Review Paper

Advancing Pediatric Medication Adherence Through Digital Health Psychology: A Narrative Review

Ghasem Rahmatpour Rokni[1], Mobina Khalilnezhadevati[2], Hossein Sadeghnezhad[3], Ghodratollah Abbasi[4]

1. Department of Dermatology, School of Medicine, Mazandaran University of Medical Sciences, Sari, Iran.
2. Department of Psychology, Go.C., Islamic Azad University, Gorgan, Iran.
3. School of Paramedical, Mazandaran University of Medical Sciences, Sari, Iran.
4. Department of Psychology, Sar.C., Islamic Azad University, Sari, Iran.

Use your device to scan and read the article online

Citation Rahmatpour Rokni Gh, Khalilnezhadevati M, Sadeghnezhad H, Abbasi Gh. Advancing Pediatric Medication Adherence Through Digital Health Psychology: A Narrative Review. Journal of Pediatrics Review. 2026; 14(1):63-72. http://dx.doi.org/10.32598/jpr.14.1.1237.2

http://dx.doi.org/10.32598/jpr.14.1.1237.2

Article info:
Received: 18 Feb 2025
First Revision: 02 Mar 2025
Accepted: 13 Apr 2025
Published: 01 Jan 2026

Key Words:
Digital health, Health behavior, Medication adherence, Patient compliance, Pediatrics

ABSTRACT

Background: Insufficient adherence to medication regimens creates a major challenge in the management of chronic pediatric diseases. This challenge can result in unfavorable clinical outcomes, increased healthcare costs, and reduced quality of life. This narrative review examines and synthesizes the existing evidence on the effectiveness of integrated approaches (combining health psychology principles and digital technologies) for enhancing pediatric medication adherence.

Methods: This study was a narrative review based on a systematic search across PubMed, Scopus, Web of Science, and PsycINFO from 2013 to 2025. The inclusion criteria comprised studies that examined integrated interventions in children with chronic diseases. The psychological principles included theoretical foundations such as motivational interviewing, parent education, and behavior change frameworks. The digital technologies encompassed mainly Wearables/ Telemonitoring, Web Portals, Mobile Apps, and other digital tools. Study selection and data extraction were performed according to the PRISMA narrative-adapted guidelines.

Results: Digital technologies, including wearable devices, physical monitoring systems, web portals, mobile applications, and other useful technologies, are effective in promoting medication adherence among pediatric patients with chronic diseases. By providing reminders, feedback, and education, these tools increased self-efficacy and intrinsic motivation. They improved patients' and families' quality of life, consistent with the principles of health psychology regarding behavior change. Parental involvement was a key factor in the success of these interventions, with the highest effectiveness observed in diseases such as asthma, Type 1 diabetes, and epilepsy. Simultaneously, digital access inequality, low health literacy, and privacy concerns were identified as major challenges in implementing these programs.

Conclusions: This review reveals that an integrated approach grounded in digital health psychology provides a comprehensive and effective framework for enhancing pediatric medication adherence. This approach not only targets the multiple barriers to adherence but also improves treatment outcomes and reduces readmissions. Nevertheless, effectiveness is influenced by factors such as active parental involvement, digital health literacy, and cultural and economic barriers. For future research, the development of integrated models using systematic frameworks, the engagement of stakeholders, the conduct of longitudinal trials with large and diverse samples, and the examination of ethical and legal dimensions, including data security and informed consent, are essential.

** Corresponding Author:*
Ghodratollah Abbasi, Associate Professor.
Address: *Department of Psychology, Sar.C., Islamic Azad University, Sari, Iran.*
Tel: *+98 (11) 34445761*
E-mail: *gh_abbasi@iausari.ac.ir*

Introduction

Pediatric patients with chronic or acute diseases, such as asthma, type 1 diabetes, leukemia, and long-term inflammatory disorders, face unique challenges in managing their health [1-3]. This group, which includes those under 18 years of age, is more susceptible than other age groups to problems related to self-care and treatment management due to developmental characteristics, heavy reliance on parents, and limitations in understanding the nature of the illness and the treatment process [4]. One of the major challenges in this area is medication adherence, defined as the correct and consistent use of medication in accordance with the prescribed dosage, timing, and the physician's instructions throughout the treatment period [5]. Research has shown that poor adherence is highly prevalent in this group and can lead to deterioration in health status, increased emergency room visits, recurrent hospitalizations, and higher care costs [1, 6-8]. Medication non-adherence in pediatric patients with chronic diseases can double the risk of readmission and significantly increase healthcare costs [9]. Beyond physical outcomes, non-adherence reduces the quality of life for the children and the family, creating a psychological burden, including anxiety and depression [10].

Multiple factors contribute to non-adherence, including unpleasant medication taste, complexity of the treatment regimen, psychological barriers, and executive difficulties. Therefore, designing multifaceted interventions that engage the family and are grounded in the principles of health psychology and behavioral sciences is of paramount importance [11, 12]. In this regard, leveraging validated theoretical models such as the Health Belief Model and Self-Regulation Theory allows for the design of educational and motivational programs and the establishment of sustainable medication habits [13, 14]. Scientific evidence also indicates that such interventions, especially when the family is involved, are effective in enhancing medication adherence [15, 16].

