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HEAL-D Online: A mixed methods evaluation exploring the feasibility of implementing a virtual culturally tailored diabetes self-management programme for African and Caribbean communities.

Short running title:

HEAL-D Online feasibility evaluation.

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ABSTRACT

Objectives: To assess the feasibility and acceptability of delivering the HEAL-D Online.

Intervention: HEAL-D Online - culturally tailored 7-week diabetes Type 2 educational programme delivered using online platform,

Setting: Programme delivered by Guy's and St Thomas NHS Foundation Trust, with patients referred from primary care via a central booking system.

Participants: People who answered the service users' questionnaires (n=53). From this sample, 14 people were interviewed, along with 7 health care staff.

Design: Mixed methods evaluation.

Method: Service activity data assessed service user engagement, acceptability and perceived patient benefit. Views and experiences of service users and service delivery staff about the feasibility and acceptability of HEAL-D Online were explored using semi-structured interviews. Data were analysed using framework methodology. Fidelity was measured through observations using a fidelity checklist.

Results: Service activity data showed that initial uptake of HEAL-D Online was good (62% attendance) with a high adherence to the programme (77% completion). A high fidelity (94%) was observed, and qualitative findings showed that staff and service users were satisfied with all aspects of course delivery. Both service activity and qualitative data indicated that attendees felt more confident in controlling their diet and managing their diabetes post-HEAL-D Online.

Conclusion: This evaluation demonstrates the feasibility of delivering HEAL-D using an online platform, with its ability to achieve similar goals compared with its face-to-

face counterpart. Challenges were identified around the identification, recruitment and referral of eligible patients into the programme, which need to be addressed for successful implementation on a wider scale.

Word count: 248

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This evaluation is the first to assess the feasibility of delivering this type of diabetes management programme for the UK African and Caribbean community using a digital platform.
- The mixed methods, pragmatic design enabled the rapid gathering of insights and identification of practical barriers and enablers to implementation, whilst delivering maximum benefit to service users.
- A key strength was the co-design and delivery of the study, which brought together a collaboration between the HIN and NIHR ARC South London (UK), in partnership with people from African and Caribbean communities with a lived experience of diabetes.
- A limitation is the absence of a control group and the use of routinely collected data, which means the study is unable to determine causation or effectiveness.

KEY WORDS

Diabetes, self-management educational programme, feasibility, implementation.

INTRODUCTION

Type 2 diabetes (T2D) is a major health concern for the United Kingdom (UK) Caribbean and African population with prevalence estimated to be three times higher [1], onset 10 years earlier [2], and poorer health outcomes compared to white Europeans [3–5]. Compared to other population cohorts, uptake of self-management programmes, which are recommended as a core component of management, is low in African and Caribbean communities [6]. To address these ethnic inequalities in diabetes healthcare access and outcomes for UK African and Caribbean communities, a culturally tailored 7-week T2D educational programme, Healthy Eating and Active Lifestyles for Diabetes (HEAL-D), was co-designed [7]. HEAL-D was originally designed to be delivered face-to face, and feasibility work has showed it is highly acceptable [8].

The COVID-19 lockdown required service providers to reconfigure the way in which health programmes were delivered, leading to the development of online service delivery. HEAL-D Online is one such service, using the same approach and contents as the original face-to face programme, but delivery via an online platform. HEAL-D Online was selected to be part of NHS England's NHS Insights Prioritisation Programme, which aimed to accelerate the implementation and evaluation of innovations that support post pandemic ways of working [9]. However, concerns of digital exclusion, particularly among underserved groups, remains an important consideration for HEAL-D Online, given the target population.

This paper presents an evaluation of the feasibility and acceptability of delivering the HEAL-D Online service using an online platform delivered by an NHS service provider in south London. The evaluation aimed to address the following objectives [9]: i) acceptability to service users; ii) feasibility to staff delivering the online programme; iii) feasibility of digital participation for service users; iv) potential benefits to service users following participation; v) potential future improvements to HEAL-D Online.

METHODS

Setting

The evaluation focused on the delivery of HEAL-D Online, a programme managed and delivered by Guy's and St Thomas NHS Foundation Trust (GSTT), London, UK. Patients were referred from primary care via a central booking system.

Procedure

A detailed description of the procedures is provided in the published protocol [9]. This was a prospective, pragmatic, mixed methods service evaluation, using service activity records, service user questionnaires, observational data and interviews. Service activity records and responses from a post-course telephone questionnaire were used to assess service user acceptability of HEAL-D Online as well as feasibility to using digital technology and potential patient benefit. Qualitative descriptive methods were used to explore service user and service delivery staff's perspective of HEAL-D Online. Service user interviews were used to explore reasons for acceptability, thoughts on using digital technology, benefits of HEAL-D Online and future improvements. Both service delivery staff interviews and observational data were used to assess the feasibility of delivering HEAL-D Online.

Quantitative methods

Data on service engagement – i.e. attendance rates, did not attend (DNA) rates, and completion rates – were collected by the service provider for anyone attending the HEAL-D Online programme between January and December 2022.

In addition, a post-course telephone questionnaire was administered by the service provider as part of routine care (Appendix i), to collect data on the following outcomes:

1) Acceptability of HEAL-D Online for service users (expectations met, satisfaction with delivery, accessibility issues, recommendation to others).

2) Patient benefit assessed via perceived weight loss and diabetes related psychological distress (measured pre- and post-attendance using the Problem Areas In Diabetes (PAID-5) questionnaire [10], where score of ≥8 indicates distress).

Qualitative methods:

Interviews: Fifteen service users (of the 55 who completed the post-telephone questionnaire) provided consent to be approached for interview. The evaluation team (JL, SL, LB, ZZ - all with postgraduate qualification and at least 5 years mixed methods experience in health services research/evaluation), contacted the service users by telephone to invite them to participate in the evaluation; fourteen service users agreed to participate and provided verbally recorded informed consent. Seven staff members out of 12 (initially identified by the service lead) were invited by SL or JL and agreed to participate in the interviews. All service delivery staff interviews were conducted either by SL or JL, (who had no prior relationship with the participants) and lasted between 20-59 minutes for service users and 15-90 minutes for staff. The evaluation team undertaking interviews all had formal training and practical experience in qualitative data collection methods at the time of the study.

A topic guide was used to explore experience of participating in HEAL-D Online to understand the feasibility and acceptability of the programme as part of a semi structured interview technique (Appendix ii – service user interviews; Appendix iii – service delivery staff). Interviews were conducted by the evaluation team using Microsoft Teams, with all interviews recorded and transcribed using Microsoft Teams. Upon completion of each interview, the interviewer relistened to each interview against the Teams transcript to ensure accuracy of the interview content.

Observations: As per usual practice in fidelity assessment, a customised observation checklist, based on the core components and principles underlying HEAL-D Online [11] and included key items linked to delivery structure, cultural sensitivity and competence, and underpinning theory, was used to evaluate service delivery fidelity (Appendix iv). It consisted

of 13 items, except for session 1 (11 items) and session 3 (12 items), which had components that were not relevant or unique.

Seven sessions were observed, selected from the seven HEAL-D cohorts, with the evaluation team (SL) identifying those with different delivery staff and on different days/times (to get overview of the different delivery styles). All sessions were observed by SL, three (session 3, 5 and 7) were observed by both SL and JL independently and scores compared to assess inter-observer reliability.

Data analysis

Quantitative

Frequencies and percentages were used to describe service user engagement, their perceptions on the different issues assessing both acceptability and feasibility of delivering HEAL-D Online, and explore the benefits gained from participating in the programme. To assess the level of diabetes-related emotional distress at pre- and post-attendance, total PAID-5 scores were calculated, and descriptive statistics used to describe the level of distress at both timepoints. The percentage of distressed participants (PAID-5 score ≥8) was also calculated at both timepoints. Data were summarised to understand potential patient benefits and the feasibility of delivering HEAL-D Online.

Qualitative

Interview transcripts were first read in their entirety by the interviewer. A framework method was used for analysis, using a matrix developed from the topic guide [12]. Relevant texts from each transcript were transferred to the framework and thematically analysed to summarise key concepts. A between-participant analysis was conducted to explore similarities and differences in perception of HEAL-D Online. Data were analysed with the focus of understanding the acceptability and feasibility of virtual delivery. Using a triangulation process, qualitative data was also used to understand and explain patterns in the quantitative data.

To explore the feasibility of delivering HEAL-D Online, the fidelity of the different sessions was calculated using the mean rating score from the observations on the fidelity checklist. Inter-rater reliability was calculated looking at the checklist items where both observers rated similarly, over those they rated differently (see Appendix iv).

Patient and public involvement

Co-design has been integral throughout the development of HEAL-D, and this ethos continued in this evaluation with a group of people of African and Caribbean heritage who had completed HEAL-D Online recruited to form a reference group [7,13]. The reference group met regularly, approximately bi-monthly, from initial review of the evaluation design, through to co-design of service user interview materials (consent form, information sheet, topic guide), review of the post course questionnaire, and discussion and input into analysis and reporting. Results were shared with the reference group, and members engaged with dissemination activities related to the programme, including a podcast and conference presentations.

Results

Participants

Service users

Qualitative

Demographic and clinical characteristics for service user interviewees are presented in Table 1. Of the 14 participants, the majority were female (n=8, 57%), had an African heritage (n=8, 57%), and an average age of 51 years. The median time since diagnosis was 2 years (interquartile range IQR: 1-4; range: 0.3-20). Most had been provided with some information about diet and the need to exercise (n=9, 64%) and only two (14%) had been on a DESMOND diabetes programme [www.desmond.nhs.uk] or a similar self-management course.

Table 1: Demographic and clinical characteristics of service user participants in qualitative arm of the evaluation

Characteristic	Frequency (percentage)	
Sex (%)	Female	8 (57)
	Male	6 (43)
Cultural heritage (%)	African	8 (57)
	Caribbean	6 (43)
Age (n=4)	Median (yrs)	51
	Range (yrs)	43-63
Time since diabetes 2 diagnosis (years)	Median	2
	IQR (range)	1-5.25 (0.3-20)
Diabetes self-management interventions (pre-HEAL-D)	Dietary advice and/or exercise	9
	Blood monitoring	3
	None specified	3

	Desmond course	1
	Week course on healthy eating	1

Note: Denominator for each characteristic = 14 participants (unless otherwise stated).

Quantitative

No demographic data were collected for the quantitative sample other than the fact that all participants were either from an African or Caribbean heritage, due to privacy statements for the participating NHS Trust about sharing personal data.

Service delivery staff

The characteristics of the 7 service delivery staff interviewees are presented in Table 2. The sample was all female, mainly from black cultural heritages with a median of 2 years (range: <1 year to 9 years) experience working on HEAL-D Online. All service delivery roles were represented: service management; physiotherapy, dietitian, lay educator and cooking workshop facilitator.

Table 2: Demographic and clinical characteristics for service delivery staff - qualitative arm of the evaluation

Characteristic	**Number (percentage)**	
Sex (%)	Female	7 (100)
	Male	0 (0)
Cultural heritage (%)	Black (British/African/Caribbean)	5 (71)
	White (UK/other)	2 (29)
Job designation within HEAL-D Online (%)	Dietitian	2 (29)
	Lay educator	2 (29)
	Physiotherapist	1 (14)
	Cooking session facilitator	1 (14)
	Service manager	1 (14)
Time working on HEAL-D Online (yr)	Median	2

	Range <1y -9

Note: Denominator for each characteristic = 7 participants (unless otherwise stated).

Results

1. Is HEAL-D Online acceptable for service users?

Service user engagement with HEAL-D:

Eighteen courses ran between January and December 2022 offering 197 places for potential participants to attend. 135 places were booked, of which 84 patients attended the first session and 51 "did not attend", indicating a 62% attendance rate. An analysis of programme attendance showed that 65 individuals completed the course (attending at least 4/7 of the sessions), giving a completion rate of 77% for the 84 participants who attended the first session and 48% for the 135 people who were initially booked.

Interview data suggests that this high level of engagement for people who attended the first session may be related to both relevance of the course to their lives and the new knowledge gained from it.

> "*When I stumbled onto the programme, it just got my interest. You know the way the programme was being introduced. The topics, I was like, wow. I didn't want to finish because every day you go in, you learn a new thing."* (Service user 1013)

Service users' perceptions of service provision:

Figure 1 outlines participant satisfaction with the delivery of the seven key HEAL-D Online elements that were explored in the post course questionnaire (n=53). Nearly all participants were satisfied with the way that all seven key elements of HEAL-D Online were delivered. All 53 participants reported that the facilitator delivery was either excellent or good. At least 48 (91%) participants gave a similarly positive rating to the other aspects of HEAL-D Online, which included the initial contact with the HEAL-D team, interaction with the facilitator,

HEAL-D participant pack, cooking and exercise sessions, and interaction with other service users. All participants reported they would recommend HEAL-D Online to family and friends. Qualitative data suggests peer support and achieving their learning goals were key reasons behind a willingness to recommend.

> *"The reason why I will refer other people to it [HEAL-D] is because I learned a lot about my diet, exercises, drinking, and hearing from other people, reassuring me that don't worry. It's gonna be OK. You're not on your own."* (Service user 1005)

Thirty-two service users were asked whether the HEAL-D Online programme met their expectations. All agreed that it had either met or exceeded their expectations. The fact that HEAL-D is attended only by people of African and Caribbean heritage made the experiences of living with diabetes more relevant to those attending the group and made HEAL-D Online more acceptable than other diabetes educational courses people had attended previously.

> "*So that's what brought me back and also other people's experiences of black people's experiences of how diabetes affect them."* (Service user 1007)

2. How did a digital mode of delivery affect service user participation?

Service delivery data on the 53 participants showed that most (83%, n=44) found the BlueJeans video calling facilities (the online delivery platform used to deliver HEAL-D Online) easy to use and the instructions for use easy to follow (92%, n=49) (Figure 2), indicating that service users had little difficulty in using the technology. These findings are supported by interview data, which showed that nearly all participants had no major challenges using the technology to access HEAL-D Online, although a few had some issues either downloading or accessing BlueJeans. Some participants commented that they were generally comfortable with using digital technology, whilst one service user had been provided with technical support by her granddaughter to access HEAL-D Online. Some

stated that with the onset of the COVID-19 pandemic, in general people were more accustomed to programmes being delivered online.

> *"I suppose because we've come out of lockdown, I've been used to doing lots of things virtually anyway, because even a support group that I mean, that's been virtual, so that was OK*." (Service user 1010)

This was reiterated by service delivery staff, who felt that service users had become more accustomed to online delivery of services due to the COVID-19 pandemic.

> "*I joined at a time where people have become used to virtual, if this was before COVID I think it would be a lot more challenging. It's almost like people are used to it and are more open to the idea now of doing things virtually*" (Service delivery staff 2002)

Qualitative data highlighted convenience and flexibility as two advantages of virtual course delivery. Not only was it easier for service users to attend the sessions, but they could also attend if they were away from home, and thereby not miss a session.

> *"I actually joined it while I was on holiday with the time difference and all that stuff, and there was another lady that I know that she was in [west African country] and she joined it as well. I really wanted to do it, so I took my computer with me and everything." (*Service user 1011)

Delivery staff recognised the benefits around the flexibility and convenience that virtual delivery provides, with the potential to allow more service users to access the HEAL-D programme.

> *"I think it's great because people, after work, can't always be somewhere face to face and you know having that option of just logging in whenever. We had people log in on their lunch break, we had people log in on their way to work and participate. So it*

opens up a door to people who don't want to do face to face sessions." (Service delivery staff 2003)

3. Is HEAL-D Online feasible for service delivery staff to deliver?

The observational data showed that service delivery staff were successful in delivering the components of HEAL-D using a digital platform and that HEAL-D Online was being delivered as intended. This is indicated by a mean fidelity score of 94% (Appendix v) showing that 118/126 items on the fidelity checklist were observed by two independent raters during the delivery sessions. Inter-rater reliability between the two independent observers showed 100% agreement on the three joint observations. The observation data showed that service delivery staff achieved 100% fidelity in 4 of the 7 sessions, and it was only in one session that the fidelity rate was less than 90%.

Although the observational data indicated the feasibility of delivering HEAL-D Online, qualitative data identified challenges in delivering these sessions from service delivery staff. Those who had previously been involved in face-to-face delivery noted how online delivery requires different skills to ensure that service users are engaged.

"*When you're online I feel that you have to work extra hard to keep people engaged and one of the ways to do this is by being "more animated*" (Service delivery staff 2007)

These issues could arise in balancing the importance of showing respect for the older age group in African and Caribbean culture with their potential lack of knowledge in using the new technologies. For service delivery staff, it was important to recognise this where individuals faced challenges with the technology.

"*Respect and regard for this kind of age group is quite important in the black African and Caribbean culture, and to help them to not feel silly or to carry them along very respectfully, but in a way that they don't feel that they are technologically behind. I*

think it takes a different kind of skill because they're also dealing with a chronic illness, which they're probably really worried about. So, it's kind of trying to lighten that and make it not such a big deal [if they struggle with the technology]" (Service delivery staff 2007)

Another key challenge with online delivery was encouraging interaction and engagement with service users, especially at the start. The option to turn cameras off further added an additional complexity when trying to assess service user participation and engagement.

"*There's an option to turn your camera off. So those people who are just signing in because they feel they need to show that they are attending but will turn the camera off and not engage in any conversation, that can be quite challenging. Whereas if they physically were there, they can't turn the screen off.*" (Service delivery staff 2002)

This difficulty in assessing engagement resulted in safety concerns when delivering the exercise component and made it harder for the physiotherapy team to determine the right level of exercise for the group.

"*If someone's cameras are off, it can be quite difficult to gauge how they're finding it, so thinking of a safety element as well, it can be difficult to know. And you know, am I offering the right options? Is it too easy or hard? Even when the cameras are on, it's quite difficult. You can't hear someone breathing heavily or not. And sometimes you can't see their whole body.*" (Service delivery staff 2006)

Delivering the cooking session effectively online was also challenging, as there are sensory aspects, such as smells and physically seeing and touching the ingredients, that are difficult to recreate in a virtual environment.

"It's quite different to being in the kitchen where people are quite engaged if there's a lot of sensory aspects to being in the kitchen, the smells, the auditory, the touch.

When you're online, you have to work extra hard to keep people engaged, even though our videos are fantastic." (Service delivery staff 2007)

An additional challenge in the online delivery was the use of a digital platform that service delivery staff were unfamiliar with. It was not possible to use the digital platforms that delivery staff were used to, such as Zoom or Microsoft Teams, as they were not considered secure enough to deliver patient care. Instead, the health providers used a digital platform called BlueJeans which works in a similar way to Zoom or Microsoft Teams, but has high levels of data security. Unfortunately, many service delivery staff had issues using BlueJeans in delivering the online course, such as sharing session videos or understanding how to operate the platform, even for staff who consider themselves "tech savvy".

"Some of the feedback we get is a difficulty with BlueJeans, like some of the dietitians find that quite difficult to navigate. I guess we use MS Teams most of the time, so it's kind of like using a different system." (Service delivery staff 2001)

It was acknowledged that over time the online platform became easier to use as they became more familiar with it.

