**Why you should read this article:**

● To learn about digital technologies that can support the management and prevention of cardiovascular disease
● To find out what research has been conducted into digital technologies and cardiovascular disease
● To remind yourself of the benefits of empowering patients with long-term conditions to take control of their health

# Benefits of digital technologies in empowering patients to take control of their cardiovascular health

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## Abstract

Cardiovascular disease (CVD) is preventable. Risk factors for CVD include high blood pressure, being overweight and type 2 diabetes. Empowering patients to take control of their health and lead healthier lifestyles is an important component in reducing the risk of CVD. Digital technologies – for example, text messaging services, mobile applications, wearable devices and digital assistants – can support patients to make lifestyle changes recommended as part of the management and prevention of long-term conditions such as CVD and diabetes. Research investigating the use of digital technologies in healthcare has generally demonstrated positive outcomes.

This article discusses the use of digital technologies in the management and prevention of CVD and diabetes, including their potential to support medicine adherence, lifestyle changes, management of hypertension and patient self-management.

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CARDIOVASCULAR DISEASE (CVD) affects approximately 7.6 million people in the UK (British Heart Foundation 2021), accounts for a quarter of deaths in England and costs the NHS an estimated £7 billion per year, yet it is recognised as highly preventable (Kearney 2019). Risk factors for developing CVD include high blood pressure (BP), being overweight and type 2 diabetes (Chudasama et al 2020, Diabetes UK 2021a, Diabetes UK 2021b).

Empowering patients to take control of their health and lead healthier lifestyles is an important component in reducing the risk of CVD. Exercising regularly, stopping smoking and eating a healthy,

balanced diet can all reduce the risk of CVD (Chudasama et al 2020, Diabetes UK 2021a). However, encouraging such lifestyle changes can be challenging. Alageel et al (2017) conducted a systematic review and meta-analysis of 31 randomised controlled trials that had explored the effectiveness of multiple health behaviour change interventions for the primary prevention of CVD in primary care. They found that health behaviour change interventions delivered to CVD-free participants in primary care did not appear to have quantitatively important effects on risk factors for CVD (Alageel et al 2017).

Digital technologies can support patients to make lifestyle changes recommended as part

of the management and prevention of long-term conditions such as CVD and diabetes. These technologies are varied and include, for example, text messaging services, mobile applications (apps), wearable devices and digital assistants. Text messaging services have already been trialled or used in UK general practices (Cottrell et al 2015), but mobile apps are more challenging to implement because their use requires the availability of adequate devices.

Research investigating the use of digital technologies in healthcare has generally demonstrated positive outcomes. In a systematic review of the literature, Widmer et al (2015) found evidence that digital health interventions – including telemedicine, web-based strategies, email, mobile phones, mobile apps, text messaging and monitoring sensors – reduced overall CVD outcomes (that is, CVD events, hospitalisations and all-cause mortality) compared with usual care and were associated with an improvement in risk factors for CVD. Han and Lee (2018) conducted a systematic review of the literature to examine the effectiveness of mobile apps in changing health-related behaviours and clinical outcomes. Among the 20 studies included, 16 reported that mobile apps had a positive effect on health-related behaviours and clinical outcomes (Han and Lee 2018).

This article discusses the use of digital technologies in the management and prevention of CVD and diabetes, including their potential to support medicine adherence, lifestyle changes, management of hypertension and patient self-management. This article is derived from an evidence review of the effectiveness of digital apps and devices in the management or prevention of cardiovascular diseases conducted at Midlands Partnership NHS Foundation Trust (Iqbal et al 2020).

## Digital technologies used to support patients
Mobile apps and other digital technologies are not intended to replace traditional treatment modalities and channels such as medicines or face-to-face appointments, but to encourage and empower patients to take control of their health, with the support of their family and/or informal carers where appropriate. In the context of the management and prevention of CVD, digital technologies can support patients with components of care such as:
» Medicine adherence.
» Lifestyle changes.
» Management of hypertension.
» Self-management.

### Medicine adherence
Non-adherence to medicine regimens is a challenge for healthcare professionals. It has been reported that many as 40-50% of patients who are prescribed medicines for chronic conditions such as diabetes and hypertension do not adhere to their medicine regimen (Kleinsinger 2018). This can negatively affect patients' ability to control their condition – for example, to keep their blood glucose levels or BP within acceptable ranges.