In recent years, digital health tools such as electronic medication monitors, smart inhalers, mobile applications, and smart pillboxes have been increasingly used in managing pediatric health behaviors by providing immediate feedback and personalized support [17-20]. Digital health tools include a range of technologies that utilize electronic capabilities and internet connectivity to provide real-time monitoring, user-centered interaction, and instant feedback [21]. Recent reviews have shown that these tools can improve medication adherence and some clinical outcomes, although the quality of evidence and uniformity of results have varied. For example, a systematic review conducted between 2014 and 2022 examined 14 randomized controlled trials on mobile applications. The results indicate that most of these applications have improved pediatric medication adherence [22]. Furthermore, technologies such as SMS messaging or mobile applications have shown promising effects in the Pediatric population. However, results have been scattered, and the need for longer-term studies is felt [23].

However, most previous studies have focused only on one of the two areas—psychological interventions or digital technology—and a comprehensive review that examines both dimensions in an integrated manner within the pediatric population is very limited. Moreover, many conventional interventions have failed to effectively address the specific developmental and behavioral needs of pediatric patients, resulting in limited effectiveness. Furthermore, in the design of many pediatric medication programs, sufficient use of evidence-based health psychology interventions has not been made, leading to reduced sustainability of behavioral changes. Conversely, existing studies have paid less attention to the role of psychological factors in the acceptance and use of digital tools, even though these factors can determine the level of engagement and the actual effectiveness of these technologies. Finally, the available data on the long-term outcomes of digital interventions, including sustainable changes in health behaviors, family outcomes, and effects on the health system, remain limited [1, 11, 24-26]. Therefore, the present study aims to conduct a narrative review that, by integrating psychological interventions and digital technology, addresses the design of targeted, sustainable, and generalizable solutions to enhance pediatric medication adherence.

Materials and Methods

This study was designed as a narrative-descriptive and analytical review to conceptually examine the combined role of health psychology-based interventions and digital health solutions in enhancing Pediatric medication adherence. In narrative reviews, the focus is on critical analysis, conceptual synthesis, and interpretation of findings, rather than on comprehensive searching and quantitative synthesis, as in systematic reviews. To enhance clarity and reporting quality, recognized criteria for evaluating narrative reviews guided the writing of this section; specifically, the principles articulated in the SANRA (scale for the assessment of narrative review ar-

ticles) scale were utilized to ensure items such as clarity of purpose, logical description of source selection, rational organization, and critical discussion were maintained in the text. This approach ensures that the narrative review, while maintaining explanatory flexibility, demonstrates acceptable methodological criteria.

Databases and search strategy

Electronic search was conducted across key databases, including PubMed (MEDLINE), Scopus, Web of Science, PsycINFO, and the Cochrane Library. Supplementary search was also conducted in Google Scholar and by reviewing the reference lists of selected articles to identify influential studies and gray literature. The search was limited to English-language studies published between 2013 and 2025 to gather evidence on novel technologies and contemporary applications. The scope of the review was restricted to studies that explicitly addressed the combination of health psychology components (such as parent-pediatric education, motivational interviewing, behavioral strategies, cognitive restructuring, and programs based on the health belief theory) with digital health tools (such as mobile applications, SMS/text messaging, IoT devices, Telemedicine, and electronic medication monitors) and whose main outcome was at least one of the indicators of medication adherence, caregiver involvement, or related clinical outcomes. Search terms were a combination of keywords and subject headings, for example: (“Digital health” OR “mobile health” OR “E-health” OR “mobile applications” OR “telemedicine”) AND (“health behavior” OR “behavioral intervention” OR “health psychology”) AND (“medication adherence” OR “treatment adherence” OR “medication compliance” OR “patient compliance”) AND (“children” or “children” or “adolescents”).

Inclusion and exclusion criteria

Included studies were primarily experimental, including randomized clinical trials, quasi-experimental studies, and mixed-methods designs that provided valid quantitative or qualitative data. Other articles, such as systematic reviews, scoping reviews, and purely theoretical studies, were used solely for background context.

Study selection process

In the initial stage, titles and abstracts were screened by two independent researchers using Rayyan software, according to the inclusion and exclusion criteria. Articles that met the inclusion criteria were reviewed in the second stage as full-text. Any disagreements between the two researchers were resolved through discussion and, if necessary, by consulting with other researchers.

Data extraction

Data were extracted in a structured manner using a standard form. The extraction template included information on the author(s) and year of publication, country of study, sample characteristics (size, age group, clinical diagnosis, role of caregivers), description of the intervention (psychological components and technological tools), adherence measures and methods (objective monitoring, self-report, caregiver report), relevant clinical outcomes, and implementation considerations (acceptance, continued use, digital access, and digital literacy). Data extraction was performed independently by two researchers, and discrepancies were resolved through joint discussion or referral to other researchers.

