Digital Self-Management and Psychological Well-Being in Hypertensive Patients: The Mediating Role of Adherence Across the Life Course

Prima Trisna Aji*[1], Elinda Rizkasari[2], Arief Shofyan Baidhowy[1]
[1]Universitas Muhammadiyah Semarang, Indonesia
[2]Universitas Slamet Riyadi Surakarta, Indonesia
Corresponding Author: primatrisnaaji@unimus.ac.id*

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ABSTRACT

Hypertension remains a major global health concern, with low adherence to self-care contributing to poor psychological outcomes and disease management. This study aims to examine the effect of digital self-management on psychological well-being among hypertensive patients, with adherence as a mediating variable within a life-course perspective. A quasi-experimental design with a pretest–posttest approach was employed involving hypertensive patients who received a digital self-management intervention. Data were collected using validated instruments measuring self-management behavior, treatment adherence, and psychological well-being. Statistical analysis was conducted using mediation analysis to assess both direct and indirect effects. The results indicated that digital self-management significantly improved psychological well-being ($p < 0.05$). Furthermore, adherence partially mediated the relationship between digital self-management and psychological well-being, demonstrating a significant indirect effect. These findings highlight that improved adherence serves as a key mechanism through which digital interventions influence psychological outcomes. In conclusion, digital self-management is an effective approach to enhance psychological well-being in hypertensive patients, particularly when adherence is strengthened across different life stages. This study underscores the importance of integrating digital health interventions with psychosocial strategies to improve long-term health outcomes.

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INTRODUCTION

Hypertension remains one of the most significant non-communicable diseases globally, contributing substantially to morbidity, mortality, and reduced quality of life. Despite advances in pharmacological management, the control of blood pressure among hypertensive patients remains suboptimal, largely due to poor adherence to treatment and inadequate self-management behaviors (World Health Organization, 2024). Beyond its physiological impact, hypertension is also closely associated with psychological distress, including anxiety, stress, and decreased psychological well-being, which further complicate disease management and long-term outcomes (Tarrats-pons et al., 2025).

In recent years, digital health interventions, particularly digital self-management programs, have emerged as innovative approaches to improve patient engagement and health outcomes. Digital self-management refers to the use of mobile applications, telehealth platforms, and other digital tools that support patients in monitoring symptoms, adhering to treatment regimens, and adopting healthy lifestyles (Tejada-Gallardo et al., 2020). Evidence suggests that digital interventions can enhance self-care behaviors and improve adherence among patients with chronic

diseases, including hypertension (Baidhowy, 2025). However, most existing studies primarily focus on clinical outcomes, such as blood pressure control, with limited attention to psychological dimensions, including well-being and emotional adjustment.

Psychological well-being is a crucial component of overall health, encompassing individuals' perceptions of life satisfaction, emotional balance, and sense of purpose (Lizarte Simón et al., 2024). In the context of chronic illness, psychological well-being plays a vital role in influencing patients' motivation, coping strategies, and engagement in self-care activities (H. J. Kim et al., 2025). Patients with higher levels of psychological well-being are more likely to demonstrate consistent adherence to treatment and better disease management. Conversely, poor psychological well-being can lead to reduced adherence and worsening health outcomes, creating a negative cycle that is difficult to break.

Treatment adherence is widely recognized as a key determinant of successful hypertension management. It involves patients' ability to follow prescribed medication regimens, maintain lifestyle modifications, and consistently engage in self-care behaviors (Aji, Rizkasari, & Rahmawati, 2026). Previous research has identified adherence as both an outcome and a mediator in health behavior models, suggesting that it may serve as a mechanism through which interventions exert their effects on broader outcomes, including psychological well-being (Carranza Esteban et al., 2022). However, the mediating role of adherence in the relationship between digital self-management and psychological well-being remains underexplored, particularly within a life course framework.

The life course perspective provides a comprehensive theoretical lens to understand how health behaviors and outcomes evolve, influenced by individual, social, and environmental factors (Sanseverino et al., 2023). This perspective emphasizes that cumulative experiences, transitions, and critical life events shape health trajectories. In the context of hypertension, factors such as age, illness duration, family support, and socio-economic conditions may influence adherence and psychological well-being differently across various stages of life (Aji, Rizkasari, & Rahmawati, 2026). Despite its relevance, the integration of life course theory into studies of digital health interventions and psychosocial outcomes remains limited.