Text message services could support people to establish and follow a routine of taking prescribed medicines. A single-centre pilot randomised controlled trial was conducted over 12 months into the use of text messaging to promote adherence to medicines among patients receiving cardiac rehabilitation after myocardial infarction (Pandey et al 2017). It showed that text message reminders significantly increased medicine adherence. Pandey et al (2017) conducted a similar trial into the effect of text messaging on adherence to exercise and obtained similar results. They concluded that text messaging represents a simple and scalable method to ensure the consistent use of evidence-based cardiovascular therapies (Pandey et al 2017).

Digital assistants and voice technology, such as Echo and/or Alexa devices or Google Home Hubs, are further digital modalities that could assist patients with medicine adherence. In a pilot project, 58 patients with long-term conditions, including 18 with diabetes, were provided with an Alexa device (Beaney et al 2020). One of the functions of that technology is to create digital lists and set reminders. Feedback was positive, with patients reporting that the digital lists reminded them not only to take their medicines but also which medicines they had already taken and which they still needed to take (Beaney et al 2020).

### Lifestyle changes
Being overweight is a known risk factor for CVD (Cercato and Fonseca 2019) and approximately 90% of patients with type 2 diabetes are classified as overweight or obese (National Institute for Health and Care Excellence 2020), so supporting patients who are overweight to make lifestyle changes can reduce their risk of developing CVD.

In a review of the evidence on the use of mobile apps to support diabetes control, Wu et al (2019) found that mobile apps were effective in encouraging lifestyle changes – including exercising and adopting a healthy diet – in patients with type 2 diabetes but not in those with type 1 diabetes. Lunde et al

(2018) found that app-based interventions to promote lifestyle changes were effective in reducing levels of glycated haemoglobin (HbA1c) in patients with diabetes. There are mobile apps available that can support patients to modify their diet. Apps such as the Low Carb Program (Low Carb Program 2021) and Second Nature (Second Nature 2021) provide educational resources and dietary advice, including what types of food to avoid, what to eat and how to manage food cravings.

Patients could also be supported to make lifestyle changes through the use of digital assistants. In a pilot project conducted with 20 patients with diabetes, participants reported that the functions of an Alexa device were useful to improve their understanding of, and access to, dietary information – for example, the amount of carbohydrates contained in certain foods or recipe ideas for low-fat meals (Chambers et al 2020). The ability of the Alexa device to make lists, set reminders and organise online calendars are non-health specific but can be used for health purposes (Chambers et al 2020).

Wearable devices such as fitness watches and pedometers are becoming increasingly popular in the general population. A literature review on the use of pedometers when undertaking physical activity and its association with health outcomes found that wearing a pedometer was associated with significant increases in physical activity and significant decreases in body mass index (BMI) and BP (Bravata et al 2007). When data from all studies were combined, pedometer users increased their physical activity by 26.9% over baseline and decreased their BMI by 0.38 (Bravata et al 2007).

**Management of hypertension**
Research investigating digital technologies to support patient self-management of hypertension has been generally positive. In a systematic review and meta-analysis of seven studies with a total of 1,259 participants, McLean et al (2016) found that interactive digital interventions aimed at promoting self-management in adults with hypertension lowered both systolic and diastolic BP compared with usual care. The interactive digital interventions used a variety of technologies including mobile phone, websites, automated messages, emails, interactive voice response systems and computer-controlled speech (McLean et al 2016). Lu et al (2019) found that mobile health interventions can significantly reduce BP and suggested they may be particularly useful for patients with inadequate BP control.

One advantage of patients measuring their BP at home is that it can reduce 'white-coat hypertension' (Cottrell et al 2015), whereby patients' BP is artificially raised because of the environment in which readings are taken. As part of the Advice & Interactive Messaging (AIM) programme, patients with hypertension were supported to take responsibility for the monitoring and shared management of their BP. Patients were prompted to send BP readings via text message and if their readings were outside the acceptable range, they were provided with education and self-management advice (Cottrell et al 2015). A service evaluation of the AIM programme found that BP control was achieved by 5-22% of 1,495 patients signed up to one of the programme's monitoring protocols. Patient engagement with the monitoring protocols was initially good but reduced over time (Cottrell et al 2015).

