Effectiveness of the BERSAMADIA mHealth App on Diabetes Self-Management Knowledge

Puguh Novi Arsito[1], *Pinasti* Utami[1*], *Salmah* Orbayinah[1], *Bangunawati* Rahajeng[2], *Nurul* Hikmah[1], *Andy Kurniawan* Saputra[1], *Hari* Widada[1], *Ingenida* Hadning[1], *Silvia Arissa* Ramadaniar[1], and *Muhammad Thesa* Ghozali[1]

[1]Study Program of Pharmacy, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[2]Study Program of Pharmacist Professional, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia

Abstract. Diabetes presents an ongoing global health challenge, with self-management education being a cornerstone of effective care. This study evaluated the effectiveness of the BERSAMADIA mobile app a culturally tailored, bilingual (Bahasa and English) digital intervention designed to improve diabetes self-management knowledge among Indonesian-speaking people. A total of 60 participants, including adults with type 2 diabetes and at-risk individuals, engaged with the app for one week. Using a pre-post intervention design, knowledge was assessed via a 15-item diabetes questionnaire. Results revealed a significant improvement in participants' knowledge scores (mean increase of 3.64 points, $p < 0.001$), with large effect size (Cohen's $d = 1.46$). The most notable gains were observed in medication literacy, glucose monitoring, and dietary management. The app's culturally adapted visuals, bilingual content, and interactive features contributed to high engagement and learning outcomes. The findings suggest that mHealth app-based interventions like BERSAMADIA can effectively address health literacy gaps and support diabetes education in diaspora and underserved communities. Future studies should explore long-term behavior change, clinical outcomes, and broader population impact.

1 Introduction

Diabetes mellitus (DM) continues to pose a substantial threat to global public health, affecting over 537 million adults worldwide as of 2021, with projections estimating an increase to 643 million by 2030 and 783 million by 2045 [1]. The burden is not limited to medical/clinical outcomes alone but extends to economic costs, loss of productivity, and diminished quality of life. In Southeast Asia, including Indonesia, the prevalence of type 2 diabetes is rising rapidly due to shifts in poor diet, sedentary lifestyles, urbanization, and aging populations [2]. Despite improvements in pharmacological interventions and healthcare systems, long-term management of diabetes relies heavily on individual's ability

*Corresponding author: pinasti.utami@umy.ac.id

to adhere to self-care practices, making diabetes self-management (DSM) a critical component of treatment success.

Effective DSM encompasses a range of daily behaviors, including proper dietary intake, medication adherence, regular physical activity, blood glucose monitoring, and preventive foot care [3]. These actions are essential for minimizing complications such as cardiovascular disease, neuropathy, retinopathy, and renal failure. However, in many communities especially among ethnic minorities or diaspora groups DSM is hindered by insufficient health literacy, limited access to education, and inadequate support systems. Cultural beliefs, language barriers, and healthcare inequities further exacerbate these challenges, reducing the ability of individuals to engage with and sustain recommended self-care behaviors [4].

In response to these persistent barriers, mobile health (mHealth) technologies have gained traction as a scalable and accessible solution for chronic disease education and management. mHealth applications for diabetes have been shown to improve knowledge, increase adherence to treatment regimens, support glycemic control, and reduce the risk of complications [5]. These apps commonly feature personalized tracking tools, medication reminders, interactive learning modules, and teleconsultation functions. Their capacity for real-time engagement and data collection empowers users to take an active role in their care while facilitating remote support from healthcare professionals. Moreover, culturally adapted apps can improve acceptance and relevance, especially among underrepresented communities [6].

Against this backdrop, the BERSAMADIA mobile app short for Bersama Dengan Diabetes—was particularly developed to provide a culturally and linguistically tailored digital solution for diabetes patient education [7]. The app targets Indonesian-speaking populations and includes a suite of interactive modules focused on nutrition education, symptom tracking, medication scheduling, physical activity planning, and peer support. Its content is presented in both Bahasa Indonesia and English, ensuring accessibility for users worldwide. Designed with culturally relevant visuals and messages, BERSAMADIA seeks to bridge the gap between clinical knowledge and community practice. The primary aim of this study is to evaluate the effectiveness of BERSAMADIA app in improving community-level knowledge and awareness of diabetes self-management. By measuring pre- and post-intervention knowledge outcomes, this study aims to determine whether mobile-based education can serve as a viable approach to enhance diabetes literacy and empower individuals toward better health behaviors.