"We now know exactly what settings are [needed] and are better at troubleshooting. Now if something were to happen just through that experience, some of it happening before. So yes, I definitely feel like it's much smoother." (Service delivery staff 2006)

4. What are the potential benefits to service users from participating in HEAL-D Online?

Service users reported a range of benefits from participating in HEAL-D Online (Figure 3). All agreed that it was helpful to meet other people with diabetes and that it provided them with support to live with diabetes. Most felt they learnt practical skills and that it helped their confidence in managing their diabetes. The qualitative data further illustrated that service

users felt that they were more knowledgeable on diabetes management and recognised the importance of managing their diet, understanding their food intake, doing more exercise and regularly monitoring their weight and blood sugar levels.

> *"How to manage my diabetes in regard to the kind of food I eat. These are routines that I never used to do. Now I'm very careful what I eat. I watch the portion sizes. I do the exercises and then I'll make sure that the way the food is prepared, because the way most of our foods are prepared, that's where we get it wrong."* (Service user 1013)

Of the 32 service users asked, 78% (25/32) self-reported weight loss following the HEAL-D programme, and 72% (23/32) noticed a reduction in waist measurement. Service users showed improvement in diabetes-related emotional distress after completing HEAL-D Online, with a reduction in total median PAID-5 scores from 7 at pre-course to 4 at post-course. This improvement was further illustrated by a decrease in the proportion of participants showing diabetes-related emotional distress (i.e. PAID-5 score ≥ 8) from 49% pre-course to 23% at post-course. The qualitative data further supports this quantitative evidence of potential benefits, with service users reporting that they had changed their dietary and exercise behaviour and had become more conscious of monitoring their weight and blood sugar levels. Service users felt more confident in managing their diabetes. For some service users, this also improved their level of happiness.

> *"It makes me feel happier with myself as a person and makes me feel better knowing that I'm trying all I can to manage my diabetes."* (Service user 1013).

Qualitative data suggested that HEAL-D Online acts to build both the confidence and the social support network of service users which facilitated their ability to use the skills taught during the programme to manage their diabetes. Most acknowledged the role of the educators' ability in engaging service users, and creating a safe and non-judgmental space to discuss sensitive topics.

> *"They (the facilitators) were lovely in how they presented the course, the way they were engaging and how they're having the discussions. They were supportive and encouraging. They make you feel involved and welcome. So you can literally be yourself and then, it allows you to be more open, to be able to discuss things that you normally don't talk about."* (Service user 1011)

Even using a digital platform, the educators were able to create a safe space for service users that encouraged them to develop a forum for peer support, create group cohesion and provide the conditions for service users to share stories and experiences. By sharing learning amongst themselves, service users could find relevant solutions in living with diabetes and reassurances that their situation was not unique and that other people from similar cultural backgrounds had experienced similar situations.

> *"The thing is that we're talking, no one was looked down upon. Everybody was listening to you. It was just like a little family gathering, whereby we could talk to each other and tell people what is wrong with us and find solutions." (*Service user 1013)

5. Improvements to HEAL-D Online

Qualitative data indicated that service users were generally overwhelmingly positive about the programme. From the interviews, two service users felt that no further improvement was necessary, with the remaining 12 identifying specific issues in two key areas: 'post-course follow-up support' and 'increasing engagement for those with impairments'.

Post-course follow-up support

Many service users had a sense of loss when the HEAL-D Online programme ended. Most would have liked follow-up from the HEAL-D team. One felt that a post-course review would encourage participants to maintain their commitment to changing their behaviour.

> *"I think a monthly or quarterly review (after the last session). Just call the participant "how are things, is everything OK, any challenges, can we support you? Say that you'll be receiving a call from the team, who may ask about your diet? May be useful if you're not someone that can self-motivate, you will just slide back to your old habit"* (Service user 1011)

Many service users made close connections with their peers and would have liked to have maintained these once the course had finished. Some suggested sharing contact details, with one suggesting specifically setting up a WhatsApp group to connect peers as a source of support and advice.

Increasing engagement for users with impairments

Service users reported that it is important for course administrators to check with service users if they had any issues or impairments which limit their ability to participate with the delivery of an online programme. One service user with a visual impairment had difficulties in seeing the slides on their phone.

> *"The slides could have been clearer, so more work to be done on the slides so if you were viewing it on a computer or a phone, you would be able to see."* (Service user 1007)

Discussion

This evaluation demonstrates the feasibility of implementing a virtually delivered culturally tailored T2D self-management programme specifically aimed at the UK African and Caribbean population. To the best of our knowledge, this is the first of this type of diabetes management programme for this community delivered using a digital platform. Our findings showed a high level of acceptance amongst service users, as highlighted by a 77%

completion rate of service users who attended the first HEAL-D Online session. Service users appreciated the convenience and flexibility that the online programme offered.

Service delivery staff were successful in delivering the key elements of the programme (educational sessions, exercise class, cooking workshop) using an online platform, whilst service users generally had few problems using the technology to access the programme. At the same time, qualitative findings highlighted potential safety issues that future service delivery staff need to be aware of in delivering, for example exercise sessions, especially if HEAL-D Online is scaled up to a national level.

As with the face-to-face version of HEAL-D [8], HEAL-D Online showed potential service user benefit in improving both understanding of diet and knowledge of diabetes management and its ability to encourage the behavioural change needed to elicit a subsequent reduction in weight and blood sugar level. A reduction in diabetes-related distress was also observed following attendance at the programme. Qualitative findings illustrated that the supportive elements provided by the educators could also be recreated using an online platform such as the ability to provide a safe environment for service users to ask questions, allowing open discussions and supporting conditions for peer support.

Service delivery data showed that attendance uptake of 62% for HEAL-D Online was high compared with the national attendance figure of 8.2% of people with T2D who are offered to attend a structured diabetes educational course [14]. This suggests that HEAL-D Online is successfully targeting and engaging with individuals. Nevertheless, this evaluation was unable to record reasons why the remaining 38% did not attend their first session and it is important to understand if people are unable to take up the offer of HEAL-D Online because of its digital nature, and if non-attendance at session one was because of digital access of capability issues. A limitation of this evaluation was that no attempt was made to explore this.

Service users were happy with the programme content but would have appreciated further follow up afterwards. Specific improvements to the programme include providing post-intervention support from the HEAL-D Online team and a needs assessment for attendees with sensory disabilities to ensure better accessibility during the sessions and to check that programme participants can read the presented material, for them to gain the most out of the sessions.

Some caution is needed in interpreting these findings. Both the service delivery data and qualitative data are from service users who completed the course, which indicates some level of self-selection bias. It is not possible to comment on the representativeness of the service users to the intended target population as no demographic data were collected from those who completed the service delivery questionnaires, although demographic data from the qualitative sample suggested the intended population was targeted. Future evaluations would need to incorporate the views of service users who did not complete the sessions or take up their places, to understand why they did not accept and explore potential barriers to accessing HEAL-D Online.

Our sample of service users appeared to be digitally literate or had family members who could provide necessary support. This sample had access to a range of devices such as laptops, tablets or mobile phones. Although the COVID-19 pandemic and associated rapid digital transformation have provided people with greater exposure and confidence in using digital technology, 'digital poverty' is still an issue, with 10% of the adult UK population lacking access, skills or confidence to use the internet or digital technology [15], and rates are highest in both older and socioeconomically deprived people, who are also more likely to live with T2D [16]. In addition, specific issues such as distrust of technology and lack of understanding of how to navigate online health services are recognised in people from minority ethnicities [17]. This is an area of further exploration where more studies are needed to explore if digital-specific issues are a cause of non-attendance. This evaluation relied on self-reporting in measuring weight loss and future evaluation should aim to collect

the relevant key clinical outcomes (weight and blood glucose levels) to objectively confirm that a change in clinical outcomes has occurred. Finally, as there was no control group, it cannot be concluded that the potential patient benefits identified were because of HEAL-D Online. Evaluating this question would require testing using an experimental design.

Conclusion

It is feasible to deliver HEAL-D using an online platform, with online delivery achieving similar goals compared with its face-to-face counterpart, Implementation challenges focused on identification, recruitment and referral of eligible patients into the programme and safety issues need to be considered when delivering the exercise component. Subsequent studies need to establish scaled implementation feasibility and causal links between HEAL-D Online and diabetes outcome improvement.

WORD COUNT: 4917 (MAX 5000)

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Data sharing statement: No additional unpublished data are available.

FIGURES

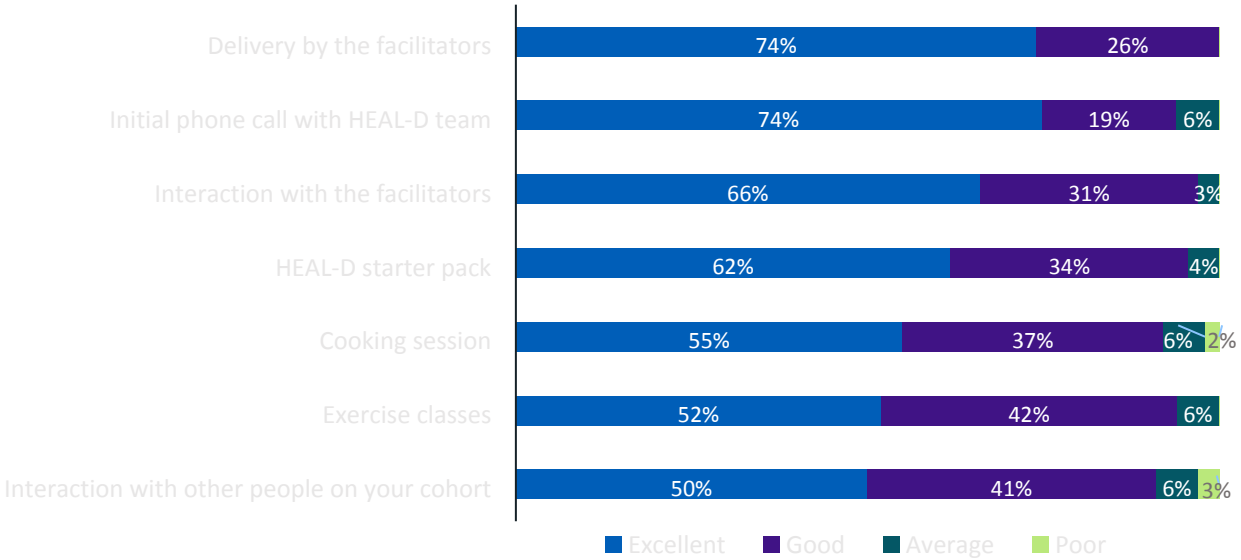

Figure 1 Satisfaction with the 7 elements of delivery in HEAL-D On-line (n=53)

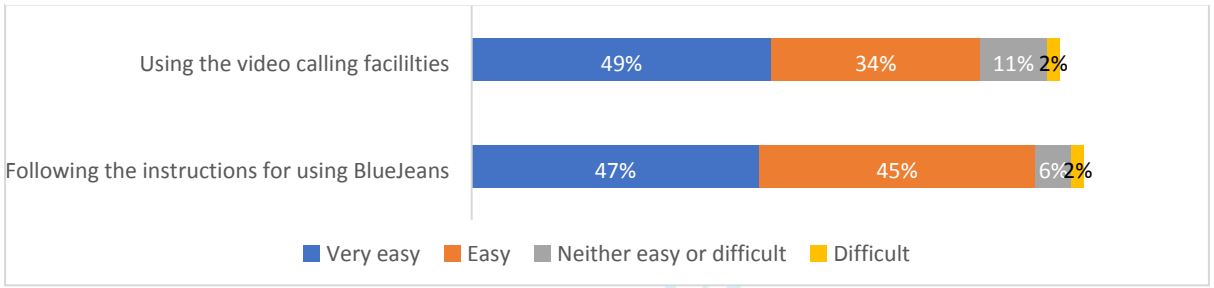

Figure 2 Ease of using the Video Calling facilities for HEAL-D Online (n=53).

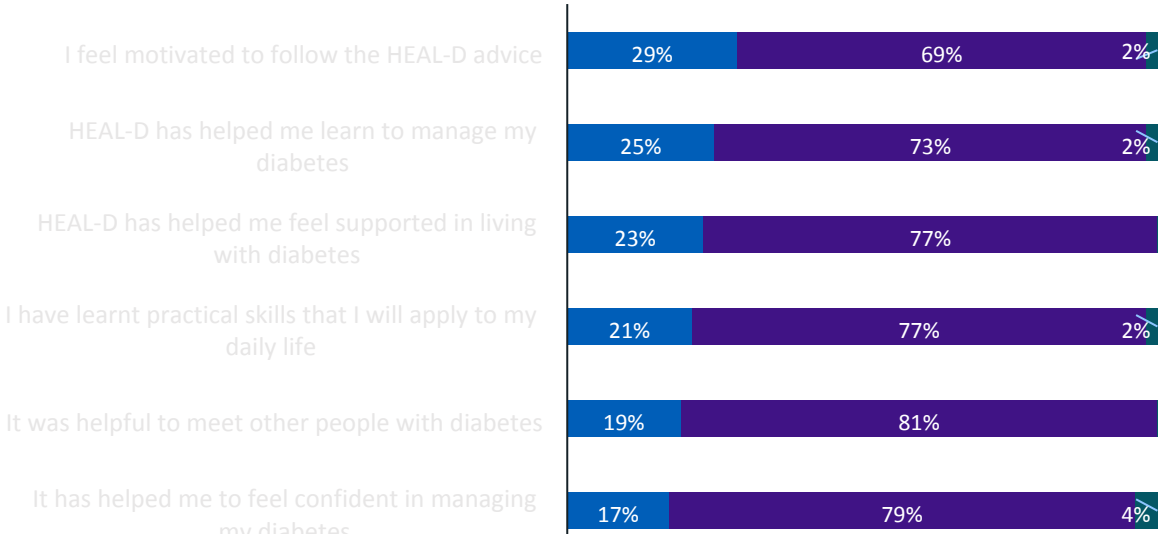

Figure 3 Learning outcomes following HEAL-D Online (n=53)

APPENDIX I: POST HEAL-D COURSE QUESTIONNAIRE

All HEAL-D Online course participants get asked the below questionnaire (over the telephone) at the end of the course.

Question	**Response options**
Attendance status *(this is completed by the person asking the questions)*	Attended Cancelled Did not attend
How did you hear about HEAL-D?	GP Diabetic nurse Dietician Family / friend Other (please note)
When you first heard about HEAL-D, what 3 main things did you expect to get out of the course? To what extent were these expectations met? Were your expectations exceeded, met, partially met or not met?	*Free text box* Exceeded met partially met not met
On a scale of 1-5 where 1 is not a problem and 5 is a serious problem, please can you rate the following statements: Feeling scared when you think about living with diabetes Feeling depressed when you think about living with diabetes	1 Not a problem 2 Minor Problem 3 Moderate problem 4 Somewhat a serious problem 5 Serious problem

Worrying about the future and the possibility of serious complications Feeling that diabetes is taking up too much of your mental & physical energy every day Coping with the complication of diabetes	
Please rate the following statements about HEAL-D, on a scale of 1 – 5 where 1 is strongly agree and 5 is strongly disagree HEAL-D has helped me learn to manage my diabetes I have learnt practical skills that I will apply to my daily life I feel motivated to follow the HEAL-D advice HEAL-D has helped me feel supported in living with diabetes It was helpful to meet other people with diabetes	1 Strongly agree 2 Agree 3 Neither agree nor disagree, 4 Disagree 5 Strongly disagree
Please rate the following aspects of HEAL-D on a scale of excellent, good, average or poor. And can you please let me know why you have given this rating? Initial phone call with HEAL-D team HEAL-D starter pack Exercise classes Cooking session Delivery by the facilitators Interaction with the facilitators Interaction with other people on your cohort	Excellent Good Average Poor *Free text box for comments after each*

Thinking about the video calling facilities, How easy did you find it to use? On a scale of 1—5 where 1 is very easy and 5 is very difficult How did you find the instructions for using BlueJeans? Excellent, good, average or poor?	Very Easy, Easy, Neither Easy nor Difficult, Difficult, Very Difficult Excellent, good, average or poor
Have you lost any weight since you started the course? Have you noticed a reduction in your waist measurements?	*Open text boxes*
If HEAL-D was available face-to-face or remote, which would you prefer?	Face to face Remote No preference
When would be your preferred timing for attending HEAL-D?	no preference weekday daytime weekday evening Saturday morning
Overall - Please tell us what went well	*Open text box*
Overall - Please tell us if there is anything that you believe would enhance the course	*Open text box*
Overall - Would you recommend HEAL-D to family/friends (Yes / No)	Yes No
Do you have any other comments/feedback?	*Open text box*
We are currently completing an evaluation of the HEAL-D programme, and we are asking people to complete a telephone / video interview in order to find out their experiences. It will be similar to this questionnaire, and	Yes No

will take approx. 30 minutes. You will also be offered £15 for your time. If you would be interested in taking part, can you please confirm that you are happy for me to share your details with the project team?	
HEAL-D is currently only delivered in South London, but we are looking to develop it further. Would you be interested in hearing about HEAL-D in the future?	Yes No

Appendix ii: Topic guides for service users.

HEAL-D – Service User Interviews
Sign up script and form

Script to use to speak to individuals when signing up to complete form below:

[INTRODUCE SELF, RESPONDING TO EMAIL / CALL RE: HEAL-D CONVERSATION].

Thank you for offering to have a conversation with us around your experience of the diabetes self-management HEAL-D online course, we are very grateful to have your input.

You may have previously completed a telephone questionnaire after HEAL-D, this conversation may feel similar to that but we just want to find out a bit more detail.

Can we please arrange a date and time for full conversation. It is expected to take around 45 minutes, depending on your answers. We would like to conduct this virtually via video call on Microsoft Teams [if not possible, can do via telephone].

[IF MS TEAMS / ZOOM] I will need to send you an invite via email so that you have a link to click on, can you please give me your email address. When I email you I will also send a copy of an information sheet which just gives you a bit of information about why we are doing this.

[IF TELEPHONE] I can give you a ring.

[ARRANGE DATE, TIME & TELEPHONE NUMBER / EMAIL THAT IS BEST AND COMPLETE TABLE].

Also, you may be aware that you can be £15 paid for your time – this can be either bank transfer or shopping voucher. Would you like to receive this?

[IF YES]:

- [IF BANK TRANSFER] Please can you have your bank details to hand when we call you and we can fill in the form with you over the phone.
- [IF VOUCHER] We can offer you a high-street shopping voucher which will be sent to you after the conversation in the post or via email

[IF NO] – thank you. If you change your mind about this, please just let us know when we call you back for the conversation.

Name	
Date & time of interview	
Interviewer Name	
Interview method	☐ Telephone ☐ MS Teams video ☐ Zoom
Email address / number to call on	
Payment	☐ No ☐ Yes – Bank Transfer ☐ Yes – Voucher
Any special requirements	☐ None ☐ Interpreter ☐ Equipment Details (if applicable):

Thank you for your time. I / my colleague, look forward to speaking to you on [DATE and TIME].

HEAL-D Service User Interview Topic Guide

Introduction
Introduction Hi, I am [INTRODUCE SELF] Before we start, can you please confirm your name? **Purpose of discussion:** Thank you for agreeing to talk to me today. This discussion is expected to last approximately 30 - 45 minutes dependent on your responses. The purpose of this discussion is to understand your experience as a someone who has recently taken part in the HEAL-D online course.