There are several mobile apps that can be used to assist with the management of hypertension. Know Your Numbers (KYN) is a free mobile app that encourages users to take more responsibility for their health and well-being by tracking their BP, blood glucose levels, cholesterol and BMI (Vu et al 2018). Another free mobile app is cVitals (British Lung Foundation 2019), which aids communication between the patient and the overseeing healthcare professional by enabling the sharing of BP measurements in a secure way. If there is an agreed shared access arrangement, the healthcare professional can remotely see how patients are doing with their hypertensive management. Alternatively, patients can text their BP readings to the healthcare professional. A further mobile app, the Kardia app, enables patients to track their weight and BP. If connected to a KardiaMobile device, the Kardia app also enables patients to record their own electrocardiograms (ECGs) (AliveCor 2021, Mathew and Chambers 2021).

**Self-management**
Self-management is an important component of the management of long-term conditions such as CVD, diabetes and chronic pulmonary disease (Lunde et al 2018). Most of the research into the use of digital technologies to support self-management investigates their use in diabetes, and research in other conditions is less developed (Hanlon et al 2017). Hanlon et al (2017) found that, overall, telehealth-mediated care was not superior to usual care but that there were some promising outcomes, such as reduced hospital admissions and reduced mortality in type 2 diabetes and heart failure.

## Key points

- Empowering patients to take control of their health is an important component in managing and preventing cardiovascular disease (CVD)

- Exercising regularly, stopping smoking and eating a healthy, balanced diet can all reduce the risk of CVD

- Digital technologies can support medicine adherence, lifestyle changes, management of hypertension and self-management in patients with or at risk of CVD

- Digital technologies used to support patients to make lifestyle changes include text messaging services, mobile applications, wearable devices and digital assistants

- It is important to ensure that the use of digital technologies does not create or exacerbate health inequalities

NHS England has launched a range of online tools to support patient self-management in type 1 and type 2 diabetes (NHS England 2020). These tools include apps, online videos and elearning courses designed to enhance patients' confidence with self-managing their condition.

### Avoiding health inequalities

Digital technologies applied to healthcare have evolved rapidly in recent years and can be applied through many modalities, such as interactive texting and video consultations, and in many settings, such as care homes and primary care settings.

The coronavirus disease 2019 (COVID-19) pandemic has resulted in an increase in the number of online healthcare consultations, which, in March 2020, had doubled from 900,000 to almost 1.8 million compared with March 2019 (Bibby and Leavey 2020). This wide-scale engagement of patients and healthcare professionals with digital technologies has provided further evidence of their benefits for empowering patients to take control of their health.

However, it is important that the increase in the use of digital technologies in healthcare does not unintentionally create or exacerbate health inequalities for people who do not have access to these technologies – for example, people who do not have an internet connection or a smartphone. There are also groups of people who may have access to digital technologies but lack digital literacy.

Statistics suggest that older people are those who least use the internet. Since 2011, people over the age of 65 years have consistently made up the largest proportion of adults who do not use the internet, and their proportion among all adult non-users of the internet has steadily increased. In 2018, over half of all adults who do not use the internet were over the age of 75 years. However, the gap is narrowing between the proportion of internet users over the age of 65 years and those in younger age groups (Office for National Statistics 2019).

More programmes, such as the NHS Widening Digital Participation programme (Stone et al 2020), are needed to help educate people and provide them with the digital skills required to access information online.

### Conclusion

Cardiovascular disease (CVD) affects approximately 7.6 million people in the UK but is highly preventable. Digital technologies can provide innovative ways of empowering patients to take control of their cardiovascular health. These technologies can support components of care such as medicine adherence, lifestyle changes, management of hypertension and self-management in patients with or at risk of CVD. However, it is important to be aware of potential inequalities that can be created or exacerbated by the use of digital technologies, since people who lack digital literacy or access to digital technologies will be prevented from receiving healthcare services provided through digital technologies.

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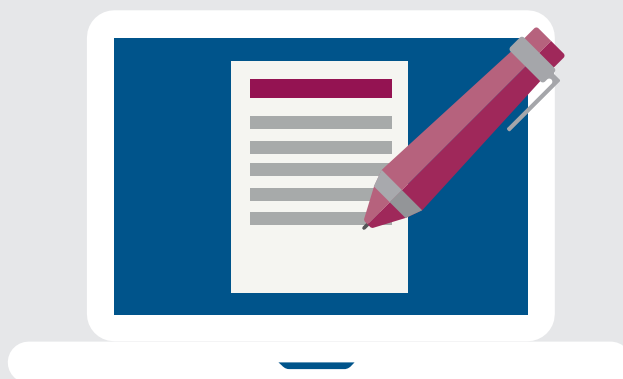
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