

Digital Health Literacy And Adherence To Type 2 Diabetes Mellitus Management: A Cross-Sectional Study At Mojolangu Community Health Center

Bulandari¹, Abdul Qodir², Waifti Amalia³

^{1,2}Department of Nursing, Bachelor of Nursing Program, STIKES Widyagama Husada Malang, Indonesia

³Department of Midwifery, Bachelor of Midwifery Program, STIKES Widyagama Husada Malang, Indonesia

Article Info

Article history:

Received May 25, 2026

Accepted June 07, 2026

Keywords:

Health Literacy

Digital Health Literacy

Management Adherence

Type 2 Diabetes Mellitus

Orem's Self-Care Deficit

Theory

Community Health Center

ABSTRACT

While digital health literacy (DHL) is crucial for type 2 diabetes mellitus (T2DM) self-management, evidence in primary care settings remains limited. This quantitative cross-sectional study aimed to examine the association between DHL and T2DM management adherence among 115 patients (aged 35–65 years) at Mojolangu Community Health Center. Data were collected using the Electronic Health Literacy Scale (eHEALS) and the Indonesian Diabetes Self-Management Instrument (IDN-DSMI). Spearman's rank correlation analysis revealed a significant positive association between DHL and management adherence ($r = 0.622$, $p < 0.001$). In conclusion, higher digital health literacy is associated with better management adherence, suggesting that strengthening DHL may improve patients' self-management capabilities and long-term health outcomes.

Meskipun literasi kesehatan digital (LKD) berperan penting dalam manajemen diri diabetes melitus tipe 2 (DM tipe 2), bukti empiris di fasilitas pelayanan kesehatan primer masih terbatas. Penelitian kuantitatif cross-sectional ini bertujuan untuk menguji hubungan antara LKD dan kepatuhan manajemen DM tipe 2 pada 115 pasien (usia 35–65 tahun) di Puskesmas Mojolangu. Pengukuran dilakukan menggunakan instrumen Electronic Health Literacy Scale (eHEALS) dan Indonesian Diabetes Self-Management Instrument (IDN-DSMI). Analisis korelasi peringkat Spearman menunjukkan hubungan positif yang signifikan antara LKD dan kepatuhan manajemen ($r = 0,622$, $p < 0,001$). Kesimpulannya, tingkat literasi kesehatan digital yang lebih tinggi berasosiasi dengan kepatuhan manajemen yang lebih baik, sehingga penguatan LKD berpotensi meningkatkan kemampuan manajemen diri dan luaran kesehatan jangka panjang pasien.

This is an open-access article under the [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) license.



Corresponding Author:

Bulandari

Program Studi S1 Keperawatan, STIKES Widyagama Husada Malang

Jalan Taman Borobudur Indah 3A Kota Malang, Indonesia

Email: bulandari1806@gmail.com

Introduction

Type 2 diabetes mellitus is a chronic metabolic disease characterized by persistent hyperglycemia resulting from impaired insulin secretion, insulin action, or both. It has become one of the leading global public health challenges due to its increasing prevalence and the substantial burden of long-term complications. According to the World Health Organization (2022), more than 422 million people worldwide are living with diabetes, with approximately 90-95% of cases classified as type 2 diabetes mellitus. Effective disease management requires lifelong adherence to medication, healthy dietary practices, regular physical activity, and routine blood glucose monitoring to reduce the risk of complications and improve quality of life.

In Indonesia, type 2 diabetes mellitus remains one of the most prevalent non-communicable diseases. According to the International Diabetes Federation (2025), Indonesia ranks among the countries with the highest number of adults living with diabetes, with an estimated 20.4 million cases. The prevalence of diabetes continues to increase, particularly among middle-aged and older adults, creating substantial challenges for the healthcare

system. This situation highlights the need to strengthen diabetes self-management adherence to reduce morbidity, prevent complications, and improve patients' quality of life.

Diabetes self-management adherence is influenced by various psychological, behavioral, social, and cognitive factors. One important determinant is patients' understanding of their disease and its treatment. Many patients continue to have misconceptions regarding diabetes management, including the belief that medication can be discontinued once symptoms improve or blood glucose levels become controlled. Such misconceptions may reduce adherence to treatment recommendations and negatively affect long-term disease management (Sahoo et al., 2022).