Quality assessment and data analysis

A formal risk-of-bias assessment using quantitative tools was not performed, but the quality of the studies was qualitatively assessed. In the critical analysis, criteria such as study design, sample size, clarity of outcome measures, follow-up duration, and the psychological rationale of the intervention were considered as interpretive weighting indicators. Furthermore, the review explicitly examined critical ethical and legal issues related to the use of digital tools in pediatric population (data privacy, age-appropriate consent/assent, the role of caregivers, regulatory implications, and risks related to inequality in access and digital literacy) and framed them within the context of implementability, practical recommendations for research and implementation were provided based on these considerations. His emphasis on ethical and equity dimensions is a key component of the narrative and is highly recommended in reviews focusing on digital health and vulnerable populations.

Data synthesis

The synthesis of findings was conducted thematically and conceptually. Thematic and summary matrices were used to highlight patterns and to compare them.

Study flow

A total of 66 articles were identified through the search. Then, 66 articles were identified as eligible for full-text evaluation. Following careful review, 44 studies ultimately met the inclusion criteria for this review and

were included in the final analysis. The flow of study selection was conducted in accordance with the PRISMA-Narrative Adapted guideline.

Results

The synthesis of current studies indicates that integrated approaches that embed health psychology principles into digital technologies represent the most effective framework for enhancing medication adherence in the pediatric population. The predominant focus of existing research has been on the pediatric age group (under 18 years) with chronic conditions such as asthma, type 1 diabetes, epilepsy, ADHD, and cancer [27]. It is noteworthy that, while the theoretical foundations of health psychology (such as Motivational Interviewing and feedback) have a long history of improving clinical outcomes, recent evidence suggests that translating these principles into operational capabilities within digital tools has revolutionized their effectiveness [28, 29].

Recent evidence also demonstrates the significant potential of pure digital interventions. For example, a 2021 review indicates that, in pediatric patients with asthma, the use of mobile applications, reminder text messages, and telemonitoring improved medication adherence across several studies; however, the evidence regarding the impact of these interventions on disease control was reported as less conclusive [18]. Nevertheless, the main advancement in recent years has been the emergence of "digital health psychology" as an independent field, in which various apps serve as comprehensive digital assistants by inherently integrating functions such as reminders, tracking, and training [30]. A crucial point is the conscious and structured integration of health psychology theoretical frameworks—such as the health belief model, the theory of planned behavior, and the reinforcement of self-efficacy—into the core design of these tools, which directly enhances their effectiveness [31, 32]. For instance, designing digital interventions based on the health belief model has helped improve adherence by influencing parental beliefs about disease severity and treatment barriers [32].

Multiple factors influence the effectiveness of these digital interventions. The active involvement of parents and caregivers has been identified as a key determinant factor in the success of digital interventions [33]. Empowering caregivers through digital platforms regarding medication management and the consequences of non-adherence has led to significant improvement in outcomes, particularly in diseases such as epilepsy and asthma [33]. However, families' digital health literacy directly affects the adoption and effective use of these technologies [34]. Furthermore, cultural-linguistic barriers [35] and socio-economic challenges, such as family economic status and unequal access to digital technologies (like smartphones and the internet), can limit the effectiveness of interventions and contribute to the widening of health disparities [4, 36].

Digital tools are diverse, and differences in design, content, and interaction lead to varying effects on adherence [37]. Digital interventions have significant potential not only to increase medication adherence but also to directly affect psychological indicators such as self-efficacy, symptom awareness, disease-related anxiety, health-related quality of life (HRQoL), and caregiver burden [38]. In other words, medication applications do not only improve "adherence," they can also strengthen "self-efficacy in medication management," "parental awareness of symptoms," and "reduction of anxiety related to fear of forgetting or error in medication administration," which in turn facilitates the improvement of HRQoL and the reduction of the family's psychological burden [39].

These tools can be grouped into 4 main categories: Wearables/telemonitoring [40], Web Portals [41], Mobile Apps [42], and other digital tools [43]. Each of these categories is introduced in detail below.

Wearables/telemonitoring

The wearables/telemonitoring category includes physical devices equipped with sensors that automatically or semi-automatically collect and transmit health data. Example tools include ePRO diary (handheld device for pain logging) [44], AdhereTech (smart pill bottle) [45], Wisepill (connected pillbox) [46], Smartwatch app (smartwatch application for asthma) [47], and Store-and-Forward home video systems [48]. These tools enable objective, real-time monitoring of health parameters (such as medication consumption, pain, and respiratory symptoms). For example, IoT devices such as smart inhalers enable objective monitoring of medication use and provide real-time feedback to pediatric patients and their parents. Studies have confirmed that these systems can automatically record medication timing and provide feedback to patients [49]. Electronic medication monitoring devices are accurate tools for recording medication consumption patterns and identifying instances of non-adherence, providing the treatment team with objective, quantitative data [27]. Although these technologies offer significant opportunities, they face challenges such as high costs, training requirements, and privacy and equitable access issues [27, 50].

