

Diabetes care in the time of COVID-19: video consultation as a means of diabetes management

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Abstract

Background: This review specifically focuses on the use of video consultation in diabetes management, in comparison to standard care. The population of chronic condition sufferers in the UK is considerable and teleconsultation use has, in recent years, been explored. COVID-19 has created an additional pressure on health services to use teleconsultation. Diabetes mellitus affects approximately four million people in the UK. If clinical outcomes are uncompromised, the benefits of using a remote service could encourage the use of video consultation for diabetes management in normal practice.

Aims: A systematic review of the use of video consultation in place of standard consultation in the management of diabetes mellitus. Both clinical and non-clinical outcomes are reviewed, in addition to patient satisfaction levels after using video consultation.

Methods: A systematic literature search was conducted to select published articles from web-based health databases. Data extraction and analysis of results followed.

Results: Twelve studies were selected. Overall, the clinical outcomes (HbA_{1c}, low-density lipoprotein levels and blood pressure) appeared to be uncompromised with the use of video consultation. Patient satisfaction was high, with few limitations found. The economic and time saving benefits of this approach proved to be additional advantages.

Conclusions: Despite there being a lack of literature identified in this field, the results support the use of video consultation in diabetes management. The evidence suggests that this approach should be utilised in the time of COVID-19 and beyond. Future research should assess the use of video consultation over a reasonable duration through randomised controlled trials. Copyright © 2022 John Wiley & Sons.

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Key words

COVID-19; diabetes; video consultation; teleconsultation

Introduction and background

The demand for eHealth is increasing in tandem with technology capabilities; 'eHealth is the use of information and communication technologies (ICT) for health.'¹ This includes telephone calls, video calls, texting or internet platforms aiming to educate patients on their condition and its management. Teleconsultation is defined as 'a general term for any consultation between doctors or between doctors and patients on a network or video link (e.g. Facetime, intranet, internet, Skype, etc.)'.² Private companies have offered GP video consultations to patients in the past; however, implementing teleconsultation within the NHS has been a slow process.³ The recent COVID-19 pandemic has put

pressure on the NHS to adopt teleconsultation as a method of primary health care in general practice wherever possible.^{4–6}

The prevalence of diabetes is estimated to be four million in the UK, with its management accounting for 10% of the annual NHS budget for England and Wales.⁷ Without proper management and monitoring, uncontrolled diabetes can lead to further, avoidable, complications.⁸ Once the disease is controlled, diabetes patients attend face-to-face follow-up appointments every three to 12 months. Lee *et al.*, and others, found that teleconsultation maintains the health care professional-patient relationship, and continues to utilise evidence-based medicine to

give the best care to the patient, while providing economic benefit to both the NHS and patient.^{9–11}

Remote medical consultations have proved to be beneficial in rural populations and for those unable to travel.¹² To date, ICT has been successful in the management of chronic conditions such as diabetes, stroke and Parkinson’s disease.^{13–17} The main limitations identified were lack of access to a smart device/internet, and usability of technology. However, the benefits seem to outweigh the limitations, and as technology is evolving so is its accessibility.

Epidemiological data on the COVID-19 pandemic showed that patients comorbid with diabetes had an increased risk of in-hospital death due to COVID-19.¹⁸ It is important to note that this could be due to common comorbidities in patients with diabetes, such as obesity. Nevertheless, these data highlighted the importance of taking measures to limit contact between these patients and health care professionals where possible, which further advocates for the use of video consultation.

A comparison is yet to be made between the benefit of using video consultation compared to conventional management of diabetes, which is usually face-to-face consultation. Video consultation is defined by the NHS as a process ‘where you speak to a doctor or health care professional using the video camera in your smartphone, tablet or computer’.¹⁹ This systematic review aims to assess the use of video consultation vs conventional face-to-face consultation in the management of diabetes mellitus, by examining both clinical outcomes and patient satisfaction levels.

Method

Study design

The PICO (Population, Intervention, Comparison and Outcome) method of formulating a research question and framing eligibility criteria was used to address research aims. The population to be studied was patients with diabetes mellitus type 1 or 2,

using an intervention of video consultation in comparison to conventional management. Comparison to conventional management in this study means studies using data from face-to-face appointments, or patient baseline data before intervention can be included. HbA_{1c} levels, low-density lipoprotein (LDL) cholesterol level and blood pressure (BP) are primarily monitored in patients with diabetes.

