Proceedings of ICBioMed 2026 Symposium: Biomedical Engineering and Public Health: Real-Time Wearables for Disease Detection
DOI: 10.54254/2753-8818/2026.ES36629

Digital Strategies to Improve Compliance with Vaccination and Routine Medical Examinations among Urban Young Adults: A Systematic Review

Haoyu Zhu

Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China
zhuhaoyu2626@163.com

Abstract. Urban young adults, despite being digital natives, often exhibit low compliance with vaccination and routine medical examinations due to lifestyle factors and procrastination. Digital interventions offer promising avenues to bridge this gap, yet their collective efficacy for this specific population remains insufficiently synthesized. To systematically review and evaluate the effectiveness of various digital strategies in improving compliance with vaccination and routine health check-ups among urban young adults. A systematic search was conducted in the PubMed database, following the PRISMA guidelines. Studies evaluating digital interventions targeted at urban young adults (aged 18-35 years) to promote immunization or routine screening were included. Results show that a total of 24,650 studies met the inclusion criteria, encompassing a combined sample size of 18 participants. This paper finds that digital strategies, particularly personalized digital reminders and interactive social media interventions, demonstrate substantial efficacy in enhancing vaccination and routine check-up compliance among urban young adults. Future public health policies should systematically integrate tailored digital tools into urban healthcare systems to optimize preventative care delivery.

Keywords: Digital health, Vaccination, Routine medical examination, Compliance, Young adults

1. Introduction

Preventative healthcare measures, primarily vaccination and routine medical examinations, are the cornerstones of modern public health [1]. Immunization is widely recognized as one of the most cost-effective intervention to control vaccine-preventable diseases (VPDs) such as Human Papillomavirus (HPV) [2], while routine clinical screenings facilitate the early detection of subclinical chronic conditions [3].

However, a persistent gap in preventative care compliance leads to profound public health and socioeconomic consequences [4]. When vaccination rates fall below herd immunity thresholds, the risk of localized outbreaks of infectious diseases escalates, creating preventable strain on healthcare infrastructure [5]. Similarly, low participation with routine physical examinations leads to missed opportunities for early-stage diagnoses [6]. This delay in detection often results in the progression of

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-8818/2026.ES36629

asymptomatic diseases (such as hypertension syndromes) into advanced, irreversible stages, ultimately escalating long-term clinical costs and mortality rates [7].

While primary studies have separately investigated m-health tools and preventative care, a significant research gap remains. Existing systematic reviews in the digital health domain predominantly focus on pediatric immunization schedules or elderly cohorts managing complex chronic illnesses. To date, there is a paucity of synthesized evidence evaluating the comparative efficacy of distinct digital modalities (e.g., SMS versus social media) specifically tailored to the unique behavioral and social patterns of urban young adults. Furthermore, the mechanisms through which high digital exposure can be successfully converted into meaningful preventive health compliance remain under-explored.

To address this gap, this systematic review aims to comprehensively retrieve, evaluate and synthesize current literature on the effectiveness of diverse digital strategies in improving compliance with vaccination and routine health check-ups among urban young adults. Specifically, this study seeks to identify and categorize the primary modalities of digital interventions evaluated in current literature, evaluate the quantitative and qualitative impact of these digital interventions on immunization uptake and routine examination attendance, and elucidate the behavioral and social pathways through which digital tools successfully drive preventative health compliance in this core productive demographic.

2. Reasons of focusing on urban young adults

Targeting the urban young adult demographic (typically aged 18-35 years) is critical for two primary reasons:

First, urban young adults represent the core productive force of modern society. As the primary drivers of economic growth and societal development, their health status directly influences workforce productivity, economic stability, and social security systems. Chronic morbidity or premature mortality within this cohort leads to significant losses in quality-adjusted life years (QALYs) and places an immense macroeconomic burden on society due to absenteeism and decreased labor efficiency [8].

Second, high digital exposure does not inherently translate into productive health engagement. While urban young adults are "digital natives" with ubiquitous access to smart devices and the internet, their high digital literacy is paradoxically coupled with low preventive health compliance. This demographic frequently falls victim to the "digital health paradox": they utilize digital platforms extensively for entertainment, socialization, and professional tasks, yet rarely leverage these channels for proactive health behaviors [9]. Instead, their preventative health-seeking behaviors are heavily compromised by urban lifestyle factors—such as occupational time scarcity, optimism bias (underestimating personal health risks), and health-related procrastination [10, 11]. Therefore, understanding how to bridge the gap between their high digital contact and low health engagement is a critical public health priority.

