An educational mobile application-based strategy for schizophrenic family caregiver in Indonesia: The pilot study

Amar Akbar
Bina Sehat PPNI University
Mojokerto, Indonesia

ABSTRACT:

- **A mobile health app improves medication adherence in patients with schizophrenia.**
- **A mobile health app improves quality of life in patients with schizophrenia.**
- **A mobile health app has advantages of convenience and efficiency.**

KEYWORDS Mobile app, Schizophrenic family caregiver, Interventional study

Background

Schizophrenia is a chronic, recurrent severe mental illness associated with high levels of disability, and patients usually have poor functional outcomes (Devaramane, 2011). Most patients with schizophrenia inevitably receive long-term treatment with antipsychotics (King et al., 2014). However, it is very difficult to maintain continuous treatment because of poor medication adherence in patients with schizophrenia (Tarutani et al., 2016). Velligan et al. (2009) indicated t'at approximately 50% of outpatients with schizophrenia could not adhere to antisychotic drug treatment. Aprevious study suggested that medication adherence was related to relapse, rehospitalization, and suicide attempts in patients w,' schizophrenia (V~lim~ki et al.,2013). Furthermore, adherence to medication ·&ald reduce hospitalization risk (Jiang and Ni, 2015) and improve functional o comes (Hayhurst et al., 2014) for patients with schizophrenia. Therefore, improv, ·g medication adherence is essential to ensure quality of life and functional outcme, in patients with schizophrenia.

Lack of medical staff supervision, side effects, and strong stigma may be the key risk factors for poor medication, adherence (Tham et al., 2016). Taking these risk factors into account, methcls 1or enhancing medication adherence can be grouped into educational and b'avioral strategies (Greenley et al., 2013). Currently, media technologies have been verified as useful tools for performing educational and behavioral strategies to manage diseases such as diabetes, hypertension, and depression (Gabarron and Wynn, 2016). As a representative media technology, short message service (SMS) has been widely used in health care and disease management (Shi et al., 2013). Although studies have shown that SMS-based strategies could improve treatment adherence in patients with AIDS (Lester et al., 2010) and enhance adherence to antipsychotic medication among patients with schizophrenia (Montes et al., 2012), in recent years, these have been gradually replaced by mobile messaging software in many areas because of intergenerational replacement of modem social tools (Li et al., 2016). Debon et al. (2019) indicated that mobile health applications (mHealth APP) could promote adherence to treatment and change the lifestyle of patients with chronic diseases. A mobile-based digital health intervention has been found to improve motivation and quality of life in patients with schizophrenia (Schlosser et al., 2016; Schlosser et al., 2018). Combining commercially available mobile health applications and theoretically based, soc' ·edia-delivered health interventions may promote certain physiological, ps /cn, social, and quality of life outcomes among breast cancer survivors (Zachary ' al., 2019). In addition, such applications have been used to deliver or recei' e cre by health-care professionals, patients, and caregivers (Phongtankuel et · .1.,)f' 18). Significantly, all of these studies showed that the use of mobile r.cations could improve clinical outcomes effectively (Bacigalupe, 2011).

WeChat (Tencent Ltd., Shen: ne,, China) is a popular smartphone-based social media application similar to Fa et, ·k, Twitter, and WhatsApp, which currently has 600 million active users ou of its 1.12 billion registered users. The application has a multifunctional back round interface that allows service

providers to deliver texts, voice recordings, videos, and images online to all subscribers without limitations of time and space. A WeChat-based intervention has more advantages than face-to-face interventions by improving the accessibility of intervention programs, solving the difficulty of transportation and distance during the intervention, and expanding such programs to remote areas. Many studies showed that WeChat-based health educational programs were effective in improving adherence to treatment and increasing follow-up rates in patients with chronic illnesses (Feng et al., 2017, Zhang et al., 2020). Jiang et al. (2020) found that a WeChat-based pulmonary rehabilitation strategy had better effects on improving self-efficacy and quality of life and alleviating symptoms in patients with chronic obstructive pulmonary disease (COPD) compared with face-to-face intervention. Based on the advantages mentioned above, WeChat-based clinical teaching (Zeng et al., 2016), health education and disease management (Kang et al., 2016) have been widely used for clinical treatment and nursing. Wang et al. (2017) used WeChat as an educational platform to deliver health education, which linked patients to their health providers Ho.ever, the effects of a WeChat-based intervention consisting of medication .minders and educational messages on adherence to antipsychotic medication ve not to date been evaluated on discharged patients with schizophrenia.