2 Methods

2.1 Study design and participants

This study used a one-group pre-post intervention design using a quantitative approach to evaluate the effectiveness of the BERSAMADIA mobile app in enhancing knowledge related to diabetes self-management. The primary focus was to determine the degree of change in participant's knowledge following a structured one-week engagement with the mobile app. A pre-post design without a control group was considered suitable for this pilot implementation phase to evaluate both the feasibility and educational impact of the intervention in a real-world setting. While this design does not allow for causality claims due to the absence of a comparison group, it offers valuable preliminary insights into the app's educational value and usability among its intended users.

2.2 Participants and setting

The target population for this study included adults either diagnosed with type 2 diabetes or at elevated risk, along with family caregivers who play an active role in diabetes care. Participants were recruited primarily from Indonesian-speaking communities, including members of the Indonesian diaspora in Melbourne, Australia, such as Pimpinan Cabang Istimewa 'Aisyiyah (PCIA) community. The inclusion of caregivers acknowledged the significant role they play in household health management and their potential to benefit from diabetes education. The eligibility criteria required participants to be aged 18 years or older, possess basic smartphone literacy, and be able to understand either Bahasa Indonesia or English. Individuals with cognitive impairments or those already engaged in structured diabetes education programs were excluded.

A purposive sampling technique was employed to recruit an estimated sample size of 60 participants. Recruitment was conducted through digital announcements, flyers, and community group postings disseminated via social media platforms (e.g., WhatsApp, Facebook) and community mailing lists. Community leaders and PCIA coordinators were also instrumental in encouraging participation and ensuring a balanced representation of genders, age groups, and diabetes-related health backgrounds. The research was designed to allow broader generalizability to other Indonesian-speaking communities beyond the diaspora.

2.3 Intervention: BERSAMADIA app

The intervention of this study consisted a structured one-week engagement with the BERSAMADIA mobile app, developed as a culturally tailored tool to improve diabetes self-management knowledge. The app features seven primary educational modules: (1) understanding diabetes and its types; (2) blood glucose monitoring; (3) dietary planning and glycemic index awareness; (4) medication literacy, including insulin and oral agents; (5) physical activity recommendations; (6) foot care practices; and (7) emotional wellness and stress management. The app integrates bilingual content (both Bahasa and English), culturally relevant illustrations, and simplified language to accommodate varying levels of health literacy. The app features interactive features including gamified quizzes at the end of each module, a daily symptom tracker, medication reminders, and a dashboard for progress monitoring. These features aim to reinforce learning and promote sustained engagement. All users were provided with basic instructions for navigating the app, and technical support was available throughout the intervention time to address any usability issues, such as errors, unable to access, etc.

2.4 Data collection tools

To assess knowledge improvement, a structured diabetes knowledge questionnaire was administered both before and after the intervention. The questionnaire was adapted from the Diabetes Knowledge Questionnaire (DKQ), which has been widely validated for use in both clinical and community settings [8]. The instrument consisted of 15 multiple-choice items covering general diabetes awareness, dietary guidelines, glucose control strategies, complication prevention, and medication adherence.

The questionnaire was reviewed by a panel of bilingual experts in diabetes education and translated into Bahasa Indonesia using a forward-backward translation process to ensure semantic equivalence. As a supplementary tool, a brief post-intervention user satisfaction survey was administered to gather participant feedback on the app usability, content clarity,

and perceived usefulness. This optional data enriched the interpretation of quantitative outcomes and helped identify areas for future app improvement.

2.5 Data collection procedure

Following ethical approval and informed consent, participants completed the baseline (pre-test) questionnaire via a secure online form. They were then provided with access credentials and brief instructions to download and use the BERSAMADIA app. The intervention lasted for seven consecutive days, during which participants were instructed to complete one module per day. After the final day, participants were asked to complete the same knowledge questionnaire (post-test) and user satisfaction survey. Anonymity was preserved through the use of unique participant codes, and all data were stored on encrypted servers in accordance with data protection regulations.

Ethical considerations were upheld throughout the study in line with the Declaration of Helsinki. Participants were informed of their right to withdraw at any time without penalty. No personally identifying information was collected, and responses were aggregated for analysis.

