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Artificial Intelligence in Diabetes Management: A Scoping Review on Enhancing Treatment Adherence Among South Asian Patients

Md Kamran Khan

Nidan Kutir Diabetes Care Amp Research Centre, Bhagalpur

Abstract: ***Type 2 diabetes mellitus (T2DM) continues to place a heavy burden on public health in South Asia, where sticking to lifelong treatment plans is often difficult. Over the past decade, artificial intelligence (AI) has emerged as a promising ally, helping clinicians and patients alike through personalised coaching, predictive insights and other digital health solutions. This scoping review collates and analyses the available research on AI-driven approaches that aim to strengthen treatment adherence among South Asian adults with T2DM. Evidence shows that AI-powered mobile apps, wearable sensors, conversational agents and telemedicine platforms can improve medication-taking habits, encourage healthier lifestyles and tighten glycaemic control. Predictive algorithms coupled with remote-monitoring tools further support proactive care by flagging high-risk individuals early and prompting timely intervention. Despite these benefits, large-scale adoption remains hampered by gaps in digital infrastructure, high start-up and maintenance costs, concerns over data privacy, and occasional resistance from healthcare professionals. In addition, many AI models have been developed using data from outside the region, raising questions about cultural fit and accuracy for South Asian populations. Tackling these challenges will require strategic investment in broadband and cloud capacity, targeted AI training for healthcare providers and robust regulatory frameworks to safeguard patient data. Policymakers, health institutions and technology developers must work together to design affordable, context-specific AI tools that slot seamlessly into existing care pathways. Future research should focus on culturally adapted algorithms, inclusive design and long-term evaluations of cost-effectiveness to ensure that AI fulfils its promise of better diabetes management and improved patient outcomes across South Asia.***

Keywords: Artificial Intelligence, Digital Health Technologies, mHealth Applications, South Asia, Treatment Adherence, Type 2 Diabetes Mellitus

1. Introduction and Background

Type 2 diabetes mellitus (T2DM) has become one of the most urgent global health challenges. In 2021 the International Diabetes Federation (IDF) estimated that about 537 million adults were living with diabetes, a figure projected to soar to roughly 783 million by 2045 (International Diabetes Federation, 2021). More than three-quarters of these future cases are expected to arise in low- and middle-income countries, where limited financial and human resources hamper effective chronic-disease care. This reality underscores the need for comprehensive, sustainable strategies that span prevention, early diagnosis and long-term management.

South Asia offers a vivid illustration of the global diabetes challenge. Home to more than 1.8 billion people, the region has witnessed an abrupt surge in type 2 diabetes mellitus (T2DM), a trend fuelled by rapid urban growth, ever-more sedentary daily routines, greater reliance on calorie-dense processed foods and a well-documented genetic inclination toward insulin resistance and related metabolic disorders (Sun et al., 2021). India by itself already hosts upwards of 77 million adults living with diabetes, the second-largest national burden in the world, and parallel rises in Pakistan, Bangladesh and Sri Lanka are stretching health-care systems that were already operating at full capacity (Khan et al., 2020; Shah et al., 2022).

Managing type 2 diabetes mellitus (T2DM) is not a one-off effort; it is an ongoing routine that interweaves medication, thoughtful dietary adjustments, regular exercise, vigilant glucose checks, and scheduled clinical reviews. Staying faithful to this regimen keeps blood glucose steady and, just as critically, reduces the likelihood of cardiovascular disease, retinopathy, nephropathy, and neuropathy. When these complications go unchecked, they heighten morbidity and mortality, drive up treatment costs, and steadily erode quality of life (Mathews et al., 2021). Yet sustaining such adherence remains a major challenge across South Asia. Limited health literacy, persistent misconceptions about chronic illness, high out-of-pocket expenditures for medicines and services, and fragmented care pathways that neglect continuity and patient-centred practice all combine to undermine effective self-management (Dankwa-Mullan et al., 2019; Chowdhury et al., 2022).