Therefore, this study aimed to evaluate tl, ettects of a WeChat-based intervention in discharged patients with schizophren, over the course of the study by comparing differences between the WeChe: an' control groups in medication adherence and quality of life at three- :na smx-month follow-ups. We hypothesized that a WeChat-based intervent,n onsisting of medication reminders and educational messages could effen.ly improve medication adherence and quality of life in discharged patients w 'h schizophrenia.

Method

Inclusion and exclusion criteria

2.1 Participants

A total of 84 discharged patients were recruited from a mental health center in Mojokerto, East Java Province, Indonesia from June 2022 to August 2022. Participants were considered for inclusion if they met the established criteria, namely, 1) aged 18-60 years; 2) had a confirmed diagnosis of schizophrenia that was based on a structured clinical interview in accordance with the International Classification of Diseases and Related Health Problems 10" revision (ICD-10) (Sheehan et al., 1998); 3) can use WeChat properly in an Android or iOS smart mobile phone; 4) finished primary school education; 5) psychiatric symptoms that were in remission if Pl, P2, P3 items from positive symptoms, Nl,

N4, N6 items from negative symptoms, and G5 and G9 items from general psychopathology symptoms scores were 3 or below in the Positive and Negative Syndrome Scale (PANSS; Van et al., 2006); 6) were receiving short-acting antipsychotics. Potential participant w.re excluded from the present study if they suffered from any organic disorder, nervous system disorders, severe somatic disorders, mental retardation, or substance-related disorders, were pregnant or lactating, or were participating in other clinical trials.

2.2 Sample size

This study was a two-group, randomized controlled trial. The primary outcome was medication adherence. The san le size was calculated using Gpower (version3.1.9.2). Assuming a type e1,r probability of a = 0.05, power of 1 -3= 0.8, two groups, and three time points, a sample size of 70 subjects was sufficient to atta, • medium effect size (Cohen's f=0.25) for a two-sided, repeated-measure analysis of variance (ANOVA) (Selya et al., 2012). Assuming a potential loss to follow-up, a total sample size comprising at least 84 subjects was estimated.

2.3 Procedure

The statistician used a random number table to generate random sequences comprising 84 random numbers. Thereafter, the project leader randomly assigned the subjects to either the control group or the WeChat group (according to 1: 1, control: WeChat group). Three random allocation tables were separately placed in a sealed, opaque envelope and kept in triplicate by the statistician, project leader, and project manager who did not participate in the trial. The participants were recruited immediately following discharge by a psychiatrist according to the inclusion criteria. The participants were numbered from 1 to 84 according to the discharge order of patients by the researcher.

Medication adherence and quality of life were assessed by a psychiatric nurse at baseline, three months and six months. The psychiatric: nurse was blinded to the randomized assignments. All the researchers who pated in the trial received combined training, including information regard ng inclusion and exclusion criteria, evaluation methods, and the intervention prior to the study. The study was approved by the Institutional Ethics Bina Sehat PPNI University. All participants and their guardians written informed consent prior to enrollment in the study. If any of the criteria were met during the recruitment, the participant was withdrawn 1co,, the study. Rehospitalization was considered as study endpoint beyond we, patients were no longer eligible to continue in the study.

Rehospitalization «as clinically indicated for patients presenting with relapse/recurrence significant psychotic symptoms, dangerous or violent behavior, or deteriorated functioning, who were also not responding adequately to outpatient treatment (Lehman et al., 2004).

2.4 Intervention Program

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 (Table 1). 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.

For the WeChat public account, participants in t're VeChat group were instructed to subscribe to the WeChat official account, "enta1 Rehabilitation." The WeChat public account's educational message wa, updated by the researcher between 10:00 and 10:15 every Saturday morning. he content of the educational message was divided into four modules, includ'.. o symptom management, medication management, cognitive rehabilitation, and ps, ho-social strategies. The WeChat group members were asked to leave thei. cements at the bottom of the article after reading each educational message lL '! researcher's phone was also added to the receiver lists to monitor sending the 1 minders. Contents were in Chinese (Fig. 1). Participants in the WeChat group could access the educational contents from the menu on the conversation interface. The WeChat public account was unavailable for public subscription to prevent contamination of patients in the control group.