You may have previously completed a telephone questionnaire after HEAL-D, this conversation may feel similar to that but we just want to find out a bit more detail. So, it may feel like you are repeating yourself a bit, but please don't worry about this. **Consent:** [If consent form sent in advance over email] Have you read the information sheet and consent form that we sent to you? [If consent form not sent in advance] Run through information sheet and consent form. Confirm consent *[INTERVIEWER NOTE]* *If telephone OR MS Teams, obtain consent on audio recording.* *Check whether participant has any questions and is happy to begin the interview.*

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START RECORDING AND TRANSCRIPTION (IF APPLICABLE) I am going to take some notes throughout our conversation, so you may hear some typing. I also may need to ask you to pause briefly whilst I write up any key points.	
BACKGROUND	
Before asking you about your HEAL-D experience, it would be great to learn a bit more about you. **Can you tell me about when you were diagnosed with type 2 diabetes?** *Prompts (pick out a selection as needed)* • When were you diagnosed with type 2 diabetes? Was it recent? • What support were you offered?	2min
SECTION 1 – BEFORE HEAL-D ONLINE	
For this set of questions, I'd like you to think about the time before you started the HEAL-D course. **Can you tell me about when you first heard about HEAL-D Online?** *Prompts*	5min

• Who told you about it / referred you? • Had you just been diagnosed with Type 2 diabetes? • What was your first impression of HEAL-D Online? • Have you done / been invited to take part in other courses like this before? • How did you feel about the course being virtual (via video call)? **Can you tell me about any information you received before starting the course?** *Prompts* • Did anyone from the course call you? If yes, who was it with and what did they say? • Did you receive any paperwork? • How did you find this information? **Is there anything else you would you have liked to have known before you started?** *Prompts* • Would you have felt any differently if you had heard from other people who had completed HEAL-D online?	2min 1min
SECTION 2 – DURING HEAL-D ONLINE	
For this set of questions, I'd like you to think specifically about your experience whilst you were completing the HEAL-D online course **Can you tell me about the starter pack materials you were sent? E.g. the booklet, measuring tape and pedometer.** *Prompts* • Did you receive these before your first session? • Were they helpful? • Did you feel anything was missing? • Would you have liked the material in a different form? E.g. a different language? **How did you find accessing the sessions online via BlueJeans?** *Prompts* • Were you able to attend all the sessions? • Did you use your mobile phone / computer / tablet / other? • Did you need any assistance to log in? • Did you have any challenges with BlueJeans? **Can you tell me about your first session of HEAL-D Online?**	2min 3min 2min

Prompts • How long after referral was your first session? • Was there anything that made you want to come back for future sessions?	1min
How did you find the timing of the sessions? *Prompts* • Did they fit with your lifestyle? • Were you able to attend all the sessions?	2min
How did you find the exercise component of HEAL-D Online? *Prompts* • Did you stick to the programme?	2min
How supported did you feel when you were completing HEAL-D Online? *Prompts* • Did you keep in touch with anyone from the group in-between sessions? • Did you know who to contact if you had any questions? • How did you find the facilitator and lay educator? Did they attend every session?	2min
How did you find the resources on the website? *Prompts* • If used, how useful did you find these? Was everything available that you wanted? Was there anything you felt was missing? • If not used, why not?	4min
What do you believe are the key things you learnt from HEAL-D Online? *Prompts* • What was most important to you? • What have you taken away to help you live with diabetes? • What did you learn about diet and exercise?	
SECTION 3 – AFTER HEAL-D ONLINE	
Lastly, I'd like you to think about more recently and after you completed the HEAL-D online course. **How has taking part in HEAL-D Online impacted your lifestyle?** *Prompts* • Have you kept up with the course and exercise?	3min

• If you were monitoring your waist measurements, weight and/or HbA1c as part of HEAL-D, have you continued to do this?	
Has HEAL-D Online helped you to manage your diabetes? *Prompts* • Do you use things you learnt during HEAL-D to help manage your diabetes?	2min 2min
Have you told your GP / GP surgery / who referred you about how you found HEAL-D Online? *Prompts* • Have they followed up with you since you were referred?	2min
Would you recommend HEAL-D Online to others? *Prompts* • Why?	2min
What have you gained from participating in HEAL-D online? *Prompts* • Why?	2min
Is there anything that you think would help to improve HEAL-D online? *Prompts* • Why?	
OVERALL AND ADDITIONAL INFORMATION	
Is there anything else about your HEAL-D experience that you would like to comment on that we have not discussed?	3min
Would you like a copy of the evaluation report?	1min
THANK YOU & CLOSE	
That is the end of our discussion. Thank you for your participation. Do you have any questions?	

I will now stop the recording (if applicable) **STOP RECORDING AND TRANSCRIPTION (IF APPLICABLE)** You may remember that we are offering a £15 payment for your time and contributions. You previously said you would / would not like to take this up. Is this still the case? [IF YES TO BANK TRANSFER] *go through Payment Request Form and collect bank details.* [IF YES TO VOUCHER] *either collect address for physical voucher, or confirm email address for e-voucher. Contact Sophie to arrange vouchers.*	

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Appendix iii: Topic guides for service delivery staff.

HEAL-D
Sign up template and form

Use the email template below to invite staff:

Title: HEAL-D Service Evaluation – we want to speak to you

Text:

Dear [NAME],

My name is [NAME] and I am [role] at the Health Innovation Network, a NHS organisation hosted by Guy's and St Thomas' Hospital. I am getting in touch as we are in the process of evaluating the HEAL-D service in order to collect information on how the service is currently working, providing evidence for future commissioning as well as suggestions for improvement.

We would be really grateful to speak to you about your role in HEAL-D. We call this an 'interview', but please be assured that this is just a conversation! The conversation will take about 30 minutes in total. Please see the attached information sheet for more information.

We are looking to conduct these interviews over Microsoft Teams (we can use another platform if preferred) during January 2023. Can you please let me know when you would be available for the interview and I can send you a calendar invite with the link.

Please do let me know if you have any questions at all and I look forward to hearing from you.

Best wishes / Many thanks etc.…

Name	
Date & time of interview	
Interviewer Name	
Interview method	☐ Telephone ☐ MS Teams video ☐ MS Teams conference call ☐ Zoom
Email address / number to call on	
Any special requirements	☐ None ☐ Interpreter ☐ Equipment Details (if applicable):

Interview Topic Guide

INTRODUCTION	Time
Introduction Hi, I am [INTRODUCE SELF] Before we start, can you please confirm your name? **Purpose of discussion:** Thank you for agreeing to talk to me today. This discussion is expected to last approximately 30-40 minutes dependent on your responses. The purpose of this discussion is to understand your experience as a someone who has supported the delivery of the HEAL-D online course. **Consent:** Have you read the information sheet and consent form which was emailed to you? Do you have any questions? Run through consent. *[INTERVIEWER NOTE]* *If telephone OR MS Teams, obtain consent on audio recording.* *Check whether participant has any questions and is happy to begin the interview.*	

START RECORDING AND TRANSCRIPTION (IF APPLICABLE)	
I am going to take some notes throughout our conversation, so you may hear some typing. I also may need to ask you to pause briefly whilst I write up any key points.	
SERVICE EXPERIENCE	
First I'd like to ask a bit about your background just to get to know you. How long have you been working on HEAL-D and have you delivered any other similar courses before? *Prompts*	

- What were your first impressions of HEAL-D when you first heard about it?
- [If working on HEAL-D since it was implemented/the start] How were you involved in the implementation of HEAL-D Online in south London?

What is your role in the HEAL-D service?

Prompts

- Do you have direct contact with service users?
- What parts of HEAL-D are you involved in?
- Has your role changed over time?

To you, what are the core elements of HEAL-D?

Prompts

- What makes HEAL-D different from any other courses?
- What are the key stages in the HEAL-D process?

How have you found delivering HEAL-D virtually?

Prompts

- Have you ever delivered it in person? If yes, what were the differences?
- How have you found the technology?
- Have any service users ever provided you with feedback on the digital model?
- How does a digital model affect service user participation? / What implications does a digital model of delivery have on participation?

What impact do you believe HEAL-D provides for service users?

Prompts

- What positive impacts do you think there are for service users? How does HEAL-D benefit service users?
- What negative impacts do you think there are?

What impact do you believe HEAL-D provides for the service?

Prompts

- What positive impacts do you think there are for the service (HEAL-D and diabetes provision more generally)?
- What negative impacts do you think there are?
- What impact do you think HEAL-D has on service outcomes?

What impact do you believe HEAL-D provides for the health system?

Prompts

• What positive impacts do you think there are for the health system in south London? • What negative impacts do you think there are? **Overall, can you please tell me about how you have found delivering HEAL-D online?** *Prompts* • What has worked well? • What hasn't worked so well? **Is there anything that you think would help to improve HEAL-D online?** *Prompts* • Why?	
CLOSING REMARKS	
Is there anything else about your HEAL-D experience that you would like to comment on that we have not discussed?	3 mins
THANK YOU & CLOSE	
That is the end of our discussion. Thank you for your participation. Do you have any questions? I will now stop the recording (if applicable) **STOP RECORDING AND TRANSCRIPTION (IF APPLICABLE)**	

Appendix v: Fidelity ratings of the 7 HEAL-D Online sessions.

Session	Fidelity ratings (%) Observer 1	Fidelity ratings (%) Observer 2	Fidelity ratings Combined observers (1&2)
1	10/10 (100)	-	10/10
2	12/13 (92)	-	12/13
3	13/13 (100)	13/13 (100)	26/26
4	13/13 (100)	-	13/13
5	13/13 (100)	13/13 (100)	26/26
6	11/12 (92)	-	11/12
7	10/13 (77)	10/13 (77)	20/26
Total fidelity scores	82/87 (94)	36/39 (92)	118/126 (94%)

FIGURES

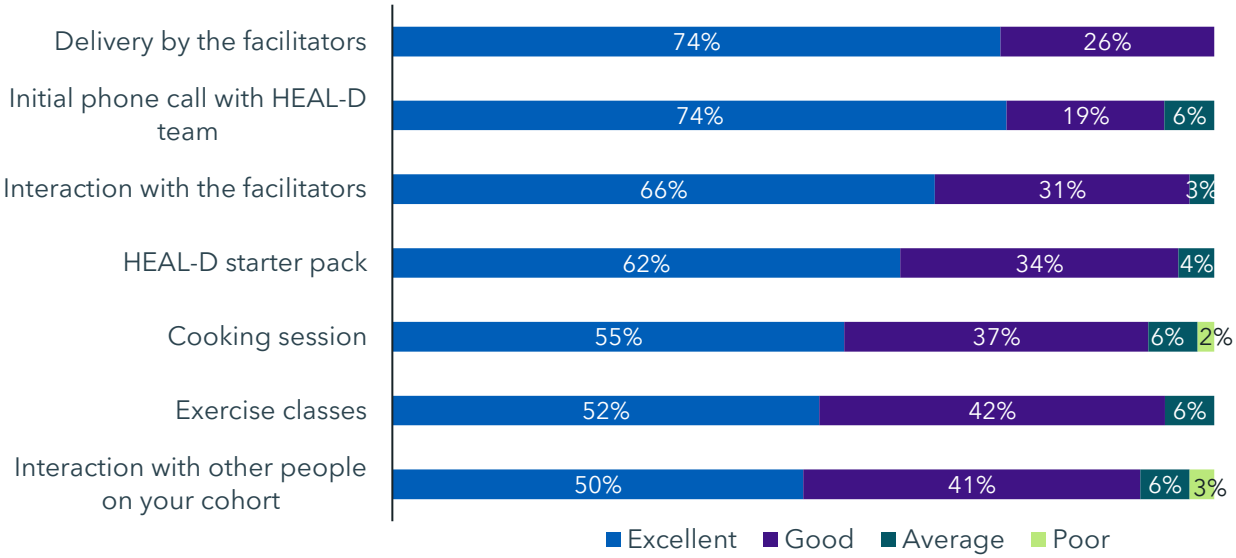

Figure 1 Satisfaction with the 7 elements of delivery in HEAL-D On-line (n=53)

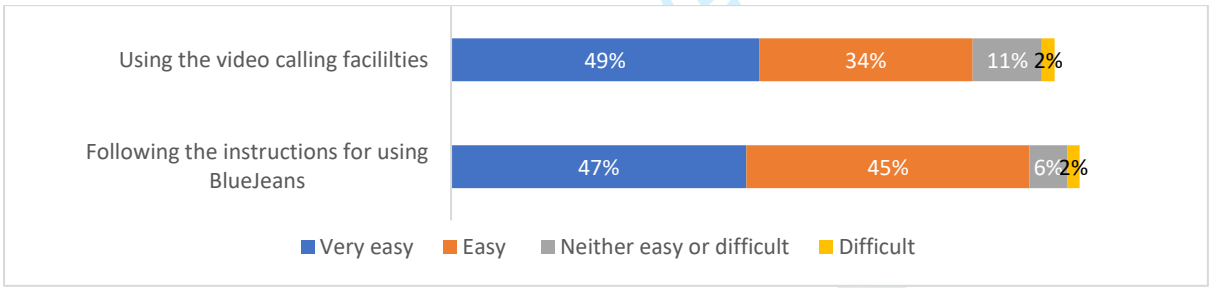

Figure 2 Ease of using the Video Calling facilities for HEAL-D Online (n=53).

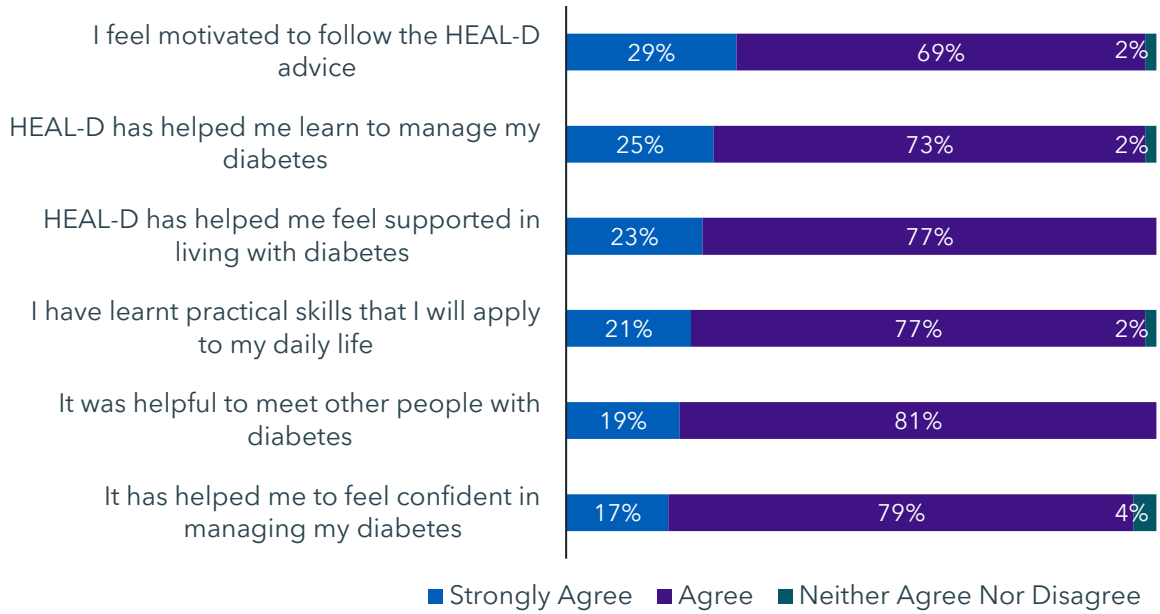

Figure 3 Learning outcomes following HEAL-D Online (n=53)

Appendix iv: HEAL-D Online - Fidelity Checklist

The purpose of this checklist is to assess fidelity to the core components and principles underpinning HEAL-D online.

Core components

Timeframe	Component	Metric	Data Source
Prior to HEAL-D	Initial phone call	All HEAL-D service users to have had initial phone call with HEAL-D team prior to starting HEAL-D course	Self-reporting from service users during interviews and post course questionnaire
Prior to HEAL-D	Starter pack	HEAL-D starter pack delivered to all service users prior to starting HEAL-D course	Self-reporting from service users during interviews and post course questionnaire
During HEAL-D	Delivery	All HEAL-D sessions delivered virtually, using BlueJeans platform Sessions delivered to a cohort Minimum number of X service users per cohort	Self-reporting from service users during interviews and post course questionnaire. Observations.
During HEAL-D	Attendance	Service users attend X% of sessions Service users attend X% of each two-hour session	Self-reporting from service user and staff interviews – including reasoning for dropping out of sessions (or joining late) eg. technical issues GST spreadsheet
During HEAL-D	Structure	7 HEAL-D sessions, which include: • 5 exercise classes • 1 cooking session • 7 education sessions • Activity cards at each session, and feedback at the following one	Self-reporting from service user and staff interviews – ask them to describe the format of HEAL-D. Observations.
During HEAL-D	Waist measurements	All service users requested to take waist measurements	Self-reporting from patients and staff interviews and post course questionnaire
During HEAL-D	Resources	All resources available on website	Self-reporting from service user and staff interviews
After HEAL-D	Post-course questionnaire	Post course questionnaire completed with all service users who started the course	Post course questionnaire analysis

Core principles

Principle	Metric	Data source
Staff	All service delivery staff trained in how to deliver HEAL-D All sessions delivered by a facilitator and a lay educator	Self-reporting from service user and staff interviews Observations
Adherence	All service users to have attended x% of course No. of service users per cohort No. of sessions attended by service users No. DNAs No. of completers	Service delivery staff data collection (spreadsheet) Observations
Cultural sensitivity / competence	Opportunity for service users to ask questions Questions answered by educators	Self-reporting from service user and staff interviews Observations
Underpinning theory - social connectedness	Facilitator and participant interaction Participant and participant interaction	Self-reporting from service user and staff interviews Observations
Underpinning theory – behaviour change	Behaviour change theory utilised (see appendix for details)	Self-reporting from service user and staff interviews Observations
HEAL-D ethos and behaviours	Interaction with service delivery staff Interaction with peers Perceptions on relevance Perceptions on acceptability	Self-reporting from service user and staff interviews Observations

Observation checklist

The purpose of this checklist is to provide a structure for observations where fidelity to the core components and principles underpinning HEAL-D online are being assessed.

Core Components

Delivery

☐ Delivered virtually (via BlueJeans)

☐ Delivered to a cohort

Structure

☐ Feedback on previous activity card at the start of the session (*except session 1*)

☐ Education session (*except at cooking session*)

☐ Exercise class (*except at session 1 or cooking session*)

☐ Cooking session (*note: only one session*)

☐ Activity card at the end of the session (*except session 1*)

Core Principles

Staff

☐ Session delivered by a facilitator and lay educator

Cultural sensitivity / competence

☐ Culturally specific elements are raised / addressed

☐ Questions answered by facilitator / educator

Underpinning theory – behaviour change

☐ Behaviour change theory utilised (see appendix for details)

HEAL-D ethos and behaviours

☐ Interaction with service delivery staff

☐ Interaction with peers

☐ Opportunity for service users to ask questions

CHECKLIST TOTAL

Session 1		Cooking session		All other sessions
/10		/12		/13

Description of the intervention components to support each behavioural change technique

Behaviour Change Theory	Intervention component
Social support (unspecified)	Social connectedness will be fostered within the group by the discursive nature of the sessions and through shared engagement in activities and structured exercise sessions
Social comparison	The *'homework'* activities will give participants opportunity to try the lifestyle targets and come back to discuss with the group and with educators. Participants will be encouraged to share their successes to encourage comparison within the group. In addition, role models will be featured in the case study video
Credible sources	Videos will be used as part of the intervention which include advice and tips from community leaders, healthcare practitioners and patients from the community that have successfully changed their habits
Information about health consequences	The educational curriculum will cover health consequences and benefits of various key lifestyle behaviours A video will explain the mechanisms of type 2 diabetes
Feedback on outcomes, self-monitoring of behaviour	Programme will start with personal measurements and blood results, and updated outcome measures will be given at the end of the programme. They will be encouraged to monitor their waist measurement through the course by completing their programme booklets.
Self-monitoring of behaviour, action planning	Participants will be given pedometers to measure their steps and will be taught to develop action plans and measure their progress against them.
Instruction on how to perform the behaviour	The curriculum will communicate health guidance clearly using culturally relevant examples.
Demonstration	Practical games, the weekly discussion tasks, a cooking session and structured exercise sessions will provide guided demonstration. An exercise DVD will be provided for participants to follow at home.
Graded tasks	Physical activity sessions and targets will be graded for ability to boost chances of success hence confidence and self-efficacy.
Goal setting (behaviour)	Participants will be guided through setting their own goals for the lifestyle targets that are important for them

Behaviour Change Theory	Intervention component
Problem solving	The *'homework'* activities will be discussed at the beginning of each session, challenges will be identified and the group will problem solve collectively. Problem solving will also form part of the education sessions about lifestyle habits.
Action planning	Participants will be guided through how to develop and adjust action plans for each of the target behaviours and for their personal objectives, to help keep them motivated.