The PRISMA study selection tool was used.²⁰ An electronic database search was conducted, and duplicate articles were removed from the results. Titles and abstracts were read by two independent reviewers, and inclusion and exclusion criteria detailed in Table 1 were used to remove further articles. The remaining articles were read in full text and removed if deemed outside of the inclusion criteria. Twelve articles were eligible for

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> • Type 1 diabetes management and/or type 2 diabetes management • Publications comparing teleconsultation to face-to-face consultation • Patient experience of video consultation • Randomised control trials • Pilot studies • Pre-post studies • Retrospective studies • Qualitative studies 	<ul style="list-style-type: none"> • Publications not in the English language • Systematic reviews • Protocol for future study • Letters and comments • Publications about gestational diabetes • Publications not specific to diabetes • Telehealth in forms apart from video consultation

Table 1. Inclusion and exclusion criteria

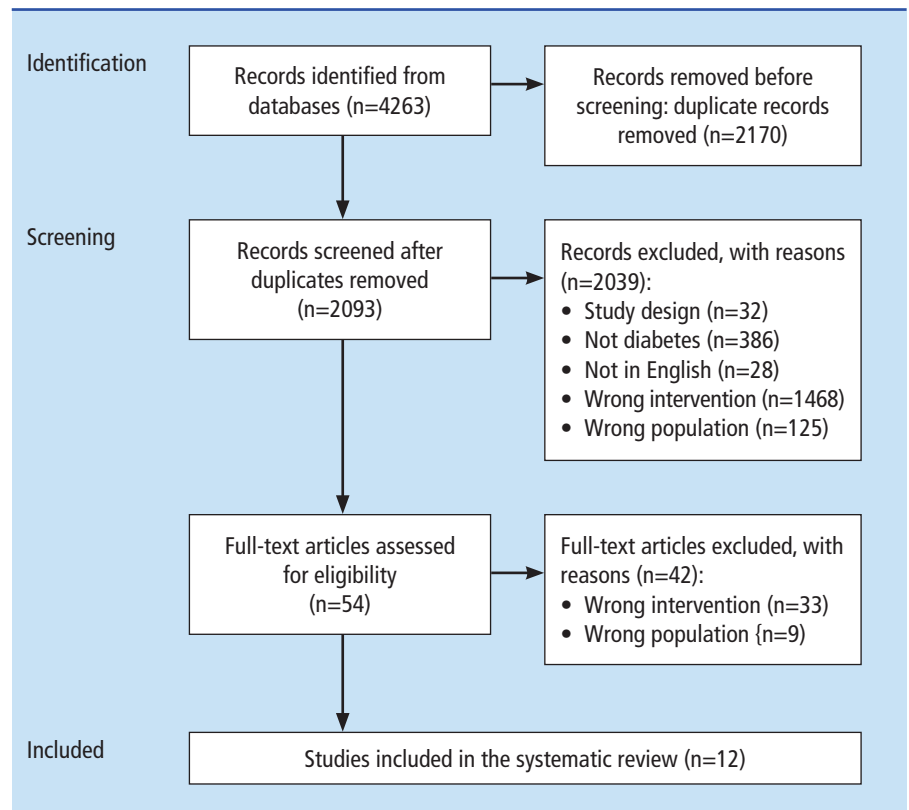


Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) flowchart showing the study selection process for qualitative and quantitative articles

inclusion in the review. A PRISMA flowchart was created to summarise the process of study selection (Figure 1).

Study identification

Structured searches were conducted on four electronic databases: Medline, Embase, Web of Science and CINAHL in May 2020. Key word search terms included video consultation, video-conferencing, video appointment, remote consultation, telemedicine, teleconsultation, m-health, face-to-face consultation, diabetes mellitus, type 1 diabetes, and type 2 diabetes. These were used to search for both qualitative and quantitative publications between the years 2010–2020, using Boolean operators. The search parameters were set between these years as the use of teleconsultation is a relatively recent field, and grey literature was not searched due to infancy of this field. Research papers which were literature reviews, letters or comments were also excluded, as these did not contain the raw data for a narrative synthesis of results. The common outcomes identified were patient HbA_{1c} level, LDL cholesterol levels, BP, and patient satisfaction. Secondary outcomes such as cost were also explored. Searches were completed on 1 August 2021.

Quality assessment and data extraction

The CASP tool was used to critically appraise selected articles, to assess bias and eligibility.²¹ Different CASP checklists were used to review different study designs. As a literature review, ethical approval was not necessary.

