

The Internet Based Intervention and Digital Technology Use for Improving Medication Adherence of Patients with Schizophrenia or Another Mental Illness: a Systematic Review

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Abstrak: The purpose of this study is to provide an overview of internet based interventions and digital technology use in patients with schizophrenia or mental illness and their documented outcomes of the medication adherence and relapse prevention. Methods: Databases searched were Scopus, CINAHL, Science Direct, Sage, and Pubmed at the time of publication between 2016 and 2022. The search terms, truncated when relevant, were ("schizophrenia" OR psychosis OR "mental illness") AND ("internet based intervention" OR "online intervention" OR "mobile health" OR telemedicine OR telehealth") AND ("medication adherence" OR "medication compliance"). Eleven peer reviewed intervention studies were reviewed and analyzed. Results: There are eight categories of interventions emerged: telephone intervention, video conference, mobile texting, texting combined telephone, smartphone intervention, texting combined smartphone intervention, web based intervention, and WeChat based intervention. Conclusions: Most of the previous literatures stated that there were significant effects of internet based intervention and digital technology use for improving medical adherence.

INTRODUCTION

Schizophrenia is a chronic, recurrent severe mental illness associated with high levels of disability, and patients usually have poor functional outcomes, most of them inevitably receive long-term treatment with antipsychotics. However, it is very difficult to maintain continuous treatment because of poor medication adherence in patients with schizophrenia. Therefore, improving medication adherence is essential to ensure quality of life and functional outcomes in patients with schizophrenia (Devaramane, Pai, & Vella, 2011; King et al., 2014; Tarutani et al., 2016; Zhu et al., 2020). With significant development in mobile technology, numerous applications (apps) in mobile health (mHealth) have been developed in an effort to deliver healthcare services to even the most underserved populations globally (Yang and Kovarik, 2019).

A growing body of literature sheds light on internet based interventions and digital technology use in mental illness. There is a review explained about digital technology for management of severe mental disorders in low-income and middle-income countries (Merchant, Torous and Rodriguez-villa, 2020). Other reviews focus on automated/semiautomated interventions for treatment adherence in schizophrenia spectrum disorders but included only 1 study with a primary outcome of medication adherence (Kauppi et al., 2014) and focus only on text-message interventions in mental illness and surveys a range of outcomes, including medication adherence (Watson, Simpson and Hughes, 2016). There is a review that examines telemedicine interventions for medication adherence in mental illness (Basit et al., 2020). Our systematic review broadly examines the internet based intervention and digital use on medication adherence in patients with schizophrenia or another mental illness, which the main population primarily is patient with schizophrenia spectrum disorder and another mental illness.

METHOD

Protocol and Registration

The protocol in this study uses the center for review and dissemination and the Joanna Briggs Institute (JBI) Guidelines as a guide in assessing the quality of studies to be summarized (Peters, 2015). JBI critical appraisal tools can also be used when creating Critically Appraised Topics (CAT), in journal clubs and as an educational tool. The JBI used here is the checklist for randomized controlled trials (Joanna Briggs Institute, 2017b) and the checklist for quasi-experimental studies (Joanna Briggs Institute, 2017a) (Hong *et al.*, 2018).

Eligibility criteria

The boundaries of the review question were clearly defined through development of inclusion and exclusion criteria using the PICOS format, which can be seen at table 1.

Table 1. Inclusion and exclusion criteria using PICOS format

Criteria	Inclusion	Exclusion
Population	Studies comprised of schizophrenia, psychosis, or another mental illness	Studies comprised of not schizophrenia, psychosis, or another mental illness
Interventions		Not digital or online intervention
Comparisons	effectiveness	There are no exclusion criteria
Outcomes	medication adherence	Not relevant to medication adherence
Study type	a quasi-experimental design, clinical trial or randomized controlled trial	Systematic or literature reviews, qualitative research, cross-sectional.
Publication type	Peer reviewed original studies	Non peer-reviewed studies

Criteria	Inclusion	Exclusion
Publication years	Since 2016	Pre 2016
Language	English	Language other than English

Information sources

Databases searched were Scopus, CINAHL, Science Direct, Sage, and Pubmed at the time of publication between 2016 and 2021 which was limited by journal source type. Search for articles or journals using keywords and boolean operators (AND, OR NOT or AND NOT) as below were ("schizophrenia" OR psychosis OR "mental illness") AND ("internet based intervention" OR "online intervention" OR "mobile health" or telemedicine or telehealth) AND ("medication adherence" OR "medication compliance").