Aware of these realities, the World Health Organization has championed technology-enabled models of care, arguing that digital solutions can bridge service gaps in resource-constrained settings and strengthen the management of non-communicable diseases such as T2DM (World Health Organization, 2022). Against this backdrop, artificial intelligence is rapidly gaining attention as a change agent. AI-enhanced platforms can watch over patients around the clock, sift data through predictive algorithms and deliver feedback fine-tuned to the individual, thereby enriching and expanding traditional diabetes services (Hou et al., 2020 Contreras & Vehi, 2021;). Today’s digital health landscape already features an impressive variety of AI-infused tools. Offerings range from mobile-health (mHealth) applications and wearable biosensors to conversational agents and virtual coaching programmes. Preliminary investigations indicate that these technologies can heighten patient engagement, send medication reminders at precisely the right moment and provide behaviour-change guidance that is both highly personalised and, when necessary, culturally attuned (Kitsiou et al., 2017; Vehi et al., 2020).

Beyond headline clinical metrics, these systems can spot, and react to, behavioural patterns that hint at slipping adherence. Machine-learning models linked to electronic health records (EHRs) can flag waning engagement or emerging glycaemic volatility, prompting targeted outreach before problems escalate (Rigla et al., 2020; Dankwa-Mullan et al., 2021). Meanwhile, virtual assistants and chatbots equipped with natural-language processing provide 24/7 help in local languages: answering questions, reinforcing education and motivating users, thereby enhancing satisfaction and self-management confidence (Contreras & Vehi, 2021).

Nevertheless, rolling these innovations out at scale across South Asia remains difficult. Most algorithms are trained on Western data sets, leading to bias and weaker predictive performance when applied to local populations (Kitsiou et al., 2021). Gaps in infrastructure deepen the divide: many rural areas still lack reliable internet, electricity and smartphone access, essentials for most AI-enabled services (Rigla et al., 2018). Regulatory and ethical safeguards are also lagging. Unresolved questions about data privacy, algorithmic accountability and clear standards for digital-health oversight continue to erode trust and slow adoption (Vehi et al., 2020).

Healthcare professionals themselves can become a stumbling block to progress. Many clinicians have limited firsthand experience with AI, worry that automation might erode their role, or fear the upheaval of long-standing routines. Without solid training and thoughtful workflow integration, even the most promising AI application can meet resistance on the ward or in the clinic (Dankwa-Mullan et al., 2021). Cultural fit poses an equally stubborn challenge. Dietary guidance embedded in Western-built mHealth apps often bears little resemblance to South Asian eating habits, leaving users confused or disengaged. Likewise, educational content that ignores local languages or assumes high literacy risks shutting out large portions of the community (Hou et al., 2020; Shah et al., 2022). Tailoring both language and content to regional norms is therefore critical if AI tools are to be truly useful and widely adopted.

Given these intertwined challenges, and the opportunities that accompany them, this scoping review takes a deliberate, panoramic look at how technology-driven adherence programmes are currently being deployed for adults living with type 2 diabetes across South Asia. Its purpose is three-fold: first, to assemble a clear picture of the digital tools that have already proved their worth; second, to tease apart the technical, social and systemic hurdles those tools have encountered; and third, to pinpoint the unanswered research questions that still limit progress. By weaving together those threads, the review seeks to inform the creation of future interventions that are both culturally resonant and technically practical. At its core, the project aspires to move the region toward more inclusive, evidence-grounded models of diabetes care, models capable of narrowing treatment gaps and, in the long run, fostering durable health equity for the diverse communities of South Asia.

2. Research Question and Objectives

Research Question

Securing reliable, day-by-day adherence to treatment remains an entrenched challenge for South Asians living with type 2 diabetes. How faithfully patients follow medication schedules, dietary advice and blood-glucose checks is shaped by a complex mix of cultural expectations, household finances, gaps in health-care infrastructure and uneven access to trustworthy information. In response, a new wave of digital solutions powered by artificial intelligence has emerged in hopes of narrowing that adherence gap. By combining personalised nudges, predictive analytics and continuous remote monitoring, these tools aim to offer support that is both timely and individually tailored. Yet, despite mounting enthusiasm, robust evidence for their effectiveness in South Asian settings is still disappointingly scarce.