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Healthy Eating and Active Living for Diabetes (HEAL-D) Online: A mixed methods evaluation exploring the feasibility of implementing a virtual culturally tailored diabetes self-management programme for African and Caribbean communities.

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Healthy Eating and Active Living for Diabetes (HEAL-D) Online: A mixed methods evaluation exploring the feasibility of implementing a virtual culturally tailored diabetes self-management programme for African and Caribbean communities.

Short running title:

HEAL-D Online feasibility evaluation.

Authors:

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ABSTRACT

Objectives: To assess the feasibility and acceptability of delivering HEAL-D Online.

Intervention: HEAL-D Online – a seven-week culturally tailored type 2 diabetes educational programme delivered using online platform.

Setting: Programme delivered by a London NHS trust, with patients referred from primary care healthcare professionals via a central booking system.

Participants: 53 HEAL-D service users completed a post-course questionnaire, and 14 service users and seven service delivery staff participated in interviews.

Design: Mixed methods service evaluation.

Method: Service activity data assessed service user engagement, acceptability and perceived patient benefit. Views and experiences of service users and service delivery staff about the feasibility and acceptability of HEAL-D Online were explored using semi-structured interviews. Data were analysed using the Framework Method. Fidelity was measured through observations using a fidelity checklist.

Results: Service activity data showed that initial uptake of HEAL-D Online was good (62% attendance) with a high adherence to the programme (77% completion). A high fidelity (94%) was observed, and qualitative findings showed that staff and service users were satisfied with all aspects of course delivery. Both service activity and qualitative data indicated that attendees felt more confident in controlling their diet and managing their diabetes post-HEAL-D Online.

Conclusion: This evaluation demonstrates the feasibility of delivering HEAL-D using an online platform, with its ability to achieve similar goals compared with its face-to-face counterpart. Challenges were identified around the identification, recruitment

and referral of eligible patients into the programme, which need to be addressed for successful implementation on a wider scale.

Word count: 247

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This evaluation is the first to assess the feasibility of delivering a diabetes management programme for UK African and Caribbean communities using a digital platform.
- The mixed methods, pragmatic design enabled the rapid gathering of insights and identification of practical barriers and enablers to implementation, whilst delivering maximum benefit to service users.
- A key strength was the co-design and delivery of the study, which brought together a collaboration between researchers, professionals working in the NHS, and people from African and Caribbean communities with a lived experience of diabetes.
- A limitation is the absence of a control group and the use of routinely collected data, which means the evaluation is unable to determine causation or effectiveness.

KEY WORDS

Diabetes, self-management educational programme, feasibility, implementation.

INTRODUCTION

Type 2 diabetes (T2D) is a major health concern for the United Kingdom (UK) Caribbean and African population with prevalence estimated to be three times higher [1], onset 10 years earlier [2], and poorer health outcomes compared to white Europeans [3–5]. Compared to other population cohorts, uptake of self-management programmes, which are recommended as a core component of management, is low in African and Caribbean communities [6]. To address these ethnic inequalities in diabetes healthcare access and outcomes for UK African and Caribbean communities, a culturally tailored 7-week T2D educational programme, Healthy Eating and Active Lifestyles for Diabetes (HEAL-D) [heal-d.org], was co-designed [7]. HEAL-D was originally designed to be delivered face-to face, and feasibility work has showed it is highly acceptable [8].

The COVID-19 pandemic disproportionately affected minoritised groups [9] so it was important to maintain services which addressed health inequalities in these groups. The associated lockdown restrictions required service providers to reconfigure the way in which health programmes were delivered, leading to the development of online delivery for services which were previously delivered face-to-face. HEAL-D Online is one such service, using the same approach and content as the original face-to face programme, but delivery via an online platform. HEAL-D Online consists of seven 2-hour sessions of group-based culturally tailored education, behaviour change support and participatory physical activity, delivered by a lay educator of black-British ethnicity and a diabetes specialist registered dietitian (no specific ethnicity). Physical activity classes, delivered by exercise instructors trained in rehabilitation exercise, were included in five sessions.

This paper presents an evaluation of the feasibility and acceptability of delivering the HEAL-D Online service using an online platform delivered by an NHS service provider in south London. The evaluation aimed to examine the following factors: i) acceptability to service users; ii) feasibility to staff delivering the online programme; iii) feasibility of digital

participation for service users; iv) potential benefits to service users following participation; v) potential future improvements to HEAL-D Online.

METHODS

Setting

The evaluation focused on the delivery of HEAL-D Online, a programme managed and delivered by an NHS trust in London, UK. Patients could be referred by healthcare professionals in primary care via a central booking system.

Procedure

A detailed description of the procedures is provided in the published protocol [10]. This was a prospective, pragmatic, mixed methods service evaluation, using service activity records, service user questionnaires, observational data and interviews. Service activity records and responses from a post-course telephone questionnaire were used to assess service user acceptability of HEAL-D Online, as well as feasibility to using digital technology and potential patient benefit. Qualitative descriptive methods were used to explore service user and service delivery staff's perspective of HEAL-D Online. Service user interviews were used to explore reasons for acceptability, thoughts on using digital technology, the perceived benefits of HEAL-D Online and future improvements. Both service delivery staff interviews and observational data were used to assess the feasibility of delivering HEAL-D Online.

Quantitative methods

Data on service engagement – i.e. attendance rates, did not attend (DNA) rates, and completion rates – were collected by the service provider for anyone attending the HEAL-D Online programme between January and December 2022.

In addition, a post-course questionnaire was administered by the service provider over the phone as part of routine care (Appendix i). The questionnaire collected data on the following outcomes:

1) Patient benefit assessed via perceived weight loss and diabetes related psychological distress. This was measured pre- and post-attendance using the validated Problem Areas In Diabetes (PAID-5) questionnaire [11], where score of ≥8 indicates distress.
2) Acceptability of HEAL-D Online for service users (expectations met, satisfaction with delivery, accessibility issues, recommendation to others). This used questions co-developed by the service provider and the study team with input from service users, and was non-standardised.
3) Service users' expectations of HEAL-D Online. Following a recommendation by the reference group, a question was added once the evaluation had started, asking participants whether HEAL-D Online met their expectations. As 21 service users had already completed the post-course questionnaire, only 32 participants were able to answer this question.

Qualitative methods:

Interviews: Of the 53 who completed the post-course telephone questionnaires, 15 service users provided consent to be approached for interview. To ensure ethical procedures were followed in recruiting participants for the qualitative interviews, these service users were first contacted via an introductory email by the evaluation team (JL, SL, LB, ZZ - all with postgraduate qualification and at least 5 years mixed methods experience in health services research/evaluation, including qualitative data collection methods). The email had an information sheet explaining the purpose of the evaluation, reason for being invited to interview, and how their personal data would be used and stored. All participants were given at least 72 hours before being contacted by telephone. The evaluation team checked whether people understood the contents of the information sheet and were given opportunities to ask questions. They were informed that they could withdraw from the evaluation at any time without any impact on them. Fourteen of the 15 service users agreed to participate and provided verbally recorded informed consent. Service user interviews were

conducted by JL, SL, LB, and ZZ (all had no prior relationship with participants) and were 20-59 minutes in duration.

The service lead identified 12 staff members who were actively involved in the ongoing delivery of HEAL-D Online. All staff were invited to an interview by SL or JL and seven agreed to participate. Service delivery staff were consented using the same process as service users. All service delivery staff interviews were conducted by either SL or JL (who had no prior relationship with the participants) and were 15-90 minutes in duration.

All interviews with service users were conducted between 1-3 months after they had completed the HEAL-D Online course. All interviews with service delivery staff were conducted while they were still delivering the HEAL-D Online course.

A topic guide was used to explore experience of participating in HEAL-D Online to understand the feasibility and acceptability of the programme as part of a semi-structured interview technique (Appendix ii – service user interviews; Appendix iii – service delivery staff). Interviews were conducted by the evaluation team using Microsoft Teams, with all interviews recorded and transcribed using Microsoft Teams. Upon completion of each interview, the interviewer relistened to each interview against the Teams transcript to ensure accuracy of the interview content. To ensure that the interviewers were accurately transcribed, JL and SL checked two of each other's interviews for accuracy. In addition, JL checked the accuracy of two interviews conducted by LB.

Observations: As per usual practice in fidelity assessment, a customised observation checklist, based on the core components and principles underlying HEAL-D Online [12] and included key items linked to delivery structure, cultural sensitivity and competence, and underpinning theory, was used to evaluate service delivery fidelity (Appendix iv). It consisted of 13 items, except for session 1 (11 items) and session 3 (12 items), which had components that were not relevant or unique.

Seven sessions were observed, selected from the seven HEAL-D cohorts, with the evaluation team (SL) identifying those with different delivery staff and on different days/times (to get overview of the different delivery styles). All sessions were observed by SL, three (session 3, 5 and 7) were observed by both SL and JL independently and scores compared to assess inter-observer reliability. Service users were informed about the purpose of the observation and permission was gained from the service users before SL and JL were allowed to observe their sessions.

Data analysis

Quantitative

Frequencies and percentages were used to describe the level of service users' engagement, their satisfaction with the delivery of HEAL-D Online, service users' expectations and any self-reported health benefits gained from participating in the programme. To assess the level of diabetes-related emotional distress at pre- and post-attendance, total PAID-5 scores were calculated, and descriptive statistics used to describe the level of distress at both timepoints. The percentage of distressed participants (PAID-5 score ≥8) was also calculated at both timepoints. Data were summarised to understand potential patient benefits and the feasibility of delivering HEAL-D Online.

Qualitative

Interview transcripts were first read in their entirety by the interviewer. The Framework Method was used for analysis, using a matrix developed from the topic guide [13]. Relevant texts from each transcript were transferred to the framework and thematically analysed to summarise key concepts. Excel was used to organise data for analysis. A between-participant analysis was conducted to explore similarities and differences in perception of HEAL-D Online. Data were analysed with the focus of understanding the acceptability and feasibility of virtual delivery. Using a triangulation process, qualitative data was also used to

understand and explain patterns in the quantitative data. To check on the accuracy of the analysis, JL and SL both independently coded two of their respective interviews.

To explore the feasibility of delivering HEAL-D Online, the fidelity of the different sessions was calculated using the mean rating score from the observations on the fidelity checklist. Inter-rater reliability was calculated looking at the checklist items where both observers rated similarly, over those they rated differently (see Appendix iv).

Patient and public involvement

Co-design has been integral throughout the development of HEAL-D, and this ethos continued in this evaluation with the recruitment of a group of people of African and Caribbean heritage who had been involved either in the original HEAL-D co-design research or had completed the online course to form a reference group [7, 14]. The reference group met regularly, approximately bi-monthly, from initial review of the evaluation design, through to co-design of service user interview materials (consent form, information sheet, topic guide), review of the post course questionnaire, and discussion and input into analysis and reporting. Results were shared with the reference group, and members engaged with dissemination activities related to the programme, including a podcast and conference presentations.

Results

Participants

Service users

Qualitative

Demographic and clinical characteristics for service user interviewees are presented in Table 1. Of the 14 participants, the majority were female (n=8, 57%), had an African heritage (n=8, 57%), and an average age of 51 years. The median time since diagnosis was 2 years (interquartile range IQR: 1-4; range: 0.3-20). Most had been provided with some information about diet and the need to exercise (n=9, 64%) and only two (14%) had been on a DESMOND diabetes programme [www.desmond.nhs.uk] or a similar self-management course before attending HEAL-D Online.

Table 1: Demographic and clinical characteristics of service user participants in qualitative arm of the evaluation

Characteristic	**Frequency (percentage)**	
Sex (%)	Female	8 (57)
	Male	6 (43)
Cultural heritage (%)	African	8 (57)
	Caribbean	6 (43)
Age*	Median (yrs)	51
	Range (yrs)	43-63
Time since diabetes 2 diagnosis (years)	Median	2
	IQR (range)	1-5.25 (0.3-20)
Diabetes self-management interventions (pre-HEAL-D)	Dietary advice and/or exercise	9
	Blood monitoring	3
	None specified	3

	DESMOND course	1
	Week course on healthy eating	1

Note: Denominator for each characteristic = 14 participants (unless otherwise stated). *only available for n=4 participants.

Quantitative

No demographic data were collected for the quantitative sample other than the fact that all participants were either from an African or Caribbean heritage, due to privacy statements for the participating NHS trust about sharing personal data.

Service delivery staff

The characteristics of the 7 service delivery staff interviewees are presented in Table 2. The sample was all female, mainly from black cultural heritages with a median of 2 years (range: <1 year to 9 years) experience working on HEAL-D Online. Data on culture heritage has been provided for completeness, as the literature notes there are potential benefits to service users when delivery staff sharing the same cultural heritage [15]. All service delivery roles were represented: service management; physiotherapy, dietitian, lay educator and cooking workshop facilitator.

Table 2: Demographic and clinical characteristics for service delivery staff - qualitative arm of the evaluation

Characteristic	**Number (percentage)**	
Sex (%)	Female	7 (100)
	Male	0 (0)
Cultural heritage (%)	Black (British/African/Caribbean)	5 (71)
	White (UK/other)	2 (29)
Job designation within HEAL-D Online (%)	Dietitian	2 (29)
	Lay educator	2 (29)
	Physiotherapist	1 (14)

	Cooking session facilitator	1 (14)
	Service manager	1 (14)
Time working on HEAL-D Online (yr)	Median	2
	Range	<1y -9

Note: Denominator for each characteristic = 7 participants (unless otherwise stated).

Results

1. Acceptance of HEAL-D Online for service users

Service users' engagement with HEAL-D:

Eighteen courses ran between January and December 2022 offering 197 places for potential participants to attend. 135 places were booked, of which 84 patients attended the first session and 51 "did not attend", indicating a 62% attendance rate. An analysis of programme attendance showed that 65 individuals completed the course (attending at least 4/7 of the sessions), giving a completion rate of 77% for the 84 participants who attended the first session and 48% for the 135 people who were initially booked.

Interview data suggests that this high level of engagement for people who attended the first session may be related to both relevance of the course to their lives and the new knowledge gained from it.

> "*When I stumbled onto the programme, it just got my interest. You know the way the programme was being introduced. The topics, I was like, wow. I didn't want to finish because every day you go in, you learn a new thing."* (Service user 1013)

Service users' perceptions of service provision:

Figure 1 outlines participant satisfaction with the delivery of the seven key HEAL-D Online elements that were explored in the post course questionnaire (n=53). Nearly all participants were satisfied with the way that all seven key elements of HEAL-D Online were delivered. All

53 participants reported that the facilitator delivery was either excellent or good. At least 48 (91%) participants gave a similarly positive rating to the other aspects of HEAL-D Online, which included the initial contact with the HEAL-D team, interaction with the facilitator, HEAL-D participant pack, cooking and exercise sessions, and interaction with other service users. All participants reported they would recommend HEAL-D Online to family and friends. Qualitative data suggests peer support and achieving their learning goals were key reasons behind a willingness to recommend.

> *"The reason why I will refer other people to it [HEAL-D] is because I learned a lot about my diet, exercises, drinking, and hearing from other people, reassuring me that don't worry. It's gonna be OK. You're not on your own."* (Service user 1005)

Thirty-two service users were asked whether the HEAL-D Online programme met their expectations. All agreed that it had either met or exceeded their expectations. The fact that HEAL-D Online is attended only by people of African and Caribbean heritage made the experiences of living with diabetes more relevant to those attending the group and made HEAL-D Online more acceptable than other diabetes educational courses people had attended previously.

> "*So that's what brought me back and also other people's experiences of black people's experiences of how diabetes affect them."* (Service user 1007)

2. *The impact of a digital mode of delivery on service user participation*

Service delivery data on the 53 participants showed that most (83%, n=44) found the BlueJeans video calling facilities (the online delivery platform used to deliver HEAL-D Online) easy to use and the instructions for use easy to follow (92%, n=49) (Figure 2), indicating that service users had little difficulty in using the technology. These findings are supported by interview data, which showed that nearly all participants had no major challenges using the technology to access HEAL-D Online, although a few had some issues

either downloading or accessing BlueJeans. Some participants commented that they were generally comfortable with using digital technology, whilst one service user had been provided with technical support by her granddaughter to access HEAL-D Online. Some stated that with the onset of the COVID-19 pandemic, in general people were more accustomed to programmes being delivered online.

> *"I suppose because we've come out of lockdown, I've been used to doing lots of things virtually anyway, because even a support group that I mean, that's been virtual, so that was OK.*" (Service user 1010)

This was reiterated by service delivery staff, who felt that service users had become more accustomed to online delivery of services due to the COVID-19 pandemic.

> "*I joined at a time where people have become used to virtual, if this was before COVID I think it would be a lot more challenging. It's almost like people are used to it and are more open to the idea now of doing things virtually*" (Service delivery staff 2002)

Qualitative data highlighted convenience and flexibility as two advantages of virtual course delivery. Not only was it easier for service users to attend the sessions, but they could also attend if they were away from home, and thereby not miss a session.

> *"I actually joined it while I was on holiday with the time difference and all that stuff, and there was another lady that I know that she was in [west African country] and she joined it as well. I really wanted to do it, so I took my computer with me and everything." (*Service user 1011)

Delivery staff recognised the benefits around the flexibility and convenience that virtual delivery provides, with the potential to allow more service users to access the HEAL-D programme.

"I think it's great because people, after work, can't always be somewhere face to face and you know having that option of just logging in whenever. We had people log in on their lunch break, we had people log in on their way to work and participate. So it opens up a door to people who don't want to do face to face sessions." (Service delivery staff 2003)

3. The feasibility for service delivery staff to deliver HEAL-D Online.

The observational data showed that service delivery staff were successful in delivering the components of HEAL-D using a digital platform and that HEAL-D Online was being delivered as intended. This is indicated by a mean fidelity score of 94% (Appendix v) showing that 118/126 items on the fidelity checklist were observed by two independent raters during the delivery sessions. Inter-rater reliability between the two independent observers showed 100% agreement on the three joint observations. The observation data showed that service delivery staff achieved 100% fidelity in 4 of the 7 sessions, and it was only in one session that the fidelity rate was less than 90%.