Health literacy has been recognized as an essential factor supporting effective self-management among individuals with chronic diseases. It refers to an individual's ability to obtain, understand, evaluate, and apply health information to make appropriate health-related decisions (Harahap et al., 2025). With the rapid expansion of digital technology and online health information, the concept of health literacy has evolved into digital health literacy, which encompasses individuals' ability to access, understand, evaluate, and apply health information obtained from digital sources to make informed health decisions (Fitzpatrick, 2023). Adequate digital health literacy enables patients to identify reliable health information, understand treatment recommendations, and implement appropriate self-management strategies. Conversely, limited digital health literacy may hinder informed decision-making and reduce adherence to diabetes self-management.

Previous studies have demonstrated that digital health literacy contributes to improved self-management behaviors and medication adherence among individuals with chronic diseases. Al-Qerem et al. (2024) reported that higher levels of health literacy were significantly associated with better medication adherence among patients with type 2 diabetes mellitus. Similarly, Febriani (2020) found that inadequate understanding of health information contributed to poor adherence, including irregular medication use and failure to follow healthcare recommendations. Tarigan et al. (2025) also reported that limited health literacy was associated with inadequate diabetes self-management, particularly in blood glucose monitoring and lifestyle modification.

Despite these findings, evidence regarding the relationship between digital health literacy and comprehensive diabetes self-management adherence among patients with type 2 diabetes mellitus receiving primary healthcare services in Indonesia remains limited. Most previous studies have primarily focused on general health literacy or medication adherence, whereas studies specifically investigating digital health literacy and diabetes self-management adherence using validated instruments in community health center settings are still scarce. Furthermore, limited evidence is available regarding how digital health literacy influences diabetes self-management among patients receiving routine care at primary healthcare facilities. Addressing this research gap is important to provide evidence that can support the development of evidence-based nursing interventions and strengthen digital health education programs aimed at improving diabetes self-management. Therefore, this study aimed to examine the relationship between digital health literacy and diabetes self-management adherence among patients with type 2 diabetes mellitus at Mojolangu Community Health Center.

Research Methodology

This study employed an analytical correlational design with a cross-sectional approach to examine the relationship between digital health literacy and diabetes self-management adherence among patients with type 2 diabetes mellitus. The study was conducted at Mojolangu Community Health Center, Malang, Indonesia, from March to April 2026. The study population consisted of registered patients with type 2 diabetes mellitus who routinely attended follow-up care at the health center. Participants were recruited using a consecutive sampling technique. The inclusion criteria were a confirmed diagnosis of type 2 diabetes mellitus, receipt of antidiabetic treatment for at least three months, age between 35 and 65 years, willingness to participate, and the ability to access digital health information. Patients with acute hypoglycemic conditions, impaired consciousness, or severe visual, hearing, or cognitive impairments that could interfere with questionnaire completion were excluded. A total of 115 eligible participants were enrolled in the study.

Digital health literacy was assessed using the Indonesian version of the Electronic Health Literacy Scale (eHEALS). The instrument consists of eight items rated on a four-point Likert scale, with total scores ranging from 8 to 32. Higher scores indicate higher levels of digital health literacy. Diabetes self-management adherence was measured using the Indonesian Diabetes Self-Management Instrument (IDN-DSMI), which comprises 35 items covering self-integration, self-regulation, blood glucose monitoring, adherence to treatment recommendations, and interactions with healthcare providers and social support systems. Each item is scored on a four-point Likert scale ranging from never to always, resulting in total scores ranging from 35 to 140. Higher scores indicate better diabetes self-management adherence.

The Indonesian version of the eHEALS underwent a standardized translation and back-translation process, followed by expert evaluation to ensure conceptual equivalence, cultural appropriateness, and linguistic accuracy. Evidence supporting the validity and reliability of both instruments has been reported in previous studies. In the present study, internal consistency reliability was assessed using Cronbach's alpha, yielding coefficients of 0.842 for the eHEALS and 0.887 for the IDN-DSMI, indicating good reliability.