Web portals

The Web Portals category encompasses browser-based management systems that provide access to health information, treatment plans, and communication tools. Examples include constant-care.com (for inflammatory bowel disease) [51], MyAsthma (for pediatric asthma) [52], and Diabit (social and educational network for diabetes) [53]. These platforms typically include various functions such as patient and parent education, symptom monitoring, setting disease management goals, medication reminders, and facilitating communication with the treatment team. Their advantages include easy access, customizability, and the active involvement of young people in managing their own health. However, challenges exist, including a gradual decline in user engagement and barriers to digital literacy and access [54].

Mobile apps

The mobile apps category includes installable programs on mobile phones or tablets that offer a wide range of self-care functionalities. Examples for medication adherence include Medisafe (medication reminder) [42], AiCure (visual confirmation of pill ingestion using artificial intelligence) [55], and Pill-photo (pill photo logging) [56]. These applications aid in better disease management by providing personalized programs [54]. One systematic review showed that among a large number of medication adherence applications, only a limited number possessed scientific evidence [57]. Other reviews suggest that mobile applications can lead to meaningful improvement in disease control (such as asthma) and increased adherence to treatment [58].

Other digital tools

Other digital tools include advanced and emerging technologies, such as smart devices and digital pills (Proteus, [59]). It also includes chatbot programs and sentiment analysis (such as the co-pilot for health project) [60]. Artificial intelligence applications guide health behaviors by interpreting user emotions, providing supportive conversation, personalized self-care recommendations, and smart nudging. They can foster a sense of control, trust, and self-efficacy, influencing the dimensions of digital health psychology [61, 62]. Although these apps provide low-cost, accessible interventions, they have limitations, such as the need for clinical validation and privacy concerns [63, 64].

This digital transformation extends medication adherence support beyond clinical encounters and embeds it in children's daily lives, providing continuity, ecological validity, and behavioral reinforcement in natural contexts. Within this framework, each category of digital tools presents specific advantages and limitations: wearable devices and remote monitoring systems offer high precision in tracking medication intake and health status through real-time, objective feedback, whereas mobile applications and web portals enable scalable interventions and active user engagement. Nevertheless, each of these tools faces particular challenges; for instance, wearables are associated with high costs and privacy concerns, mobile applications often experience low user retention, and web portals require sustained motivation and digital literacy. Furthermore, emerging technologies such as AI-driven chatbots and digital pills hold considerable potential for personalizing behavioral interventions. Yet, rigorous clinical trial validation is essential to ensure their safety, ethical use, and psychological appropriateness.

Discussion

The findings of this narrative review demonstrate that the integrated approach based on digital health psychology provides a comprehensive and effective framework for enhancing medication adherence in the Pediatric population. In this framework, psychological principles (such as increasing motivation, providing targeted education, and strengthening family-treatment team interaction) act as the theoretical foundation for designing digital interventions. Furthermore, digital tools such as therapeutic applications and personalized algorithms have enabled real-time monitoring and timely interventions [62, 65]. The resulting synergy from this strategic integration can lead to reduced medication errors, improved treatment outcomes, and a significant enhancement in the quality of life of pediatric patients [10, 27, 65].

This narrative review provided valuable insights into the role of digital health psychology in enhancing Pediatric medication adherence; however, several limitations are noteworthy. First, because the research is narrative, the review process was not conducted using systematic frameworks such as PRISMA, which may introduce bias into study selection and reduce reproducibility. Second, there was considerable heterogeneity in the reviewed studies, particularly in the type of digital tools (mobile software, web platforms, wearable sensors, electronic medication monitoring systems, and artificial intelligence tools), target populations, and outcome indicators, making direct comparison and synthesis of results

difficult. Third, publication bias is a possibility, as studies with positive results are often published, while negative or non-significant findings are less frequently reported. Fourth, technological and infrastructural challenges, including the need for high-speed internet, software and hardware incompatibility, high costs, and user resistance to new technologies, represent significant limitations on the generalizability of the findings. Finally, most research has been conducted in high-resource, affluent societies, limiting the transferability of results to diverse cultural and economic contexts.

In light of these limitations, future research should achieve greater transparency and rigor by utilizing systematic frameworks (PRISMA). The development of integrated models that merge psychological interventions with digital health technologies can yield higher effectiveness. Furthermore, the participation of various stakeholders, including Pediatric patients, parents, and the treatment team, in the design and evaluation of future interventions is essential to achieve higher acceptance, efficiency, and meaningfulness. Cost-benefit analyses and the conduct of longitudinal randomized controlled trials with large, diverse samples can also help examine the sustainability and long-term effectiveness of these interventions [1, 66]. Finally, the empirical investigation of ethical and legal dimensions, including data security, informed consent, and the digital rights of Pediatric patients, is an essential prerequisite for future research that will ensure the successful implementation of digital interventions in the Pediatric healthcare system.