Although the observational data indicated the feasibility of delivering HEAL-D Online, qualitative data identified challenges in delivering these sessions from service delivery staff. Those who had previously been involved in face-to-face delivery noted how online delivery requires different skills to ensure that service users are engaged.

"*When you're online I feel that you have to work extra hard to keep people engaged and one of the ways to do this is by being "more animated*" (Service delivery staff 2007)

These issues could arise in balancing the importance of showing respect for the older age group in African and Caribbean culture with their potential lack of knowledge in using the new technologies. For service delivery staff, it was important to recognise this where individuals faced challenges with the technology.

> "*Respect and regard for this kind of age group is quite important in the black African and Caribbean culture, and to help them to not feel silly or to carry them along very respectfully, but in a way that they don't feel that they are technologically behind. I think it takes a different kind of skill because they're also dealing with a chronic illness, which they're probably really worried about. So, it's kind of trying to lighten that and make it not such a big deal [if they struggle with the technology]*" (Service delivery staff 2007)

Another key challenge with online delivery was encouraging interaction and engagement with service users, especially at the start. The option to turn cameras off further added an additional complexity when trying to assess service user participation and engagement.

> "*There's an option to turn your camera off. So those people who are just signing in because they feel they need to show that they are attending but will turn the camera off and not engage in any conversation, that can be quite challenging. Whereas if they physically were there, they can't turn the screen off.*" (Service delivery staff 2002)

This difficulty in assessing engagement resulted in safety concerns when delivering the exercise component and made it harder for the physiotherapy team to determine the right level of exercise for the group.

> "*If someone's cameras are off, it can be quite difficult to gauge how they're finding it, so thinking of a safety element as well, it can be difficult to know. And you know, am I offering the right options? Is it too easy or hard? Even when the cameras are on, it's quite difficult. You can't hear someone breathing heavily or not. And sometimes you can't see their whole body.*" (Service delivery staff 2006)

Delivering the cooking session effectively online was also challenging, as there are sensory aspects, such as smells and physically seeing and touching the ingredients, that are difficult to recreate in a virtual environment.

"It's quite different to being in the kitchen where people are quite engaged if there's a lot of sensory aspects to being in the kitchen, the smells, the auditory, the touch. When you're online, you have to work extra hard to keep people engaged, even though our videos are fantastic." (Service delivery staff 2007)

An additional challenge in the online delivery was the use of a digital platform that service delivery staff were unfamiliar with. It was not possible to use the digital platforms that delivery staff were used to, such as Zoom or Microsoft Teams, as they were not considered secure enough to deliver patient care. Instead, the health providers used a digital platform called BlueJeans which works in a similar way to Zoom or Microsoft Teams, but has high levels of data security. Unfortunately, many service delivery staff had issues using BlueJeans in delivering the online course, such as sharing session videos or understanding how to operate the platform, even for staff who consider themselves "tech savvy".

"Some of the feedback we get is a difficulty with BlueJeans, like some of the dietitians find that quite difficult to navigate. I guess we use MS Teams most of the time, so it's kind of like using a different system." (Service delivery staff 2001)

It was acknowledged that over time the online platform became easier to use as they became more familiar with it.

"We now know exactly what settings are [needed] and are better at troubleshooting. Now if something were to happen just through that experience, some of it happening before. So yes, I definitely feel like it's much smoother." (Service delivery staff 2006)

4. Potential benefits to service users from participating in HEAL-D Online

Service users reported a range of benefits from participating in HEAL-D Online (Figure 3). All agreed that it was helpful to meet other people with diabetes and that it provided them with support to live with diabetes. Most felt they learnt practical skills and that it helped their confidence in managing their diabetes. The qualitative data further illustrated that service

users felt that they were more knowledgeable on diabetes management and recognised the importance of managing their diet, understanding their food intake, doing more exercise and regularly monitoring their weight and blood sugar levels.

> *"How to manage my diabetes in regard to the kind of food I eat. These are routines that I never used to do. Now I'm very careful what I eat. I watch the portion sizes. I do the exercises and then I'll make sure that the way the food is prepared, because the way most of our foods are prepared, that's where we get it wrong."* (Service user 1013)

Of the 32 service users asked, 78% (25/32) self-reported weight loss following the HEAL-D programme, and 72% (23/32) noticed a reduction in waist measurement. Service users showed improvement in diabetes-related emotional distress after completing HEAL-D Online, with a reduction in total median PAID-5 scores from 7 at pre-course to 4 at post-course. This improvement was further illustrated by a decrease in the proportion of participants showing diabetes-related emotional distress (i.e. PAID-5 score ≥ 8) from 49% pre-course to 23% at post-course. The qualitative data further supports this quantitative evidence of potential benefits, with service users reporting that they had changed their dietary and exercise behaviour and had become more conscious of monitoring their weight and blood sugar levels. Service users felt more confident in managing their diabetes. For some service users, this also improved their level of happiness.

> *"It makes me feel happier with myself as a person and makes me feel better knowing that I'm trying all I can to manage my diabetes."* (Service user 1013).

Qualitative data suggested that HEAL-D Online acts to build both the confidence and the social support network of service users which facilitated their ability to use the skills taught during the programme to manage their diabetes. Most acknowledged the role of the educators' ability in engaging service users, and creating a safe and non-judgmental space to discuss sensitive topics.

"They (the facilitators) were lovely in how they presented the course, the way they were engaging and how they're having the discussions. They were supportive and encouraging. They make you feel involved and welcome. So you can literally be yourself and then, it allows you to be more open, to be able to discuss things that you normally don't talk about." (Service user 1011)

Even using a digital platform, the educators were able to create a safe space for service users that encouraged them to develop a forum for peer support, create group cohesion and provide the conditions for service users to share stories and experiences. By sharing learning amongst themselves, service users could find relevant solutions in living with diabetes and reassurances that their situation was not unique and that other people from similar cultural backgrounds had experienced similar situations.

*"The thing is that we're talking, no one was looked down upon. Everybody was listening to you. It was just like a little family gathering, whereby we could talk to each other and tell people what is wrong with us and find solutions." (*Service user 1013)

5. Improvements to HEAL-D Online

Qualitative data indicated that service users were generally overwhelmingly positive about the programme. From the interviews, two service users felt that no further improvement was necessary, with the remaining 12 identifying specific issues in two key areas: 'post-course follow-up support' and 'increasing engagement for those with impairments'.

Post-course follow-up support

Many service users had a sense of loss when the HEAL-D Online programme ended. Most would have liked follow-up from the HEAL-D team. One felt that a post-course review would encourage participants to maintain their commitment to changing their behaviour.

> *"I think a monthly or quarterly review (after the last session). Just call the participant "how are things, is everything OK, any challenges, can we support you? Say that you'll be receiving a call from the team, who may ask about your diet? May be useful if you're not someone that can self-motivate, you will just slide back to your old habit"* (Service user 1011)

Many service users made close connections with their peers and would have liked to have maintained these once the course had finished. Some suggested sharing contact details, with one suggesting specifically setting up a WhatsApp group to connect peers as a source of support and advice.

Increasing engagement for users with impairments

Service users reported that it is important for course administrators to check with service users if they had any issues or impairments which limit their ability to participate with the delivery of an online programme. One service user with a visual impairment had difficulties in seeing the slides on their phone.

> *"The slides could have been clearer, so more work to be done on the slides so if you were viewing it on a computer or a phone, you would be able to see."* (Service user 1007)

Discussion

This evaluation demonstrates the feasibility of implementing a virtually delivered culturally tailored T2D self-management programme specifically aimed at the UK African and Caribbean population. To the best of our knowledge, this is the first of this type of diabetes management programme for this community delivered using a digital platform. Our findings showed a high level of acceptance amongst service users, as highlighted by a 77%

completion rate of service users who attended the first HEAL-D Online session. Service users appreciated the convenience and flexibility that the online programme offered.

Service delivery staff were successful in delivering the key elements of the programme (educational sessions, exercise class, cooking workshop) using an online platform, whilst service users generally had few problems using the technology to access the programme. At the same time, qualitative findings highlighted potential safety issues that future service delivery staff need to be aware of in delivering, for example exercise sessions, especially if HEAL-D Online is scaled up to a national level.

HEAL-D Online showed potential service user benefit in improving both understanding of diet and knowledge of diabetes management and its ability to encourage the behavioural change needed to elicit a subsequent reduction in weight and blood glucose level. A reduction in diabetes-related distress was also observed following attendance at the programme. Qualitative findings illustrated that the supportive elements provided by the educators could also be recreated using an online platform such as the ability to provide a safe environment for service users to ask questions, allowing open discussions and supporting conditions for peer support.

Service delivery data showed that attendance uptake of 62% for HEAL-D Online was high compared with the national attendance figure of 8.2% of people with T2D who are offered to attend a structured diabetes educational course [16]. This suggests that HEAL-D Online is successfully targeting and engaging with individuals. Nevertheless, this evaluation was unable to record reasons why the remaining 38% did not attend their first session and it is important to understand if people are unable to take up the offer of HEAL-D Online because of its digital nature, and if non-attendance at session one was because of digital poverty and digital literacy. A limitation of this evaluation was that no attempt was made to explore this, but there is currently a clinical trial underway which potentially will address these issues [17].

Service users were happy with the programme content but would have appreciated further follow up afterwards. Specific improvements to the programme include providing post-intervention support from the HEAL-D Online team and a needs assessment for attendees with sensory disabilities to ensure better accessibility during the sessions and to check that programme participants can read the presented material, for them to gain the most out of the sessions.

Some caution is needed in interpreting these findings. Both the service delivery data and qualitative data are from service users who completed the course, which indicates some level of self-selection bias. It is not possible to comment on the representativeness of the service users to the intended target population as no demographic data were collected from those who completed the service delivery questionnaires, although demographic data from the qualitative sample suggested the intended population was targeted. Future evaluations would need to incorporate the views of service users who did not complete the sessions or take up their places, to understand why they did not accept and explore potential barriers to accessing HEAL-D Online.

Our sample of service users appeared to be digitally literate or had family members who could provide necessary support. This sample had access to a range of devices such as laptops, tablets or mobile phones. Although the COVID-19 pandemic and associated rapid digital transformation have provided people with greater exposure and confidence in using digital technology, 'digital poverty' is still an issue, with 10% of the adult UK population lacking access, skills or confidence to use the internet or digital technology [18], and rates are highest in both older and socioeconomically deprived people, who are also more likely to live with T2D [19]. In addition, specific issues such as distrust of technology and lack of understanding of how to navigate online health services are recognised in people from minority ethnicities [20]. This is an area where more studies are needed to explore if digital-specific issues are a cause of non-attendance. This evaluation relied on self-reporting in measuring weight loss and future evaluation should aim to collect the relevant key clinical

outcomes (weight and blood glucose levels) to objectively confirm that a change in clinical outcomes has occurred. Finally, as there was no control group, it cannot be concluded that the potential patient benefits identified were because of HEAL-D Online. Evaluating this question would require testing using an experimental design.

Conclusion

It is feasible to deliver HEAL-D using an online platform, with online delivery achieving similar goals compared with its face-to-face counterpart, Implementation challenges focused on identification, recruitment and referral of eligible patients into the programme and safety issues need to be considered when delivering the exercise component. Subsequent studies need to establish scaled implementation feasibility and causal links between HEAL-D Online and diabetes outcome improvement.

WORD COUNT: 5358 (MAX 5000)

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Provenance and peer review: Not commissioned; externally peer reviewed.

Data sharing statement: No additional unpublished data are available.

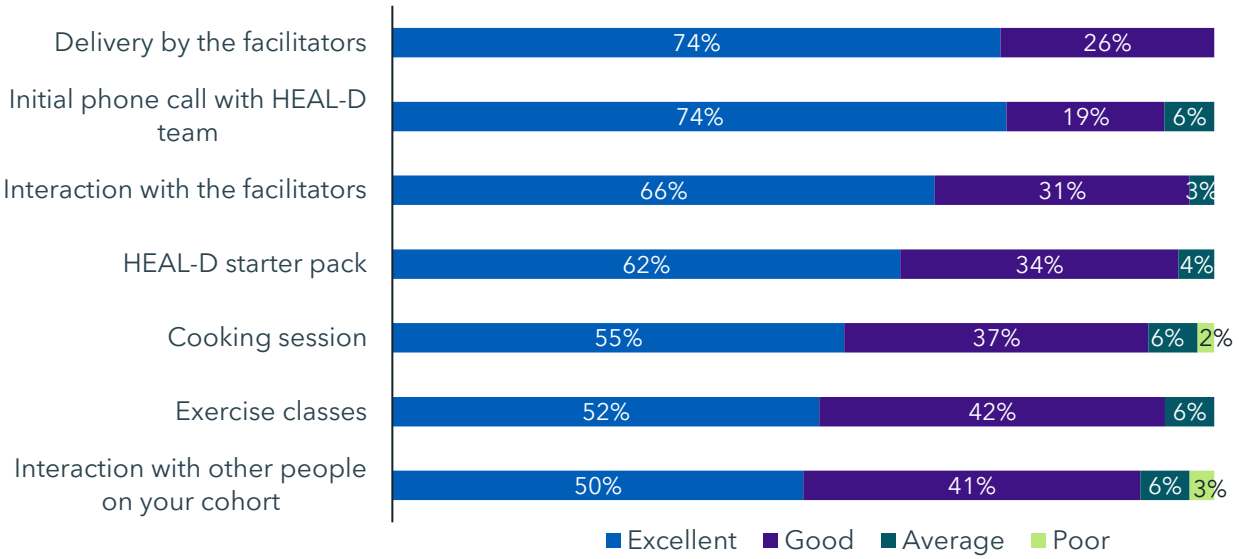

Figure 1 Satisfaction with the 7 elements of delivery in HEAL-D On-line (n=53)

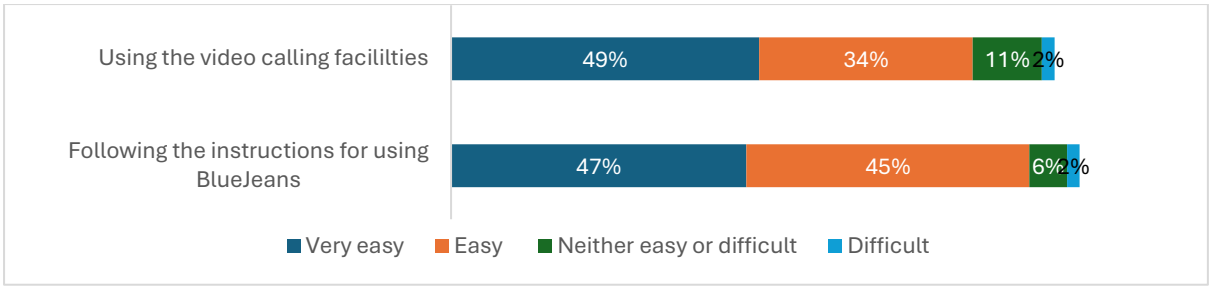

Figure 2: Ease of using the Video Calling facilities for HEAL-D Online (n=53).

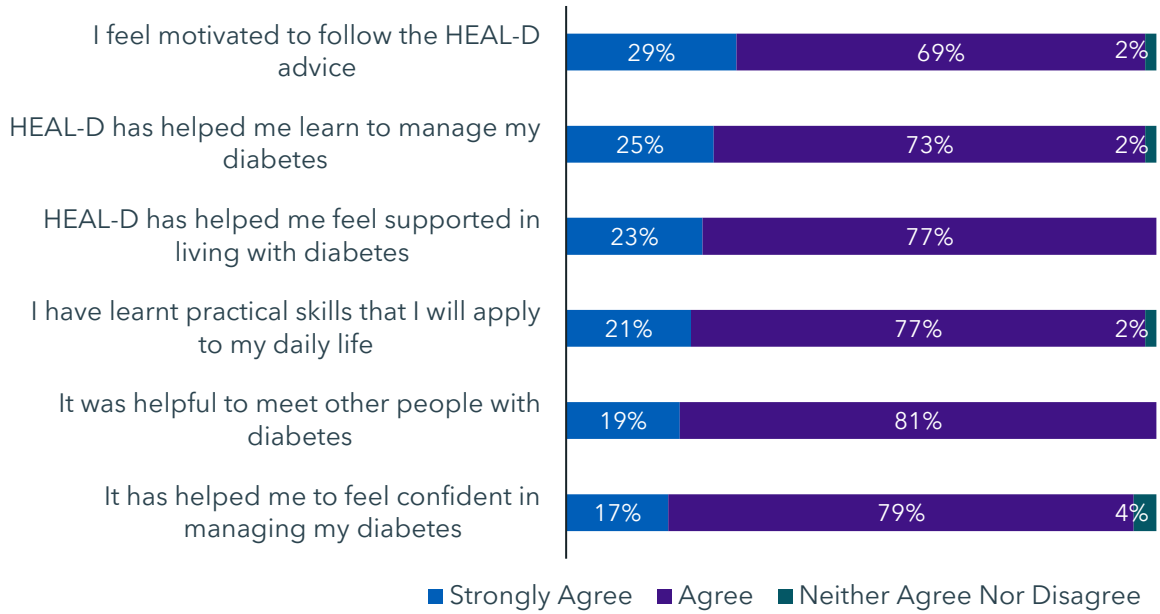

Figure 3 Learning outcomes following HEAL-D Online (n=53)

Appendix i: Post HEAL-D course questionnaire

All HEAL-D Online course participants get asked the below questionnaire (over the telephone) at the end of the course.

Question	**Response options**
Attendance status *(this is completed by the person asking the questions)*	Attended Cancelled Did not attend
How did you hear about HEAL-D?	GP Diabetic nurse Dietician Family / friend Other (please note)
When you first heard about HEAL-D, what 3 main things did you expect to get out of the course? To what extent were these expectations met? Were your expectations exceeded, met, partially met or not met?	*Free text box* Exceeded met partially met not met
On a scale of 1-5 where 1 is not a problem and 5 is a serious problem, please can you rate the following statements: Feeling scared when you think about living with diabetes Feeling depressed when you think about living with diabetes	1 Not a problem 2 Minor Problem 3 Moderate problem 4 Somewhat a serious problem 5 Serious problem

Worrying about the future and the possibility of serious complications Feeling that diabetes is taking up too much of your mental & physical energy every day Coping with the complication of diabetes	
Please rate the following statements about HEAL-D, on a scale of 1 – 5 where 1 is strongly agree and 5 is strongly disagree HEAL-D has helped me learn to manage my diabetes I have learnt practical skills that I will apply to my daily life I feel motivated to follow the HEAL-D advice HEAL-D has helped me feel supported in living with diabetes It was helpful to meet other people with diabetes	1 Strongly agree 2 Agree 3 Neither agree nor disagree, 4 Disagree 5 Strongly disagree
Please rate the following aspects of HEAL-D on a scale of excellent, good, average or poor. And can you please let me know why you have given this rating? Initial phone call with HEAL-D team HEAL-D starter pack Exercise classes Cooking session Delivery by the facilitators Interaction with the facilitators Interaction with other people on your cohort	Excellent Good Average Poor *Free text box for comments after each*

Thinking about the video calling facilities, How easy did you find it to use? On a scale of 1—5 where 1 is very easy and 5 is very difficult How did you find the instructions for using BlueJeans? Excellent, good, average or poor?	Very Easy, Easy, Neither Easy nor Difficult, Difficult, Very Difficult Excellent, good, average or poor
Have you lost any weight since you started the course? Have you noticed a reduction in your waist measurements?	*Open text boxes*
If HEAL-D was available face-to-face or remote, which would you prefer?	Face to face Remote No preference
When would be your preferred timing for attending HEAL-D?	no preference weekday daytime weekday evening Saturday morning
Overall - Please tell us what went well	*Open text box*
Overall - Please tell us if there is anything that you believe would enhance the course	*Open text box*
Overall - Would you recommend HEAL-D to family/friends (Yes / No)	Yes No
Do you have any other comments/feedback?	*Open text box*
We are currently completing an evaluation of the HEAL-D programme, and we are asking people to complete a telephone / video interview in order to find out their experiences. It will be similar to this questionnaire, and	Yes No

will take approx. 30 minutes. You will also be offered £15 for your time. If you would be interested in taking part, can you please confirm that you are happy for me to share your details with the project team?	
HEAL-D is currently only delivered in South London, but we are looking to develop it further. Would you be interested in hearing about HEAL-D in the future?	Yes No

Appendix ii: Topic guides for service users.