Findings

Study selection

A total of 4263 records were found in the initial database search, 2170 of which were found to be duplicates, which left 2093 unique articles. Only online databases were searched, due to the infancy of this intervention in diabetes care. Titles and abstracts were screened for exclusion and inclusion criteria

for eligibility; 2039 articles were excluded at this stage. Fifty-four published papers were then read in full text for eligibility, at which point 42 further articles were excluded. A final 12 articles were included in the review (Figure 1).

Methodological quality of studies

CASP checklists were used to assess bias and eligibility for the 12 studies selected for inclusion. There were a number of studies included which compared intervention values to baseline values instead of a control group with significant improvements, and therefore these data should be considered in a sceptical manner. For example, there is known variation in reported BP, due to human error or device used.

Study characteristics

Study characteristics were extracted for all 12 studies selected (Appendix 1, available online at <https://wchh.onlinelibrary.wiley.com>).

Participants

From the 12 studies included, there were 2439 participants with either type 1 or type 2 diabetes mellitus. Five of the studies were conducted in the USA: Gordon *et al.*, Shea *et al.*, Tokuda *et al.*, Maxwell *et al.* and Crossen *et al.*^{22–26} Three of the studies were conducted in Denmark: Levin *et al.*, Rasmussen *et al.* and Hansen *et al.*^{27–29} The remaining four studies were conducted in the UK, Finland, Italy and Germany.^{30–33} (Details are given in Appendix 2, available online at <https://wchh.onlinelibrary.wiley.com>).

Study findings: quantitative outcomes of interest

HbA_{1c}. HbA_{1c} levels appeared uncompromised over time in intervention groups compared to standard diabetes care, relative to either control or baseline values. All but two of the quantitative studies included in this review reported significant reduction in HbA_{1c}.^{23–26,28,29,31,33} Maxwell *et al.* also found that the percentage of patients meeting their HbA_{1c} level

goal increased from 0% to 38% at follow up.²⁵

LDL cholesterol level. Five studies included in this review reported LDL cholesterol levels in intervention groups and these, overall, reported that levels were uncompromised over time. Two of five studies found that there was a significant improvement in LDL cholesterol level at the time of follow-up appointment in the intervention groups compared to control groups of usual care or baseline values.^{23,31} The remaining three studies found there to be no significant change in LDL level at follow-up.^{24,25,27} A significant decrease in overall cholesterol level was found by Rasmussen *et al.*²⁸

Blood pressure. Blood pressure appeared to remain uncompromised in intervention groups. Six studies compared BP, of which two found that BP levels significantly dropped in the intervention group compared to baseline or control groups at follow-up.^{23,31} The remaining four studies found no significant change in BP.^{24,27–29}

Study findings: patient perspective

Of the seven studies which reported patient perspective, all concluded that the use of video consultation was a positive experience, despite limitations. Veteran populations were able to adjust to the use of technology with sufficient ease, and the standard of care across both methods was found to be uncompromised.

The main limitations reported were forming a relationship with the health care provider and difficulty in performing full physical examinations, although the latter was attempted by using 'zoom' features during video consultation. Other studies had nurses or other health care professionals in the room with the patient to complete these, while the specialist consultant was remote. Crossen *et al.* found that 94% of patients completing their study found they were 'very satisfied' with the video visit experience.²⁶

Additional points of interest

As expected, an estimated reduction of US\$60–70 in travel costs per consultation was reported, and a reduced duration of time was taken out of work to attend appointments. According to Levin *et al.*, the average video appointment requires patients to take approximately 1 hour out of their working day.²⁷ Bertuzzi *et al.* also reported reduced travel time by approximately 5 hours, a reduction in travel costs by an average of €80 per visit, and 115 minutes of time saved per video consultation. The latter is most likely due to reduced waiting times.³²

Discussion

Key findings

Overall, the studies showed that, with video consultation management, HbA_{1c} levels appeared to be uncompromised over time. This is a positive finding, and important since HbA_{1c} level can be used diagnostically for diabetes.³⁴ Diabetes is typically associated with raised LDL levels; results here suggest video consultation neither reduces nor raises LDL level.³⁵ Blood pressure is monitored in patients with diabetes as hypertension increases the risk of stroke or myocardial infarction.³⁶ In all studies reporting BP, it was either maintained or lowered with the use of video consultation. Improvement or maintenance of these outcomes are an important part of any diabetes treatment. With no detriment to HbA_{1c}, LDL and BP, these findings further support the use of video consultation as a safe and effective method of delivering diabetes care.