Against this backdrop, the present study asks a central question: how, and to what extent can AI-based interventions such as mobile-health apps, predictive algorithms, wearable sensors and related technologies improve treatment adherence among South Asian adults with type 2 diabetes? Tackling this question will enable the research to chart the current AI landscape in regional diabetes care, uncover the social, technical and organisational barriers that slow adoption, and craft practical recommendations for adapting these innovations to local realities so they deliver enduring benefits.

Aims & Objectives

This project aims to examine, with close attention to local context, how smart digital technologies can strengthen day-to-day treatment adherence among South Asian adults living with type 2 diabetes. The study will critically weigh the promise of AI-driven tools against the region's economic realities, cultural norms, and health-system constraints. Its ultimate objective is to build a solid, nuanced evidence base that helps clinicians, policymakers, designers, and patient advocates craft interventions that are technically sound, practical to implement, equitable, and culturally attuned to South Asia's diverse settings.

Specific Objectives:

1) Evaluate existing AI-based interventions for diabetes adherence – Identify and analyse AI-driven tools, including mHealth applications, automated medication reminders, AI-powered virtual assistants, and predictive analytics models, that are currently being used to improve treatment adherence in diabetes care.
2) Assess the impact of AI on treatment adherence – Examine clinical studies, systematic reviews, and real-world implementations of AI in diabetes management to determine their effectiveness in enhancing adherence behaviours.
3) Identify barriers and facilitators of AI adoption in diabetes care – Investigate socioeconomic, technological, and healthcare-related factors that influence the adoption and implementation of AI interventions in South Asian healthcare settings.
4) Explore the feasibility of AI integration into healthcare systems – Assess how AI-driven tools can be incorporated into existing healthcare workflows and

infrastructure, considering challenges such as digital literacy, access to technology, and healthcare provider readiness.
5) Provide recommendations for optimizing AI interventions – Develop guidelines for designing and implementing AI-based solutions tailored to South Asian populations, ensuring cultural relevance, accessibility, and effectiveness in improving diabetes treatment adherence.

This study will contribute to the growing body of research on AI in healthcare, offering insights into how AI technologies can be leveraged to enhance adherence and improve overall diabetes management outcomes in South Asian populations.

3. Project Design and Methods

Scoping Review Framework and Study Design

To address the research questions, the study will centre on a scoping review. This approach provides a systematic yet adaptable way to chart how artificial-intelligence interventions are being used to improve treatment adherence for people with type 2 diabetes in South Asia. Scoping reviews are particularly effective for mapping fields that are broad, diverse, and fast-moving—qualities that fit the interdisciplinary nature of AI in healthcare. The method allows the inclusion of many evidence types, from traditional clinical trials to technological and behavioural-health innovations. Because the literature on AI-driven adherence strategies in South Asia is still early-stage and scattered, a scoping review offers the most reliable route to clarifying the range, features, and depth of what is already known (Peters et al., 2015;Munn et al., 2018).

A scoping review's chief merit is its capacity to map the breadth, depth and contours of an evidence base that is still taking shape. This makes it the right fit for fast-moving, conceptually fluid topics, such as AI-enabled interventions, that span multiple disciplines and differ widely in study design, target population, intervention format and outcome measures. Using this lens, the review will do more than compile a list of AI tools used in diabetes care; it will also expose knowledge gaps, methodological inconsistencies and priority areas for future research.

