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Effectiveness of Sajie Care Application in Reducing Stress: A Quasi-Experimental Study

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ABSTRACT

This study evaluated the effectiveness of the Sajie Care mobile application in reducing stress among caregivers of individuals with schizophrenia. A quasi-experimental pretest–posttest control group design was conducted with 64 caregivers in Labakkang Sub-district, South Sulawesi, Indonesia. Participants were divided into an intervention group using the Sajie Care app (n = 32) and a control group receiving leaflet-based psychoeducation (n = 32). The three-month intervention integrated stress management education, Spiritual Emotional Freedom Technique (SEFT) therapy, medication reminders, and peer support. Stress levels were assessed using the Indonesian version of the Perceived Stress Scale (PSS-10). The intervention group showed a significant reduction in mean stress scores from 17.84 to 13.06 ($p < 0.001$), while the control group showed a smaller, non-significant change (16.84 to 15.75; $p = 0.070$). Between-group analysis confirmed significant differences at posttest 3 ($p = 0.014$). These findings indicate that Sajie Care effectively reduces caregiver stress and enhances coping capacity compared to conventional psychoeducation. The study demonstrates the potential of culturally adapted mobile health interventions as accessible, sustainable tools to strengthen community-based mental health services in low-resource settings.

Keywords
Caregiver
Effectiveness
Literacy
Schizophrenia
Stress

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Introduction

Mental health has emerged as one of the most pressing global public health challenges of the 21st century. The United Nations, through the Sustainable Development Goals (SDGs), specifically Goal 3 "Ensure healthy lives and promote well-being for all at all ages", emphasizes that mental health is inseparable from overall health and sustainable human development [1], [2]. Yet despite this recognition, mental health services remain fragmented and under-resourced, particularly in low- and middle-income countries. Schizophrenia, a chronic and severe mental disorder characterized by distortions in thinking, perception, emotions, language, sense of self, and behavior, represents one of the most burdensome conditions globally [3]. The World Health Organization (WHO) estimates that more than 21 million people worldwide are affected by schizophrenia, with relapse rates exceeding 60% in the first few years following diagnosis. This pattern of recurrence underscores the complexity of managing the disorder and the critical role played not only by medical interventions but also by psychosocial and community-based strategies [4].

The impact of schizophrenia extends far beyond the individual patient, placing immense physical, emotional, and economic burdens on caregivers. In many societies, including Indonesia, caregiving responsibilities are predominantly assumed by family members, most of whom lack professional training and adequate social support [5]. Studies indicate that more than two-thirds of schizophrenia caregivers experience moderate to severe stress, often linked to knowledge gaps, caregiver burden, stigma, and limited access to professional mental health services [6]. The consequences of caregiver stress are profound: it can diminish the quality of care provided, increase the likelihood of patient relapse, and compromise the overall well-being of families [7]. Moreover, the neglect of caregivers' psychosocial needs contradicts international and national policy frameworks, such as Indonesia's Health Law No. 17 of 2023, which explicitly recognizes the family's role in mental health service provision. Addressing the stress experienced by caregivers, therefore, is not only a matter of individual health but also a social justice imperative aligned with the UN's vision of inclusive, community-centred health systems [8].

Despite the urgency, interventions targeting caregiver well-being remain limited. Traditional mental health programs have predominantly focused on patients, with little

emphasis on strengthening family capacity and resilience [9]. In Indonesia, this gap is particularly concerning, given the rising prevalence of schizophrenia from 1.7 per mille of the population in 2013 to 1.8 per mille in 2018 and the disproportionately high number of cases reported in regions such as South Sulawesi. In Pangkep Regency alone, documented cases of schizophrenia increased from 909 in 2022 to 1,138 in 2023, reflecting both epidemiological realities and improved case detection. Yet interventions for caregivers remain scarce, hindered by persistent stigma, low levels of health literacy, and structural barriers in healthcare access. Against this backdrop, innovative, context-sensitive, and scalable interventions are urgently needed [10] [11].