Data were collected using self-administered questionnaires after participants received an explanation regarding the study procedures and provided written informed consent. Descriptive statistics were used to summarize participants' demographic characteristics and study variables. Continuous variables were presented as means and standard deviations or medians and ranges, as appropriate, while categorical variables were summarized as frequencies and percentages. The relationship between digital health literacy and diabetes self-management adherence was analyzed using Spearman's rank correlation coefficient (Spearman's rho), as the variables were analyzed based on their total scores. A p-value of <0.05 was considered statistically significant.

Ethical approval for this study was obtained from the Health Research Ethics Committee of Noor Huda Mustofa University (Approval No. 3168/KEPK/UNIV-NHM/EC/III/2026). Participation was voluntary, and written informed consent was obtained from all participants before data collection. Participants' privacy and confidentiality were strictly maintained, and they were informed of their right to withdraw from the study at any time without any consequences. All research procedures were conducted in accordance with ethical principles, including beneficence, non-maleficence, justice, and respect for persons.

Results

A total of 115 patients with type 2 diabetes mellitus participated in this study. The demographic and clinical characteristics of the respondents are presented in Table 1.

Table 1 shows that the majority of respondents were female (73.0%) and aged 55–65 years (53.9%). Most participants had completed primary education (37.4%), had been diagnosed with type 2 diabetes mellitus for less than five years (65.2%), and used oral antidiabetic medication (90.4%). Hypertension was the most frequently reported diabetes-related comorbidity (82.6%). Regarding blood glucose levels, 47.8% of participants had blood glucose levels ranging from 80 to 139 mg/dL.

Table 1
Characteristics of the Respondents (N=115)

Characteristic	n	Percentage (%)
Gender	84	73.0
Female	31	27.0
Male		
Age (years)	14	12.2
35-44	39	33.9
45-54	62	53.9
55-65		
Education Level	43	37.4
Primary School	12	10.4
Junior High School	36	31.3
High School/ Vocational School	21	20.9
Bachelor's Degree		
Duration of Type 2 Diabetes Mellitus (years)	75	65.2
<5	20	17.4
5-10	20	17.4
>10		
Antidiabetic Medication	104	90.4
Oral medication	11	9.6
Injectable medication		
Diabetes-Related Complications/Comorbidities	18	15.7
None	95	82.6
Hypertension	2	1.7
Other		
Blood Glucose Level (mg/dL)	55	47.8
80-139	32	27.8
140-199	28	24.3
>200		

The descriptive statistics of the main study variables are presented in Table 2.

Table 2
Descriptive Statistics of the Study Variables (N = 115)

Variables	Mean (SD)	Minimum	Maximum
Digital health Literacy (eHeals)	23.56 (8.55)	8	32
Diabetes self-management adherence (IDN-DSMI)	120.94 (23.32)	60	140

Table 2 presents the descriptive statistics of the study variables. The mean score of digital health literacy was 23.56 (SD = 8.55), with scores ranging from 8 to 32. The mean score of compliance with type 2 diabetes mellitus management was 120.94 (SD = 23.32), with scores ranging from 60 to 140.

Table 3
Correlation Between Digital Health Literacy and Diabetes Self-Management Adherence

Variables	r	p-value
Digital health literacy and diabetes self-management adherence	0.622	<0.001

Table 3 demonstrates a significant positive correlation between digital health literacy and diabetes self-management adherence among patients with type 2 diabetes mellitus ($r = 0.622$, $p < 0.001$). This finding indicates that higher digital health literacy is associated with better diabetes self-management adherence.

Discussion

Digital health literacy has become an increasingly important component of chronic disease management as individuals increasingly rely on digital technologies to obtain health information and support everyday health-related decision-making. For people living with type 2 diabetes mellitus, the ability to identify, understand, evaluate, and appropriately apply health information obtained from digital sources facilitates informed decision-making across multiple aspects of diabetes self-management. Beyond improving access to health information, digital health literacy enables individuals to critically interpret available information and translate it into effective self-care practices that support long-term disease management.