Conclusion

This review reveals that an integrated approach grounded in digital health psychology provides a comprehensive and effective framework for enhancing pediatric medication adherence. This approach not only targets the multiple barriers to adherence but also improves treatment outcomes and reduces readmissions. Nevertheless, effectiveness is influenced by factors such as active parental involvement, digital health literacy, and cultural and economic barriers. For future research, the development of integrated models using systematic frameworks, the engagement of stakeholders, the conduct of longitudinal trials with large and diverse samples, and the examination of ethical and legal dimensions, including data security and informed consent, are essential.

Ethical Considerations

Compliance with ethical guidelines

This article is a narrative review with no human or animal sample.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors contributions

Conceptualization and supervision: Ghodratollah Abbasi; Investigation and writing the original draft: Ghodratollah Abbasi and Mobina Khalilnezhadevati; Review and editing: All authors.

Conflicts of interest

The authors declared no conflict of interest.

Acknowledgements

The authors would like to express their gratitude to all researchers whose work was included in this narrative review. Their valuable contributions to pediatric medication adherence and digital health psychology provided the foundation for this study.

References

1. Van De Hei SJ, Stoker N, Flokstra-de Blok BM, Poot CC, Meijer E, Postma MJ, et al. Anticipated barriers and facilitators for implementing smart inhalers in asthma medication adherence management. NPJ Prim. Care Respir. Med. 2023; 33(1):22-32. [DOI:10.1038/s41533-023-00343-w] [PMID]

2. Catarino M, Charepe Z, Festas C. Promotion of self-management of chronic disease in children and teenagers: A scoping review. Healthc (Basel). 2021; 9(12):1-22. [DOI:10.3390/healthcare9121642] [PMID]

3. McCrossan P, Shields MD, McElnay JC. Medication adherence in children with asthma. Patient Prefer. Adherence. 2024; 18:555-64. [DOI:10.2147/PPA.S445534] [PMID]

4. Yang C, Yang Y, Zhang L, Li D. Examining factors that influence medication adherence with children seen at outpatient department in Western China: A cross-sectional survey. Sci. Rep. 2023; 13(1):1-7. [DOI:10.1038/s41598-023-43538-4] [PMID]

5. Schnorrerova P, Matalova P, Wawruch M. Medication adherence and intervention strategies: Why should we care. Bratisl Med J. 2025; 126:1196-206. [DOI:10.1007/s44411-025-00227-0]

6. Jaberi E, Kassai B, Berard A, Grenet G, Nguyen KA. Drug-related risk of hospital readmission in children with chronic diseases: A systematic review. Therapies. 2023; 78(4):393-408. [DOI:10.1016/j.therap.2022.09.004] [PMID]

7. Faisal S, Samoth D, Aslam Y, Patel H, Park S, Baby B, et al. Key features of smart medication adherence products: Updated scoping review. JMIR Aging. 2023; 6:e50990. 1-13. [DOI:10.2196/50990] [PMID]

8. McGrady ME, Hommel KA. Medication adherence and health care utilization in pediatric chronic illness: A systematic review. Pediatrics. 2013; 132(4):730-40. [DOI:10.1542/peds.2013-1451] [PMID]

9. Wu YP, Hommel KA. Using technology to assess and promote adherence to medical regimens in pediatric chronic illness. J. Pediatr. 2014; 164(4):922-927. [DOI:10.1016/j.jpeds.2013.11.013] [PMID]

10. Vitija A, Amirthalingam A, Soltani A. The impact of digital interventions on medication adherence in paediatric populations with attention deficit hyperactivity disorder, depression, and/or anxiety: A rapid systematic review and meta-analysis. Res Soc Adm Pharm. 2022; 18(12):4017-27. [DOI:10.1016/j.sapharm.2022.07.042] [PMID]

11. Kardas P, Potočnjak I, Ghiciuc CM, Herdeiro MT, Agh T. Recent advances in attempts to improve medication adherence-from basic research to clinical practice, volume II. Front Pharmacol. 2024; 15:1521468. [DOI:10.3389/fphar.2024.1521468] [PMID]

12. Kardas P, Bennett B, Borah B, Burnier M, Daly C, Hiligsmann M, et al. Medication non-adherence: reflecting on two decades since WHO adherence report and setting goals for the next twenty years. Front Pharm. 2024; 15:1444012. [DOI:10.3389/fphar.2024.1444012] [PMID]

13. Bayraktar İ, Yalçın N, Nalbant K, Kültür EÇ, Demirkan K. Medication adherence and attitudes in adolescent psychiatry: Key influences. Clin Child Psychol Psychiatry. 2025; 516-28. [DOI:10.1177/13591045251316607] [PMID]

14. Callejo-Black A, Wagner DV, Ramanujam K, Manabat AJ, Mastel S, Riley AR. A systematic review of external validity in pediatric integrated primary care trials. J Pediatr Psychol. 2020; 45(9):1039-52. [DOI:10.1093/jpepsy/jsaa068] [PMID]

15. Porter L. Counselling Young People: A Handbook for Trainees and Practitioners. London: Routledge; 2023. [DOI:10.4324/9781003323938]