The rapid growth of digital health technologies offers a promising solution to this challenge. Mobile mental health (mMHealth) applications have increasingly been recognized for their capacity to deliver accessible, affordable, and user-centred interventions, even in resource-constrained settings [12]. Unlike traditional psychoeducation or leaflet-based approaches, digital applications provide interactive, flexible, and continuous support, enabling caregivers to learn and practice stress management strategies at their own pace [13]. Global evidence supports the potential of such tools: smartphone-based interventions have been shown to reduce depressive symptoms, improve treatment adherence, and strengthen caregiver resilience [14]. Importantly, the integration of spiritual and cultural dimensions such as those embedded in Indonesia's Spiritual Emotional Freedom Technique (SEFT) can further enhance the relevance and effectiveness of digital health innovations, making them more acceptable and sustainable in diverse sociocultural contexts [15]. Nurses play a pivotal role in supporting families and caregivers of individuals with schizophrenia, not only in providing direct care but also in health education, counseling, and facilitating access to community-based resources. In Indonesia, nurses often serve as the first point of contact in primary health care settings, making them essential actors in implementing mental health promotion and caregiver empowerment programs. Their involvement ensures that digital interventions such as Sajie Care are not only technically feasible but also clinically relevant, culturally sensitive, and sustainably integrated into routine health services [16].

The Sajie Care application was developed as a novel intervention by the research team, specifically designed to integrate stress management education, SEFT-based therapy, medication reminders, and peer-support features. To the best of the authors' knowledge, this is the first study to implement Sajie Care as a structured intervention for schizophrenia caregivers in Indonesia, and it is not an adaptation of an existing program. Therefore, this research can be considered an initial stage in the development and evaluation of the Sajie Care model. The Sajie Care intervention applied in this study is a newly developed model by the research team, specifically designed to reduce caregiver stress through education, SEFT-based

therapy, medication reminders, and peer support features. To date, no previous studies have reported the use of the Sajie Care application, so this research represents an initial stage of its development and evaluation. While the conceptual basis draws on earlier evidence of mobile health interventions for caregivers and SEFT therapy for stress reduction the Sajie Care intervention itself has not been directly adopted from other research but was created as an innovative and culturally contextualized digital approach for caregivers of people with schizophrenia in Indonesia. By integrating education, spiritually based stress management, social support, and stigma reduction, the app provides a holistic ecosystem tailored to caregivers' realities, particularly in resource-limited settings. This study should be viewed as an early stage of the development and feasibility testing of the Sajie Care application. Rather than concluding that the application is fully suitable for use, the findings indicate that Sajie Care has demonstrated initial feasibility and acceptance among caregivers, warranting further testing and refinement before broader implementation.

Materials and Methods

A. Study Design

This study employed a quasi-experimental pretest–posttest control group design to evaluate the effectiveness of a mobile mental health intervention in reducing stress among caregivers of individuals with schizophrenia. The design allowed for comparison between intervention and control groups over three months. Although this study employed a quasi-experimental design rather than a randomized controlled trial, the research protocol was developed in accordance with internationally recognized reporting guidelines. The study design and reporting referred to the CONSORT 2025 extension for non-randomized studies and was also guided by the SPIRIT checklist to ensure methodological transparency, protocol clarity, and replicability.

B. Study Site and Population

The research was conducted in the Labakkang sub-district, Pangkajene and Islands Regency (Pangkep), South Sulawesi, Indonesia. The study population consisted of caregivers of patients with schizophrenia who were registered at community health centers within the district. Eligible participants were female caregivers experiencing mild to severe stress, given their heightened vulnerability due to multiple caregiving roles. Respondents were recruited from caregivers of individuals with schizophrenia who were registered at community health centers (Puskesmas) in the Labakkang Sub-district, Pangkajene and Islands Regency, South Sulawesi, Indonesia. The list of potential participants was obtained in collaboration with community health workers and psychiatric nurses, who identified family members currently providing daily care to patients diagnosed with schizophrenia. Caregivers were then approached directly during routine health center visits and home visits, informed about the

study objectives, and invited to participate voluntarily. Eligibility criteria included being the primary caregiver, aged ≥18 years, and experiencing mild to severe stress, as assessed by a preliminary screening questionnaire.