A critical gap in the current literature lies in the lack of integrative studies that simultaneously examine digital self-management, adherence, and psychological well-being within a unified analytical framework. While previous studies have demonstrated the effectiveness of digital interventions in improving adherence (Hudiyawati et al., 2022) and highlighted the importance of psychological well-being in chronic disease management (Freire et al., 2020), few have investigated how adherence mediates the relationship between digital self-management and psychological outcomes. Moreover, most studies do not incorporate a life-course perspective, thereby overlooking the dynamic, longitudinal nature of health behaviors and experiences.

Therefore, this study aims to address these gaps by examining the role of digital self-management in enhancing psychological well-being among hypertensive patients, with a particular focus on the mediating role of adherence across the life course. By integrating behavioral, psychological, and developmental perspectives, this study seeks to provide a more comprehensive understanding of how digital interventions can influence both adherence and psychological well-being. The findings are expected to contribute to the development of more holistic, patient-centered approaches to hypertension management, particularly in the era of digital health.

METHODS

Research Design

This study employed a quasi-experimental design with a one-group pretest–posttest approach to examine the effect of digital self-management on psychological well-being among hypertensive patients, with treatment adherence as a mediating variable. This design allows for

evaluating changes before and after the intervention while maintaining feasibility in real-world clinical and community settings (Shishov et al., 2022). Quasi-experimental approaches are widely used in health intervention studies where randomization is not feasible, but assessing causal relationships remains important (Leach et al., 2020).

Participant and Procedure

The study was conducted among adult patients diagnosed with hypertension in a community health setting. Participants were selected using a purposive sampling technique based on predefined inclusion criteria: having been diagnosed with hypertension for at least 6 months, being aged 18 years or older, being able to use a smartphone, and being willing to participate in the study. Patients with severe cognitive impairment or serious comorbid conditions were excluded to ensure optimal engagement and validity of responses.

A total of 96 participants were enrolled in the study. All participants provided informed consent prior to data collection. The sample size was considered adequate for mediation analysis, particularly for detecting indirect effects using bootstrapping techniques, which are recommended for moderate sample sizes in behavioral research (Lv & Sun, 2021).

Intervention: Digital Self-Management Program

The intervention consisted of a structured digital self-management program delivered via a mobile platform over 6 weeks. The program was designed to enhance patients' self-care behaviors and adherence through integrated features, including educational content on hypertension management, daily self-monitoring tools for blood pressure and symptoms, medication reminders, and motivational messages to improve self-efficacy and engagement. In addition, the system provided feedback and progress tracking to reinforce adherence behavior (Aji & Rizkasari, 2021).

Participants received initial guidance on using the application and were supported throughout the intervention period to ensure sustained engagement. Previous studies have demonstrated that digital self-management interventions can significantly improve adherence and health outcomes among patients with chronic conditions, including hypertension (Rusdi et al., 2023).

Research Instruments

Data were collected using standardized and validated instruments. Digital self-management was assessed using a scale that measures patients' engagement in monitoring, decision-making, and self-care activities facilitated by digital tools (Stalmach et al., 2023). Treatment adherence was measured using a validated questionnaire covering medication adherence and lifestyle compliance, both recognized as key determinants of successful hypertension management (Vrijens et al., 2020).

Psychological well-being was measured using an adapted version of Ryff's Psychological Well-Being Scale, which evaluates dimensions such as autonomy, environmental mastery, personal growth, positive relationships, purpose in life, and self-acceptance (Hair & Sabol, 2025). All instruments demonstrated acceptable reliability, with Cronbach's alpha values ranging from 0.70 to 0.90, indicating good internal consistency (Manortey & Adamaley, 2021).

Data Collection Procedure

Data collection was conducted in two phases. Baseline measurements of digital self-management, treatment adherence, and psychological well-being were obtained prior to the intervention (pretest). Following the six-week intervention period, the same variables were reassessed (posttest) to evaluate changes over time.

Participants completed the questionnaires electronically, and for those who required assistance, guided interviews were conducted to ensure the completeness and accuracy of the

data. This approach aligns with best practices in community-based research involving diverse participant characteristics (Politi et al., 2021).

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics were used to summarize participant characteristics and study variables. To examine the intervention's effect, paired-samples t-tests were conducted to compare pretest and posttest scores (Thongsalab, 2022).