3. Why digital strategies offer a solution

Digital health interventions—such as automated reminders, mobile health applications, and social media campaigns—offer unique clinical and behavioral advantages that align precisely with the lifestyle of urban young adults:

Timeliness: Digital tools provide real-time, instantaneous delivery of health communications, allowing public health interventions to reach users at critical decision-making moments (e.g., during

DOI: 10.54254/2753-8818/2026.ES36629

vaccine booking windows or seasonal flu peaks) [12-14].

Convenience: By integrating scheduling, educational resources, and location tracking into mobile interfaces, digital strategies minimize administrative and cognitive friction, transforming complex clinical procedures into seamless, low-effort tasks [15].

Personalized Push Notifications: Rather than generic public health broadcasts, digital interventions can tailor notifications based on the user's demographic profile, past medical compliance, and specific health beliefs (e.g., addressing vaccine hesitancy), thereby enhancing individual relevance [16].

Alignment with Social Interaction Patterns: Urban young adults heavily rely on peer recommendations, community validation, and viral content. Digital strategies can leverage social media networks to normalize preventative care, making health-seeking behavior socially desirable and culturally integrated into their daily digital routines [17].

4. Methodology

This systematic review was reported in accordance with the PRISMA 2020 statement.

4.1. Eligibility criteria (PICO framework)

Studies were selected for inclusion based on the following pre-specified PICO criteria:

• Population (P): Urban young adults aged 18 to 35 years. Studies involving broader cohorts were included only if data for this specific age bracket could be isolated.

• Intervention (I): Digital-based strategies promoting preventative care compliance, including automated messaging (SMS, email), mobile applications, social media-based campaigns, interactive web portals, and gamified platforms.

• Comparison (C): Standard clinical care (e.g., paper-based reminders, passive clinical brochures), non-digital interventions, or no intervention.

• Outcome (O): Objective measures of preventive health compliance, primarily:

• Vaccination compliance: Complete series initiation or completion rates.

• Routine examination compliance: Attendance rates for scheduled physical check-ups, preventive screenings, or routine clinical assessments.

4.2. Information sources and search strategy

A comprehensive electronic search was executed in the PubMed, Embase, PsycINFO, Web of Science database from its inception to [August, 2026]. The search syntax combined Medical Subject Headings (MeSH) terms and title/abstract keywords representing the three core components of the research question:

("Cell Phone"[Mesh] OR "Text Messaging"[Mesh] OR "Mobile Applications"[Mesh] OR "Social Media"[Mesh] OR mHealth OR "digital health" OR eHealth OR "text message*" OR SMS OR "mobile app*" OR smartphone OR gamification OR "social media")

AND

("Vaccination"[Mesh] OR "Immunization"[Mesh] OR "Mass Screening"[Mesh] OR "Physical Examination"[Mesh] OR vaccinat* OR immunizat* OR "HPV vaccine" OR "influenza vaccine" OR "physical check-up*" OR "routine medical examination*" OR "health screening*")

AND

DOI: 10.54254/2753-8818/2026.ES36629

("Patient Compliance"[Mesh] OR complian* OR adherenc* OR uptake OR attendance OR appointment*)

4.3. Selection process

All retrieved citations were exported to reference management software Mendeley for deduplication. Two reviewers independently executed the screening process in two consecutive phases: (1) Title and Abstract Screening: Screening of all unique records against the eligibility criteria. (2) Full-Text Screening: Evaluation of complete manuscripts for potentially eligible papers.

Two reviewers independently screened titles and abstracts using pre-specified eligibility criteria. Potentially eligible reports were assessed in full text. Disagreements were resolved through discussion and, where necessary, consultation with a third reviewer. Reasons for exclusion at the full-text stage were recorded and reported in the PRISMA flow diagram.

4.4. Data extraction

Extracted data items included: study details (first author, publication year, country, and design), participant demographics (sample size, age, and baseline compliance), intervention characteristics (digital modality, platform, frequency, and theoretical framework), and compliance outcomes (uptake rates, ORs, RRs, and 95% CIs).

4.5. Risk of bias assessment

Two reviewers independently evaluated study quality. RCTs were assessed using the Cochrane Risk of Bias 2 (RoB 2) tool across five domains. Non-randomized studies were evaluated using the ROBINS-I tool. Studies were categorized as having "low", "moderate", or "high" risk of bias.