C. Sampling Technique and Sample Size

A total of 110 caregivers of individuals with schizophrenia were initially identified from community health center records in Labakkang Sub-district, Pangkajene and Islands Regency. After applying the inclusion and exclusion criteria, 76 caregivers met the eligibility requirements. Of these, 8 declined to participate and 0 were excluded due to incomplete baseline data, resulting in 68 participants. Respondents were then randomly allocated into two groups using simple random sampling: 34 participants in the intervention group (Sajie Care application) and 34 participants in the control group (leaflet-based psychoeducation). To provide a clear overview of the recruitment process, a CONSORT-style flowchart has been added. This chart outlines the total population, exclusions, refusals, and final allocation into intervention and control groups.

D. Data Collection Instruments

Stress levels were measured using the Perceived Stress Scale (PSS-10), a 10-item instrument developed by Cohen to assess the degree to which individuals perceive situations in their life as stressful. The PSS-10 was chosen because of its brevity, ease of administration, and frequent use in mental health research, particularly among caregiver populations. The Indonesian version of the PSS-10 has been adapted and validated with satisfactory psychometric properties, including internal consistency (Cronbach's $\alpha = 0.84$) and construct validity established through confirmatory factor analysis. These characteristics justify its use in the present study to capture stress levels accurately and reliably among caregivers of people with schizophrenia.

E. Data Sources

Primary data were collected from participants through structured questionnaires. These included demographic characteristics and stress assessments conducted before and after the intervention.

F. Intervention

The Sajie Care application was developed as an Android-based mobile application. During the study, access to the application was provided through a QR code linked to Google Drive, allowing participants to download and install it directly on their smartphones. This method ensured that all respondents could uniformly obtain the application without requiring access through app stores, while also enabling the research team to monitor the installation process and provide technical assistance if needed. Participants in the intervention group received access to the Sajie Care mobile mental health application, which provided educational

materials on schizophrenia, stress recognition, and stress management strategies, including the Spiritual Emotional Freedom Technique (SEFT), medication reminders, and peer discussion features. Caregivers were instructed to use the application independently at least twice weekly over three months (24 sessions in total), with researcher monitoring at weeks 2, 4, and 12. The control group received printed leaflets containing comparable psychoeducational content, delivered at the same frequency and monitoring schedule.

G. Data Analysis

Data were analyzed using the Wilcoxon signed-rank test, Mann–Whitney U test, and Friedman test, depending on data distribution. These non-parametric statistical methods were employed to assess within-group and between-group differences in stress levels across time points. A p-value of <0.05 was considered statistically significant.

H. Ethical Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee of Politeknik Sandi Karsa, with ethical clearance number B-382/PT19.2.1/PP/VI/2025. Written informed consent was obtained from all participants prior to their enrollment in the study. All participants received comprehensive information regarding the study objectives, procedures, potential risks, and anticipated benefits before providing consent. The confidentiality and anonymity of participants' personal data were strictly protected throughout the research process, in full compliance with internationally recognized ethical standards for research involving human subjects.

Results

At this stage, the intervention was implemented and divided into two groups, namely the intervention group (*Sajie Care* application) and the control group (leaflet). The primary variable measured was the stress level of caregivers of individuals with schizophrenia.

Table 1. Distribution of Characteristics of Intervention and Control Groups of Caregivers of Patients with Schizophrenia

Characteristics	Intervention Group (n, %)	Control Group (n, %)
Age		
Early adulthood	7 (58.3)	5 (41.7)
Late adulthood	9 (40.9)	13 (59.1)
Early elderly	16 (53.3)	14 (46.7)
Occupation		
Unemployed	21 (55.3)	17 (44.7)
Employed	11 (42.3)	15 (57.7)
Education		
No formal education	16 (45.7)	19 (54.3)
Primary education	5 (62.5)	3 (37.5)
Senior high school	8 (44.4)	10 (55.6)
Higher education	3 (100.0)	0 (0.0)
Ethnicity		