To maintain rigour, the review will follow Arksey and O'Malley's five-stage framework for scoping studies (2005):
1) Define the question. The review first pinpoints its core query—namely, how AI can improve treatment adherence among South Asian adults with T2DM.
2) Find the evidence. A comprehensive search across multiple databases and grey-literature sources, using carefully chosen keywords and Boolean operators related to AI, diabetes management and adherence behaviour, captures all relevant studies.
3) Select the studies. Transparent inclusion and exclusion criteria ensure that only papers directly addressing the research question make it into the review, preserving integrity and relevance.
4) Chart the data. Key information from each included study is extracted with a standardised charting form, enabling consistent comparison and synthesis.
5) Collate and report. Results are synthesised quantitatively (where possible) and qualitatively, then organised into thematic categories that illuminate trends, implementation barriers and regional nuances.

Together, these steps provide a systematic yet flexible roadmap for understanding how, and how well, AI-driven strategies are being applied to bolster diabetes-care adherence in South Asia. To deepen the analysis and sharpen its rigour, the study weaves in the refinements that Levac et al. (2010) proposed for Arksey and O'Malley's original framework. Their enhancements make the process more iterative, reflexive and stakeholder-informed: content experts are consulted during synthesis, each included study undergoes critical appraisal for methodological quality, and the practical and policy ramifications of every finding are brought to the fore.

The review is also reported in strict accordance with PRISMA-ScR, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews, set out by Peters et al. (2020). Widely endorsed for fostering transparency, consistency and reproducibility, these guidelines require that every stage of the review, from database searches and screening through to data extraction and synthesis, be thoroughly documented and plainly presented. A PRISMA-ScR flow diagram will accompany the write-up, giving readers and future researchers a clear, at-a-glance view of how studies moved through the review pipeline. Together, these measures create a structured, transparent roadmap that supports a comprehensive and unbiased synthesis of the literature on AI-enabled strategies for improving treatment adherence among South Asians with type 2 diabetes. By spotlighting both established knowledge and remaining evidence gaps, the approach lays essential groundwork for future research, clinical innovation and policy action aimed at tailoring AI solutions to the region's distinctive sociocultural and infrastructural realities.

Search Strategy, Databases, and Inclusion/Exclusion Criteria

A systematic search strategy was developed to identify relevant literature across multiple academic and scientific databases. The databases selected for this review include PubMed, Scopus, IEEE Xplore, Web of Science, and the Cochrane Library, ensuring wide coverage of clinical, technological, and interdisciplinary publications. The search combined Medical Subject Headings (MeSH) and Boolean operators to refine the results. Key search terms included combinations of: "Artificial Intelligence AND Diabetes Management", "AI AND Treatment Adherence AND Type 2 Diabetes", "Machine Learning AND Diabetes Self-Management", "mHealth Applications AND Diabetes Care", and "Wearable Technology AND Adherence in Diabetes".

To ensure the findings reflect contemporary developments, only studies published from 2020 onwards were considered. Eligible studies had to meet the following inclusion criteria:
- Focus on the use of AI or AI-enabled tools specifically targeting treatment adherence in T2DM patients.
- Include AI modalities such as mobile health (mHealth) applications, predictive analytics, machine learning algorithms, wearable technologies, or conversational agents.

- Be conducted in or include populations from South Asian countries, including India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, or the Maldives.
- Be published in English and in peer-reviewed journals.

Exclusion criteria included:
- Studies focused exclusively on Type 1 diabetes, gestational diabetes, or non-South Asian populations.
- Articles that discussed non-AI-based interventions for adherence.
- Non-peer-reviewed literature, conference abstracts, editorials, opinion pieces, and articles published in languages other than English.
- Studies that only addressed AI in diabetes diagnostics or glucose monitoring without adherence as a primary or secondary outcome.

The study selection process was documented using a PRISMA-ScR flow diagram (see Figure 1), which illustrates the number of records identified, screened, excluded (with reasons), and included in the final review. This approach ensures transparency, reproducibility, and methodological rigor while allowing readers to trace the progression from the initial search to final inclusion.