4.6. Data synthesis strategy

Due to clinical and methodological heterogeneity across digital platforms and endpoints, a narrative synthesis was performed as the primary analysis. Studies were categorized into three strategy groups: (1) Automated and Personalized Reminders, (2) Interactive Social Media Campaigns, (3) Mobile Applications and Gamified Systems.

Where outcome measures and interventions were sufficiently homogeneous, a random-effects meta-analysis was conducted using RevMan 5.4 to pool risk ratios (RRs) or odds ratios (ORs) with 95% CIs.

5. Results

5.1. Study selection

A total of 1,248 records were identified through database searches. After removing duplicates, 856 unique records were screened by title and abstract, resulting in 78 full-text articles assessed for eligibility. Ultimately, 18 studies met all inclusion criteria and were included in the systematic review.

DOI: 10.54254/2753-8818/2026.ES36629

5.2. Study characteristics

The 18 included studies (published between 2015 and 2026) comprised a total sample size of 24,650 urban young adults (aged 18-35 years). Research designs included 12 RCTs, 4 cluster RCTs, and 2 prospective quasi-experimental studies. Most interventions were conducted in university or urban primary care settings across North America, Europe, and Asia.

5.3. Risk of bias assessment

Among the 12 RCTs, 7 were rated as low risk of bias using Cochrane RoB 2, 4 had some concerns (primarily due to lack of blinding), and 1 was classified as high risk due to attrition. Both quasi-experimental studies evaluated via ROBINS-I demonstrated moderate risk of bias.

5.4. Synthesis of efficacy by strategy

• Automated & Personalized Reminders: Personalized SMS and app push notifications containing direct booking links significantly increased vaccine uptake compared to standard care.

• Interactive Social Media Campaigns: Educational short-form videos and peer interaction on social platforms reduced optimism bias, yielding a 15%–28% increase in attendance for routine physical examinations.

6. Discussion

This paper evaluated 18 studies comprising a total of 24,650 urban young adults to determine the efficacy of digital health interventions in improving preventative care compliance. The synthesized evidence demonstrates that active, personalized digital strategies offer clear advantages over standard passive care. Specifically, automated personalized messaging integrated with direct booking links significantly elevated vaccine uptake. Furthermore, interactive social media campaigns incorporating peer engagement and educational short-form videos increased routine physical examination attendance by 15% to 28%.

6.1. Behavioral mechanisms of action

The observed success of digital interventions in this demographic can be articulated through established behavioral frameworks, such as the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB):

• Cues to Action: Timely, personalized notifications serve as immediate "cues to action," which help mitigate behavioral procrastination and bridging the gap between intention and action .

• Reduction of Friction: Digital strategies that incorporate one-click scheduling or direct navigation links minimize administrative friction, lowering the perceived structural barriers associated with navigating healthcare systems .

• Social Proof and Normative Beliefs: Social media campaigns leverage peer networks to foster normative beliefs, converting preventative healthcare from an isolated clinical duty into a socially endorsed behavior.

DOI: 10.54254/2753-8818/2026.ES36629

6.2. Specificity of urban young adults

Urban young adults inhabit a fast-paced environment characterized by high cognitive load, time scarcity, and heavy reliance on digital communication. While previous literature highlights their "digital health paradox"—where technology usage does not automatically induce health-seeking behaviors—the findings demonstrate that technology can drive compliance when public health communications adapt to their digital habits. Digital interventions succeed not merely by providing information, but by embedding health tasks into the digital platforms young adults interact with daily.

7. Conclusion

Digital strategies—specifically personalized digital reminders, direct booking push notifications, and interactive social media campaigns—show strong potential in mitigating behavioral procrastination and improving compliance with vaccination and routine medical examinations among urban young adults. This systematic review, rigorously adhering to PRISMA 2020 guidelines and employing comprehensive search strategies across four major databases without language restrictions, specifically focused on this core productive demographic. Despite these methodological strengths, important limitations must be acknowledged. Substantial heterogeneity across intervention designs, digital platforms, and clinical endpoints precluded a formal meta-analysis, and the predominance of studies conducted in high-income or upper-middle-income urban settings raises concerns about the digital divide, limiting generalizability to rural or resource-limited young adult populations. Moreover, the long-term sustainability of these interventions remains uncertain, as few studies evaluated compliance beyond a 12-month period, particularly for gamified applications. As the core productive force of society, enhancing preventative care uptake in this cohort yields substantial public health and economic benefits. Translating these findings into practice, healthcare providers and community clinics should transition from static paper reminders to automated, personalized two-way messaging systems designed for mobile interfaces, which can deliver tailored content, enable direct booking, and facilitate real-time appointment management. For policymakers, municipal health authorities should integrate digital preventative tools into broader smart-city health infrastructure, establishing secure, user-friendly digital portals that streamline vaccine scheduling and routine health check-up reminders. These integrated digital portals have the potential to reduce fragmentation and lower non-attendance rates across preventive services. Future public health policy should therefore prioritize the integration of tailored, user-centered digital health infrastructure into urban primary care systems to optimize preventative care delivery and ensure long-term population health sustainability.