HEAL-D – Service User Interviews
Sign up script and form

Script to use to speak to individuals when signing up to complete form below:

[INTRODUCE SELF, RESPONDING TO EMAIL / CALL RE: HEAL-D CONVERSATION].

Thank you for offering to have a conversation with us around your experience of the diabetes self-management HEAL-D online course, we are very grateful to have your input.

You may have previously completed a telephone questionnaire after HEAL-D, this conversation may feel similar to that but we just want to find out a bit more detail.

Can we please arrange a date and time for full conversation. It is expected to take around 45 minutes, depending on your answers. We would like to conduct this virtually via video call on Microsoft Teams [if not possible, can do via telephone].

[IF MS TEAMS / ZOOM] I will need to send you an invite via email so that you have a link to click on, can you please give me your email address. When I email you I will also send a copy of an information sheet which just gives you a bit of information about why we are doing this.

[IF TELEPHONE] I can give you a ring.

[ARRANGE DATE, TIME & TELEPHONE NUMBER / EMAIL THAT IS BEST AND COMPLETE TABLE].

Also, you may be aware that you can be £15 paid for your time – this can be either bank transfer or shopping voucher. Would you like to receive this?

[IF YES]:

- [IF BANK TRANSFER] Please can you have your bank details to hand when we call you and we can fill in the form with you over the phone.
- [IF VOUCHER] We can offer you a high-street shopping voucher which will be sent to you after the conversation in the post or via email

[IF NO] – thank you. If you change your mind about this, please just let us know when we call you back for the conversation.

Name	
Date & time of interview	
Interviewer Name	
Interview method	☐ Telephone ☐ MS Teams video ☐ Zoom
Email address / number to call on	
Payment	☐ No ☐ Yes – Bank Transfer ☐ Yes – Voucher
Any special requirements	☐ None ☐ Interpreter ☐ Equipment Details (if applicable):

Thank you for your time. I / my colleague, look forward to speaking to you on [DATE and TIME].

HEAL-D Service User Interview Topic Guide

Introduction
Introduction Hi, I am [INTRODUCE SELF] Before we start, can you please confirm your name? **Purpose of discussion:** Thank you for agreeing to talk to me today. This discussion is expected to last approximately 30 - 45 minutes dependent on your responses. The purpose of this discussion is to understand your experience as a someone who has recently taken part in the HEAL-D online course.

You may have previously completed a telephone questionnaire after HEAL-D, this conversation may feel similar to that but we just want to find out a bit more detail. So, it may feel like you are repeating yourself a bit, but please don't worry about this. **Consent:** [If consent form sent in advance over email] Have you read the information sheet and consent form that we sent to you? [If consent form not sent in advance] Run through information sheet and consent form. Confirm consent *[INTERVIEWER NOTE]* *If telephone OR MS Teams, obtain consent on audio recording.* *Check whether participant has any questions and is happy to begin the interview.*

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START RECORDING AND TRANSCRIPTION (IF APPLICABLE) I am going to take some notes throughout our conversation, so you may hear some typing. I also may need to ask you to pause briefly whilst I write up any key points.	
BACKGROUND	
Before asking you about your HEAL-D experience, it would be great to learn a bit more about you. **Can you tell me about when you were diagnosed with type 2 diabetes?** *Prompts (pick out a selection as needed)* • When were you diagnosed with type 2 diabetes? Was it recent? • What support were you offered?	2min
SECTION 1 – BEFORE HEAL-D ONLINE	
For this set of questions, I'd like you to think about the time before you started the HEAL-D course. **Can you tell me about when you first heard about HEAL-D Online?** *Prompts*	5min

• Who told you about it / referred you? • Had you just been diagnosed with Type 2 diabetes? • What was your first impression of HEAL-D Online? • Have you done / been invited to take part in other courses like this before? • How did you feel about the course being virtual (via video call)?	2min
Can you tell me about any information you received before starting the course? *Prompts* • Did anyone from the course call you? If yes, who was it with and what did they say? • Did you receive any paperwork? • How did you find this information?	1min
Is there anything else you would you have liked to have known before you started? *Prompts* • Would you have felt any differently if you had heard from other people who had completed HEAL-D online?	
SECTION 2 – DURING HEAL-D ONLINE	
For this set of questions, I'd like you to think specifically about your experience whilst you were completing the HEAL-D online course **Can you tell me about the starter pack materials you were sent? E.g. the booklet, measuring tape and pedometer.** *Prompts* • Did you receive these before your first session? • Were they helpful? • Did you feel anything was missing? • Would you have liked the material in a different form? E.g. a different language?	2min 3min
How did you find accessing the sessions online via BlueJeans? *Prompts* • Were you able to attend all the sessions? • Did you use your mobile phone / computer / tablet / other? • Did you need any assistance to log in? • Did you have any challenges with BlueJeans?	2min
Can you tell me about your first session of HEAL-D Online?	

Prompts • How long after referral was your first session? • Was there anything that made you want to come back for future sessions?	1min
How did you find the timing of the sessions? *Prompts* • Did they fit with your lifestyle? • Were you able to attend all the sessions?	2min
How did you find the exercise component of HEAL-D Online? *Prompts* • Did you stick to the programme?	2min
How supported did you feel when you were completing HEAL-D Online? *Prompts* • Did you keep in touch with anyone from the group in-between sessions? • Did you know who to contact if you had any questions? • How did you find the facilitator and lay educator? Did they attend every session?	2min
How did you find the resources on the website? *Prompts* • If used, how useful did you find these? Was everything available that you wanted? Was there anything you felt was missing? • If not used, why not?	4min
What do you believe are the key things you learnt from HEAL-D Online? *Prompts* • What was most important to you? • What have you taken away to help you live with diabetes? • What did you learn about diet and exercise?	
SECTION 3 – AFTER HEAL-D ONLINE	
Lastly, I'd like you to think about more recently and after you completed the HEAL-D online course. **How has taking part in HEAL-D Online impacted your lifestyle?** *Prompts* • Have you kept up with the course and exercise?	3min

• If you were monitoring your waist measurements, weight and/or HbA1c as part of HEAL-D, have you continued to do this?	
Has HEAL-D Online helped you to manage your diabetes? *Prompts* • Do you use things you learnt during HEAL-D to help manage your diabetes?	2min 2min
Have you told your GP / GP surgery / who referred you about how you found HEAL-D Online? *Prompts* • Have they followed up with you since you were referred?	2min
Would you recommend HEAL-D Online to others? *Prompts* • Why?	2min
What have you gained from participating in HEAL-D online? *Prompts* • Why?	2min
Is there anything that you think would help to improve HEAL-D online? *Prompts* • Why?	
OVERALL AND ADDITIONAL INFORMATION	
Is there anything else about your HEAL-D experience that you would like to comment on that we have not discussed?	3min
Would you like a copy of the evaluation report?	1min
THANK YOU & CLOSE	
That is the end of our discussion. Thank you for your participation. Do you have any questions?	

I will now stop the recording (if applicable) **STOP RECORDING AND TRANSCRIPTION (IF APPLICABLE)** You may remember that we are offering a £15 payment for your time and contributions. You previously said you would / would not like to take this up. Is this still the case? [IF YES TO BANK TRANSFER] *go through Payment Request Form and collect bank details.* [IF YES TO VOUCHER] *either collect address for physical voucher, or confirm email address for e-voucher. Contact Sophie to arrange vouchers.*	

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Appendix iii: Topic guides for service delivery staff.

HEAL-D
Sign up template and form

Use the email template below to invite staff:

Title: HEAL-D Service Evaluation – we want to speak to you

Text:

Dear [NAME],

My name is [NAME] and I am [role] at the Health Innovation Network, a NHS organisation hosted by Guy's and St Thomas' Hospital. I am getting in touch as we are in the process of evaluating the HEAL-D service in order to collect information on how the service is currently working, providing evidence for future commissioning as well as suggestions for improvement.

We would be really grateful to speak to you about your role in HEAL-D. We call this an 'interview', but please be assured that this is just a conversation! The conversation will take about 30 minutes in total. Please see the attached information sheet for more information.

We are looking to conduct these interviews over Microsoft Teams (we can use another platform if preferred) during January 2023. Can you please let me know when you would be available for the interview and I can send you a calendar invite with the link.

Please do let me know if you have any questions at all and I look forward to hearing from you.

Best wishes / Many thanks etc….

Name	
Date & time of interview	
Interviewer Name	
Interview method	☐ Telephone ☐ MS Teams video ☐ MS Teams conference call ☐ Zoom
Email address / number to call on	
Any special requirements	☐ None ☐ Interpreter ☐ Equipment Details (if applicable):

Interview Topic Guide

INTRODUCTION	Time
Introduction Hi, I am [INTRODUCE SELF] Before we start, can you please confirm your name? **Purpose of discussion:** Thank you for agreeing to talk to me today. This discussion is expected to last approximately 30-40 minutes dependent on your responses. The purpose of this discussion is to understand your experience as a someone who has supported the delivery of the HEAL-D online course. **Consent:** Have you read the information sheet and consent form which was emailed to you? Do you have any questions? Run through consent. *[INTERVIEWER NOTE]* *If telephone OR MS Teams, obtain consent on audio recording.* *Check whether participant has any questions and is happy to begin the interview.*	

START RECORDING AND TRANSCRIPTION (IF APPLICABLE)	
I am going to take some notes throughout our conversation, so you may hear some typing. I also may need to ask you to pause briefly whilst I write up any key points.	
SERVICE EXPERIENCE	
First I'd like to ask a bit about your background just to get to know you. How long have you been working on HEAL-D and have you delivered any other similar courses before? *Prompts*	

- What were your first impressions of HEAL-D when you first heard about it?
- [If working on HEAL-D since it was implemented/the start] How were you involved in the implementation of HEAL-D Online in south London?

What is your role in the HEAL-D service?

Prompts

- Do you have direct contact with service users?
- What parts of HEAL-D are you involved in?
- Has your role changed over time?

To you, what are the core elements of HEAL-D?

Prompts

- What makes HEAL-D different from any other courses?
- What are the key stages in the HEAL-D process?

How have you found delivering HEAL-D virtually?

Prompts

- Have you ever delivered it in person? If yes, what were the differences?
- How have you found the technology?
- Have any service users ever provided you with feedback on the digital model?
- How does a digital model affect service user participation? / What implications does a digital model of delivery have on participation?

What impact do you believe HEAL-D provides for service users?

Prompts

- What positive impacts do you think there are for service users? How does HEAL-D benefit service users?
- What negative impacts do you think there are?

What impact do you believe HEAL-D provides for the service?

Prompts

- What positive impacts do you think there are for the service (HEAL-D and diabetes provision more generally)?
- What negative impacts do you think there are?
- What impact do you think HEAL-D has on service outcomes?

What impact do you believe HEAL-D provides for the health system?

Prompts

• What positive impacts do you think there are for the health system in south London? • What negative impacts do you think there are? **Overall, can you please tell me about how you have found delivering HEAL-D online?** *Prompts* • What has worked well? • What hasn't worked so well? **Is there anything that you think would help to improve HEAL-D online?** *Prompts* • Why?	
CLOSING REMARKS	
Is there anything else about your HEAL-D experience that you would like to comment on that we have not discussed?	3 mins
THANK YOU & CLOSE	
That is the end of our discussion. Thank you for your participation. Do you have any questions? I will now stop the recording (if applicable) **STOP RECORDING AND TRANSCRIPTION (IF APPLICABLE)**	

Appendix iv: HEAL-D Online - Fidelity Checklist

The purpose of this checklist is to assess fidelity to the core components and principles underpinning HEAL-D online.

Core components

Timeframe	Component	Metric	Data source
Prior to HEAL-D	Initial phone call	All HEAL-D service users to have had initial phone call with HEAL-D team prior to starting HEAL-D course	Self-reporting from service users during interviews and post course questionnaire
Prior to HEAL-D	Starter pack	HEAL-D starter pack delivered to all service users prior to starting HEAL-D course	Self-reporting from service users during interviews and post course questionnaire
During HEAL-D	Delivery	All HEAL-D sessions delivered virtually, using BlueJeans platform Sessions delivered to a cohort Minimum number of X service users per cohort	Self-reporting from service users during interviews and post course questionnaire. Observations.
During HEAL-D	Attendance	Service users attend X% of sessions Service users attend X% of each two-hour session	Self-reporting from service user and staff interviews – including reasoning for dropping out of sessions (or joining late) eg. technical issues GST - spreadsheet
During HEAL-D	Structure	7 HEAL-D sessions, which include: • 5 exercise classes • 1 cooking session • 7 education sessions • Activity cards at each session, and feedback at the following one	Self-reporting from service user and staff interviews – ask them to describe the format of HEAL-D. Observations.
During HEAL-D	Waist measurements	All service users requested to take waist measurements	Self-reporting from patients and staff interviews and post course questionnaire
During HEAL-D	Resources	All resources available on website	Self-reporting from service user and staff interviews
After HEAL-D	Post-course questionnaire	Post course questionnaire completed with all service users who started the course	Post course questionnaire analysis

Core principles

Principle	Metric	Data source
Staff	All service delivery staff trained in how to deliver HEAL-D All sessions delivered by a facilitator and a lay educator	Self-reporting from service user and staff interviews Observations
Adherence	All service users to have attended x% of course No. of service users per cohort No. of sessions attended by service users No. DNAs No. of completers	Service delivery staff data collection (spreadsheet) Observations
Cultural sensitivity / competence	Opportunity for service users to ask questions Questions answered by educators	Self-reporting from service user and staff interviews Observations
Underpinning theory - social connectedness	Facilitator and participant interaction Participant and participant interaction	Self-reporting from service user and staff interviews Observations
Underpinning theory – behaviour change	Behaviour change theory utilised (see appendix for details)	Self-reporting from service user and staff interviews Observations
HEAL-D ethos and behaviours	Interaction with service delivery staff Interaction with peers Perceptions on relevance Perceptions on acceptability	Self-reporting from service user and staff interviews Observations

Observation checklist

The purpose of this checklist is to provide a structure for observations where fidelity to the core components and principles underpinning HEAL-D online are being assessed.

Core Components

Delivery

☐ Delivered virtually (via BlueJeans)

Structure

☐ Feedback on previous activity card at the start of the session (*except session 1*)

☐ Education session (*except at cooking session*)

☐ Exercise class (*except at session 1 or cooking session*)

Core Principles

Staff

Cultural sensitivity / competence

☐ Culturally specific elements are raised / addressed

Underpinning theory – behaviour change

HEAL-D ethos and behaviours

☐ Interaction with service delivery staff

☐ Interaction with peers

CHECKLIST TOTAL

Session 1		Cooking session		All other sessions
/10		/12		/13

Description of the intervention components to support each behavioural change technique

Behaviour Change Theory	Intervention component
Social support (unspecified)	Social connectedness will be fostered within the group by the discursive nature of the sessions and through shared engagement in activities and structured exercise sessions
Social comparison	The '*homework*' activities will give participants opportunity to try the lifestyle targets and come back to discuss with the group and with educators. Participants will be encouraged to share their successes to encourage comparison within the group. In addition, role models will be featured in the case study video
Credible sources	Videos will be used as part of the intervention which include advice and tips from community leaders, healthcare practitioners and patients from the community that have successfully changed their habits
Information about health consequences	The educational curriculum will cover health consequences and benefits of various key lifestyle behaviours A video will explain the mechanisms of type 2 diabetes
Feedback on outcomes, self-monitoring of behaviour	Programme will start with personal measurements and blood results, and updated outcome measures will be given at the end of the programme. They will be encouraged to monitor their waist measurement through the course by completing their programme booklets.
Self-monitoring of behaviour, action planning	Participants will be given pedometers to measure their steps and will be taught to develop action plans and measure their progress against them.
Instruction on how to perform the behaviour	The curriculum will communicate health guidance clearly using culturally relevant examples.
Demonstration	Practical games, the weekly discussion tasks, a cooking session and structured exercise sessions will provide guided demonstration. An exercise DVD will be provided for participants to follow at home.
Graded tasks	Physical activity sessions and targets will be graded for ability to boost chances of success hence confidence and self-efficacy.
Goal setting (behaviour)	Participants will be guided through setting their own goals for the lifestyle targets that are important for them

Behaviour Change Theory	Intervention component
Problem solving	The '*homework'* activities will be discussed at the beginning of each session, challenges will be identified and the group will problem solve collectively. Problem solving will also form part of the education sessions about lifestyle habits.
Action planning	Participants will be guided through how to develop and adjust action plans for each of the target behaviours and for their personal objectives, to help keep them motivated.

Appendix v: Fidelity ratings of the 7 HEAL-D Online sessions.

Session	Fidelity ratings (%) Observer 1	Fidelity ratings (%) Observer 2	Fidelity ratings Combined observers (1&2)
1	10/10 (100)	-	10/10
2	12/13 (92)	-	12/13
3	13/13 (100)	13/13 (100)	26/26
4	13/13 (100)	-	13/13
5	13/13 (100)	13/13 (100)	26/26
6	11/12 (92)	-	11/12
7	10/13 (77)	10/13 (77)	20/26
Total fidelity scores	82/87 (94)	36/39 (92)	118/126 (94%)

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Healthy Eating and Active Living for Diabetes (HEAL-D) Online: A mixed methods evaluation exploring the feasibility of implementing a virtual culturally tailored diabetes self-management programme for African and Caribbean communities.

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Healthy Eating and Active Living for Diabetes (HEAL-D) Online: A mixed methods evaluation exploring the feasibility of implementing a virtual culturally tailored diabetes self-management programme for African and Caribbean communities.

Short running title:

HEAL-D Online feasibility evaluation.

Authors:

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ABSTRACT

Objectives: To assess the feasibility and acceptability of delivering HEAL-D Online.

Intervention: HEAL-D Online – a seven-week culturally tailored type 2 diabetes educational programme delivered using online platform.

Setting: Programme delivered by a London NHS trust, with patients referred from primary care healthcare professionals via a central booking system.

Participants: 53 HEAL-D service users completed a post-course questionnaire, and 14 service users and seven service delivery staff participated in interviews.

Design: Mixed methods service evaluation.

Primary and secondary outcomes: Service user engagement, acceptability and perceived patient benefit assessed using service activity data. Feasibility and acceptability of HEAL-D Online, using semi-structured interviews to explore the views and experiences of service users and service delivery staff.