16. Frank D, Gruenbaum BF, Zlotnik A, Semyonov M, Frenkel A, Boyko M. Pathophysiology and current drug treatments for post-stroke depression: A review. Int J Mol Sci. 2022; 23(23):15114. [DOI:10.3390/ijms232315114] [PMID]

17. Lee JR, Leo S, Liao S, Ng WR, Tay TYN, Wang Y, et al. Electronic adherence monitoring devices for children with asthma: A systematic review and meta-analysis of randomised controlled trials. Int J Nurs Stud. 2021; 122:104037. [DOI:10.1016/j.ijnurstu.2021.104037] [PMID]

18. Milne-Ives M, Lam C, Meinert E. Digital technologies for monitoring and improving treatment adherence in children and adolescents with asthma: Scoping review of randomized controlled trials. JMIR Pediatr Parent. 2021; 4(3):e27999. [DOI:10.2196/27999] [PMID]

19. Wang X, Wang B, Tew WY, Yang X, Xu X, Gao Y, et al . Exploring mHealth interventions for medication management: A scoping review of digital tools, implementation barriers, and patient outcomes. PeerJ Computer Science. 2025; 11, e3190. [Link]

20. Saji AS, Komel A, Khan MH, Niraula S, Naeem B, Ahsan A, et al. Digital health technologies in pediatric infectious disease and the perspective of patients and healthcare professionals: A review. Health Sci. Rep. 2025; 8(3):e70514. [DOI:10.1002/hsr2.70514] [PMID]

21. Gilbert S, Pimenta A, Stratton-Powell A, Welzel C, Melvin T. Continuous improvement of digital health applications linked to real-world performance monitoring: Safe moving targets? Mayo Clin Proc Digit Health. 2023; 1(3):276-87. [DOI:10.1016/j.mcpdig.2023.05.010] [PMID]

22. Lanke V, Trimm K, Habib B, Tamblyn R. Evaluating the effectiveness of mobile apps on medication adherence for chronic conditions: Systematic review and meta-analysis. J Med Internet Res. 2025; 27:e60822. [DOI:10.2196/60822] [PMID]

23. Badawy SM, Thompson AA, Kuhns LM. Medication adherence and technology-based interventions for adolescents with chronic health conditions: A few key considerations. JMIR Mhealth Uhealth. 2017; 5(12):e18310. [DOI:10.2196/mhealth.8310] [PMID]

24. De Geest S, Zullig LL, Dunbar-Jacob J, Hughes D, Wilson IB, Vrijens B. Improving medication adherence research reporting: ESPACOMP medication adherence reporting guideline (EMERGE). Eur J Cardiovasc Nurs. 2019; 18(4):258-9. [DOI:10.1177/1474515119830298] [PMID]

25. Demblon MC, Bicknell C, Aufegger L. Systematic review of the development and effectiveness of digital health information interventions, compared with usual care, in supporting patient preparation for paediatric hospital care, and the impact on their health outcomes. Front Health Serv. 2023; 3:1103624. [DOI:10.3389/frhs.2023.1103624] [PMID]

26. Hagman E, Lindberg L, Putri RR, Drangel A, Marcus C, Danielsson P. Long-term results of a digital treatment tool as an add-on to pediatric obesity lifestyle treatment: A 3-year pragmatic clinical trial. Int J Obes. (Lond.) 2025; 49(5):973-83. [DOI:10.1038/s41366-025-01738-0] [PMID]

27. McGrady ME, Keenan-Pfeiffer ME, Lang AC, Noser AE, Tyagi AP, Herriott JK, et al. Systematic review and meta-analysis of interventions to promote medication adherence among children, adolescents, and young adults with medical conditions. J Pediatr Psychol. 2024 ;49(5):531-49. [DOI:10.1093/jpepsy/jsae036] [PMID]

28. Kyeremaa EAA, Scott S, Smith C, Lawthom C, Stewart A, Alorabi M, et al. Barriers and enablers to antiseizure medication adherence in children with epilepsy: A systematic review using meta-ethnography. Seizure. 2025; 115-34. [DOI:10.1016/j.seizure.2025.06.016] [PMID]

29. Feldman JM, Serebrisky D, Starr S, Castaño K, Greenfield N, Silverstein G, et al. Reduced asthma morbidity during COVID-19 in minority children: Is medication adherence a reason? J Asthma. 2023; 60(3):468-78. [DOI:10.1080/02770903.2022.2059510] [PMID]

30. Ralph JE, Sezgin E, Stanek CJ, Landier W, Pai AL, Gerhardt CA, et al. Improving medication adherence monitoring and clinical outcomes through mHealth: A randomized controlled trial protocol in pediatric stem cell transplant. PLoS One. 2023; 18(8):e0289987. [DOI:10.1371/journal.pone.0289987] [PMID]

31. Shih S, Cohen LL. A systematic review of medication adherence interventions in pediatric sickle cell disease. J Pediatr Psychol. 2020; 45(6):593-606. [DOI:10.1093/jpepsy/jsaa031] [PMID]