Study selection

488 articles obtained with the keywords as above in journal source types, research article, which the subjects were medicine, psychology, nursing, and healthcare articles, published in 2016-2021 as seen on (Figure 1). Duplication articles searched by reference manager were 120. The title screened excluded 313 articles, and an abstract review excluded 44 articles, and only 11 articles were suitable with the variables needed which the independent variable was internet based intervention and digital use, and the dependent variable chosen was medication adherence of the patients with schizophrenia or another mental illness.

RESULT AND DISCUSSION

There are 11 studies analyzed, most conducted randomized control trials. The studies categorized into eight themes, which are telephone intervention, video conference, mobile texting, texting combined telephone, smartphone intervention, texting combined smartphone intervention, web based intervention, and We Chat based intervention. There are two studies explain about telephone based interventions, one about video conference intervention, three studies discuss about text messaging interventions, one focuses on combined text messaging and telephone based intervention, one about smartphone intervention, one about web based intervention and one study emphasizes on WeChat ntervention.

The study about phone intervention (Schulze *et al.*, 2019) conducted telephone intervention calls which contains of five moduls for 88 partients with schizophrenia and bipolar disorder (intervention group, N=42; control group, N=46) in three psychiatric hospitals from either day care units or inpatient wards from January 2015 to October 2017 in Germany. Logistic regression analysis of medication adherence rating scales (MARS) showed that intervention group participants were significantly more likely than control group participants to be medication adherent at 6 months. The second phone intervention delivered by (Uslu, 2019) provided a telenursing application that planned weekly Telephone Intervention Problem Solving (TIPS) for 46 patients with schizophrenia