Results: Service activity data showed that initial uptake of HEAL-D Online was good (62% attendance) with a high adherence to the programme (77% completion). A high fidelity (94%) was observed, and qualitative findings showed that staff and service users were satisfied with all aspects of course delivery. Both service activity and qualitative data indicated that attendees felt more confident in controlling their diet and managing their diabetes post-HEAL-D Online.

Conclusion: This evaluation demonstrates the feasibility of delivering HEAL-D using an online platform, with its ability to achieve similar goals compared with its face-to-face counterpart. Challenges were identified around the identification, recruitment

and referral of eligible patients into the programme, which need to be addressed for successful implementation on a wider scale.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

- The mixed methods, pragmatic design enabled the rapid gathering of insights and identification of practical barriers and enablers to implementation, whilst delivering maximum benefit to service users.
- A key strength was the co-design and delivery of the study, which brought together a collaboration between researchers, professionals working in the NHS, and people from African and Caribbean communities with a lived experience of diabetes.
- A limitation is the absence of a control group and the use of routinely collected data, which means the evaluation is unable to determine causation or effectiveness.

KEY WORDS

Diabetes, self-management educational programme, feasibility, implementation.

INTRODUCTION

Type 2 diabetes (T2D) is a major health concern for the United Kingdom (UK) Caribbean and African population with prevalence estimated to be three times higher [1], onset 10 years earlier [2], and poorer health outcomes compared to white Europeans [3–5].

Compared to other population cohorts, uptake of self-management programmes, which are recommended as a core component of management, is low in African and Caribbean communities [6]. To address these ethnic inequalities in diabetes healthcare access and outcomes for UK African and Caribbean communities, a culturally tailored 7-week T2D educational programme, Healthy Eating and Active Lifestyles for Diabetes (HEAL-D) [heal-d.org], was co-designed [7]. HEAL-D was originally designed to be delivered face-to face, and feasibility work has showed it is highly acceptable [8].

The COVID-19 pandemic disproportionately affected minoritised groups [9] so it was important to maintain services which addressed health inequalities in these groups. The associated lockdown restrictions required service providers to reconfigure the way in which health programmes were delivered, leading to the development of online delivery for services which were previously delivered face-to-face. HEAL-D Online is one such service, using the same approach and content as the original face-to face programme, but delivery via an online platform. HEAL-D Online consists of seven 2-hour sessions of group-based culturally tailored education, behaviour change support and participatory physical activity, delivered by a lay educator of black-British ethnicity and a diabetes specialist registered dietitian (no specific ethnicity). Physical activity classes, delivered by exercise instructors trained in rehabilitation exercise, were included in five sessions.

This paper presents an evaluation of the feasibility and acceptability of delivering the HEAL-D Online service using an online platform delivered by an NHS service provider in south London. The evaluation aimed to examine the following factors: i) acceptability to service users; ii) feasibility to staff delivering the online programme; iii) feasibility of digital participation for service users; iv) potential benefits to service users following participation; v) potential future improvements to HEAL-D Online.

METHODS

Setting

The evaluation focused on the delivery of HEAL-D Online, a programme managed and delivered by an NHS trust in London, UK. Patients could be referred by healthcare professionals in primary care via a central booking system.

Procedure

A detailed description of the procedures is provided in the published protocol [10]. This was a prospective, pragmatic, mixed methods service evaluation, using service activity records, service user questionnaires, observational data and interviews. Service activity records and responses from a post-course telephone questionnaire were used to assess service user acceptability of HEAL-D Online, as well as feasibility to using digital technology and potential patient benefit. Qualitative descriptive methods were used to explore service user and service delivery staff's perspective of HEAL-D Online. Service user interviews were used to explore reasons for acceptability, thoughts on using digital technology, the perceived benefits of HEAL-D Online and future improvements. Both service delivery staff interviews and observational data were used to assess the feasibility of delivering HEAL-D Online.

Quantitative methods

Data on service engagement – i.e. attendance rates, did not attend (DNA) rates, and completion rates – were collected by the service provider for anyone attending the HEAL-D Online programme between January and December 2022.

In addition, a post-course questionnaire was administered by the service provider over the phone as part of routine care (Appendix i). The questionnaire collected data on the following outcomes:

1) Patient benefit assessed via perceived weight loss and diabetes related psychological distress. This was measured pre- and post-attendance using the

validated Problem Areas In Diabetes (PAID-5) questionnaire [11], where score of ≥8 indicates distress.

2) Acceptability of HEAL-D Online for service users (expectations met, satisfaction with delivery, accessibility issues, recommendation to others). This used questions co-developed by the service provider and the study team with input from service users, and was non-standardised.

3) Service users' expectations of HEAL-D Online. Following a recommendation by the reference group, a question was added once the evaluation had started, asking participants whether HEAL-D Online met their expectations. As 21 service users had already completed the post-course questionnaire, only 32 participants were able to answer this question.

Qualitative methods:

Interviews: Of the 53 who completed the post-course telephone questionnaires, 15 service users provided consent to be approached for interview. To ensure ethical procedures were followed in recruiting participants for the qualitative interviews, these service users were first contacted via an introductory email by the evaluation team (JL, SL, LB, ZZ - all with postgraduate qualification and at least 5 years mixed methods experience in health services research/evaluation, including qualitative data collection methods). The email had an information sheet explaining the purpose of the evaluation, reason for being invited to interview, and how their personal data would be used and stored. All participants were given at least 72 hours before being contacted by telephone. The evaluation team checked whether people understood the contents of the information sheet and were given opportunities to ask questions. They were informed that they could withdraw from the evaluation at any time without any impact on them. Fourteen of the 15 service users agreed to participate and provided verbally recorded informed consent. Service user interviews were conducted by JL, SL, LB, and ZZ (all had no prior relationship with participants) and were 20-59 minutes in duration.

The service lead identified 12 staff members who were actively involved in the ongoing delivery of HEAL-D Online. All staff were invited to an interview by SL or JL and seven agreed to participate. Service delivery staff were consented using the same process as service users. All service delivery staff interviews were conducted by either SL or JL (who had no prior relationship with the participants) and were 15-90 minutes in duration.

All interviews with service users were conducted between 1-3 months after they had completed the HEAL-D Online course. All interviews with service delivery staff were conducted while they were still delivering the HEAL-D Online course.

A topic guide was used to explore experience of participating in HEAL-D Online to understand the feasibility and acceptability of the programme as part of a semi-structured interview technique (Appendix ii – service user interviews; Appendix iii – service delivery staff). Interviews were conducted by the evaluation team using Microsoft Teams, with all interviews recorded and transcribed using Microsoft Teams. Upon completion of each interview, the interviewer relistened to each interview against the Teams transcript to ensure accuracy of the interview content. To ensure that the interviewers were accurately transcribed, JL and SL checked two of each other's interviews for accuracy. In addition, JL checked the accuracy of two interviews conducted by LB.

Observations: As per usual practice in fidelity assessment, a customised observation checklist, based on the core components and principles underlying HEAL-D Online [12] and included key items linked to delivery structure, cultural sensitivity and competence, and underpinning theory, was used to evaluate service delivery fidelity (Appendix iv). It consisted of 13 items, except for session 1 (11 items) and session 3 (12 items), which had components that were not relevant or unique.

Seven sessions were observed, selected from the seven HEAL-D cohorts, with the evaluation team (SL) identifying those with different delivery staff and on different days/times

(to get overview of the different delivery styles). All sessions were observed by SL, three (session 3, 5 and 7) were observed by both SL and JL independently and scores compared to assess inter-observer reliability. Service users were informed about the purpose of the observation and permission was gained from the service users before SL and JL were allowed to observe their sessions.

Data analysis

Quantitative

Frequencies and percentages were used to describe the level of service users' engagement, their satisfaction with the delivery of HEAL-D Online, service users' expectations and any self-reported health benefits gained from participating in the programme. To assess the level of diabetes-related emotional distress at pre- and post-attendance, total PAID-5 scores were calculated, and descriptive statistics used to describe the level of distress at both timepoints. The percentage of distressed participants (PAID-5 score ≥8) was also calculated at both timepoints. Data were summarised to understand potential patient benefits and the feasibility of delivering HEAL-D Online.

Qualitative

Interview transcripts were first read in their entirety by the interviewer. The Framework Method was used for analysis, using a matrix developed from the topic guide [13]. Relevant texts from each transcript were transferred to the framework and thematically analysed to summarise key concepts. Excel was used to organise data for analysis. A between-participant analysis was conducted to explore similarities and differences in perception of HEAL-D Online. Data were analysed with the focus of understanding the acceptability and feasibility of virtual delivery. Using a triangulation process, qualitative data was also used to understand and explain patterns in the quantitative data. To check on the accuracy of the analysis, JL and SL both independently coded two of their respective interviews.

To explore the feasibility of delivering HEAL-D Online, the fidelity of the different sessions was calculated using the mean rating score from the observations on the fidelity checklist. Inter-rater reliability was calculated looking at the checklist items where both observers rated similarly, over those they rated differently (see Appendix iv).

Patient and public involvement

Co-design has been integral throughout the development of HEAL-D, and this ethos continued in this evaluation with the recruitment of a group of people of African and Caribbean heritage who had been involved either in the original HEAL-D co-design research or had completed the online course to form a reference group [7, 14]. The reference group met regularly, approximately bi-monthly, from initial review of the evaluation design, through to co-design of service user interview materials (consent form, information sheet, topic guide), review of the post course questionnaire, and discussion and input into analysis and reporting. Results were shared with the reference group, and members engaged with dissemination activities related to the programme, including a podcast and conference presentations.

Results

Participants

Service users

Qualitative

Demographic and clinical characteristics for service user interviewees are presented in Table 1. Of the 14 participants, the majority were female (n=8, 57%), had an African heritage (n=8, 57%), and an average age of 51 years. The median time since diagnosis was 2 years (interquartile range IQR: 1-4; range: 0.3-20). Most had been provided with some information about diet and the need to exercise (n=9, 64%) and only two (14%) had been on a DESMOND diabetes programme [www.desmond.nhs.uk] or a similar self-management course before attending HEAL-D Online.

Table 1: Demographic and clinical characteristics of service user participants in qualitative arm of the evaluation

Characteristic	**Frequency (percentage)**	
Sex (%)	Female	8 (57)
	Male	6 (43)
Cultural heritage (%)	African	8 (57)
	Caribbean	6 (43)
Age*	Median (yrs)	51
	Range (yrs)	43-63
Time since diabetes 2 diagnosis (years)	Median	2
	IQR (range)	1-5.25 (0.3-20)
Diabetes self-management interventions (pre-HEAL-D)	Dietary advice and/or exercise	9
	Blood monitoring	3
	None specified	3

	DESMOND course	1
	Week course on healthy eating	1

Note: Denominator for each characteristic = 14 participants (unless otherwise stated). *only available for n=4 participants.

Quantitative

No demographic data were collected for the quantitative sample other than the fact that all participants were either from an African or Caribbean heritage, due to privacy statements for the participating NHS trust about sharing personal data.

Service delivery staff

The characteristics of the 7 service delivery staff interviewees are presented in Table 2. The sample was all female, mainly from black cultural heritages with a median of 2 years (range: <1 year to 9 years) experience working on HEAL-D Online. Data on culture heritage has been provided for completeness, as the literature notes there are potential benefits to service users when delivery staff sharing the same cultural heritage [15]. All service delivery roles were represented: service management; physiotherapy, dietitian, lay educator and cooking workshop facilitator.

Table 2: Demographic and clinical characteristics for service delivery staff - qualitative arm of the evaluation

Characteristic	**Number (percentage)**	
Sex (%)	Female	7 (100)
	Male	0 (0)
Cultural heritage (%)	Black (British/African/Caribbean)	5 (71)
	White (UK/other)	2 (29)
Job designation within HEAL-D Online (%)	Dietitian	2 (29)
	Lay educator	2 (29)
	Physiotherapist	1 (14)

	Cooking session facilitator	1 (14)
	Service manager	1 (14)
Time working on HEAL-D Online (yr)	Median	2
	Range	<1y -9

Note: Denominator for each characteristic = 7 participants (unless otherwise stated).

Results

1. *Acceptance of HEAL-D Online for service users*

Service users' engagement with HEAL-D:

Eighteen courses ran between January and December 2022 offering 197 places for potential participants to attend. 135 places were booked, of which 84 patients attended the first session and 51 "did not attend", indicating a 62% attendance rate. An analysis of programme attendance showed that 65 individuals completed the course (attending at least 4/7 of the sessions), giving a completion rate of 77% for the 84 participants who attended the first session and 48% for the 135 people who were initially booked.

Interview data suggests that this high level of engagement for people who attended the first session may be related to both relevance of the course to their lives and the new knowledge gained from it.

> "*When I stumbled onto the programme, it just got my interest. You know the way the programme was being introduced. The topics, I was like, wow. I didn't want to finish because every day you go in, you learn a new thing."* (Service user 1013)

Service users' perceptions of service provision:

Figure 1 outlines participant satisfaction with the delivery of the seven key HEAL-D Online elements that were explored in the post course questionnaire (n=53). Nearly all participants were satisfied with the way that all seven key elements of HEAL-D Online were delivered. All

53 participants reported that the facilitator delivery was either excellent or good. At least 48 (91%) participants gave a similarly positive rating to the other aspects of HEAL-D Online, which included the initial contact with the HEAL-D team, interaction with the facilitator, HEAL-D participant pack, cooking and exercise sessions, and interaction with other service users. All participants reported they would recommend HEAL-D Online to family and friends. Qualitative data suggests peer support and achieving their learning goals were key reasons behind a willingness to recommend.

> *"The reason why I will refer other people to it [HEAL-D] is because I learned a lot about my diet, exercises, drinking, and hearing from other people, reassuring me that don't worry. It's gonna be OK. You're not on your own."* (Service user 1005)

Thirty-two service users were asked whether the HEAL-D Online programme met their expectations. All agreed that it had either met or exceeded their expectations. The fact that HEAL-D Online is attended only by people of African and Caribbean heritage made the experiences of living with diabetes more relevant to those attending the group and made HEAL-D Online more acceptable than other diabetes educational courses people had attended previously.

"*So that's what brought me back and also other people's experiences of black people's experiences of how diabetes affect them."* (Service user 1007)

2. The impact of a digital mode of delivery on service user participation

Service delivery data on the 53 participants showed that most (83%, n=44) found the BlueJeans video calling facilities (the online delivery platform used to deliver HEAL-D Online) easy to use and the instructions for use easy to follow (92%, n=49) (Figure 2), indicating that service users had little difficulty in using the technology. These findings are supported by interview data, which showed that nearly all participants had no major challenges using the technology to access HEAL-D Online, although a few had some issues

either downloading or accessing BlueJeans. Some participants commented that they were generally comfortable with using digital technology, whilst one service user had been provided with technical support by her granddaughter to access HEAL-D Online. Some stated that with the onset of the COVID-19 pandemic, in general people were more accustomed to programmes being delivered online.

> *"I suppose because we've come out of lockdown, I've been used to doing lots of things virtually anyway, because even a support group that I mean, that's been virtual, so that was OK.*" (Service user 1010)

This was reiterated by service delivery staff, who felt that service users had become more accustomed to online delivery of services due to the COVID-19 pandemic.

> "*I joined at a time where people have become used to virtual, if this was before COVID I think it would be a lot more challenging. It's almost like people are used to it and are more open to the idea now of doing things virtually*" (Service delivery staff 2002)

Qualitative data highlighted convenience and flexibility as two advantages of virtual course delivery. Not only was it easier for service users to attend the sessions, but they could also attend if they were away from home, and thereby not miss a session.

> *"I actually joined it while I was on holiday with the time difference and all that stuff, and there was another lady that I know that she was in [west African country] and she joined it as well. I really wanted to do it, so I took my computer with me and everything." (*Service user 1011)

Delivery staff recognised the benefits around the flexibility and convenience that virtual delivery provides, with the potential to allow more service users to access the HEAL-D programme.

> *"I think it's great because people, after work, can't always be somewhere face to face and you know having that option of just logging in whenever. We had people log in on their lunch break, we had people log in on their way to work and participate. So it opens up a door to people who don't want to do face to face sessions."* (Service delivery staff 2003)

3. The feasibility for service delivery staff to deliver HEAL-D Online.

The observational data showed that service delivery staff were successful in delivering the components of HEAL-D using a digital platform and that HEAL-D Online was being delivered as intended. This is indicated by a mean fidelity score of 94% (Appendix v) showing that 118/126 items on the fidelity checklist were observed by two independent raters during the delivery sessions. Inter-rater reliability between the two independent observers showed 100% agreement on the three joint observations. The observation data showed that service delivery staff achieved 100% fidelity in 4 of the 7 sessions, and it was only in one session that the fidelity rate was less than 90%.

Although the observational data indicated the feasibility of delivering HEAL-D Online, qualitative data identified challenges in delivering these sessions from service delivery staff. Those who had previously been involved in face-to-face delivery noted how online delivery requires different skills to ensure that service users are engaged.

> "*When you're online I feel that you have to work extra hard to keep people engaged and one of the ways to do this is by being "more animated*" (Service delivery staff 2007)

These issues could arise in balancing the importance of showing respect for the older age group in African and Caribbean culture with their potential lack of knowledge in using the new technologies. For service delivery staff, it was important to recognise this where individuals faced challenges with the technology.

"*Respect and regard for this kind of age group is quite important in the black African and Caribbean culture, and to help them to not feel silly or to carry them along very respectfully, but in a way that they don't feel that they are technologically behind. I think it takes a different kind of skill because they're also dealing with a chronic illness, which they're probably really worried about. So, it's kind of trying to lighten that and make it not such a big deal [if they struggle with the technology]*" (Service delivery staff 2007)

Another key challenge with online delivery was encouraging interaction and engagement with service users, especially at the start. The option to turn cameras off further added an additional complexity when trying to assess service user participation and engagement.

"*There's an option to turn your camera off. So those people who are just signing in because they feel they need to show that they are attending but will turn the camera off and not engage in any conversation, that can be quite challenging. Whereas if they physically were there, they can't turn the screen off.*" (Service delivery staff 2002)

This difficulty in assessing engagement resulted in safety concerns when delivering the exercise component and made it harder for the physiotherapy team to determine the right level of exercise for the group.

"*If someone's cameras are off, it can be quite difficult to gauge how they're finding it, so thinking of a safety element as well, it can be difficult to know. And you know, am I offering the right options? Is it too easy or hard? Even when the cameras are on, it's quite difficult. You can't hear someone breathing heavily or not. And sometimes you can't see their whole body.*" (Service delivery staff 2006)

Delivering the cooking session effectively online was also challenging, as there are sensory aspects, such as smells and physically seeing and touching the ingredients, that are difficult to recreate in a virtual environment.

"It's quite different to being in the kitchen where people are quite engaged if there's a lot of sensory aspects to being in the kitchen, the smells, the auditory, the touch. When you're online, you have to work extra hard to keep people engaged, even though our videos are fantastic." (Service delivery staff 2007)

An additional challenge in the online delivery was the use of a digital platform that service delivery staff were unfamiliar with. It was not possible to use the digital platforms that delivery staff were used to, such as Zoom or Microsoft Teams, as they were not considered secure enough to deliver patient care. Instead, the health providers used a digital platform called BlueJeans which works in a similar way to Zoom or Microsoft Teams, but has high levels of data security. Unfortunately, many service delivery staff had issues using BlueJeans in delivering the online course, such as sharing session videos or understanding how to operate the platform, even for staff who consider themselves "tech savvy".

