



Topic Exploration Report

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

- Determine the quantity of evidence available for a technology of interest.
- Identify any gaps in the evidence.
- Inform decisions on topics that warrant fuller assessment by Health Technology Wales (HTW).

Topic exploration report number:	TER450
Topic:	Digital tools for Diabetes management and education.
Summary of findings:	<p>Diabetes mellitus is a fast-growing health problem in the UK and worldwide, treatments for type 2 diabetes account for just under 9% of the annual NHS budget. In many cases, diabetes is well managed following effective self-monitoring of blood glucose levels and education programmes. In recent years, the application of digital tools to aid in self-management and provide education for adults with diabetes is of increasing interest - MyWay diabetes was highlighted as a specific example of such an intervention.</p> <p>Two potentially relevant guidelines, three systematic reviews and meta-analyses, a systematic review, an economic evaluation, and an individual study were identified. Results show that digital tools may be effective in aiding management of diabetes, with associated decreases in HbA1C levels. Some tools also contain artificial intelligence (AI) components, which are primarily focused around the creation of care plans for the user, though further evidence is needed as to their application. There is evidence to suggest that MyWay diabetes may result in cost saving for the NHS compared to standard practice (Cunningham et al, 2022). However, the evidence highlights a need for more high-quality evidence that assesses clinical effectiveness of digital tools for diabetes management and education.</p>

Introduction and aims

Diabetes mellitus is a lifelong condition which impacts a person's blood sugar levels. It is primarily caused by insufficient insulin production, or by a loss of insulin effectiveness. Diabetes is a growing health problem in the UK and globally, with Type 2 diabetes treatments accounting for just under 9% of the annual NHS budget (approximately £8.8bn a year). It is associated with premature mortality, macro and microvascular complications and adverse mental health outcomes.

There are three main categories of diabetes: type 1, caused by little or no insulin production; type 2, characterised by the body developing a resistance to insulin; and gestational, which manifests during pregnancy and typically does not continue following birth.

As diabetes is characterised by fluctuations in blood sugar, the effective monitoring of blood sugar levels and education on how best to control them form a key component of diabetes care in the UK, alongside medications such as metformin or insulin based treatments. In recent years, digital tools that facilitate the self-management of diabetes, and provide education to users have risen in popularity. MyDiabetes was identified by the topic proposer as an example of such a technology.

Health Technology Wales assessed a previous version of MyDiabetes under the title of 'MyDiabetesMyWay' in 2019. The original topic exploration report (TER) is available at: <https://healthtechnology.wales/reports-guidance/mydiabetesmyway/>.

Health Technology Wales researchers searched for evidence on the clinical and cost-effectiveness of digital tools for diabetes management and education.

Evidence overview

We identified two potentially relevant pieces of guidance, three systematic reviews and meta-analyses, one systematic review, one economic evaluation and three individual studies.

Guidance

Two pieces of potentially relevant guidance were identified.

NICE guideline NG28 'Type 2 diabetes in adults: management' recommends that adults diagnosed with type 2 diabetes should be offered structured education that is evidence-based, with person-specific aims and learning objectives delivered by trained educators (1.2.1, 1.2.2). The guideline also recommends that if adults with type 2 diabetes are self-monitoring their blood glucose levels, a structured assessment should occur to determine the person's self-monitoring skills, the quality and frequency of the testing and to ensure the person knows how to interpret the results, and what actions to take (1.6.16)

NICE guideline NG17 'Type 1 diabetes in adults: diagnosis and management' recommends that adults diagnosed with type 1 diabetes should be offered individual care plans that include diabetes education and self-monitoring (1.2.6). The guideline recommends that the education offered should be structured and of proven benefit and delivered by trained educators - if adults with type 1 diabetes prefer not to take part in group education, the alternative should be of an equal standard (1.3.1, 1.3.4, 1.3.3). Any education should also enable adults with type 1 diabetes to make 'best use' of data from self-monitoring of blood glucose (1.6.28).

Systematic Reviews and Meta-Analyses

Three systematic reviews and meta-analyses were identified.