The economic benefit and time saving in consultation and travel are significant. This is beneficial for both the health care provider and the patient. Since there is a high percentage of the population with diabetes, implementing video consultation could be of considerable economic benefit for the NHS.³⁵

Still, the main obstacle to overcome in full-scale implementation of video consultation is patient

satisfaction. If patients are unresponsive to the service, it presents major challenges to its application. In this review of literature, few limitations were found by patients. An overwhelming majority of patients would use video consultation again.³² Even in older populations, where technological aptitude presents more of a challenge, the general findings indicate a positive experience.

In previous literature, the importance of implementing teleconsultation or eHealth within the correct window for each patient is highlighted.³⁷ The optimum intervention time for use of video consultation in diabetes management is to be established. However, once stability of clinical outcomes is reached and once a health care professional–patient relationship has been formed, use of video consultation for follow-up appointments would be most appropriate.

Practical and theoretical implications

It would be feasible to use video consultation for follow-up appointments, and continue use of face-to-face appointments for certain physical examinations such as monitoring diabetic retinopathy, although some of these would be able to be done remotely, such as most of a foot examination. Practically, training for both patient and health care professional would be needed, in addition to access to appropriate equipment.

Strengths and limitations

One strength of this review is that solely the use of video consultation under the umbrella term of teleconsultation is examined, and this has not been explored previously. In addition, both quantitative and patient perspective outcomes were reported, which creates a more well-rounded report relevant to clinical practice.

There were limitations to the studies selected for this review. An improvement in HbA_{1c} in type 2 diabetes mellitus could be due to introduction or modification of insulin. Additionally, the lack of a predefined

control group in some studies meant that baseline data from either national databases or the patient's previous medical record were used. This is made clear for each study in Appendix 2 for comparison groups. These data were used for comparison to data collected after video consultation intervention. This could introduce confounding variables and as such the results of this study must be interpreted cautiously. Some patient populations were predominantly male, younger or older, which may make the results less applicable to wider populations. Finally, the duration of studies varied between one video consultation and five years of video consultation use, and some studies had a small sample size due to the infancy of this field.

This review has its own limitations. It includes four pilot studies which generally test feasibility of the use of the video consultation model, rather than concentrating on patient outcomes. However, the decision to include these was carefully considered, and the benefit of these articles to add weight to this review outweighed any hesitations – particularly as there were few studies selected due to the recent introduction of this intervention in diabetes care. In addition, 12 studies were selected for review, and widening search terms could make a more robust review.

Future study

In the future, exploring other forms of telecare use in diabetes, rather than confining results to the use of video consultation, would expand this evolving field of research. In addition, studies exclusively reporting type 1 diabetes mellitus patient data would be useful in determining whether improvement of HbA_{1c} was due to video consultation, or medication. Future studies should assess larger sample sizes for a longer duration of time in order to obtain more accurate results. The need for further evidence of the impact of teleconsultation on diabetes patients' outcomes is apparent.

The COVID-19 virus provides a unique opportunity to study video consultation.³⁸ Use of a standardised checklist such as the Alphabet strategy for diabetes consultation would allow patient education and timely multidisciplinary team intervention.³⁹ It would be useful to study the use of a remote consultation strategy such as this as a viable standardised tool to use during teleconsultation during the COVID-19 pandemic and in the future.

Conclusion

It is feasible to use video consultation in the place of conventional consultation in clinical practice for the treatment of diabetes. Implementation may take some time, with training required for both patients and health care professionals. However, the economic and time saving advantages of video consultation, in addition to having clinical outcomes similar to those of conventional management, make for a convenient method of diabetes management.

Declaration of interests

There are no conflicts of interest declared.