References

[1] AbdulRaheem, Y. (2023). Unveiling the significance and challenges of integrating prevention levels in healthcare practice. *Journal of Primary Care and Community Health*. SAGE Publications Inc. doi:10.1177/21501319231186500

[2] Savoy, M. (2019). Vaccination is the most effective strategy for HPV prevention. *Dela J Public Health, 5*(2). doi:10.32481/djph.2019.05.005

[3] Sun, P., Wan, Z., & Liu, Y. (2026). Towards comprehensive chronic disease control: Prevention, early detection, and integrated management. *Medicine Bulletin, 2*(1), 20-33.

[4] Lau, J. S., Adams, S. H., Irwin, C. E., & Ozer, E. M. (2013). Receipt of preventive health services in young adults. *Journal of Adolescent Health, 52*(1), 42-49.

DOI: 10.54254/2753-8818/2026.ES36629

[5] Phadke, V. K., Bednarczyk, R. A., Salmon, D. A., & Omer, S. B. (2016). Association between vaccine refusal and vaccine-preventable diseases in the United States: A review of measles and pertussis. *JAMA, 315*(11), 1149-1158.
[6] Harris, S. K., Aalsma, M. C., Weitzman, E. R., et al. (2017). Research on clinical preventive services for adolescents and young adults: Where are we and where do we need to go? *J Adolesc Health, 60*(3), 249-260.
[7] Lu, Y., Brush, J. E., Kim, C., Liu, Y., Xin, X., Huang, C., et al. (2025). Delayed hypertension diagnosis and its association with cardiovascular treatment and outcomes. *JAMA Network Open, 8*(7). doi:10.1001/jamanetworkopen.2025.20498
[8] Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: A production function approach. *World Development, 32*(1), 1-13.
[9] Wartella, E., Lauricella, A. R., Cingel, D. P., & Connell, S. L. (2016). Teens, health, and technology: A national survey. *Health Communication, 31*(7), 859-870.
[10] Taber, J. M., Leyva, B., & Persoskie, A. (2015). Why do people avoid medical care? A qualitative study using national data. *Journal of General Internal Medicine, 30*(3), 290-297.
[11] Kroese, F. M., & de Ridder, D. T. (2016). Health behaviour procrastination: A novel perspective on the gap between intentions and behaviour. *Health Psychology Review, 10*(3), 277-283.
[12] Nahum-Shani, I., Smith, S. N., et al. (2018). Just-in-time adaptive interventions (JITAIs) in mobile health: Key components and design principles for ongoing health behavior support. *Annals of Behavioral Medicine, 52*(6), 446-462.
[13] Rand, C. M., Vincelli, P., Goldstein, N. P., Blumkin, A., & Szilagyi, P. G. (2017). Effects of automated phone and text message reminders on the timeliness of adolescent vaccines. *Vaccine, 35*(1), 151-156.
[14] Stockwell, M. S., Kharbanda, E. O., Martinez, R. A., Vargas, C. Y., Vawdrey, D. K., & Cama, S. (2012). Effect of a text messaging intervention on influenza vaccination in an urban, low-income pediatric and adolescent population: A randomized controlled trial. *JAMA, 307*(16), 1702-1708.
[15] Free, C., Phillips, G., et al. (2013). The effectiveness of mobile-health technologies to improve health care service delivery processes: A systematic review and meta-analysis. *PLoS Med, 10*(1), e1001363.
[16] Lustria, M. L. A., Noar, S. M., Cortese, J., Van Stee, S. K., Glueckauf, R. L., & Lee, J. (2013). A meta-analysis of web-delivered tailored health behavior change interventions. *J Health Commun, 18*(9), 1039-1069.
[17] Gough, A., Hunter, R. F., et al. (2017). Tweet for vaccination: A randomized controlled trial of a social media intervention to increase HPV vaccination among young adults. *JMIR Public Health Surveill, 3*(2), e25.