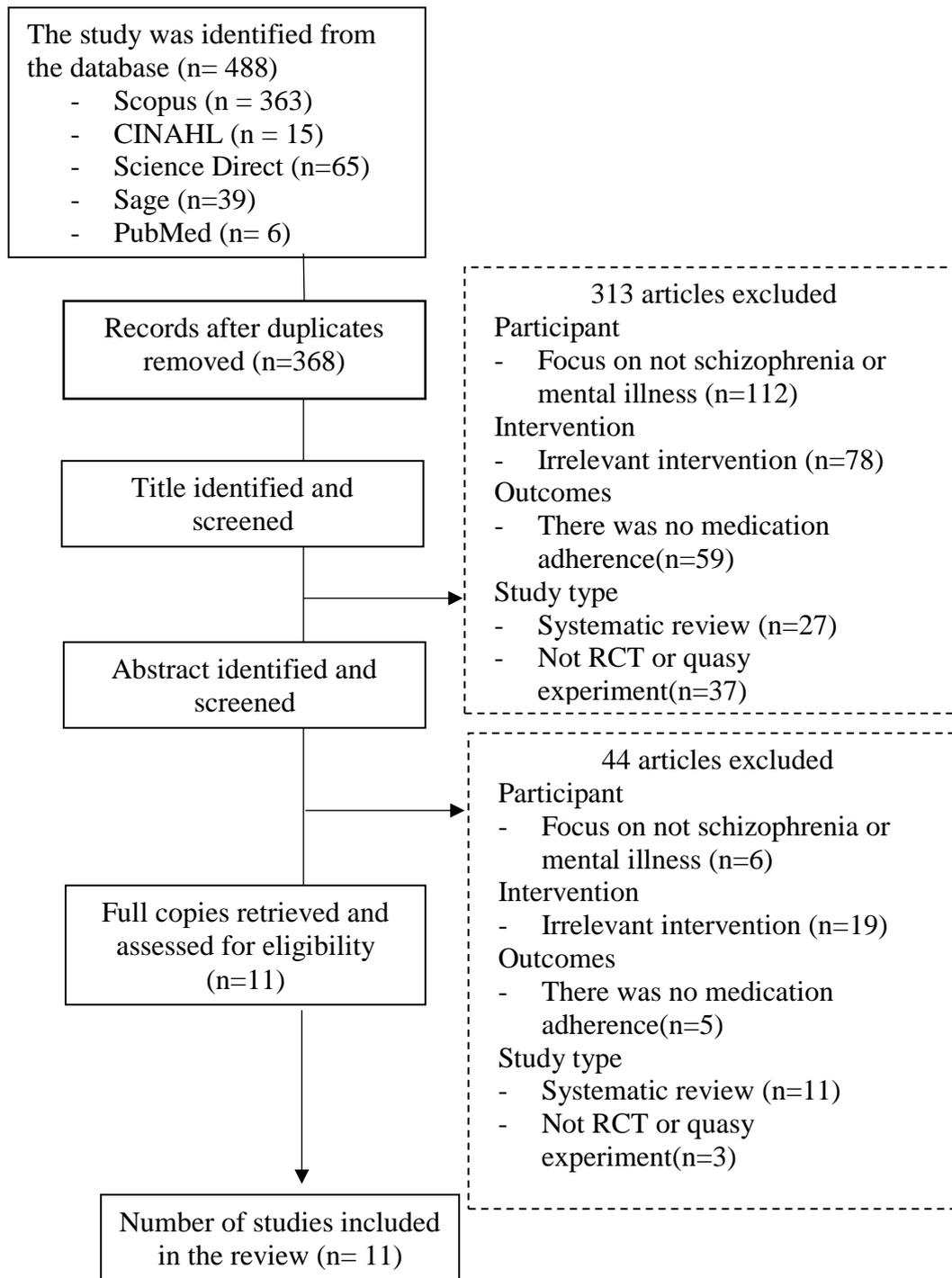


Figure 1. Study selection

randomized in intervention group (n=21), and control group (n=24) in Turkey. After one year intervention, MARS scores were compared within groups after TIPS. A statistically significant decrease in MARS scores was observed for the participants in the control group ($P = 0.001$), whereas a statistically significant increase was observed in the intervention group ($P < 0.001$). In comparisons between the groups after TIPS, however, the MARS scores of the intervention group were statistically higher than those of the control group ($P < 0.001$).

(Junkins *et al.*, 2020) focused on depressive patient with HIV using videoconference in delivering intervention. CBT for depression and antiretroviral therapy adherence (CBT-AD) approach (Safren *et al.*, 2009) using videoconferencing conducted for 6 months. The CBT-AD condition sessions focused on: (1) Life Steps; (2) motivational interviewing exercises to address pros and cons of improving depression and HIV care adherence; (3) behavioral activation designed to increase activities that involve pleasure and mastery; (4) cognitive restructuring, with special attention given to negative automatic thoughts that are related to HIV care adherence; (5) problem-solving, with development of an action plan targeting problems that contribute to depression as well as barriers to HIV care adherence; and (6) relaxation training (teaching of muscle relaxation and diaphragmatic breathing skill). The evaluation showed that both intervention and control group made improvement in medication adherence at 3 months, and 6 months.

The study conducted by (Maritta *et al.*, 2017) about tailored, patient-led SMS intervention, semiautomated 1-way text messages, that content of the 85 text messages designed by both service users and health care professionals, delivered for up to 12 months to people with psychosis of study group (n=563/569) and control group (n=560/570). Contrary to the preliminary assumption, tailored mobile telephone text messages did not reduce patients' use of health services in a psychiatric hospital (ie, readmission rate, the primary outcome). Receiving the text messages did not have any clear effect on time spent in hospital, time between hospitalizations, or number of days in the year that the person was thought to be well (healthy days). The patient medication adherence was not better after the SMS intervention, that shown by the number of readmissions were not lower in the intervention group.

(Sibeko *et al.*, 2017) studied about a treatment partner and text message intervention vs Treatment as usual (TAU). The intervention incorporated TAU with the addition of (1) a treatment partner contracting and psychoeducation session and (2) text message reminders of clinic appointments. The study conducted to 77 participants with severe mental illness in Cape Town, South Africa, randomized as intervention group (42) and control group (35). After 3 months, treatment adherence which measured use Medication Adherence Rating Scales (MARS) were similarly low in both groups.