Kim, et al. (2022) assessed the clinical effects of digital tools for the management of type 2 diabetes. The review identified 12 randomised controlled trials in the analysis. Interventions included were largely mobile/smartphone applications (9) and management platforms (2). One randomised controlled trial where the intervention was a glucose meter with USB connection was also included. The review found that management for type 2 diabetes in adults who used digital healthcare technology significantly decreased HbA1c levels when compared with usual care ($p < 0.001$, SMD = -0.49) and showed marginal decrease to triglyceride levels ($p = 0.06$, SMD = -0.18). The results indicate that digital tools can improve clinical outcomes, but there is a need for further well-designed randomized controlled trials.

Nkhoma, et al. (2021) assessed the clinical effectiveness of digital health interventions for diabetes self-management education and support in both type 1 and type 2 diabetes. 39 randomised controlled trials were included for analysis with a total of 6,861 participants. The meta-analysis revealed that intervention effects on HbA1c for type 2 diabetes showed a difference in means (MD) from baseline -0.480% (-0.661, -0.299), at 6 months and -0.457% (-0.761, -0.151) 81% at 12 months. For type 1 diabetes, the means difference from baseline was -0.41% (-1.022, 0.208) I^2 83% at 6 months, and -0.03% (-0.210, 0.142) at 12 months, though it is worth noting that there is a high level of heterogeneity across studies. The review found non-significant changes in health-related quality of life (HrQoL) outcomes and concluded that digital health tools are effective in improving HbA1c levels and knowledge of diabetes, specifically for type 2 diabetes. Similarly, the authors state that the intervention effect on HbA1c was 'more impressive' if delivered through mobile apps or patient portals, but further research is needed, especially for newly diagnosed diabetes patients.

Pal, et al. (2014) assessed the impact of computer-based diabetes self-management interventions on health status, cardiovascular risk factors and quality of life in adults with type 2 diabetes. Sixteen randomised controlled trials were included with a total of 3,578 participants. The review found that computer-based diabetes self-management interventions offered a small benefit in glycaemic control – the pooled effect on HbA1c was -0.20% (-2.3 mmol/mol [95% CI -0.4 to -0.1%]) and a subgroup analysis on mobile phone-based interventions demonstrated a larger effect – the pooled effect on HbA1c from three studies was -0.50% (-5.46 mmol/mol [95% CI -0.7 to -0.3%]). The study concluded that there was no evidence of improvement in terms of mental health, quality of life, blood pressure, serum lipids or weight.

Systematic Reviews

Stevens, et al. (2022) performed a systematic review of the effectiveness of mobile health apps (mHealth) for patients with diabetes mellitus. 25 studies were included with a total of 3,360 patients. Overall, participants diagnosed with type one or type two diabetes, as well as those diagnosed as being pre-diabetic demonstrated greater improvements in HbA1c as a result of using a digital health technology (DHT) than those who received standard care. The study revealed overall improvements in HbA1c compared with standard practice, with a mean HbA1c difference of -0.56% for type 1 diabetes, -0.90% for type 2 diabetes, and -0.26% for pre-diabetes. The study concludes that diabetes-specific mobile health apps may help to reduce overall HbA1c levels in patients with type 1 and type 2 diabetes, as well as those who are pre-diabetic. The study highlights the need for further research on the clinical effectiveness of technologies specific to type 1 diabetes and pre-diabetes that capture short-term glycaemic variability or hypoglycaemic events.

Economic Evaluation

Cunningham, et al (2022) performed a cost-utility analysis of the 'My Diabetes My Way' (MDMW) technology over ten years following its implementation in Scotland. The study aimed to compare the cost-utility of using MDMW compared with standard care in adults with type 2 diabetes who do not use insulin. Using the United Kingdom Prospective Diabetes Study (UKPDS) 2,576 MDMW users were compared with a matched cohort of adults receiving standard care (n=11,628). Results show that MDMW is both cost-saving and life improving when compared to standard care with a cumulative mean QALY gain of 0.054 (0.044-0.062) years and a mean cost difference of -£118.82 (-£54.16 to£150.16) over ten years.