Characteristics	Intervention Group (n, %)	Control Group (n, %)
Bugis	2 (20.0)	8 (80.0)
Makassar	18 (54.5)	15 (45.5)
Bugis–Makassar	10 (58.8)	7 (41.2)
Toraja	1 (50.0)	1 (50.0)
Mandar	1 (50.0)	1 (50.0)
Stress level		
Mild	29 (90.6)	29 (9.4)
Severe	3 (90.6)	3 (9.4)

Table 1 shows that in the intervention group, the highest proportion of caregivers was in the early elderly age category, had primary education, were unemployed, and predominantly belonged to the Makassar ethnic group. In contrast, in the control group, the highest proportion was also in the early elderly age category, but with higher education as the most common educational background. For occupation, both the employed and unemployed categories had the same proportion, while the majority ethnicity was also Makassar.

Table 2. Changes in Stress Levels in Stress Management Among Caregivers of Individuals with Schizophrenia

Group	Pre-test Mean	Posttest 1 Mean	Posttest 2 Mean	Posttest 3 Mean	Mean Difference (Pre–Post3)	p*
*Sajie Care*App	17.84	16.72	15.25	13.06	4.78	0.001*
Leaflet	16.84	16.94	15.19	15.75	1.09	0.070*
p	0.562**	0.710**	0.787**	0.014**		

Table 2 shows that the baseline stress levels between the intervention and control groups did not differ significantly at the initial measurement (p = 0.562). However, after the intervention, the posttest 1 results remained non-significant (p = 0.710), while posttest 3 indicated a significant difference (p = 0.014). The effectiveness of the *Sajie Care* application in reducing stress was demonstrated by the mean difference between posttest 3 and pretest, with the intervention group showing a greater reduction compared to the control group, with a mean difference of 3.69.

Beyond statistical significance, the reduction in stress scores observed in the intervention group also holds important clinical implications. A mean decrease of 4.78 points on the PSS-10 indicates not only a numerical change but also a transition from moderate stress toward a lower-stress category. This suggests that caregivers experienced tangible improvements in their daily coping ability, emotional stability, and capacity to provide consistent care for family members with schizophrenia. Clinically, such reductions are meaningful because even small but sustained decreases in perceived stress are associated with better caregiver resilience, lower risk of burnout, and improved quality of patient care. Thus, the Sajie Care intervention is not only effective in a statistical sense but also clinically relevant for enhancing caregiver well-being and supporting family-centered mental health care.

Table 3. Differences in Stress Levels Between Pre- and Post-Intervention Measurements in the Intervention Group of Caregivers of Individuals with Schizophrenia

Measurement	n	p*
Stress Pre–Post1	32	0.001*
Stress Pre–Post2	32	<.001*
Stress Pre–Post3	32	<.001*
Stress Post1–Post2	32	0.003*
Stress Post1–Post3	32	<.001*
Stress Post2–Post3	32	<.001*

Note: Wilcoxon test applied.

Table 3 demonstrates significant differences in caregiver stress levels before and after the intervention. Comparisons between the pretest and each posttest stage revealed statistically significant values ($p < 0.05$), indicating that the intervention had a measurable impact on reducing caregiver stress. The first significant reduction was observed between pretest and posttest 1 ($p = 0.001$), showing that the intervention had already begun to exert a positive psychological effect on caregivers early in the process. This decreasing trend continued consistently at posttest 2 ($p < 0.001$) and posttest 3 ($p < 0.001$), suggesting that the intervention had a sustained effect. Moreover, comparisons across posttest stages also showed significant differences, namely between posttest 1–2 ($p = 0.003$), posttest 1–3 ($p < 0.001$), and posttest 2–3 ($p < 0.001$). These results indicate that stress reduction occurred not only once but also continued progressively throughout the intervention period.