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KEY POINTS

- The pressure on health services caused by the COVID-19 pandemic has meant means of chronic disease management, such as video consultation, have been implemented
- This review compares clinical outcomes and patient satisfaction levels between video consultation and standard management of diabetes mellitus
- Clinical outcomes (HbA_{1c}, low-density lipoprotein levels, blood pressure) appeared to be uncompromised over time
- Patient satisfaction of video consultation use was high, with few limitations found
- The results support the use of video consultation in clinical practice for the treatment of diabetes, both during the pandemic and beyond

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Study authors	Study design	Country of origin	No.	Age	Intervention	Duration	Comparison	Outcomes of interest
Levin <i>et al.</i> , 2013 ²⁷	Retrospective study	Denmark	78	56–74	T with specialist & nurse	7 years	National baseline values (DVDD)	HbA _{1c} , lipid levels, BP, pt satis.
Tokuda <i>et al.</i> , 2016 ²⁴	RCT. Pilot study	USA	100	61.6 C 60.4 I	T – group & individual	5 months	Control group	HbA _{1c} , lipid levels, BP, pt satis.
Rasmussen <i>et al.</i> , 2016 ²⁸	RCT	Denmark	40	64.6 C 60.7 I	T	6 months	Control group	HbA _{1c} , 24-hr BP, cholesterol levels
Bertuzzi <i>et al.</i> , 2018 ³²	RCT	Italy	77	34 C 36 I	T	12 months	Control group	HbA _{1c} , pt satis.
Nikkanen <i>et al.</i> , 2008 ³¹	Uncontrolled pre-post study	Finland	101	62 mean	T	10–12 months	Patient baseline	HbA _{1c} LDL levels, systolic BP
Shea <i>et al.</i> , 2009 ²³	RCT	USA	1445	70.9 C 70.8 I	T with nurse	5 years	Control group	HbA _{1c} , LDL levels, BP
Morris <i>et al.</i> , 2017 ³⁰	Mixed methods evaluation. Pilot study	England	104	20–49 median range	T	3 years	Patient baseline	Pt satis.
Maxwell <i>et al.</i> , 2016 ²⁵	Single-centre, prospective, pre–post pilot study	USA	26	64 mean	T with pharmacist	6 months	Patient baseline	HbA _{1c} , LDL levels, BP, pt satis.
Gordon <i>et al.</i> , 2020 ²²	Qualitative study	USA	27	66 mean	T	At least 1 teleconsultation visit	Patient baseline	Pt satis.
Hansen <i>et al.</i> , 2017 ²⁹	Randomised cross-sectional study	Denmark	165	56.8 mean	T with nurse	6 months	Patient baseline & control group	HbA _{1c} , BP, weight
Sengbusch <i>et al.</i> , 2020 ³³	Multi-centred controlled clinical trial	Germany	240	10.9 mean	T monthly	6 months + extension phase	Patient baseline & control group	Primary outcome HbA _{1c}
Crossen <i>et al.</i> , 2020 ²⁶	Quantitative intervention study	USA	36	3–17 range	T every 4–8 weeks	6 months	Patient baseline	HbA _{1c} , pt satis.

RCT = randomised control trial; DVDD = Danish National Diabetes Registry; C = mean for control group; I = mean for intervention group; T = teleconsultation; HbA_{1c} = glycated haemoglobin (level of haemoglobin linked to sugar); LDL = low-density lipoprotein; BP = blood pressure; Pt satis = patient satisfaction levels.

Appendix 1. Study characteristics of 12 articles selected for this study

Study authors	Quantitative outcomes of interest	Quantitative results	Qualitative outcomes of interest	Qualitative results
Levin <i>et al.</i> , 2013 ²⁷	HbA _{1c} , lipid levels, blood pressure (BP)	All results were comparable to baseline values. Post intervention, HbA _{1c} in type 1 diabetes patients was 8.0% (7.4–8.6%) vs 7.9% [64 (57–71) vs 63mmol/mol], not significant; and in type 2 diabetes patients was 7.4% (7.1–7.7%) vs 7.6% [57 (54–61) vs 60mmol/mol], $p < 0.05$. BP and lipid values were comparable with the Danish National Diabetes Registry	Patient satisfaction: improvement compared to standard care, transportation time and cost effectiveness	The elderly patient population quickly accustomed to the audiovisual communication
Tokuda <i>et al.</i> , 2016 ²⁴	HbA _{1c} , lipid levels, BP	Significant decline in HbA _{1c} in video-shared medical appointments vs usual care (9.1 ± 1.9 to 8.3 ± 1.8 vs 8.6 ± 1.4 to 8.7 ± 1.6 , $p = 0.03$). No significant change in BP or lipid levels was found between the groups	Patient satisfaction: initial survey, followed by focus groups	6 themes emerged from focus groups. Overall, patients reported the intervention helped to raise level of self-efficacy in diabetes self-care, and they were satisfied with clinical management
Rasmussen <i>et al.</i> , 2016 ²⁸	HbA _{1c} , LDL levels, 24-hour BP	Significant difference in HbA _{1c} (-15 vs -11%). No differences in LDL (-4 vs -6%), diastolic diurnal BP (-1 vs -7%), and systolic diurnal BP (0 vs -1%) were found	–	–
Bertuzzi <i>et al.</i> , 2018 ³²	HbA _{1c}	HbA _{1c} changes were not statistically different within groups ($p = 0.56$ for standard care group; $p = 0.45$ for telemedicine group)	Patient satisfaction: questionnaire focused on perception of advantages and limitations of teleconsultation. Cost savings and estimate of time saved	All 30 patients who completed a patient perspective questionnaire scored time saving and level of comfort 5/5. 29 out of 30 patients were fully satisfied with the service (5/5 Likert scale). Improvement of diabetes management and cost saving also scored highly with 19 and 24 patients scoring 5/5 for these respectively. Only 2 patients found limitations of using teleconsultation, such as technical issues, or poor interaction with the health care professional. All 30 patients were interested in continuing to use teleconsultation
Nikkanen <i>et al.</i> , 2008 ³¹	HbA _{1c} , LDL levels, systolic BP	Mean HbA _{1c} was 8.0% at baseline and 7.6% at follow-up ($p = 0.007$). Mean LDL cholesterol was 3.3mmol/L at baseline and 2.7mmol/L at follow-up ($p < 0.001$). Mean systolic BP was 146mmHg at baseline and had decreased by 6mmHg at follow-up ($p = 0.004$)	–	–