To test the mediating role of treatment adherence, a mediation analysis was performed using the PROCESS macro (Model 4) developed by Hastjarjo (2020). The analysis estimated both direct and indirect effects, and bootstrapping with 5,000 resamples was applied to determine the significance of the mediation effect. The mediation effect was considered statistically significant when the 95% confidence interval did not include zero, which is a robust approach for testing indirect effects in behavioral research (Orkan Okan, Leena Paakkari, 2020).

Ethical Considerations

Ethical considerations were carefully addressed throughout the study. The research protocol was reviewed and approved by the appropriate institutional authority, ensuring compliance with established ethical standards for research involving human participants. All participants were fully informed about the purpose, procedures, potential risks, and benefits of the study prior to participation. Written informed consent was obtained from all participants, and confidentiality and anonymity were strictly maintained.

Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any time without any negative consequences. The study was conducted in accordance with internationally recognized ethical principles for medical and health research involving human subjects (Kurihara et al., 2024).

RESULT AND DISCUSSION

Results

A total of 96 hypertensive patients participated in this study. The majority of participants were aged 45-65 years, with a balanced gender distribution. Most participants had been diagnosed with hypertension for more than one year and reported regular use of antihypertensive medication. These characteristics indicate that the sample represents a population with chronic disease experience, making them suitable for evaluating self-management interventions.

Table 1. Changes in Digital Self-Management, Adherence, and Psychological Well-Being Before and After Intervention

Variable	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference	p-value
Digital Self-Management	58.42 ± 8.15	72.36 ± 7.28	+13.94	<0.001
Treatment Adherence	60.18 ± 7.90	75.21 ± 6.85	+15.03	<0.001
Psychological Well-Being	62.75 ± 9.10	78.44 ± 8.02	+15.69	<0.001

The results of the paired-samples t-test indicated a statistically significant improvement in all variables following the intervention ($p < 0.001$). Digital self-management scores increased substantially, reflecting enhanced patient engagement in self-care behaviors. Similarly, treatment adherence improved significantly, indicating better compliance with medication and lifestyle recommendations. Psychological well-being also increased markedly, suggesting that the intervention positively influenced patients' emotional and psychological states.

Although all variables showed statistically significant improvement, variability in individual responses was observed, indicating that not all participants experienced the same level of change. This finding reflects the natural heterogeneity in behavioral and psychological adaptation among patients with chronic conditions.

Furthermore, effect size analysis revealed a large effect size across all variables (Cohen's d > 0.80), indicating that the digital self-management intervention had a substantial and meaningful impact on both behavioral and psychological outcomes.

Mediation Analysis

Table 2. Mediation Analysis of Treatment Adherence in the Relationship Between Digital Self-Management and Psychological Well-Being

Pathway	Coefficient (β)	SE	t-value	p-value	95% CI
Digital Self-Management → Adherence (a)	0.62	0.08	7.75	<0.001	0.46 – 0.78
Adherence → Psychological Well-Being (b)	0.55	0.07	7.14	<0.001	0.39 – 0.69
Total Effect (c)	0.65	0.10	6.50	<0.001	0.45 – 0.85
Direct Effect (c')	0.31	0.09	3.44	-	0.13 – 0.49
Indirect Effect (a × b)	0.34	0.07	-	-	0.22 – 0.48

The mediation analysis was conducted using the PROCESS macro (Model 4) with 5,000 bootstrap resamples. The results showed that digital self-management had a significant total effect on psychological well-being ($\beta = 0.65$, $p < 0.001$). When treatment adherence was included as a mediator, the direct effect of digital self-management remained significant ($\beta = 0.31$, $p = 0.001$), indicating that the effect was reduced but not eliminated.

Digital self-management significantly predicted treatment adherence ($\beta = 0.62$, $p < 0.001$), and treatment adherence significantly predicted psychological well-being ($\beta = 0.55$, $p < 0.001$). The indirect effect of digital self-management on psychological well-being through adherence was statistically significant, as confirmed by the bootstrapped 95% confidence interval that did not include zero (CI = 0.22-0.48).

These findings indicate that treatment adherence partially mediates the relationship between digital self-management and psychological well-being. The persistence of a significant direct effect alongside a significant indirect effect suggests that digital self-management influences psychological well-being both directly and indirectly through adherence mechanisms.

Discussion

The findings of this study demonstrate that digital self-management significantly improves psychological well-being among hypertensive patients, both directly and indirectly through increased adherence. The observed improvement in self-management behaviors suggests that digital interventions are effective in enhancing patient engagement and promoting active participation in disease management. These findings are consistent with previous studies indicating that digital health interventions can facilitate behavioral change and improve adherence in patients with chronic conditions (Aji, Bhadowy, et al., 2026).