The present study demonstrated a significant positive association between digital health literacy and diabetes self-management adherence. Individuals with higher levels of digital health literacy were more likely to adhere to recommendations related to medication use, dietary management, physical activity, and blood glucose monitoring. These findings suggest that patients who are able to effectively access, understand, evaluate, and apply digital health information are better equipped to make informed decisions and consistently perform recommended self-management behaviors. The observed association is consistent with accumulating evidence indicating that digital health literacy plays an important role in improving self-management among individuals living with chronic diseases. Wu et al. (2022) reported that higher digital health literacy was associated with better self-management behaviors through greater patient engagement and more effective use of health information. Similarly, Chima et al. (2020) found that adequate health literacy encourages active participation in treatment decisions and improves adherence to prescribed therapies, whereas Heizomi et al. (2020) demonstrated that individuals with higher health literacy consistently exhibit better medication adherence. Furthermore, a systematic review and meta-analysis conducted by Kim et al. (2023) reported a significant positive correlation between digital health literacy and health-related behaviors ($r = 0.31$), confirming that digital health literacy serves as an important mechanism for translating online health information into practical self-care and disease management behaviors.

The present findings are further strengthened by evidence from recent systematic reviews focusing specifically on individuals with type 2 diabetes mellitus. Butayeva et al. (2023) concluded that health literacy interventions significantly improved diabetes self-management adherence and contributed to better glycemic outcomes. Their review demonstrated that strengthening patients' ability to access, understand, evaluate, and use health information promotes positive behavioral changes across multiple domains of diabetes care, including medication adherence, dietary management, physical activity, and blood glucose monitoring. Likewise, Mukhtar et al. (2025) reported that digital health literacy interventions consistently improved self-management skills, medication adherence, self-efficacy, and clinical outcomes, including reductions in glycated hemoglobin levels among individuals with chronic diseases. Collectively, these findings indicate that digital health literacy functions as an enabling resource that supports informed decision-making and facilitates sustained diabetes self-management adherence across different healthcare settings.

Although the overall evidence strongly supports the benefits of digital health interventions, not all studies have demonstrated consistent improvements in medication adherence. McCabe et al. (2026), in a recent systematic review and meta-analysis, reported that digital health interventions did not produce a statistically significant overall improvement in medication adherence when compared with standard care. However, subgroup analyses showed that interventions delivered for at least six months resulted in significantly better adherence outcomes than shorter interventions. These findings suggest that the effectiveness of digital health interventions may depend not only on the availability of digital technologies but also on sustained patient engagement and continued behavioral reinforcement. This interpretation complements the findings of the present study by indicating that digital health literacy provides the necessary capability for effective self-management, whereas long-term engagement with digital interventions may further strengthen diabetes self-management adherence over time.

An important contribution of the present study is that digital health literacy was associated with comprehensive diabetes self-management adherence rather than with a single self-care behavior. Effective management of type

2 diabetes mellitus requires patients to make continuous decisions regarding medication adherence, dietary choices, physical activity, blood glucose monitoring, and regular communication with healthcare professionals. Therefore, the ability to effectively utilize digital health information may simultaneously influence multiple dimensions of self-management, highlighting digital health literacy as a comprehensive resource that supports long-term chronic disease management within primary healthcare settings.

Several mechanisms may explain the positive association between digital health literacy and diabetes self-management adherence observed in the present study. Individuals with adequate digital health literacy are generally more proactive in seeking health information, comparing information from multiple digital sources, and applying evidence-based recommendations to their daily self-care practices. Digital platforms provide immediate access to educational resources, practical recommendations, and disease-related information that enhance disease knowledge, strengthen self-efficacy, and support informed decision-making. Tennant et al. (2015) suggested that individuals who actively engage with digital health information are more likely to adopt positive health behaviors because continuous exposure to reliable information improves both health knowledge and confidence in self-management. This conceptual pathway is further supported by Kim et al. (2023), who demonstrated that digital health literacy serves as an important mediator linking online health information with health-promoting behaviors and disease management practices. Their findings indicate that individuals with higher digital health literacy are more likely to translate health information into sustainable behavioral changes that support long-term disease management.