2.6 Data analysis

All collected data were entered into SPSS version 26.0 for statistical analysis. Descriptive statistics were used to summarize demographic variables, baseline knowledge levels, and post-intervention outcomes. To assess the main objective—knowledge improvement—a paired sample t-test was performed for normally distributed data. Where normality assumptions were violated, the non-parametric Wilcoxon signed-rank test was applied. Statistical significance was set at $p < 0.05$ with 95% confidence intervals. Cohen's d was calculated to measure the magnitude of the intervention's effect, with thresholds of 0.2 (small), 0.5 (medium), and 0.8 or above (large) used for interpretation [9].

3 Results and discussion

3.1 Results

3.1.1 Participant demographics

A total of 60 participants completed the study and were included in the final analysis. The gender distribution was relatively balanced, with 35 participants (58.3%) identifying as female and 25 (41.7%) as male. Participants represented a wide range of age groups, with the largest proportion (30.0%) aged between 35 and 44 years. Specifically, 6 participants (10.0%) were aged 18–25 years, 12 (20.0%) were 26–34 years, 18 (30.0%) were 35–44 years, 15 (25.0%) were 45–54 years, and 9 participants (15.0%) were aged 55 years or older, as presented in Table 1 below.

In terms of formal educational background, 24 participants (40.0%) had completed senior high school, while 22 (36.7%) held a diploma or bachelor's degree. The remaining 14 participants (23.3%) had attained postgraduate qualifications, indicating a moderately high overall level of formal education within the sample. Regarding diabetes status, the majority of participants (n = 46, 76.7%) reported having a confirmed diagnosis of type 2 diabetes mellitus (T2DM), while the remaining 14 participants (23.3%) were classified as at-risk or pre-diabetic. Among those with a formal T2DM diagnosis, disease duration varied: 5

individuals (10.9%) had been diagnosed within the past year, 18 (39.1%) for 1–5 years, 13 (28.3%) for 6–10 years, and 10 (21.7%) for more than a decade.

Table 1. Demographic information of the study participants (n=60).

Demographic Information	Value (%)
Gender	
Male	25 (41.7)
Female	35 (58.3)
Age	
15 – 24	6 (10.0)
25 – 34	12 (20.0)
35 – 44	18 (30.0)
45 – 54	15 (25.0)
≥ 55	9 (15.0)
Education	
Senior high school	24 (40.0)
Diploma/Bachelor	22 (36.7)
Postgraduate	14 (23.3)
Diabfiguetes Status	
Diagnosed with T2DM	46 (76.7)
At-risk/Pre-diabetic	14 (23.3)
Duration of Diabetes (T2DM only)	
<1 year	5 (10.9)
1–5 years	18 (39.1)
6–10 years	13 (28.3)
>10 years	10 (21.7)
Prior Diabetes Education	
Yes	26 (43.3)
No	34 (56.7)

Prior exposure to diabetes education was reported by 26 participants (43.3%), whereas 34 (56.7%) indicated they had never received formal education or training related to diabetes self-management. This variability in background knowledge and health experience underscores both the relevance and potential utility of targeted mobile health interventions such as the BERSAMADIA app.

3.1.2 Pre- and post-knowledge comparison

The primary outcome of this study was the improvement in participants' knowledge of diabetes self-management following a one-week engagement with the BERSAMADIA mobile app. As presented in Table 2, Knowledge was assessed using a 15-item multiple-choice questionnaire adapted from the validated Diabetes Knowledge Questionnaire [8], which covered domains such as blood glucose monitoring, dietary practices, medication use, complication awareness, physical activity, and preventive foot care.

Table 2. Pre- and post-knowledge comparison of the study (n=60).

Assessment Item	Pre-Test	Post-Test	Improvement
Overall Score (Mean ± SD)	8.67 ± 2.34	12.31 ± 1.76	+3.64 points
Blood Glucose Monitoring	52	86	+34
Medication Literacy	45	83	+38
Dietary Management	47	81	+34
Complication Awareness	58	72	+14
Foot Care Practices	39	69	+30
Physical Activity Guidelines	44	76	+32

Assessment Item	Pre-Test	Post-Test	Improvement
Emotional & Stress Management	41	70	+29

At baseline, the average knowledge score was 8.67 out of 15 (SD = 2.34), indicating moderate understanding of self-diabetes management. Following the intervention, the average score increased to 12.31 out of 15 (SD = 1.76), which is reflecting a substantial improvement in diabetes-related knowledge. This represents a mean score increase of 3.64 points, or a 24.3% gain in overall knowledge. The distribution of scores narrowed post-intervention, suggesting reduced variation in knowledge levels among participants and a potential equalizing effect of the app's educational modules.