Individual Studies

Conway, et al (2019) performed an acceptability study of the My Diabetes My Way (MDMW) platform by administering an online questionnaire to all users of the platform in May 2015. A total of 1,095 active users (27.5% of user base) completed the survey. The majority of respondents found the system useful in supporting diabetes self-management and reported the greatest utility among those with new diagnosis of diabetes.

Digital Health Technologies

Digital tools for diabetes management and education have been determined by Health Technology Wales researchers to be a digital health technology (DHT) according to the [Evidence Standards Framework for Digital Health Technologies](#). Technologies within this classification will provide information that will be used to aid treatment or diagnosis, to triage or identify early signs of a disease or condition, or will be used to guide next diagnostics or next treatment interventions. For technologies of this classification, it is recommended that satisfactory evidence for effectiveness is produced to demonstrate effectiveness of the technology. This includes studies conducted in a setting similar to the UK health and care system, peer-reviewed studies and prospective studies. Evidence to support the claimed benefits of the DHT should include real-world evaluations of its clinical utility, and include 1 or more high-quality studies that support the claimed benefits of the DHT in a relevant setting, showing improvements in relevant outcomes. Similarly, appropriate assessment of the economics of the DHT should be undertaken

Areas of uncertainty

Further clarification is required in the following areas:

- Matters of information governance and data protection, especially where they relate to personal health data
- Specific information as to how AI is used as part of these technologies
- Further evidence for the clinical effectiveness of the technology and further assessment of the economics of the technology
- How this intervention would embed in the current NHS structure and practice.

Literature search results

Health technology assessments and guidance

NICE. (2022). [NG17] Type 1 Diabetes in adults: diagnosis and management. Available at: <https://www.nice.org.uk/guidance/ng17> [accessed 23/02/23]

NICE. (2022). [NG28] Type 2 diabetes in adults: management. Available at: <https://www.nice.org.uk/guidance/ng28> [accessed 23/02/23]

Evidence reviews and economic evaluations

Cunningham SG, Stoddart A, Wild SH, et al. (2022). Cost-Utility of an Online Education Platform and Diabetes Personal Health Record: Analysis Over Ten Years. *J Diabetes Sci Technol*. 19322968211069172. doi: 10.1177/19322968211069172

Kim JE, Park TS, Kim KJ. (2022). The Clinical Effects of Type 2 Diabetes Patient Management Using Digital Healthcare Technology: A Systematic Review and Meta-Analysis. *Healthcare (Basel)*. 10(3). doi: 10.3390/healthcare10030522

Nkhoma DE, Soko CJ, Bowrin P, et al. (2021). Digital interventions self-management education for type 1 and 2 diabetes: A systematic review and meta-analysis. *Comput Methods Programs Biomed*. 210: 106370. doi: 10.1016/j.cmpb.2021.106370

Pal K, Eastwood SV, Michie S, et al. (2014). Computer-Based Interventions to Improve Self-management in Adults With Type 2 Diabetes: A Systematic Review and Meta-analysis. *Diabetes Care*. 37(6): 1759-66. doi: 10.2337/dc13-1386

Stevens S, Gallagher S, Andrews T, et al. (2022). The effectiveness of digital health technologies for patients with diabetes mellitus: A systematic review. *Frontiers in Clinical Diabetes and Healthcare*. 3. doi: 10.3389/fcdhc.2022.936752

Individual studies

Conway NT, Allardice B, Wake DJ, et al. (2019). User Experiences of an Electronic Personal Health Record for Diabetes. *J Diabetes Sci Technol*. 13(4): 744-50. doi: 10.1177/1932296818818837

Date of search:

February 2023

Concepts used:

Digital diabetes management, myway diabetes, diabetes myway, digital diabetes tools

Proposed research question and evidence selection criteria (if selected)

Proposed research question	What is the clinical and cost effectiveness of digital platforms for the education and management of diabetes in adults?
-----------------------------------	---

	Included	Excluded
Population	Adults with Diabetes	Children / Young people
Intervention	Digital tools for diabetes management and education	Digital technologies i.e Continuous glucose monitors, sensor assisted pumps
Comparison/ comparators	Standard practice	
Outcomes	Improved glucose control, reduction in long-term complications, improved quality of life Cost data related to reduction in both direct and indirect costs	
Study design	Randomised controlled trials	