(Roman *et al.*, 2019) examined the text message intervention in improving medication adherence, symptoms, and functioning among people with schizophrenia in a resource-poor community in rural China. 278 patients with schizophrenia was involved, which each intervention and control group was 139 patients. The intervention group received nationwide community-based mental health program that provided free antipsychotic medications and also LEAN (Lay

health supporters, E-platform, Award, and iNtegration), a program that featured recruitment of a lay health supporter and text messages for medication reminders, health education, monitoring of early signs of relapses, and facilitated linkage to primary healthcare, and the control group received nationwide community-based mental health program that provided free antipsychotic medications only. Medication adherence (proportion of dosages taken) assessed by 2 unannounced home-based pill counts 30 days apart at the 6-months endpoint. Medication adherence measured by the unannounced home-based pill counts was 27% greater in the intervention group (0.61) than in the control group (0.48).

A study conducted by (Rosen *et al.*, 2017) examined a Telephone Care Management (TCM) on treatment adherence and clinical outcomes among veterans with Post Traumatic Stress Disorder (PTSD) in . Participants randomly assigned to usual care (n=165) received regular care from their counselors or psychiatrists. Participants in the TCM arm (n=182) received usual care augmented by fortnightly telephone monitoring and support during their first three months of treatment. The telephone monitoring intervention was delivered from a centralized call center by clinical psychology graduate students supervised by a clinical psychologist. If participants did not answer the telephone, the care manager left a message and toll-free call-back. Telephone care managers followed a semiscripted protocol to assess participants' treatment attendance, medication compliance and side effects, symptom severity (PTSD, depression, and anger. Telephone care managers verbally reinforced positive behaviors, such as using coping skills or adhering to treatment. They provided brief problem-solving support or motivation enhancement to help address behaviors that could interfere with treatment, such as missing appointments, misusing substances, or not communicating concerns to provider. During the three-month intervention period, participants in the TCM condition completed 43% more mental health visits (5.966.8) than did those in usual care (4.164.2). More specifically, veterans in the TCM condition completed significantly more sessions of psychotherapy for PTSD (3.165.2) than did those receiving usual care. Nearly half of the usual care participants (47%, N=77) completed no PTSD psychotherapy visits, compared with 35% (N=67) of those receiving TCM. Yet, few participants in either the TCM (15%, N=29) or the usual care (10%, N=16) conditions completed eight or more sessions of psychotherapy for PTSD during the initial three-month period. The number of PTSD psychotherapy visits or other mental health visits in the nine month postintervention period did not differ by condition.

(Id *et al.*, 2019) conducted a pre post test design to test a software application called A4i. The participants were 38 patients with schizophrenia spectrum disorder received a software intervention consisted of two main types of features: real-time features such as the newsfeed and offline features such as the toolkit and voice detector. A4i functionality included (i) addressing social isolation through personalized prompts, scheduling of activities, and connections to a range of resources relevant to social engagement. (ii) Fostering engagement in the recovery process through evidence-informed content that made suggestions and provided resources relevant to coping with psychosis symptoms, negative symptoms of schizophrenia, cognitive challenges, motivation and anxiety as relevant to the individual. With that outlier removed, there was a significant pre-

post improvement in the Brief adherence Rating Scales (BARS) adherence scores ($p = .03$; $d = 0.21$) however this improvement needs to be interpreted with caution due to the outlier issue, the ceiling effect on this measure, and its' not remaining significant after controlling for multiple comparisons.

The pre post test design study conducted in patients with schizophrenia (Kreyenbuhl *et al.*, 2019) showed that smartphone use can improve medication adherence. Seven patients with schizophrenia received a smartphone intervention based (MedActive) for two weeks trial (range for 14 to 18 days). MedActive consists of an android-compatible smartphone application that reminds individuals to take their antipsychotic medications, stores and tracks information about their self-reported medication adherence, positive psychotic symptoms, and antipsychotic side effects, and allows them to research topics regarding schizophrenia and antipsychotic medications. Participants were contacted on days 2 and 7 of the 2-week study period to troubleshoot any difficulties with the phone or app. If a participant did not respond to any of the adherence, symptom, or side effects EMAs over any 2-day period during the trial, they were contacted by the research staff. The result showed participants self-reporting taking their antipsychotic medication in 100% of adherence by ecological momentary assessments (EMAs) to which they responded.