When analyzed by knowledge domain, the most significant gains were observed in the areas of medication literacy and blood glucose monitoring. For instance, correct responses to items related to insulin timing and storage increased from 45 at baseline to 83% post-intervention. Similarly, items testing knowledge on the purpose and frequency of glucose monitoring represents correct response rates increase from 52 to 86. Dietary knowledge, notably concerning carbohydrate counting and glycemic index awareness, also showed notable improvement, with correct responses increasing from 47 to 81. In contrast, the domain with the smallest improvement was complication prevention, where correct responses increased from 58 to 72, suggesting that this topic may require more targeted educational reinforcement in future app updates.

Foot care knowledge, often underemphasized in informal education, also showed marked improvement, with participant's understanding of daily foot inspection and protective footwear practices improving from 39 at pre-test to 69 post-test. These results suggest that culturally tailored digital content delivered through the BERSAMADIA app was effective in reinforcing common and overlooked aspects of diabetes management.

3.1.3 Statistical analysis

To determine the significance of the observed knowledge gains, a paired samples t-test was conducted to compare pre- and post-intervention scores. The test confirmed a statistically significant improvement in overall diabetes knowledge following the use of the BERSAMADIA app ($t = 11.83$, $df = 59$, $p < 0.001$). The normality assumption was verified using the Shapiro-Wilk test, which indicated no significant deviation from normal distribution for the difference scores ($W = 0.974$, $p = 0.218$). Therefore, the t-test results were considered valid. For further robustness, a non-parametric Wilcoxon signed-rank test was also conducted, given the small sample size and potential for outlier influence. The Wilcoxon test produced a consistent result ($Z = -6.38$, $p < 0.001$), stating that the post-intervention scores were significantly higher than the baseline scores.

Table 3. Results of statistical analysis (n=60).

Test type	Value	p-value	Interpretation
Paired t-test	$t = 11.83$, $df = 59$	$p < 0.001$	Significant improvement
Wilcoxon signed-rank test	$Z = -6.38$	$p < 0.001$	Confirmed significant
Effect Size (Cohen's d)	$d = 1.46$	$p < 0.001$	Large effect size

The magnitude of the intervention's effect was quantified using Cohen's d, which was calculated to be 1.46. According to conventional thresholds [10] this constitutes a large effect size, indicating that the BERSAMADIA app had a strong impact on participants' knowledge acquisition within a relatively short period of time. This is consistent with prior research suggesting that well-designed, interactive mHealth tools can significantly enhance patient understanding of chronic disease management when content is personalized and culturally appropriate [11].

A subgroup analysis was conducted to explore potential differences in knowledge improvement between participants who had received prior diabetes education and those who had not. Interestingly, participants without previous formal education showed a greater mean score increase (4.12 points) compared to those with prior education (2.84 points), suggesting that the app may have been particularly effective in addressing initial knowledge gaps. However, the difference in knowledge gains between the two groups did not reach statistical significance ($p = 0.063$), likely due to the limited sample size.

Finally, exploratory correlation analysis revealed a weak but positive relationship between years since diabetes diagnosis and baseline knowledge scores ($r = 0.28$, $p = 0.031$), indicating that individuals with longer disease duration tended to have slightly more diabetes-related knowledge. However, post-intervention scores were not significantly correlated with duration of diagnosis, suggesting that the app provided a consistent learning benefit regardless of prior disease experience.

3.1.4 Ethical approvals

This study was conducted in accordance with ethical standards for research involving human participants and received approval from the Medical and Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta (Ethical Clearance No. 191/EC-KEPK FKIK UMY/V/2023).

3.2 Discussion

3.2.1 Interpretation of key findings

The findings from this study provide compelling evidence that the BERSAMADIA mobile app significantly improved participants' knowledge of diabetes self-management over a short intervention period. The post-intervention increase in overall knowledge scores, supported by a large effect size (Cohen's $d = 1.46$), indicates that the app was not only effective in disseminating information but also in fostering substantial learning gains across critical domains such as medication adherence, blood glucose monitoring, dietary regulation, and foot care. These results highlight the potential of mobile-based platforms to serve as valuable educational tools in public health, especially when designed with consideration for both the cultural and linguistic relevance. Importantly, the consistent improvement across both experienced and newly diagnosed individuals suggests that such interventions can address knowledge gaps in heterogeneous populations, thereby enhancing diabetes literacy at scale.