Participants in the control group only received treatment as usual and a telephone service such as medications, symptoms twice a month for six months (Table 2).

2.5 Assessment

2.5.1 Primary outcome

Medication adherence: The Medication Adherence Questionnaire (MAQ) was used to assess medication adherence of patients with schizophrenia

(Adelufosi et al., 2012). The MAQ was a structured, self-reported medication adherence measure containing four items. The four self-rated items are as follows: 1) Do you ever forget to take your medicine? 2) Are you careless at times about taking your medicine? 3) When you feel better, do you sometimes stop taking your medicine? 4) Sometimes, if you feel worse when you take your medicine, do you stop taking it? It ir a s ·lf-rated questionnaire that consists of four questions with yes/no answers. W'ten 'he answer is "yes,'a score of l is recorded. The total score ranges from 0 (good a'herence) to 4 (poor adherence) (Vikas et al., 2018). The MAQ presented a hig'. nternal consistency reliability and good convergent validity (Morisky et al., 1

2.5.2 Secondary outcome

Quality of life: The Chinese ers n of the Schizophrenia Quality of Life Scale (SQLS) was used to asses tne quality of life of discharged patients with schizophrenia because of , good validity and reliability (Wilkinson et al., 2000). This instrument 's a sel -rated scale including 30 items in three domains, namely, psychosocial (15 its), motivation and energy (7 items), and symptoms and side effects (8 items). All items are scored on a five-point Likert scale (0 = never, 1 = rarely, 2 = sometimes, 3 = often, and 4 = always), except for four items (items 12, 13,

15, and 20), which are reverse coded. The score of each subscale is 0-100, in which a low score represents good quality of life, whereas a high score indicates poor quality of life (Li et al., 2003).

2.6 Data analysis

All statistical analyses were performed using SPSS software, version 22.0 (IBM SPSS Inc., Chicago, IL, USA). The intention-to-treat (ITT) sample included every originally randomized (to either the WeChat or the control group) subject, regardless of subsequent protocol deviation or follow-up attrition. Missing data were handled with mean substitution and imputed by SPSS software. All analyses were conducted on the ITT sample.

Descriptive statistical analyses were performed on sample ..:haracteristics; categorical variables were described as percentages, quantitative v riau'es as mean ± standard deviation (SD). The chi-squared test was used to co.pa e the categorical variables between the WeChat and control groups at baselne, and independent samples t-tests were used to compare all outcome variable between the two groups at baseline. Repeated-measure ANOVA was condnc, d to determine interactions between time points (baseline, and months three an six) and groups (WeChat and control). Partial eta-squared was used to describe 'he magnitude of effect sizes in this trial (small =

0.01; medium = 0.06; lan,e .., 0.14) (Richardson et al., 2011). A two-tailed

significance level of 95¾. wa: considered for all analyses. The statistical significance level was set at P <0 0.

3. Results

3.1 Sample characteristics

A total of 106 patients were assessed for eligibility. Sixteen patients refused to participate, six patients were excluded, and 84 participants (control group: n = 42; WeChat group: n = 42) provided written informed consents. Three patients were unable to continue the trial due to rehospitalization (control group: n = 2; WeChat group: n = 1) and two patients (control group: n = 2) refused to participate in the

follow up assessment (Fig. 2). According to medical records, three patients were re-hospitalized due to relapse, which met the criteria for schizophrenia relapse used by -Oc;ok et al (2006). There were no significant differences in the proportion of patients who dropped out of the trial between the WeChat and control groups at each

time point (= 0.000, p = 1.000 and p = 0.241 for three and six months,respectively).

No substantial sociodemographic or major clinical differ rces existed between the WeChat and control groups (Table 3). At baseline, no sign ficant differences were observed between the two groups for MAQ, SOLS ttal, psychosocial-domain, motivation/energy-domain, and symptom/side ef' ct-'omain scores (Table 5).

