Hawkes and Shi *BMC Digital Health* (2026) 4:46
https://doi.org/10.1186/s44247-026-00279-4

BMC Digital Health

EDITORIAL Open Access

Harnessing the potential for digital diabetes management in the era of artificial intelligence

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Abstract
Digital diabetes technologies continue to evolve and offer new opportunities to personalise care. For this upcoming Collection on 'Digital diabetes monitoring and management', we set out opportunities for research aligned with this Collection's focus to further advance our understanding of how digital solutions can best support individuals living with diabetes.

Diabetes is one of the greatest global health challenges of the 21st century, characterised by elevated blood glucose levels with associated complications including loss of vision, nerve pain, limb amputation, and cardiovascular problems. More than 1 in 10 adults are living with diabetes [1], and it is estimated that the global economic burden of diabetes will cost more than 2.1 trillion dollars by 2030 [2]. This growing burden places increasing pressure on healthcare systems, clinicians, and patients to manage the condition effectively. Traditional approaches to diabetes monitoring – such as self-monitoring of blood glucose levels via finger-prick testing, and manual record-keeping, alongside in-person consultations with clinicians – have underpinned diabetes self-management. However, limitations of these methods include only providing a snapshot of glucose levels rather than trends throughout the day, the inconvenience of frequent testing, and a higher risk for inaccurate results.

In parallel, the past decade has seen a rapid expansion of digital health technologies and digital health services, introducing new possibilities for chronic disease management. Digital health technologies now offer continuous real-time data, automated feedback, and opportunities for remote engagement between patients and healthcare providers. These innovations are particularly well suited to conditions like diabetes, where ongoing self-management and timely adjustments are essential to maintaining glycaemic control and preventing complications. Technologies such as continuous glucose monitoring systems, smart insulin pens, and mobile health applications are enabling more proactive, personalised, and data-driven approaches to care, which can help to support patients in understanding their diabetes and engaging more actively in their own health.

This Collection aims to bring together research exploring the development, evaluation, and use of digital health technologies in diabetes monitoring and management. The aim is to highlight the potential of these tools to improve outcomes, enhance patient experience, and reshape care pathways, while also examining the challenges and research needs that accompany their

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adoption. By showcasing technological innovation to real-world implementation, we hope to advance understanding of how digital solutions can best support individuals living with diabetes.

Key technologies in digital diabetes management

The development of digital health technologies such as mobile health interventions (e.g., apps, SMS messaging) might incorporate a range of different elements to help patients with their diabetes self-management, including tools to monitor health behaviours (e.g., logging glucose readings, meals, physical activity), educational content, online peer support, behaviour change techniques, and prompts designed encourage health behaviour change and medication adherence. Systematic review evidence suggests mobile health interventions can improve glycaemic control and self-efficacy, particularly when integrated with clinician feedback or decision-support tools [3]. Also central to diabetes management are diabetes self-management education and support (DSMES) services, providing structured education to help patients manage their condition including guidance on diet, physical activity, glucose control and medication. Delivering DSMES programmes in a digital format has the potential to address some of the limitations of attending face-to-face structured education programmes (e.g., logistics of travel, childcare), and can be effective, acceptable and promote patient autonomy [4].

Despite the benefits of mobile health interventions and digital DSMES, if patients do not engage with these tools, they will not receive important intervention content to help with their diabetes self-management which could result in reduced health outcomes. More research is therefore needed to better understand (1) exactly what elements of these digital tools people engage with and (2) choose not to engage with, (3) the amount of clinician support required to keep patients engaged in these digital tools and (4) how this support is best delivered (e.g., via telephone, messaging) [5]. Such research will help develop approaches to meet the needs of diverse user groups, including those with limited digital literacy.

Another significant advancement in digital diabetes care is the widespread adoption of continuous glucose monitors (CGM) – a wearable medical device providing real-time glucose readings, trend information, and predictive alerts, thus offering a more comprehensive picture of glycaemic patterns than traditional finger-prick testing. However, the most significant barrier to CGM has been the limited funding and access, including insurance coverage (e.g., lack of Medicaid coverage for CGM in the United States) and limited National Health Service (NHS) funding in the United Kingdom for patients with type 2 diabetes. A nationally subsidised CGM programme in Australia has demonstrated cost-effectiveness compared with a self-funded CGM approach [6].

Other non-cost barriers to digital health adoption include poor integration with clinical workflows, interconnected challenges in areas of lack of broadband, and privacy/mistrust concerns on sharing patient-generated data due to lack of data governance structures [7]. Designing and implementing digital diabetes management tools that are accessible, trustworthy, and motivating – integrated within healthcare services and appropriate payment models, and promoted through patient-centred efforts – can address barriers to adoption in the under-served communities and may help to narrow the digital divide [8].

Future directions and conclusion

Digital health combined with artificial intelligence (AI) is transforming healthcare by enabling personalised medicine, improving diagnostic accuracy, and optimising operational efficiency [9]. Key applications in digital health of diabetes management include AI-driven wearable devices for continuous monitoring and virtual health chatbots, ultimately enhancing diabetes care quality while reducing costs and supporting clinicians in decision-making. The agentic digital health technologies that are emerging shift from passive, rule-based digital health tools to proactive, intelligent systems capable of reasoning, planning, and taking autonomous actions to improve healthcare delivery [10].

As digital diabetes technologies continue to evolve and offer new opportunities to personalise care, ongoing research will be essential to optimise their adoption, effectiveness, and equity. This Collection aims to contribute to that effort by bringing together research that advances understanding of digital technologies in diabetes monitoring and management. By facilitating discussion and contributions across clinical, technological, and behavioural science disciplines, we hope to support the development of solutions that meaningfully improve the lives of individuals living with diabetes.

Abbreviations

AI	Artificial Intelligence
CGM	Continuous Glucose Monitors
DSMES	Diabetes Self-Management Education and Support
NHS	National Health Service

Acknowledgements

Not applicable.

Author contributions

RH and LS conceived, drafted and revised the Editorial. All authors read and approved the final manuscript.

Funding

None.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
Both RH and LS are guest editors for the Collection titled: 'Digital diabetes monitoring and management' hosted within BMC Digital Health.

Received: 2 March 2026 / Accepted: 17 June 2026
Published online: 22 June 2026

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