P <0.001).
Short message service as an alternative in the drug consumption evaluation of persons with tuberculosis in Malang, Indonesia (Kumboyono, 2017) Indonesia	**Design :** *Quasy-experiment* **Sample:** 90 patient **Sampling Technique:** *probability sampling with simple random sampling* **Variables:** **Variable Independent:** *SMS* **variable Dependent :** TB patient treatment adherence **analysis:** 1. Fisher's Exact test	The results of the Exact Fisher's test with a 95% confidence interval (P-value = 0.059) stated that there was no significant difference between the intervention group and the control group.
Text messaging to decrease tuberculosis treatment attrition in TB-HIV coinfection in Uganda (Hermans et al., 2017) Uganda-Afrika	**Design :** *Quasy-experimental* **Sample:** 485 patient **Sampling Technique:** *Consecutive sampling* **Variables:** **Variable Independent:** *SMS* **Variable Dependent :** TB patient treatment adherence **analysis:** 1. $\chi 2$ or Fisher's exact test 2. modified Intention To Treat (ITT)	The SMS-reminder service is highly rated, and there are no breaches of confidentiality. However, the SMS intervention did not show a significant effect on the short-term risk of Loss Follow Up (LFU) events (RR 0.27, 95% CI 0.03–2.07; P = 0.22).
Effect of Using Mobile Phone Messaging Reminders in Improving Adherence to Treatment of Pulmonary Tuberculosis Patients in Jeddah , During 2016-2017 : A Randomized Control Study .	**Design :** RCT **Sample:** 216 patient **Sampling Technique:** *simple random sampling* **Variables:** **Variable Independent:** *SMS Reminder* **variable Dependent :** TB patient treatment adherence **Instrument:** Patient's adherence self- assessment by	The use of SMS Reminder can improve treatment adherence in TB patients with the result that there is a significant difference in the intervention group. Participants in this study were not bothered by the SMS reminder system, and they recommend using it in the future.

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Title and Author	Method	Result
	(VAS)	
(Alotaibi, 2019) Jeddah-Arab	**Analysis:** 1. *The student's t-test* 2. *Chi-square test* 3. *Fisher's exact test* 4. *Intention-To-Treat Method*	VAS test results with t-test for compliance showed Mean ± SD = 94.3 ± 15.98, p-value = <0.001
Mobile health treatment support intervention for HIV and tuberculosis in Mozambique: Perspectives of patients and healthcare workers (Nhavoto et al., 2017) Mozambique-Afrika	**Design :** RCT **Sample:** 404 patient **Sampling Technique:** **Variables:** **Variable Independent:** *SMS Reminder* **Variable Dependent :** TB patient treatment adherence and Patient HIV **analysis:** 1. *Man-Whitney U test* 2. *Fisher's exact test* 3. *Spearman's Rho correlation test*	Digital technology in the form of SMS is proven to reduce treatment failures, increase medication control appointments, increase patient motivation and can improve communication between health workers and patients
Implementation and effectiveness of evriMED with short messages service (SMS) reminders and tailored feedback compared to standard care on adherence to treatment among tuberculosis patients in Kilimanjaro, Tanzania: Proposal for a cluster randomized controlled trial (Sumari-De Boer et al., 2019) Kalimanjaro - Afrika	**Design :** RCT **Sample:** 336 **Sampling Technique:** **Variables:** **Variable Independent:** *short messages service (SMS) reminders* **variable Dependent :** TB patient treatment adherence **analysis** 1. *(CRF) is pre-programmed* 2. *Redcap (Research Electronic Data Capture)* 3. *t-tests* 4. *χ2 tests* 5. *regression models*	SMS reminders and customized feedback during clinic visits, proven to improve TB treatment adherence and treatment outcomes, and acceptable, feasible, and accurate, can be recommended for standard cards among TB patients in Sub-Saharan Africa.

DISCUSSION

This systematic review is compiled based on the identification of 11 articles with the RCTs and the Quasy-experiments method of analyzing text message reminders on TB patient compliance. Efforts to improve TB patient compliance in the digital era can use an innovative approach to existing ones that are accessible, comfortable, flexible, and able to empower clients. One of the interventions developed from cell phone facilities is text messages that can help convey health information intended for both health workers and patients and families (Ali & Prins, 2019). The intervention was carried out by sending a

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text message reminder to the patient according to the prescribed treatment time. The work of this application is that patients will receive text messages in the form of motivation, reminders to take medication and even reminders of scheduled visits to health care workers who will stop when the patient responds by replying, or calling and even reading the text of the message (Bediang et al., 2018).

The results of a review of 11 journals showed 6 articles explained the increase in TB treatment adherence after being given the intervention and 5 other articles did not. Factors affecting this failure can be caused by the use of an SMS reminder which only allows for one-way communication (Kumboyono, 2017), the inability to verify whether the message reaches the respondent and the possibility of the respondent changing his phone number at any time during the study (Sholikhah et al., 2019). Research using interventions with text message reminders in TB patients is still small in number and even shows that there is no significant effect on TB patients. However, the use and ownership of cell phones in the digital era is growing and increasing. The flexible, always on hand mobile phone makes the nurse-client relationship more interactive. Clients can also easily obtain health information about their disease and can be actively involved in care through nurse-client interactive responses (Efendi & Sari, 2017), reduce missed drug doses, reduce the number of interrupted care and increase awareness for re-control of health care (Fang et al., 2017). Through this interactive relationship, the client and family will feel cared for and be able to increase motivation to adhere to the treatment regimen (Nhavoto et al., 2017).

Two-way communication between patient-health workers improves social support (Ali & Prins, 2019). The use of interventions with text message reminders is categorized as an intervention that is cheap, cost-effective, and removes distance barriers (Farooqi et al., 2017). Short messages or SMS can be used as an approach between health workers and patients to strengthen adherence, awareness and improve health for patients (Chen et al., 2011 ; Putri et al., 2018). This intervention can be redeveloped by health workers as an alternative method of efforts to increase medication adherence in TB patients (Has et al., 2015).

CONCLUSION

The use of text message interventions for TB patients is likely to be applied in Indonesia. The application of this intervention is considered easy, inexpensive, and flexible because this intervention uses cell phones whose ownership is widely circulated in the community so that health workers do not need to buy this instrument. The use of text message reminders can reduce missed drug doses, enable communication between patient-health workers, increase motivation to recover, and increase treatment adherence in TB patients through the reminders sent.

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