3.2 Primary outcome: medication adherence

Significant differences in medicati :z dherence were found between groups (F =28.087, p <0.001, 1,=0.255), an& within time (F= 112.871, p <0.001, 1, = 0.579), and both effects had large effct ·es. There was also a significant group and time interaction for medication therence (F = 28.726, p <0.001, 1, = 0.259), with a large effect size (see Table 4 a."ig. 3). The WeChat group (month 3, M = 1.43, SD =0.55; month 6, M = 1.3 1, ½u = 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 (Table 5).

3.3 Secondary outcome: quality oflife

3.3.1. SQLS total score

Significant differences in SQLS total score were found between groups (F = 29.546, p

<0.001, np2 = 0.265), and within time (F = 259.885, p < 0.001, np2 = 0.760), and

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both effects had large effect sizes. There was also a significant group and time interaction for SQLS total score (F = 102.225, p < 0.001, np2= 0.555), with a large effect size (Table 4 and Fig. 4a). The WeChat group (month 3, M = 76.87, SD= 9.82; month 6, M = 74.23, SD= 10.21) had significantly greater SQLS total score than the control group (month 3, M = 82.03, SD= 8.75; month 6, M = 103.01, SD= 9.83) at both three and six months (Table 5).

3.3.2. Psychosocial-domain score

Significant difference in psychosocial-domain score was fou d between groups (F=4.317, p <0.05, 1p2 = 0.050), with a moderate eff ct ice; Significant difference in psychosocial-domain score was found within tie F = 46.195, p < 0.001, 1p2 =0.360), with a large effect size; There was pficant group and time interaction forpsychosocial-domain score (F = 27.75,p 0.001, 1p2 = 0.253), with a large effect size (Table 4 and Fig. 4b). The WeChat ,_;roup (month 6, M = 27.88, SD= 4.62) had significantly greater psychosoci: I- Iain score than the control group (month 6, M=33.50, SD = 4.84) at six mon,·s (1able 5).

3.3.3. Motivation- and eere y-domain score

Significant differenc. in motivation- and energy-domain score was found between groups (F = 68.349, p <0.001, 1p2= 0.455), with a moderate effect size; Significant difference in motivation- and energy-domain score was found within time (F =263.589, p <0.001, 1p2 = 0.763), with a large effect size; There was significant group and time interaction for motivation- and energy-domain score(F = 89.529, p < 0.001, np2 = 0.522), with a large effect size (Table 4 and Fig. 4c). The WeChat group (month 3, M = 31.63, SD= 5.02; month 6, M = 30.36, SD= 6.18) had significantly greater motivation- and energy-domain score than the

control group (month 3, M = 34.88, SD = 6.50; month 6, M = 49.68, SD = 5.37) at both three and six months

(Table 5). Appendix

3.3.4. Symptom- and side effect-domain score

Significant differences in symptom- and side effect-domain score were found within time (F = 29.296, p < 0.001,np2= 0.263), and group and time interaction (F = 19.927, p < 0.001, np2= 0.145), and both effects had large effect sizes. However, there was no significant difference in symptom- and side effect-dorna, score between groups (F

= 0.995,p =0.321, np2 = 0.012) (Table 4 and Fig. 4d). 1'e VeChat group (month 6, M= 16.08, SD = 4.65) had significantly greater s mm,tom- and side effect-domain score than the control group (month 6, M = 19.8, SD = 5.44) at six months (Table 5).

3.4 Secondary outcome: rehospitalization r

The WeChat Service did not signifiantly decrease the hospitalized rate at the end of the intervention (=0,df=1,p=1.'00).

3.5 Participation of WeChat public account

A total of 41 participants WeChat group read all the WeChat public account's educational messages a' commented on the posts.

4. Discussion

Medication adherence is a key risk factor for relapse that has a negative effect on functional outcome in patients with schizophrenia (Yalarnova, 2015, Zhou et al.,

2014). Patients with schizophrenia take antipsychotics for a long time, with inevitable side effects that include extrapyrarnidal side effects, weight gain, diabetes rnellitus, dyslipidernia, prolactin increase, somnolence, and so on, which are key risk factors in reducing or stopping antipsychotic drugs without authorization for discharged patients.

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Phan et al. (2016) suggested that discharged patients exhibited decreased adherence over time because of symptom improvement, which can be attributed to the patients' misperception of schizophrenia, as well as adverse side

effects. Therefore, professional and timely medical assistance is especially important for discharged patients. Compared with previous studies, our WeChat-based intervention program not only overcomes the limitations of time and space, but also integrates education and behavior strategies. We believe that the WeChat-based intervention program is worthy of promotion and application in the field of rnu' illness management because of its convenience and timeliness.