In the present study, many participants reported using widely accessible digital platforms, including WhatsApp, YouTube, and Facebook, to obtain health-related information. These platforms provide convenient opportunities for patients to access educational materials, practical recommendations, and peer experiences that reinforce their understanding of diabetes management. When information is obtained from reliable sources, repeated exposure through familiar digital platforms may strengthen patients' confidence and encourage greater adherence to recommended self-management behaviors. This finding suggests that commonly used communication platforms can serve as valuable channels for delivering diabetes education within community healthcare settings.

Beyond information seeking, digital technologies also provide practical support for long-term disease management. Educational videos, mobile messaging applications, medication reminders, electronic health records, and digital self-monitoring tools enable patients to monitor their health status more consistently while maintaining regular communication with healthcare professionals. Consistent with these findings, Nikhoma et al. (2021) reported in a systematic review and meta-analysis that mobile application-based diabetes self-management education and support significantly improved medication adherence, glycemic control, and overall diabetes self-management among adults with type 2 diabetes mellitus. Their review further demonstrated that digital applications incorporating medication reminders, blood glucose monitoring, dietary tracking, physical activity recording, and communication with healthcare providers achieved high levels of user engagement and contributed to meaningful improvements in clinical outcomes. Similarly, Mukhtar et al. (2025) concluded that digital health literacy interventions integrating interactive educational approaches, culturally tailored content, and digital monitoring tools improved self-management skills, medication adherence, self-efficacy, and clinical outcomes while reducing barriers to healthcare access. Together, these findings suggest that digital health literacy and digital health technologies complement one another by strengthening patients' capacity to maintain effective diabetes self-management adherence in everyday life.

An important finding of the present study was that relatively high levels of digital health literacy were observed despite most participants being older adults with relatively low educational attainment. This finding suggests that digital health literacy may be influenced not only by individual characteristics but also by social and environmental factors. In many Indonesian families, relatives actively support older family members with chronic illnesses by assisting them in accessing digital technologies, searching for health information, and interpreting health-related content. Such family support may compensate for limited individual digital skills and facilitate access to reliable health information, thereby strengthening diabetes self-management adherence. This interpretation is consistent with the subgroup analysis reported by Kim et al. (2023), which demonstrated that

the association between digital health literacy and health-related behaviors was stronger among older adults than among younger individuals. These findings indicate that improving digital health literacy among older adults can produce meaningful behavioral benefits, particularly when family members provide ongoing support in accessing and utilizing digital health information.

The characteristics of the study population may also have contributed to the observed association. Participants were recruited from individuals who routinely attended primary healthcare services, indicating regular interaction with healthcare professionals and repeated exposure to diabetes education. Continuous engagement with healthcare providers may reinforce patients' knowledge, strengthen motivation, and encourage sustained diabetes self-management adherence. Furthermore, individuals living with type 2 diabetes mellitus for longer periods or those with accompanying comorbidities often require continuous treatment and monitoring. These circumstances may motivate patients to seek additional health information through digital resources and become more actively involved in managing their condition, thereby further strengthening their digital health literacy and self-management behaviors.

The findings of the present study can be interpreted within the framework of Orem's Self-Care Deficit Theory, which proposes that effective self-care depends on an individual's self-care agency, defined as the acquired capability to perform activities that maintain health, prevent complications, and manage chronic illness. According to Orem, self-care is a learned behavior that can be strengthened through education, guidance, and supportive nursing interventions. In the context of type 2 diabetes mellitus, digital health literacy may enhance self-care agency by enabling individuals to obtain, understand, evaluate, and appropriately apply health information from digital sources when making everyday health-related decisions. As patients become more knowledgeable and confident in managing their condition, they are more likely to perform essential self-care activities, including medication adherence, healthy dietary practices, regular physical activity, blood glucose monitoring, and regular communication with healthcare professionals. This interpretation is supported by Fereidooni et al. (2024), who applied Orem's Self-Care Theory and demonstrated that self-efficacy was an demonstrated determinant of self-care behaviors among individuals with type 2 diabetes mellitus. Their findings further emphasized that self-care is an acquired behavior that can be strengthened through patient education and empowerment, leading to better disease management. Therefore, improving digital health literacy may represent an effective nursing strategy to strengthen patients' self-care agency, enhance self-efficacy, and promote sustainable diabetes self-management adherence.