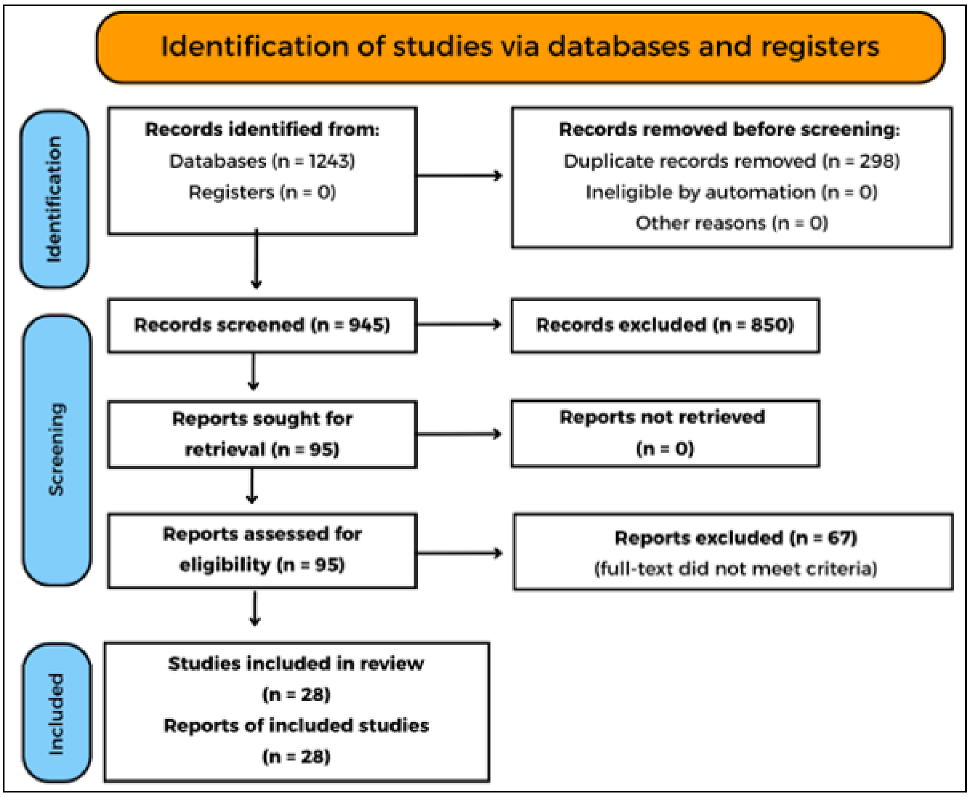

Figure 1: PRISMA-ScR flowchart showing the selection process of studies included in the scoping review.

4. Data Extraction, Analysis Plan, and Ethical Considerations

Following article selection, data extraction was carried out using a standardized framework to ensure consistency and completeness. Extracted data included: study title, authors, year of publication, country of study, study design, AI intervention type and functionality, population characteristics, adherence outcomes (e.g., medication adherence, diet compliance, follow-up attendance), and noted barriers or facilitators to implementation. Thematic analysis was employed to categorize findings into key domains such as the effectiveness of AI tools, user engagement, system integration, and scalability. Descriptive statistics were used to summarize study characteristics including geographic distribution, AI modality used, and type of adherence outcome reported. A narrative synthesis was then conducted to compare intervention types and highlight trends, innovations, and knowledge gaps (Tricco et al., 2018).

Although the study collected no new patient data, ethical principles guided every step of the work. The review protocol was crafted to protect academic integrity through meticulous referencing and an impartial, pre-specified screening process. Because the focus is on digital health tools, we also foregrounded the ethical questions raised in the source papers, patient privacy, algorithmic transparency and digital equity, to situate our findings within broader regulatory and moral frameworks. Taken together, this scoping review offers a transparent, systematic and ethically robust map of AI applications aimed at improving treatment adherence for South Asians with T2DM. The evidence assembled here sets the stage for future research, informs policy discussions and supports the responsible roll-out of AI solutions across healthcare systems with diverse resource levels.