We found that the standardized WeChat-based n eaation reminder and personalized educational message on the WeChat public z·count effectively improved medication adherence and quality of life in disch ged patients with schizophrenia. As an educational strategy, the educational n, ssage on the WeChat public account delivered knowledge about diseases, 'gs and rehabilitation to optimize patient acknowledgement of illness. th eby allowing them to better manage their disease, which could account fo:.. th... improvement in medication adherence in discharged patients with schizor are ia. In addition, the medication reminder programs based on behavioral learning heory may be effective strategies to enhance medication adherence (Greenley et al., 2013, Brannon et al., 2013). Based on behavioral learning theory, medication reminders sent 2-4 times per day aimed to increase medication adherence by modifying patient behavior through the use of external stimuli. Once the behavior of taking medication is maintained, the habit is acquired. Our study suggests that medication reminders should be useful for patients who frequently forget to take their medication owing to a lack of a prompt reminder service.

Another important finding was that the SQLS and motivation/energy dimensions

significantly improved at three and SIX months; the psychosocial-domain and symptom- and side effect-domain significantly improved at SIX months. The educational message may explain the improvement in motivation/energy dimensions of quality of life among patients in the WeChat group. The content of the educational message included setting life goals, increasing mental resiliency, gaining educational information on schizophrenia and its treatment, preventing relapse, managing symptoms, and improving social relationships. The message not only guided patients to deal with negative emotions, but also encouraged the" initiate certain daily activities like housework and cultivated their motivaton 'hrough social activities. In

addition, WeChat has a multi-functional backgron interface, which can not only support multi-group chat, but friends can also 'e dded through the WeChat code

search. Although the WeChat platform in ''. s'dy was only used to send medication reminder messages and WeChat pu lic account education messages through which the group members did not intent, they could have added friends through the WeChat code search. If they di' tl·, they could have shared information about mental rehabilitation and support' each other emotionally. This would have potential for peer support. Several pre • us studies showed that peer support had positive effects on reducing the sev.rny of symptoms, improving

quality of life, motivation, energy, hope and self-efficacy in patients with severe mental illness (Firmin et al., 2015; Fortuna et al., 2018).

Our study has several limitations. First, there is no gold standard for measuring medication adherence. Self-reported adherence assessment is the commonly used approach because of the low cost and easy implementation in a variety of settings (Garfield et al., 2011). However, this method of assessment may introduce bias due to social desirability and inaccurate recall, resulting in overestimation of adherence

(Nguyen et al., 2014). The objective measures of medication adherence such as pill counting and electronic monitoring can accurately record the number, dose, and interval of medication (McClintock et al., 2020). However, the accuracy of the objective measurement of medication adherence relies on the assumption that the patients really take the medicine, and that there are no hidden or lost pills. Future research should try to combine objective and subjective measures of medication adherence to improve reliability of research conclusions. Second, all subjects were from one mental health center, which limits the generalizabity of the findings. Third, we recruited discharged patients with schizophrenia 'n + mission. Hence, we could not generalize our findings to patients with acute ex erbation of schizophrenia who may lack insight into their illness and cannot b .ne,t from an intervention program based WeChat. On the other han ', fr patients with acute exacerbation of schizophrenia, it is more important th t caregivers identify the signs of the onset of the disease and make timely co.tact with psychiatrists for medical treatment. Furthermore, it may be a good 'ea to implement a WeChat-based intervention program for caregivers to xplore the effects of these interventions. Finally, lack of longer follow-up, the du, on of the benefits is unknown, this is important because discharged patients . itn schizophrenia require long-term maintenance therapy.

5. Conclusion

WeChat is a convenient social media tool which is viable and easy to use. This WeChat-based intervention consisting of medication reminders and educational messages suggests significant advantages for remotely improving medication adherence and quality of life in discharged patients with schizophrenia.

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Author Contact

Asst.Prof. Amar Akbar, S.Kep. Ns.M.Kes.Ph.D
Email: amarstikesppni@gmail.com
The Postdoctoral Fellow Mahidol University
Email: amar@student.mahidol.ac.th