Over time and with repeated practice, the use of this application gradually became an ingrained habit, enabling caregivers to feel more confident and capable of managing stress independently. Furthermore, caregivers in the Labakkang sub-district maintain strong family bonds, where emotional support from extended family and neighbours plays a significant role in reinforcing the adaptation process. In addition, financial constraints often prevent caregivers from accessing formal mental health services, making application-based interventions a more affordable and flexible alternative that is easier to follow, as it can be accessed anytime without interfering with their primary responsibilities.

Thus, it can be concluded that the stress management literacy model delivered through the *Sajie Care* application has been consistently effective in reducing stress among caregivers of patients with schizophrenia. The effects are not only immediate but also progressively increase over time, indicating the potential of this intervention to be implemented more broadly and sustainably in primary health care settings, both in the short and long term. This is further reinforced by caregivers' statements that this is the first time attention has been given to their needs, and that the intervention has been truly helpful in supporting them in caring for individuals with schizophrenia.

Discussions

The findings of this study contribute significantly to the growing body of literature on digital mental health interventions, particularly in low- and middle-income countries where access to psychiatric services is limited. The Sajie Care application demonstrated a significant reduction in stress among caregivers of individuals with schizophrenia, underscoring the importance of technology-based interventions in addressing mental health disparities. These results align with the United Nations' Sustainable Development Goal 3 (Good Health and Well-being), which emphasizes the promotion of mental health and well-being for all people, especially vulnerable populations.

Digital health and caregiver support. Recent international studies have highlighted the potential of mobile health (mHealth) applications in supporting caregivers of patients with chronic mental illness. Digital health interventions improved user experience and reduced burden among caregivers of people with first-episode psychosis [17], [18]. Demonstrated that smartphone-based interventions helped individuals with schizophrenia identify early warning signs of relapse, thereby indirectly reducing caregiver stress [19]. These studies support the evidence from the Sajie Care intervention, suggesting that accessible, context-specific mobile health platforms are a viable tool for promoting mental health literacy and resilience among caregivers [20] [21].

Unlike many Western-designed apps, Sajie Care was culturally tailored to Indonesian caregivers, incorporating features such as the Spiritual Emotional Freedom Technique (SEFT) therapy [22]. This spiritual component resonates who reported that SEFT-based interventions improved psychological well-being in cancer patients undergoing chemotherapy [23]. By integrating spiritual healing with digital education, Sajie Care addresses not only cognitive but also emotional and spiritual needs, creating a more holistic model of caregiver support [24] [25].

Caregiver burden and health literacy, the stress experienced by caregivers of people with schizophrenia is a multifactorial problem, influenced by stigma, limited knowledge, and lack of social support. Previous international research has shown that 67% of caregivers experience moderate to severe stress [26] [27]. The present study demonstrated that providing structured education through a digital platform significantly reduced stress over three months, who emphasized that caregiver education improves quality of life and reduces relapse rates in patients with psychosis [28].

This reinforces the concept of health literacy as a determinant of mental health outcomes. Health literacy enhances individuals' ability to manage health conditions effectively [29]. In this study, the use of Sajie Care provided caregivers with accessible knowledge and practical coping tools, which not only reduced their stress but also empowered them to play a

more active role in managing the care process. This aligns with UN frameworks on empowering communities through health education as a pathway to sustainable development [30].

Integration with global digital mental health trends globally, digital interventions are becoming increasingly sophisticated, incorporating artificial intelligence, chatbots, and wearable devices. Even one-minute chatbot-based interactions could significantly reduce stress [31]. Wearable-based monitoring systems improved relapse prevention in psychotic disorders [32]. While Sajie Care does not yet integrate these advanced technologies, its strength lies in its simplicity, cultural adaptation, and accessibility for communities with limited resources. These characteristics make it a model for scalable interventions in similar low-resource settings across the Global South. Moreover, Sajie Care aligns with recommendations from the Lancet Commission on Global Mental Health and Sustainable Development [33], which highlighted the urgent need for community-based, cost-effective mental health interventions. By targeting caregivers, a group often neglected in traditional mental health services, this study contributes to reshaping mental health systems toward a more inclusive and holistic model [34] [35].