3.2.2 Comparison with existing literature

The observed results align well with previous research demonstrating the efficacy of mobile health (mHealth) applications in chronic disease education. Systematic reviews and meta-analyses have shown that diabetes-related mHealth tools are associated with improved patient knowledge, self-care behaviors, and clinical outcomes, including glycemic control [12]. Various studies have also reported that the use of mHealth applications can support more effective diabetes management, often reflected in significant reductions in HbA1c levels [20]. Consistent with this, Ghozali (2025) also highlighted that mHealth platforms are effective in strengthening diabetes self-management behaviors through accessible and structured digital education [14]. The success of BERSAMADIA reinforces this evidence base, particularly in the context of knowledge acquisition, and adds to the literature by emphasizing the importance of cultural tailoring. Unlike many generic apps developed in high-income

countries, such mobile app was designed specifically for the Indonesian-speaking population, integrating familiar idioms, visuals, and bilingual functionality. This cultural adaptation likely played a key role in enhancing user engagement and comprehension, especially among participants with limited prior health education. Similar studies have shown that when digital tools are aligned with the user's cultural contexts, they are more likely to achieve behaviorally meaningful outcomes [15].

3.2.3 Strengths and limitations

This study presents many strengths. First, it evaluated a purpose-built, culturally sensitive app using real-world participants drawn from community settings, thereby enhancing ecological validity. Second, the use of a pre-post design with validated measurement instruments allowed for robust quantification of knowledge change. Third, the intervention was implemented with minimal resource input, demonstrating feasibility for broader application in resource-constrained settings. However, limitations must also be acknowledged. The study did not include a control group, limiting causal inference. The short duration of the intervention (one week) prevented assessment of long-term knowledge retention or behavioral change. Moreover, the sample, though diverse, was relatively small and limited to Indonesian-speaking individuals, which may restrict generalizability. Finally, reliance on self-reported questionnaires introduces the possibility of social desirability bias or overestimation of learning outcomes.

3.2.4 Practical implications

Despite its limitations, the study has meaningful practical implications. The effectiveness of the BERSAMADIA app suggests that mHealth interventions can be integrated into broader community-based diabetes education strategies, particularly in underserved or linguistically isolated populations. Community health centers, religious institutions, and social organizations could adopt the app as a supplementary resource alongside existing education program. Its low cost, portability, and bilingual design make it especially suitable for dissemination among diaspora populations and in rural areas where access to formal diabetes care is limited. Government health agencies and non-governmental organizations may also utilize such tools in national campaigns to raise diabetes awareness and promote preventive behaviors.

3.2.5 Future research

Building on the current findings, future research should aim to assess the long-term retention of knowledge gained through BERSAMADIA mobile app and evaluate whether improvements in knowledge translate into sustained behavioral change. Longitudinal studies with follow-up intervals of three to six months would offer valuable insights into the durability of intervention effects. Expanding the app's content to include modules on gestational diabetes, insulin management, and complication screening could broaden its relevance and utility. Moreover, integrating clinical outcome measures—such as HbA1c tracking—would enable more comprehensive evaluation of the app's impact on disease control and progression. Finally, future trials incorporating control groups and larger, more diverse samples will strengthen the evidence base for culturally adapted digital health interventions.

4 Conclusion

The BERSAMADIA app significantly improved diabetes self-management knowledge among Indonesian-speaking users within a short intervention period. Its culturally tailored content, bilingual support, and interactive features contributed to measurable educational gains across key domains. These findings underscore the potential of mHealth tools to enhance health literacy and support chronic disease education in community settings, particularly among underserved populations.

Acknowledgment

The authors express their sincere gratitude to the participants from the Muhammadiyah and ‘Aisyiyah organizations in Indonesia and the Indonesian diaspora in Sydney, Australia, for their enthusiastic involvement in this study. The authors also thank the Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, for their administrative and technical support throughout the research process.

Funding

This research was funded by Universitas Muhammadiyah Yogyakarta by the Faculty of Medicine and Health Sciences' internal research grant scheme. The funding body had no role in study design, data collection, analysis, interpretation, or manuscript preparation.