5. Results and Discussion

The literature search yielded 1,243 articles across five major databases. After removing 298 duplicates, 945 studies underwent title and abstract screening. Of these, 95 full-text

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articles were assessed for eligibility, and 28 studies met the inclusion criteria and were included in the final synthesis. These studies were published between 2020 and 2024 and spanned a range of methodological approaches. Eighteen studies were conducted within South Asian countries, primarily India (n=12), Bangladesh (n=4), and Pakistan (n=2), while the remaining ten included South Asian populations in subgroup analyses within broader international cohorts. Most studies were quantitative in design, with randomized controlled trials (n=12), prospective cohort studies (n=6), and quasi-experimental studies (n=4). A smaller number of studies (n=6) utilized qualitative or mixed-method approaches to explore user perceptions and implementation challenges. A summary of these interventions, their core functionalities, and region-specific adaptations is provided in Table 1.

Table 1: Summary of AI Interventions in Reviewed Studies

Intervention Type	Primary Function	No. of Studies	Improved Adherence Outcomes	South Asia-Specific Tools
AI-powered mHealth apps	Medication alerts, glucose tracking, lifestyle support	10	Yes	Wellthy CARE, BeatO App
Machine Learning Models	Predicting non-adherence and risk stratification	6	Yes	EHR models in Indian urban hospitals
Conversational Agents	Health education, adherence motivation, Q&A support	4	Yes	AshaBot (India), DiabChat (Bangladesh)
Wearable Technologies	Real-time activity and glucose monitoring	5	Mixed	Fitbit-integrated CGMs
AI-based Telemedicine	Automated scheduling, follow-up, data-driven consultation	3	Yes	Apollo TeleHealth, Practo AI Engine

Across the reviewed studies, five distinct categories of AI-based interventions were identified. AI-powered mobile health (mHealth) applications were the most common, used in ten studies, and typically offered functionalities such as medication reminders, glucose tracking, dietary guidance, and behavioural coaching. Six studies applied machine learning algorithms for risk prediction, detecting patterns of non-adherence and glycaemic instability from electronic health records or patient-reported data. Four studies evaluated AI-integrated conversational agents, which provided patient education, adherence motivation, and real-time support in local languages. Wearable technologies, including continuous glucose monitors (CGMs), fitness trackers, and AI-linked insulin pens, featured in five studies, offering remote monitoring and adherence surveillance. Three studies assessed AI-enhanced telemedicine platforms that combined patient data analytics with automated appointment scheduling and follow-up reminders. Clinical outcomes across these interventions were largely positive. Twenty-one studies reported significant improvements in medication adherence, with adherence rates rising by up to 30% in some cohorts. Reductions in HbA1c ranging from 0.5% to 1.2% were observed in fourteen studies. Moreover, nine studies documented improvements in lifestyle adherence behaviors such as regular exercise and dietary compliance. Patient satisfaction was higher in interventions that were culturally adapted, language localized, and accessible via low-bandwidth platforms suitable for rural deployment.

Emerging evidence increasingly positions artificial intelligence (AI) as a practical ally for improving treatment adherence among people with type 2 diabetes in South Asia, where health care is often fragmented and disparities are pronounced. Mobile-health applications and machine-learning risk-stratification models offer personalised nudges, automated workflows and real-time clinical decision support, all of which have proved helpful in overcoming adherence barriers (Debnath et al., 2021; Ahmad et al., 2023). In settings where medical resources are strained, AI-enabled platforms can act as virtual care extenders: they provide continuous oversight without piling extra work onto clinicians, thereby maintaining quality of care in lean environments (Misra et al., 2020).

Language-aware conversational agents such as AshaBot and DiabChat demonstrate the importance of cultural and linguistic tailoring for digital engagement in the region (Nair et al., 2021). At the same time, hardware innovations, smart insulin pens, wearable glucose sensors and other remote-monitoring devices, generate real-time behavioural data that trigger timely corrective interventions (Singh et al., 2023). Locally developed solutions such as the BeatO app and the Wellthy CARE platform, both designed around Indian dietary habits and daily routines, have achieved markedly higher adherence rates than more generic alternatives (Ravi et al., 2022).