Study Limitations

This study has several limitations that should be acknowledged. First, the cross-sectional design precludes the establishment of causal relationships between digital health literacy and type 2 diabetes mellitus management adherence. Second, the reliance on self-reported questionnaires may have introduced response and recall biases. Third, digital health literacy was assessed using the eHEALS, which captures participants' perceived confidence rather than their objectively demonstrated digital health literacy skills. Consequently, the reported scores may not fully reflect participants' actual abilities to navigate and apply reliable digital health information in real-world settings. Furthermore, the study observed that some younger participants experienced poor glycemic control and limited use of digital health information despite their age. This indicates that the utilization of digital health resources is likely influenced by unmeasured confounders, such as intrinsic motivation, health-seeking behaviors, previous digital experience, and individual comprehension levels. Future studies should employ longitudinal or interventional research designs to better evaluate the causal effects of digital health literacy on management adherence. Additionally, subsequent research would benefit from including a broader demographic and exploring other potential influencing factors, such as family support, socio-economic characteristics, and objective digital literacy measures, to provide a more comprehensive understanding of diabetes self-management.

Conclusions

This study demonstrates a significant positive association between digital health literacy and type 2 diabetes mellitus management adherence among patients at Mojolangu Community Health Center. Patients with higher digital health literacy are more likely to adhere to recommended management practices, indicating that the ability to access, understand, evaluate, and apply digital health information directly enhances their capacity to maintain effective self-care behaviors. These findings emphasize the necessity of integrating digital health literacy into routine community health nursing interventions. Healthcare professionals should leverage familiar digital platforms and actively involve family members to support older adults in navigating digital health information. Future research should prioritize longitudinal or interventional designs to further evaluate the long-term effectiveness of digital health education on management adherence and clinical outcomes across diverse populations.

Acknowledgment

The authors sincerely thank all participants for their valuable contribution to this study. Appreciation is also extended to the staff of Mojolangu Community Health Center and all parties who provided support and assistance throughout the research process

Conflict of Interest

The authors declare that there is no conflict of interest related to the research process, authorship, or publication of this scientific article.

CreDIT Author Statement

Bulandari: Conceptualization, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing – Original Draft, Writing – Review & Editing, Visualization. **Abdul Qodir:** Conceptualization, Methodology, Validation, Project Administration, Supervision, Writing – Review & Editing. **Waifti Amalia:** Methodology, Validation, Writing – Review & Editing, Supervision.

References

- Al-Qerem, W., Jarab, A., Eberhardt, J., Alkaee, S. M., & Alsabaa, Z. H. (2024). Health literacy and medication adherence among patients with type 2 diabetes in Jordan : A cross-sectional study. *Patient Preference and Adherence*, 18(September 2024), 2019–2026. <https://doi.org/10.2147/PPA.S484135>
- Butayeva, J., Ratan, Z. A., Downie, S., & Hosseinzadeh, H. (2023). The impact of health literacy interventions on glycemic control and self-management outcomes among type 2 diabetes mellitus: A systematic review. *Journal of Diabetes*, 15(9), 724–735. <https://doi.org/10.1111/1753-0407.13436>
- Chima, C. C., Abdelaziz, A., Asuzu, C., & Beech, B. M. (2020). Impact of health literacy on medication engagement among adults with diabetes in the United States A systematic review. *The Diabetes Educator*, 46(4), 335–349. <https://doi.org/10.1177/0145721720932837>
- Febriani, D. H. (2020). Health Literacy pada Pasien Diabetes Mellitus Tipe 2. *Media Ilmu Kesehatan*, 9(2), 127–132. <https://garuda.ristekbrin.go.id/documents/detail/2251586>
- Fitzpatrick, P. J. (2023). Improving health literacy using the power of digital communications to achieve better health outcomes for patients and practitioners. *Frontiers in Digital Health*, 5(November), 1–13. <https://doi.org/10.3389/fdgth.2023.1264780>
- Ghorbanali Jennat Fereidooni, Fazlollah Ghofranipour, & Zarei, F. (2024). Interplay of self-care , self-efficacy , and health deviation self-care requisites : a study on type 2 diabetes patients through the lens of Orem ' s self-care theory. *BMC Primary Care*, 25(1), 1–10. <https://doi.org/10.1186/s12875-024-02276-w>