32. Ge P, Liu ST, Xu SX, Zhang JZ, Lai YJ, Fu RC, et al. The influence of parents on medication adherence of their children in China: A cross-sectional online investigation based on health belief model. Front Public Health. 2022; 10:845032. [DOI:10.3389/fpubh.2022.845032] [PMID]

33. Shanbhag S, Prabhu S. Medication adherence and practices in pediatric patients. J Pharm Care. 2024; 12(3):153-7. [DOI:10.18502/jpc.v12i3.16770]

34. Waldock WJ, Zhang J, Guni A, Nabeel A, Darzi A, Ashrafian H. The accuracy and capability of artificial intelligence solutions in health care examinations and certificates: Systematic review and meta-analysis. J Med Internet Res. 2024; 26:e56532. [DOI:10.2196/56532] [PMID]

35. Annor FB, Amene EW, Zhu L, Stamatakis C, Picchetti V, Matthews S, et al. Parental absence as an adverse childhood experience among young adults in sub-Saharan Africa. Child Abuse Negl. 2024; 150:106556. [DOI:10.1016/j.chiabu.2023.106556] [PMID]

36. Wu M, Xue Y, Ma C. The association between the digital divide and health inequalities among older adults in China: Nationally representative cross-sectional survey. J Med Internet Res. 2025; 27:e62645. [DOI:10.2196/62645] [PMID]

37. Moon Z, Walsh J. Digital interventions in medication adherence: A narrative review of current evidence and challenges. Front Pharmacol. 2025; 16:1632474. [DOI:10.3389/fphar.2025.1632474] [PMID]

38. Dzavakwa NV, Kranzer K, Khan P, Mackworth-Young CR, Mujuru HA, Ferrand RA, et al. Electronic monitoring device informed interventions for treatment. Int J Nurs Stud. 160: 1-12. [DOI:10.1016/j.ijnurstu.2024.104903]

39. Bryant BR, Sisk MR, McGuire JF. Efficacy of gamified digital mental health interventions for pediatric mental health conditions: A systematic review and meta-analysis. JAMA Pediatr. 2024; 178;(11):1136-46. [DOI:10.1001/jamapediatrics.2024.3139] [PMID]

40. Mauro J, Mathews KB, Sredzinski ES. Effect of a smart pill bottle and pharmacist intervention on medication adherence in patients with multiple myeloma new to lenalidomide therapy. J Manag Care Spec Pharm. 2019;25(11):1244-54. [DOI:10.18553/jmcp.2019.25.11.1244] [PMID]

41. Hatzenbuehler ML, Keyes KM. Inclusive anti-bullying policies and reduced risk of suicide attempts in lesbian and gay youth. J Adolesc Health. 2013; 53(1):21-6. [DOI:10.1016/j.jadohealth.2012.08.010] [PMID]

42. Morawski K, Ghazinouri R, Krumme A, Lauffenburger JC, Lu Z, Durfee E, et al. Association of a smartphone application with medication adherence and blood pressure control: the MedISAFE-BP randomized clinical trial. JAMA Intern. Med. 2018; 178(6):802-9. [DOI:10.1001/jamainternmed.2018.0447] [PMID]

43. Han Y, Faulkner MS, Fritz H, Fadoju D, Muir A, Abowd GD, et al. A pilot randomized trial of text-messaging for symptom awareness and diabetes knowledge in adolescents with type 1 diabetes. J. Pediatr. Nurs. 2015; 30(6):850-61. [DOI:10.1016/j.pedn.2015.02.002] [PMID]

44. Bingham CO, Gaich CL, DeLozier AM, Engstrom KD, Naegeli AN, De Bono S, et al. Use of daily electronic patient-reported outcome (PRO) diaries in randomized controlled trials for rheumatoid arthritis: Rationale and implementation. Trials. 2019; 20(1):1-10. [DOI:10.1186/s13063-019-3272-0] [PMID]

45. DeMeo D, Morena M. Medication adherence using a smart pill bottle. PAPER PRESENTED AT: 2014 11th International Conference & Expo on Emerging Technologies for a Smarter World (CEWIT). 29-30 October 2014; Melville, USA. [DOI: 10.1109/CEWIT.2014.7021149]

46. Kizito S, Namuwonge F, Brathwaite R, Neilands TB, Nabunya P, Bahar OS, et al. Monitoring adherence to antiretroviral therapy among adolescents in Southern Uganda: Comparing Wisepill to self-report in predicting viral suppression in a cluster-randomized trial. J Int AIDS Soc. 2022; 25(9):e25990. [DOI:10.1002/jia2.25990] [PMID]

47. Lu L, Zhang J, Xie Y, Gao F, Xu S, Wu X, et al. Wearable health devices in health care: Narrative systematic review. JMIR Mhealth Uhealth. 2020; 8(11):e18907. [DOI:10.2196/18907] [PMID]

48. Elliott T, Yopes MC. Direct-to-consumer telemedicine. J Allergy Clin Immunol. Pract. 2019; 7(8):2546-52. [DOI:10.1016/j.jaip.2019.06.027] [PMID]