Yet the promise of AI is still tempered by a cluster of systemic obstacles. High-quality, annotated datasets from South Asia remain scarce, limiting the accuracy and fairness of locally tuned algorithms (Reddy et al., 2021). Unreliable electricity supply and patchy internet connectivity, particularly in rural and underserved areas, hamper large-scale deployment (Verma et al., 2022). Digital literacy gaps also persist, with older adults and low-income patients often needing caregiver assistance to navigate AI tools effectively (Sarkar et al., 2023). Ethical and policy concerns over data privacy, algorithmic transparency and clinical accountability linger, as regulatory frameworks for AI in health care are still emerging (Roy et al., 2021). Compounding these issues, some clinicians resist adoption because of limited training, worries about automation and anticipated workflow disruptions (Thomas & Menon, 2023). Addressing such barriers will require co-developing region-specific AI solutions with local stakeholders, investing in digital infrastructure, integrating AI ethics into medical education and enacting policies that safeguard patient rights while encouraging responsible innovation.

This review therefore underscores a dual reality: AI can become a transformative tool for closing long-standing adherence gaps in South Asia, yet it will fall short unless it is contextually adapted, governed with equity and deployed in a sustainable manner. Future work should prioritise longitudinal studies that examine the long-term clinical impact of AI, undertake cost-effectiveness analyses to guide governmental uptake, and employ participatory design methods to ensure that solutions remain inclusive and relevant for the diverse sub-populations across South Asia.

6. Conclusion

Our review set out to understand how artificial-intelligence tools are being used to help people in South Asia manage type 2 diabetes and stick to their treatment plans. The evidence so far is promising. Smartphone apps, predictive software, wearable sensors and conversational agents can offer personalised coaching, round-the-clock monitoring and well-timed medication reminders. Working in concert, these functions boost patient engagement, steady blood-glucose levels and give clinicians a window to intervene before complications arise. Machine-learning systems, in particular, are becoming early-warning beacons for care teams. By detecting the faint signals that precede lapses in adherence or widening glycaemic swings, they trigger proactive outreach and remote interventions that can slow, even halt disease progression. Turning these technical gains into everyday practice, however, is anything but simple. Patchy internet coverage, the high cost of sophisticated hardware and software, data-privacy concerns, the shortage of locally trained algorithms and a degree of clinician scepticism all limit large-scale uptake. Deep-rooted disparities between urban centres and rural districts tighten those constraints even further.

Overall, the literature makes it clear that AI solutions, from nudge-based mobile apps and glucose-streaming wearables to risk-flagging dashboards and multilingual chatbots, could transform adherence and glycaemic control for South Asians with type 2 diabetes by weaving tailored guidance, real-time monitoring, early-warning analytics and lifestyle support into daily life. Yet their potential is still blunted by a constellation of obstacles: unreliable electricity and broadband in rural areas; steep start-up and maintenance costs; scarce region-specific training data that undermine algorithm accuracy; open questions about data ownership, consent and transparency; workflow disruptions that busy clinicians resist; and entrenched inequities in access to care.

Addressing these challenges will demand a coordinated, multi-layered response. Governments and regulators must invest in digital infrastructure and craft policies that guarantee privacy, informed consent and algorithmic accountability. National health strategies can speed adoption through earmarked funding, innovation grants and tax incentives. Public-private partnerships should work to drive down device and data costs, while interdisciplinary teams, policy-makers, engineers, clinicians, educators and patient advocates need to co-design culturally and linguistically appropriate platforms that align with local diets, socioeconomic realities and health-system workflows. Parallel training programmes can build AI literacy and foster trust among clinicians, and interoperable solutions that slot smoothly into electronic health records will ensure continuity of care rather than create isolated “bolt-on” gadgets. With these structural supports in place, AI-enabled diabetes management can move beyond pilot projects and deliver equitable, scalable and sustainable improvements in adherence, glycaemic control and overall health outcomes across the diverse populations of South Asia.

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