However, while the current study found a substantial improvement in psychological well-being, some previous studies have reported more modest or inconsistent psychological outcomes following digital interventions. This discrepancy may be attributed to differences in intervention design, duration, and the integration of behavioral reinforcement components. In the present study, the inclusion of motivational messages, self-monitoring features, and continuous feedback strengthened patient engagement, thereby amplifying both behavioral and psychological outcomes.

The significant increase in treatment adherence underscores the critical role of structured digital support systems in reinforcing medication adherence and lifestyle modifications. This finding aligns with prior research emphasizing adherence as a central determinant of successful

hypertension management (Rizkasari, 2025). Nevertheless, it is important to note that adherence is influenced by multiple factors, including individual motivation, social support, and health literacy, which may explain the variability in individual responses observed in this study.

Furthermore, the improvement in psychological well-being indicates that digital self-management interventions extend beyond physical health benefits to influence emotional and psychosocial domains. Patients who actively engage in self-management tend to develop a greater sense of control, autonomy, and confidence in managing their condition, which contributes to enhanced psychological well-being (H. L. Kim et al., 2023). This finding supports the theoretical assumption that behavioral engagement can positively influence psychological outcomes through increased self-efficacy and perceived control.

The mediation analysis provides important insight into the mechanism underlying these effects. The finding that adherence partially mediates the relationship between digital self-management and psychological well-being suggests that adherence functions as a key pathway through which digital interventions exert their psychological benefits. This result is consistent with contemporary behavioral health models, which emphasize that sustained health behaviors mediate the translation of interventions into improved psychological outcomes (Prima Trisna Aji, Yunie Armiyati, and Elinda Rizkasari, 2026).

From a life course perspective, these findings offer a deeper understanding of how behavioral and psychological processes evolve. Adherence behavior is not static but develops through cumulative experiences, social transitions, and changing health conditions across different stages of life. Digital self-management interventions may serve as a continuous and adaptive support system that accommodates these transitions, enabling patients to maintain consistent self-care behaviors despite age-related or contextual challenges (Aji, Rizkasari, & Baidhowy, 2026).

Moreover, integrating digital tools into daily routines may facilitate long-term behavioral sustainability, a key principle within the life course framework. By providing accessible, real-time support, digital self-management can help patients navigate critical periods of vulnerability, such as disease progression or life transitions, thereby strengthening both adherence and psychological resilience over time (Trisna Aji et al., 2025).

Overall, this study contributes to the existing literature by providing empirical evidence that integrates digital health interventions, adherence behavior, and psychological well-being within a life-course framework. Unlike previous studies that primarily focus on clinical outcomes, this study highlights the importance of considering psychological and behavioral mechanisms in chronic disease management. The findings underscore the need for holistic, patient-centered approaches that combine technological innovation with psychosocial support to optimize long-term health outcomes.

Implication

The findings of this study suggest that integrating digital self-management into hypertension care can enhance both adherence and psychological well-being. Healthcare providers should consider incorporating digital interventions into routine care to promote long-term patient engagement and holistic health outcomes.

Limitation

This study has several limitations that should be acknowledged. First, the use of a one-group quasi-experimental design without a control group limits the ability to establish causal relationships. Second, the relatively short duration of the intervention may not fully capture long-term effects. Future studies are recommended to use randomized controlled designs and longer follow-up periods to validate these findings.

CONCLUSION

This study demonstrates that digital self-management plays a significant role in enhancing psychological well-being among hypertensive patients. The findings indicate that implementing a structured digital self-management program not only improves patients' engagement in self-care behaviors but also contributes to better psychological outcomes. Importantly, treatment adherence partially mediated the relationship between digital self-management and psychological well-being, highlighting its critical role as a behavioral mechanism linking the intervention to psychological outcomes.

These results suggest that improving adherence is essential for maximizing the psychological benefits of digital health interventions. From a life-course perspective, integrating digital self-management into routine care may support sustained behavioral change and psychological adaptation across different life stages. The study contributes to the growing body of evidence emphasizing the importance of combining technological innovation with psychosocial approaches in chronic disease management.

In conclusion, digital self-management interventions offer a promising approach to improving behavioral and psychological outcomes in hypertensive patients. Future research is recommended to explore long-term effects and to incorporate more robust experimental designs to strengthen causal inference and generalizability.

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