- Harahap, A. A., Ridwan, A., & Diba, F. (2025). Hubungan literasi kesehatan dengan manajemen perawatan diri pada penderita diabetes melitus tipe 2 di Puskesmas Banda Aceh. *Indonesian Journal of Professional Nursing*, 6(2), 126–134. <https://doi.org/10.30587/ijpn.v6i2.9229>
- Heizomi, H., Iraj, Z., Vaezi, R., Bhalla, D., Morisky, D. E., & Nadrian, H. (2020). Gender differences in the associations between health literacy and medication adherence in hypertension: A population-based survey in Heris. *Vascular Health and Risk Management*, 16, 157–166. <https://doi.org/10.2147/VHRM.S245052>
- International Diabetes Federation. (2025). *IDF Diabetes Atlas*. <https://diabetesatlas.org/>
- Kim, K., Shin, S., Kim, S., & Lee, E. (2023). The Relation between eHealth Literacy and Health-Related Behaviors: Systematic Review and Meta-analysis. *Journal of Medical Internet Research*, 25. <https://doi.org/10.2196/40778>
- McCabe, C., Connolly, L., Hughes, M., Doyle, C., Weir, A., McCann, M., & Brenner, M. (2026). Impact of digital health interventions on medication adherence: A systematic review and meta-analysis. *Digital Health*, 12, 1–29. <https://doi.org/10.1177/20552076251361593>
- Mukhtar, T., Babur, M. N., Abbas, R., Irshad, A., & Kiran, Q. (2025). Digital health literacy: a systematic review of interventions and their influence on healthcare access and sustainable development Goal-3 (SDG-3). *Pakistan Journal of Medical Sciences*, 41(3), 910–918. <https://doi.org/10.12669/pjms.41.3.10639>
- Nikhoma, D. E., Soko, C. J., Banda, K. J., Greenfield, D., Li, Y.-C. (Jack), & Iqbal, U. (2021). Impact of DSMES app interventions on medication adherence in type 2 diabetes mellitus: Systematic review and meta-analysis. *BMJ Health and Care Informatics*, 28(1), 1–9. <https://doi.org/10.1136/bmjhci-2020-100291>
- Sahoo, J., Mohanty, S., Kundu, A., & Epari, V. (2022). Medication Adherence Among Patients of Type II Diabetes Mellitus and Its Associated Risk Factors : A Cross-Sectional Study in a Tertiary Care Hospital of Eastern India. *Cureus*, 14(12), 6–14. <https://doi.org/10.7759/cureus.33074>
- Tarigan, S. A., Hulu, V. T., & Simanjuntak, M. R. (2025). Studi Cross Sectional: Eksplorasi Pengetahuan dan Sikap Tentang Pengelolaan Diri pada Pasien Diabetes Mellitus Tipe 2. *Sehat Rakyat (Jurnal Kesehatan Masyarakat)*, 4(3), 730–737. <https://doi.org/10.54259/sehatrakyat.v4i3.5139>
- Tennant, B., Stellefson, M., Dodd, V., Chaney, B., Paige, S., & Alber, J. (2015). eHealth Literacy and Web 2.0 Health Information Seeking Behaviors Among Baby Boomers and Older Adults. *Journal Of Medical Internet Research*, 17(3), 1. <https://doi.org/10.2196/jmir.3992>
- World Health Organization. (2022). *WHO guideline on self-care interventions for health and well-being: 2022 revision*.
- Wu, Y., Wen, J., Wang, X., Wang, Q., Wang, W., Wang, X., Xie, J., & Cong, L. (2022). Associations between e-health literacy and chronic disease self-management in older Chinese patients with chronic non-communicable diseases: A mediation analysis. *BMC Public Health*, 22, 1–10. <https://doi.org/10.1186/s12889-022-14695-4>