A Randomized Controlled Trial conducted by (Lobban *et al.*, 2017) for assessing feasibility and acceptability of Web-Based Enhanced Relapse Prevention for Bipolar Disorder (ERPonline). The study involved a total of 96 people with bipolar disorder were randomized (49 to wait list (WL), 47 to ERPonline). The intervention provided online on ERPonline site and included feedback on content of draft modules, user testing of the ERPonline website, and providing video and case material of lived experience which are integral parts of the intervention site. The aim of the intervention was to help people develop a coherent working model of their mood changes, recognize and manage triggers and EWS, and develop coping strategies to manage these effectively. Each module included information, suggested strategies, and case examples. Users interacted with the site to input personal information relevant to their own triggers, EWS, and coping strategies. These informed an individualized staying well plan. The site also provided signposting to additional formal and informal support. Participants were free to choose the order they visited modules (although they were listed in logical order), and were invited to involve a supporter of their choosing. Each module included recommendations of how the supporter could be involved in relapse prevention. All participants continued to receive any other treatment as usual throughout the study. The measurement after 24 weeks and 48 weeks follow up showed that medication adherence was high (indicated by high score on the MARS) throughout the study and did not differ between groups.

(Zhu *et al.*, 2020) developed a mobile health application-based strategy for enhancing adherence to antipsychotic medication that conducted in patients with schizophrenia in China. The randomized control trial delivered to 42 patients with schizophrenia in intervention group and 42 patients in control group. Participants in the WeChat group received WeChat reminders for taking medication 2–4 times a day and WeChat public account education messages once a week, for six months using the WeChat platform. Four WeChat subgroups were established based on the

discharged patients' medication time. The first subgroup took medication in the morning, noon, afternoon, and evening; the second subgroup took medication in the morning, noon, and afternoon; the third subgroup took medication in the morning and afternoon; and the fourth subgroup took medication in the morning and evening. The researcher sent the medication reminder message "Please remember to take your medicine" to patients in the WeChat group in the morning between 8:00 and 8:30, at noon between 11:00 and 11:30, in the afternoon between 16:00 and 16:30, and in the evening between 20:00 and 20:30. Patients were asked to reply to the reminder if possible. The content of the educational message was divided into four modules, including symptom management, medication management, cognitive rehabilitation, and psychosocial strategies. The WeChat group (month 3, $M = 1.43$, $SD = 0.55$; month 6, $M = 1.31$, $SD = 0.56$) had significantly greater medication adherence than the control group (month 3, $M = 2.09$, $SD = 0.62$; Month 6, $M = 2.64$, $SD = 0.58$) at both three and six months.

Discussion

The eleven studies involved total of 2019 participants, primarily patients with schizophrenia, bipolar, and psychosis. Most of the digital studies discuss digital based interventions show the medication adherence improvement among the patients. The two studies on telephone based interventions both present the Medication Adherence Rating Scales (MARS) scores of the intervention group are statistically higher than those of the control group. Contrarily the two studies about text messaging interventions doesn't give better impact, which proven by the evidence that the medication adherence were not better after the interventions. Nevertheless, a mobile texting based intervention (LEAN) conducted in patients with schizophrenia show that the medication adherence was 27% greater in the intervention group than in the control group. Moreover, a study of texting combined phone intervention in patients with bipolar shows better treatment adherence than the control group in three months, but the adherence to complete therapy sessions wasn't significantly differ than the control group. It is suggested that the telephone intervention as a two way communication could be better choice to develop intervention to improve medication adherence.

A study focused on depressive patient with HIV using videoconference describes both intervention and control group make improvement in medication adherence. A smartphone intervention based (MedActive) shows that participants self-reporting taking their antipsychotic medication in 100% of adherence by ecological momentary assessments (EMAs) to which they responded. Web-Based Enhanced Relapse Prevention for Bipolar Disorder (ERPonline) shows medication adherence was high. The WeChat group has significantly greater medication adherence than the control group. Besides the phone intervention, the evidence is leading us to consider the videoconference treatment, smartphone intervention, web based intervention, and also WeChat intervention as alternatives for improving medication adherence among patients with schizophrenia or another mental illness. Eventhough this study has limitations, that the sample sizes are vary and the measure outcomes of medication adherence are not similarly between studies, but

the themes presented can give another horizons a consideration for improving future clinical research especially in schizophrenia or mental illness management.

CONCLUSION

Most of the eleven studies show there were significant effects of internet based intervention and digital technology use for improving medical adherence of patients with schizophrenia or another mental illness.

SUGGESTION

Based on the result of the review, the writers suggest that the next researcher should do other deepest review about one of the theme has been explained.

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