49. Aung HW, Murphy A, Greening NJ. The evolving landscape of digital inhaler platforms and adherence support in chronic airways disease. Chronic Respir Dis. 2025; 22:1-15. [DOI:10.1177/14799731251366969] [PMID]

50. Bocian IY, Chin AR, Rodriguez A, Collins W, Sindher SB, Chinthrajah RS. Asthma management in the digital age. Front Allergy. 2024; 5:1-8. [DOI:10.3389/falgy.2024.1451768] [PMID]

51. Carlsen K, Frederiksen NW, Wewer V. Integration of eHealth into pediatric inflammatory bowel disease care is safe: 3 years of follow-up of daily care. J Pediatr Gastroenterol Nutr. 2021; 72(5):723-7. [DOI:10.1097/MPG.0000000000003053] [PMID]

52. Ahmed S, Ernst P, Bartlett SJ, Valois MF, Zaihra T, Paré G, et al. The effectiveness of web-based asthma self-management system, My Asthma Portal (MAP): A pilot randomized controlled trial. J Med Internet Res. 2016; 18(12):e313. [DOI:10.2196/jmir.5866] [PMID]

53. Manders IG, Stoecklein K, Lubach CHC, Bijl-Oeldrich J, Nanayakkara PWB, Rauwerda JA, et al. Shift in responsibilities in diabetes care: the nurse-driven diabetes in-hospital treatment protocol (N-DIABIT). Diabet Med. 2016; 33(6):761-7. [DOI:10.1111/dme.12899] [PMID]

54. Li Z, Lu F, Wu J, Bao R, Rao Y, Yang Y, et al. Usability and effectiveness of eHealth and mHealth interventions that support self-management and health care transition in adolescents and young adults with chronic disease: Systematic review. J Med Internet Res. 2024; 26:e56556. [DOI:10.2196/56556] [PMID]

55. Roy D, Zhu Z, Guan L, Feng S, Daniels K, Sand M. AI-based adherence prediction for patients: leveraging a mobile application to improve clinical trials. CNS Spectr. 2023; 28(2):224. [DOI:10.1017/S1092852923001438]

56. Nguyen TT, Le Nguyen P, Kawanishi Y, Komamizu T, Ide I. Zero-shot pill-prescription matching with graph convolutional network and contrastive learning. IEEE Access. 2024; 12:55889-904. [DOI:10.1109/ACCESS.2024.3390153]

57. Ahmed I, Ahmad NS, Ali S, Ali S, George A, Danish HS, et al. Medication adherence apps: Review and content analysis. JMIR Mhealth Uhealth. 2018; 6(3):e6432. [DOI:10.2196/mhealth.6432] [PMID]

58. Prado MGA, Arcanjo FPN, de Andrade LOM, Barreto I, de Andrade Teles L, de Sousa Justino J, et al. Use of web and mobile device technologies in the management of childhood asthma: A systematic review and meta-analysis. J Pediatr. (Rio J.) 2025; 101(4):485-93. [DOI:10.1016/j.jped.2025.01.013] [PMID]

59. Plowman RS, Peters-Strickland T, Savage GM. Digital medicines: Clinical review on the safety of tablets with sensors. Expert Opin Drug Saf. 2018; 17(9):849-52. [DOI:10.1080/14740338.2018.1508447] [PMID]

60. Alhur A. Redefining healthcare with artificial intelligence (AI): The contributions of ChatGPT, Gemini, and Co-pilot. Cureus. 2024; 16(4):e57795. [DOI:10.7759/cureus.57795]

61. Chiam J, Lim A, Nott C, Mark N, Teredesai A, Shinde S. Co-Pilot for health: personalized algorithmic AI nudging to improve health outcomes. arXiv preprint. 2024. [DOI:10.48550/arXiv.2401.10816]

62. Martinez RG, Haisma H. MICG-AI: A multidimensional index of child growth based on digital phenotyping with Bayesian artificial intelligence. arXiv preprint. 2024. [DOI:10.48550/arXiv.2412.14720]

63. Yang F, Wei J, Zhao X, An R. Artificial intelligence-based mobile phone apps for child mental health: Comprehensive review and content analysis. JMIR Mhealth Uhealth. 2025; 13(1):e58597. [DOI:10.2196/58597] [PMID]

64. Mahlous AR, Okkali B. A digital mental health intervention for children and parents using a user-centred design. Adv Hum.-Comput Interact. 2022; 1:1-12. [DOI:10.1155/2022/4322177]

65. Karabulut E, Yazıcı HG, Özkan S. Maximizing pharmacological treatment adherence of children and adolescents: a randomized controlled study. J Psychosoc Nurs Ment. Health Serv. 2023; 61(1):16-24. [DOI:10.3928/02793695-20220705-02] [PMID]

66. Kalaman CR, Ibrahim N, Shaker V, Cham CQ, Ho MC, Visvalingam U, et al. Parental factors associated with child or adolescent medication adherence: A systematic review. Healthcare (Basel). 2023; 11(4):1-32. [DOI:10.3390/healthcare11040501] [PMID]

This Page Intentionally Left Blank