Psychological mechanisms of stress reduction, the progressive reduction in stress observed across three post-test measurements highlights the role of repetition and habit formation in psychological adaptation. This supports the spacing effect, which emphasizes the importance of repeated reinforcement in long-term knowledge retention and behavior change [36]. In practice, caregivers who regularly engaged with Sajie Care gradually internalized stress management techniques, leading to sustained improvements in their well-being [37]. Furthermore, the integration of SEFT healing techniques resonates transactional Model of Stress and Coping, which argues that stress outcomes depend on individuals' appraisal and coping strategies. By fostering self-reflection, forgiveness, acceptance, and surrender, the intervention enhanced caregivers' coping capacity, leading to reduced psychological distress and improved resilience. The findings of this study also highlight the important role of community nurses in supporting caregivers through primary health centers. In Indonesia, nurses at Puskesmas often serve as the first point of contact for families, not only delivering direct care but also strengthening caregiver capacity through health education, counseling, and monitoring. By integrating the Sajie Care application into community nursing practice, nurses can facilitate sustained use of digital interventions, encourage peer-support networks, and provide timely guidance when caregivers face difficulties. This collaborative approach enhances caregiver resilience, enabling families to adapt more effectively to the challenges of schizophrenia care. Strengthening the role of community nurses in digital health interventions

therefore represents a strategic pathway to reinforce both caregiver well-being and the sustainability of community-based mental health services.

Limitations and Future Directions

Despite its strengths, this study faced certain limitations. The quasi-experimental design did not provide the same level of causal certainty as randomized controlled trials (RCTs). Additionally, the sample was predominantly female, which may limit the generalizability of findings to male caregivers. These gaps point to future research directions, including conducting multicenter RCTs, extending follow-up periods to assess long-term sustainability, and integrating advanced digital features such as chatbots or wearable-based monitoring. Moreover, scaling up interventions like Sajie Care will require collaboration with government health agencies and alignment with Indonesia's Health Law No. 17/2023, which emphasizes family and community participation in mental health services. Such integration would contribute directly to UN SDG targets on strengthening community-based health systems, reducing inequalities in access to care, and promoting mental well-being globally. The present study underscores the effectiveness of Sajie Care as a digital, culturally sensitive, and sustainable tool for reducing caregiver stress in schizophrenia. Its success demonstrates the transformative potential of mHealth interventions when grounded in local culture, spiritual values, and evidence-based stress management techniques. In the broader global context, these findings add to international evidence that digital health literacy interventions can empower caregivers, reduce stigma, and strengthen resilience, ultimately advancing the UN's vision of ensuring healthy lives and well-being for all.

Conclusion

The findings of this study highlight the effectiveness of the Sajie Care application as a culturally adapted digital health intervention to reduce stress among caregivers of individuals with schizophrenia. By integrating health literacy, spirituality-based stress management, and peer support features, the application empowered caregivers to manage psychological burdens more independently and sustainably. Compared with conventional leaflet-based interventions, Sajie Care produced significantly greater reductions in stress levels, demonstrating its clinical relevance and potential for scalability. This research underscores the importance of leveraging mobile health technologies (m-Health) in strengthening community-based mental health services, particularly in regions with limited access to formal psychiatric care. The integration of SEFT therapy and continuous digital education not only reduced caregiver stress but also fostered resilience, enhanced coping strategies, and contributed to the prevention of patient relapse. In line with global mental health priorities and the United Nations' commitment to ensure well-being for all, Sajie Care represents an innovative, practical,

and scalable model for empowering caregivers, improving family resilience, and promoting mental health equity. Future research should focus on broader implementation, inclusion of diverse caregiver populations, and long-term evaluation to further establish its effectiveness across different contexts. Based on the study findings, it is recommended that community nurses and nurses working in primary health centers be actively involved in the implementation of the Sajie Care application. Their role is essential in facilitating caregiver education, monitoring stress management practices, and fostering peer-support networks. By integrating digital interventions into routine nursing practice, community nurses can strengthen caregiver resilience, ensure continuity of mental health services, and contribute to sustainable community-based mental health programs.

Conflict of Interest

The authors declare no conflict of interest.

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