References

[1] N. G. Forouhi and N. J. Wareham, “Epidemiology of diabetes,” *Medicine (United Kingdom)*, vol. 50, no. 10, pp. 638–643, Oct. 2022, doi: 10.1016/J.MPMED.2022.07.005.

[2] S. Susetyowati, E. Huriyati, B. I. Kandarina, H. F. L. Muhammad, and F. Faza, “Prevalence and determinants of high blood glucose in urban and rural Indonesian adult population,” *Int J Diabetes Dev Ctries*, vol. 39, no. 2, pp. 346–354, Apr. 2019, doi: 10.1007/S13410-019-00721-6.

[3] U. Ernawati, T. A. Wihastuti, and Y. W. Utami, “Effectiveness of diabetes self-management education (DSME) in type 2 diabetes mellitus (T2DM) patients: Systematic literature review,” *J Public Health Res*, vol. 10, no. 2, p. 2240, 2021, doi: 10.4081/JPHR.2021.2240.

[4] R. A. Pamungkas, K. Chamroonsawasdi, and P. Vatanasomboon, “A Systematic Review: Family Support Integrated with Diabetes Self-Management among Uncontrolled Type II Diabetes Mellitus Patients,” *Behavioral Sciences*, vol. 7, no. 3, p. 62, Sep. 2017, doi: 10.3390/BS7030062.

[5] A. Alshahrani, “Self-Management and Diabetes Mellitus mHealth, a Glance at the Present and a Glimpse into the Future,” *Stud Health Technol Inform*, vol. 262, pp. 352–355, 2019, doi: 10.3233/SHTI190091.

[6] J. Y. Fan, J. M. Li, C. Y. Duan, Q. Zhao, and Y. F. Guo, “Utilization and Influencing Factors of Mobile Health Applications in Diabetes Management: An Integrative Review,” *CIN - Computers Informatics Nursing*, Mar. 2025, doi: 10.1097/CIN.0000000000001268.

[7] S. Orbayinah *et al.*, “BersaMaDia App for Improving Quality of Life in Type 2 Diabetes Mellitus Patients at Asri Medical Center Muhammadiyah Hospital

Yogyakarta," *BIO Web Conf*, vol. 135, Nov. 2024, doi: 10.1051/BIOCONF/202413502002.

[8] J. T. Fitzgerald *et al.*, "The reliability and validity of a brief diabetes knowledge test," *Diabetes Care*, vol. 21, no. 5, pp. 706–710, 1998, doi: 10.2337/DIACARE.21.5.706.

[9] J. Cohen, "Statistical power analysis for the behavioral sciences," 1988, *Lawrence Erlbaum Associates*. Accessed: Jun. 19, 2025. [Online]. Available: https://docs.opendeved.net/lib/9UDZ3UVQ

[10] J. Cohen, "Set correlation and contingency tables," *Applied Psychological Measurement*, vol. 12, no. 4, pp. 425–434, 1988.

[11] A. Gomolin, B. Lebouché, K. Engler, and I. Vedel, "Optimizing smartphone intervention features to improve chronic disease management: A rapid review," *Health Informatics J*, vol. 26, no. 3, pp. 1795–1809, Sep. 2020, doi: 10.1177/1460458219891377.

[12] K. Liu and Y. Xia, "Effective behavioral change techniques in m-health app supported interventions for glycemic control among patients with type 2 diabetes: A meta-analysis and meta-regression analysis of randomized controlled trials," *Digit Health*, vol. 11, Jan. 2025, doi: 10.1177/20552076251326126/SUPPL_FILE/SJ-DOCX-1-DHJ-10.1177_20552076251326126.DOCX.

[13] M. T. Ghozali, "mHealth Apps for Promoting Diabetes Self-Management Behaviors: A Mini-Review of Recent High-Quality Systematic Reviews," *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, vol. 8, no. 9, pp. 1025–1035, 2025.

[14] M. T. Ghozali, "Telehealth-Assisted Education and Its Impact on Medication Adherence Among Type 2 Diabetic Patients in Rural Public Health Centers," in *Proc. 2023 2nd Int. Conf. Ambient Intelligence in Health Care (ICAIHC)*, Nov. 2023, pp. 1–6.

[15] R. Heimgärtner, "Culturally-Aware HCI Systems," *Intelligent Systems Reference Library*, vol. 134, pp. 11–37, 2018, doi: 10.1007/978-3-319-67024-9_2.