Appendix 2. Data extraction from 12 studies. (Continued on next page)

Study authors	Quantitative outcomes of interest	Quantitative results	Qualitative outcomes of interest	Qualitative results
Shea <i>et al.</i> , 2009 ²³	HbA _{1c} , LDL levels, BP	Estimated differences (95% CI) in year 5 were 0.29% (0.12, 0.46) for HbA _{1c} , 3.84mg/dL (0.08, 7.77) for LDL cholesterol, and 4.32mmHg (1.93, 6.72) for systolic and 2.64mmHg (1.53, 3.74) for diastolic BP	–	–
Morris <i>et al.</i> , 2017 ³⁰	–	–	Patient satisfaction: interview in person or via telephone and patient focus groups	Patients found the service convenient, empowering, and dependent on a pre-existing relationship with their clinician, and found teleconsultation delivered as good quality of care as face to face. Patients felt that webcam appointments were not appropriate for all encounters but could be interspersed with traditional clinic visits
Maxwell <i>et al.</i> , 2016 ²⁵	HbA _{1c} , LDL levels, BP	Significantly reduced HbA _{1c} values from baseline of 2±2.4% (p=0.0002). There were insignificant reductions in LDL level and BP	Patient satisfaction: survey at the final 6-month visit	Patient satisfaction scores also indicated a high level of satisfaction (an overall median patient satisfaction score of 39.5/40 with the pharmacist-led Clinical Video Telehealth service)
Gordon <i>et al.</i> , 2020 ²²	–	–	Patient satisfaction: telephone patient interviews on advantages and limitations to teleconsultation	Several themes were identified related to patients' perspectives. Better access to appointments, shorter travel time, and less time in the waiting room were reported. In addition, concerns about errors in patient care due to difficulty in completing the physical exam, feelings that providers paid less attention to them, barriers to speaking up and asking questions. Patients felt uncomfortable if they had not already built a relationship with their care provider
Hansen <i>et al.</i> , 2017 ²⁹	HbA _{1c} , BP, weight	HbA _{1c} was significantly reduced in the intervention group over 8 months intervention compared to control. There was no significant change in BP or weight	–	–
Sengbusch <i>et al.</i> , 2020 ³³	HbA _{1c}	HbA _{1c} was shown to be statistically insignificant at 6 months, but significant at 12 and 15 months	Psychosocial outcomes were measured using validated patient reported outcome measures and measures of patient-reported experiences	Quality of life was similar in both intervention and control groups, diabetes burden decreased in the intervention group, and treatment satisfaction improved more in the intervention group
Crossen <i>et al.</i> , 2020 ²⁶	HbA _{1c}	Mean HbA _{1c} reduction among patients completing 6 months was 0.8%	Patient satisfaction: a standardised survey was administered at 6 months	94% of patients completing 6 months of the intervention were 'very satisfied'. Percentage of patients having difficulty with the video application fell from 18% initially to only 2% at subsequent visits

Appendix 2. Data extraction from 12 studies. (Continued from previous page)