"Some of the feedback we get is a difficulty with BlueJeans, like some of the dietitians find that quite difficult to navigate. I guess we use MS Teams most of the time, so it's kind of like using a different system." (Service delivery staff 2001)

It was acknowledged that over time the online platform became easier to use as they became more familiar with it.

"We now know exactly what settings are [needed] and are better at troubleshooting. Now if something were to happen just through that experience, some of it happening before. So yes, I definitely feel like it's much smoother." (Service delivery staff 2006)

4. Potential benefits to service users from participating in HEAL-D Online

Service users reported a range of benefits from participating in HEAL-D Online (Figure 3). All agreed that it was helpful to meet other people with diabetes and that it provided them with support to live with diabetes. Most felt they learnt practical skills and that it helped their confidence in managing their diabetes. The qualitative data further illustrated that service

users felt that they were more knowledgeable on diabetes management and recognised the importance of managing their diet, understanding their food intake, doing more exercise and regularly monitoring their weight and blood sugar levels.

> *"How to manage my diabetes in regard to the kind of food I eat. These are routines that I never used to do. Now I'm very careful what I eat. I watch the portion sizes. I do the exercises and then I'll make sure that the way the food is prepared, because the way most of our foods are prepared, that's where we get it wrong."* (Service user 1013)

Of the 32 service users asked, 78% (25/32) self-reported weight loss following the HEAL-D programme, and 72% (23/32) noticed a reduction in waist measurement. Service users showed improvement in diabetes-related emotional distress after completing HEAL-D Online, with a reduction in total median PAID-5 scores from 7 at pre-course to 4 at post-course. This improvement was further illustrated by a decrease in the proportion of participants showing diabetes-related emotional distress (i.e. PAID-5 score ≥ 8) from 49% pre-course to 23% at post-course. The qualitative data further supports this quantitative evidence of potential benefits, with service users reporting that they had changed their dietary and exercise behaviour and had become more conscious of monitoring their weight and blood sugar levels. Service users felt more confident in managing their diabetes. For some service users, this also improved their level of happiness.

> *"It makes me feel happier with myself as a person and makes me feel better knowing that I'm trying all I can to manage my diabetes."* (Service user 1013).

Qualitative data suggested that HEAL-D Online acts to build both the confidence and the social support network of service users which facilitated their ability to use the skills taught during the programme to manage their diabetes. Most acknowledged the role of the educators' ability in engaging service users, and creating a safe and non-judgmental space to discuss sensitive topics.

> *"They (the facilitators) were lovely in how they presented the course, the way they were engaging and how they're having the discussions. They were supportive and encouraging. They make you feel involved and welcome. So you can literally be yourself and then, it allows you to be more open, to be able to discuss things that you normally don't talk about."* (Service user 1011)

Even using a digital platform, the educators were able to create a safe space for service users that encouraged them to develop a forum for peer support, create group cohesion and provide the conditions for service users to share stories and experiences. By sharing learning amongst themselves, service users could find relevant solutions in living with diabetes and reassurances that their situation was not unique and that other people from similar cultural backgrounds had experienced similar situations.

> *"The thing is that we're talking, no one was looked down upon. Everybody was listening to you. It was just like a little family gathering, whereby we could talk to each other and tell people what is wrong with us and find solutions." (*Service user 1013)

5. Improvements to HEAL-D Online

Qualitative data indicated that service users were generally overwhelmingly positive about the programme. From the interviews, two service users felt that no further improvement was necessary, with the remaining 12 identifying specific issues in two key areas: 'post-course follow-up support' and 'increasing engagement for those with impairments'.

Post-course follow-up support

Many service users had a sense of loss when the HEAL-D Online programme ended. Most would have liked follow-up from the HEAL-D team. One felt that a post-course review would encourage participants to maintain their commitment to changing their behaviour.

> *"I think a monthly or quarterly review (after the last session). Just call the participant "how are things, is everything OK, any challenges, can we support you? Say that you'll be receiving a call from the team, who may ask about your diet? May be useful if you're not someone that can self-motivate, you will just slide back to your old habit"* (Service user 1011)

Many service users made close connections with their peers and would have liked to have maintained these once the course had finished. Some suggested sharing contact details, with one suggesting specifically setting up a WhatsApp group to connect peers as a source of support and advice.

Increasing engagement for users with impairments

Service users reported that it is important for course administrators to check with service users if they had any issues or impairments which limit their ability to participate with the delivery of an online programme. One service user with a visual impairment had difficulties in seeing the slides on their phone.

> *"The slides could have been clearer, so more work to be done on the slides so if you were viewing it on a computer or a phone, you would be able to see."* (Service user 1007)

Discussion

This evaluation demonstrates the feasibility of implementing a virtually delivered culturally tailored T2D self-management programme specifically aimed at the UK African and Caribbean population. To the best of our knowledge, this is the first of this type of diabetes management programme for this community delivered using a digital platform. Our findings showed a high level of acceptance amongst service users, as highlighted by a 77%

completion rate of service users who attended the first HEAL-D Online session. Service users appreciated the convenience and flexibility that the online programme offered.

Service delivery staff were successful in delivering the key elements of the programme (educational sessions, exercise class, cooking workshop) using an online platform, whilst service users generally had few problems using the technology to access the programme. At the same time, qualitative findings highlighted potential safety issues that future service delivery staff need to be aware of in delivering, for example exercise sessions, especially if HEAL-D Online is scaled up to a national level.

HEAL-D Online showed potential service user benefit in improving both understanding of diet and knowledge of diabetes management and its ability to encourage the behavioural change needed to elicit a subsequent reduction in weight and blood glucose level. A reduction in diabetes-related distress was also observed following attendance at the programme. Qualitative findings illustrated that the supportive elements provided by the educators could also be recreated using an online platform such as the ability to provide a safe environment for service users to ask questions, allowing open discussions and supporting conditions for peer support.

Service delivery data showed that attendance uptake of 62% for HEAL-D Online was high compared with the national attendance figure of 8.2% of people with T2D who are offered to attend a structured diabetes educational course [16]. This suggests that HEAL-D Online is successfully targeting and engaging with individuals. Nevertheless, this evaluation was unable to record reasons why the remaining 38% did not attend their first session and it is important to understand if people are unable to take up the offer of HEAL-D Online because of its digital nature, and if non-attendance at session one was because of digital poverty and digital literacy. A limitation of this evaluation was that no attempt was made to explore this, but there is currently a clinical trial underway which potentially will address these issues [17].

Service users were happy with the programme content but would have appreciated further follow up afterwards. Specific improvements to the programme include providing post-intervention support from the HEAL-D Online team and a needs assessment for attendees with sensory disabilities to ensure better accessibility during the sessions and to check that programme participants can read the presented material, for them to gain the most out of the sessions.

Some caution is needed in interpreting these findings. Both the service delivery data and qualitative data are from service users who completed the course, which indicates some level of self-selection bias. It is not possible to comment on the representativeness of the service users to the intended target population as no demographic data were collected from those who completed the service delivery questionnaires, although demographic data from the qualitative sample suggested the intended population was targeted. Future evaluations would need to incorporate the views of service users who did not complete the sessions or take up their places, to understand why they did not accept and explore potential barriers to accessing HEAL-D Online.

Our sample of service users appeared to be digitally literate or had family members who could provide necessary support. This sample had access to a range of devices such as laptops, tablets or mobile phones. Although the COVID-19 pandemic and associated rapid digital transformation have provided people with greater exposure and confidence in using digital technology, 'digital poverty' is still an issue, with 10% of the adult UK population lacking access, skills or confidence to use the internet or digital technology [18], and rates are highest in both older and socioeconomically deprived people, who are also more likely to live with T2D [19]. In addition, specific issues such as distrust of technology and lack of understanding of how to navigate online health services are recognised in people from minority ethnicities [20]. This is an area where more studies are needed to explore if digital-specific issues are a cause of non-attendance. This evaluation relied on self-reporting in measuring weight loss and future evaluation should aim to collect the relevant key clinical

outcomes (weight and blood glucose levels) to objectively confirm that a change in clinical outcomes has occurred. Finally, as there was no control group, it cannot be concluded that the potential patient benefits identified were because of HEAL-D Online. Evaluating this question would require testing using an experimental design.

Conclusion

It is feasible to deliver HEAL-D using an online platform, with online delivery achieving similar goals compared with its face-to-face counterpart, Implementation challenges focused on identification, recruitment and referral of eligible patients into the programme and safety issues need to be considered when delivering the exercise component. Subsequent studies need to establish scaled implementation feasibility and causal links between HEAL-D Online and diabetes outcome improvement.

WORD COUNT: 5358 (MAX 5000)

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Provenance and peer review: Not commissioned; externally peer reviewed.

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List of figures

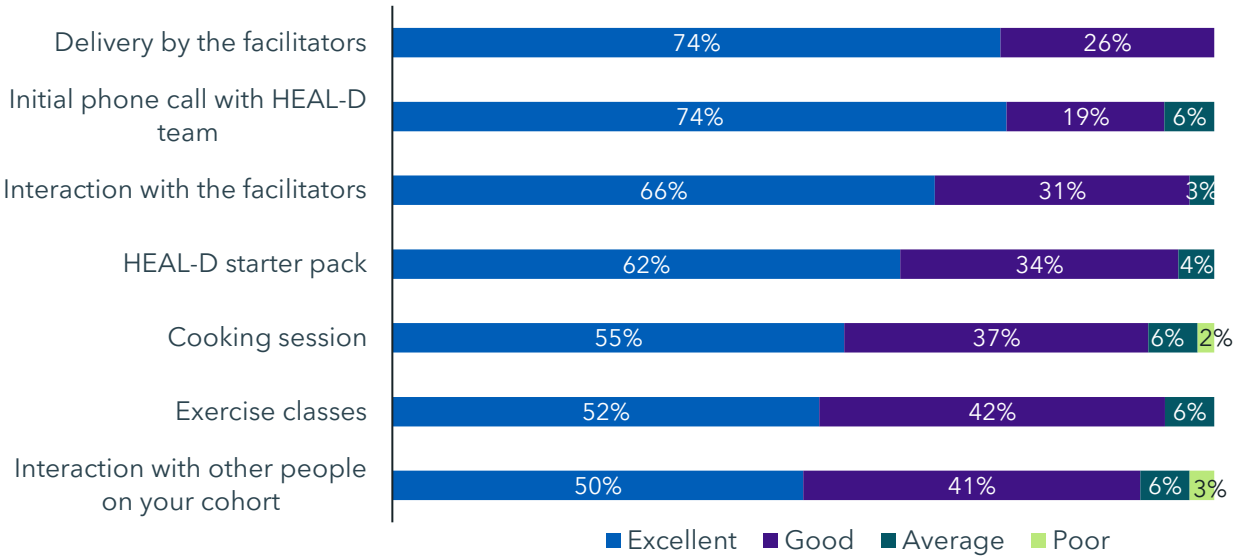

Figure 1 Satisfaction with the 7 elements of delivery in HEAL-D On-line (n=53)

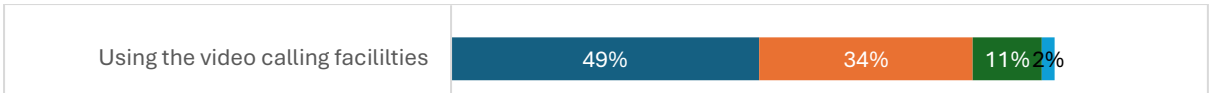

Figure 2: Ease of using the Video Calling facilities for HEAL-D Online (n=53).

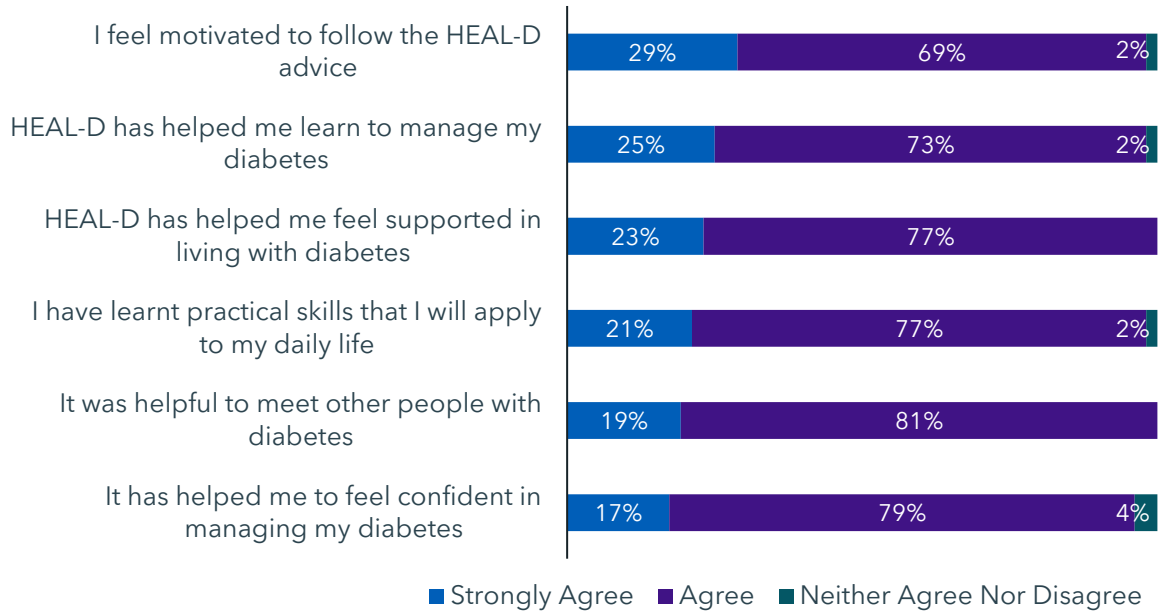

Figure 3 Learning outcomes following HEAL-D Online (n=53)

Appendix i: Post HEAL-D course questionnaire

All HEAL-D Online course participants get asked the below questionnaire (over the telephone) at the end of the course.

Question	**Response options**
Attendance status *(this is completed by the person asking the questions)*	Attended Cancelled Did not attend
How did you hear about HEAL-D?	GP Diabetic nurse Dietician Family / friend Other (please note)
When you first heard about HEAL-D, what 3 main things did you expect to get out of the course? To what extent were these expectations met? Were your expectations exceeded, met, partially met or not met?	*Free text box* Exceeded met partially met not met
On a scale of 1-5 where 1 is not a problem and 5 is a serious problem, please can you rate the following statements: Feeling scared when you think about living with diabetes Feeling depressed when you think about living with diabetes	1 Not a problem 2 Minor Problem 3 Moderate problem 4 Somewhat a serious problem 5 Serious problem

Worrying about the future and the possibility of serious complications Feeling that diabetes is taking up too much of your mental & physical energy every day Coping with the complication of diabetes	
Please rate the following statements about HEAL-D, on a scale of 1 – 5 where 1 is strongly agree and 5 is strongly disagree HEAL-D has helped me learn to manage my diabetes I have learnt practical skills that I will apply to my daily life I feel motivated to follow the HEAL-D advice HEAL-D has helped me feel supported in living with diabetes It was helpful to meet other people with diabetes	1 Strongly agree 2 Agree 3 Neither agree nor disagree, 4 Disagree 5 Strongly disagree
Please rate the following aspects of HEAL-D on a scale of excellent, good, average or poor. And can you please let me know why you have given this rating? Initial phone call with HEAL-D team HEAL-D starter pack Exercise classes Cooking session Delivery by the facilitators Interaction with the facilitators Interaction with other people on your cohort	Excellent Good Average Poor *Free text box for comments after each*

Thinking about the video calling facilities, How easy did you find it to use? On a scale of 1—5 where 1 is very easy and 5 is very difficult How did you find the instructions for using BlueJeans? Excellent, good, average or poor?	Very Easy, Easy, Neither Easy nor Difficult, Difficult, Very Difficult Excellent, good, average or poor
Have you lost any weight since you started the course? Have you noticed a reduction in your waist measurements?	*Open text boxes*
If HEAL-D was available face-to-face or remote, which would you prefer?	Face to face Remote No preference
When would be your preferred timing for attending HEAL-D?	no preference weekday daytime weekday evening Saturday morning
Overall - Please tell us what went well	*Open text box*
Overall - Please tell us if there is anything that you believe would enhance the course	*Open text box*
Overall - Would you recommend HEAL-D to family/friends (Yes / No)	Yes No
Do you have any other comments/feedback?	*Open text box*
We are currently completing an evaluation of the HEAL-D programme, and we are asking people to complete a telephone / video interview in order to find out their experiences. It will be similar to this questionnaire, and	Yes No

will take approx. 30 minutes. You will also be offered £15 for your time. If you would be interested in taking part, can you please confirm that you are happy for me to share your details with the project team?	
HEAL-D is currently only delivered in South London, but we are looking to develop it further. Would you be interested in hearing about HEAL-D in the future?	Yes No

Appendix ii: Topic guides for service users.

HEAL-D – Service User Interviews
Sign up script and form

Script to use to speak to individuals when signing up to complete form below:

[INTRODUCE SELF, RESPONDING TO EMAIL / CALL RE: HEAL-D CONVERSATION].

Thank you for offering to have a conversation with us around your experience of the diabetes self-management HEAL-D online course, we are very grateful to have your input.

You may have previously completed a telephone questionnaire after HEAL-D, this conversation may feel similar to that but we just want to find out a bit more detail.

Can we please arrange a date and time for full conversation. It is expected to take around 45 minutes, depending on your answers. We would like to conduct this virtually via video call on Microsoft Teams [if not possible, can do via telephone].

[IF MS TEAMS / ZOOM] I will need to send you an invite via email so that you have a link to click on, can you please give me your email address. When I email you I will also send a copy of an information sheet which just gives you a bit of information about why we are doing this.

[IF TELEPHONE] I can give you a ring.

[ARRANGE DATE, TIME & TELEPHONE NUMBER / EMAIL THAT IS BEST AND COMPLETE TABLE].

Also, you may be aware that you can be £15 paid for your time – this can be either bank transfer or shopping voucher. Would you like to receive this?

[IF YES]:

- [IF BANK TRANSFER] Please can you have your bank details to hand when we call you and we can fill in the form with you over the phone.
- [IF VOUCHER] We can offer you a high-street shopping voucher which will be sent to you after the conversation in the post or via email

[IF NO] – thank you. If you change your mind about this, please just let us know when we call you back for the conversation.

Name	
Date & time of interview	
Interviewer Name	
Interview method	☐ Telephone ☐ MS Teams video ☐ Zoom
Email address / number to call on	
Payment	☐ No ☐ Yes – Bank Transfer ☐ Yes – Voucher
Any special requirements	☐ None ☐ Interpreter ☐ Equipment Details (if applicable):

Thank you for your time. I / my colleague, look forward to speaking to you on [DATE and TIME].

HEAL-D Service User Interview Topic Guide

Introduction
Introduction Hi, I am [INTRODUCE SELF] Before we start, can you please confirm your name? **Purpose of discussion:** Thank you for agreeing to talk to me today. This discussion is expected to last approximately 30 - 45 minutes dependent on your responses. The purpose of this discussion is to understand your experience as a someone who has recently taken part in the HEAL-D online course.

You may have previously completed a telephone questionnaire after HEAL-D, this conversation may feel similar to that but we just want to find out a bit more detail. So, it may feel like you are repeating yourself a bit, but please don't worry about this. **Consent:** [If consent form sent in advance over email] Have you read the information sheet and consent form that we sent to you? [If consent form not sent in advance] Run through information sheet and consent form. Confirm consent *[INTERVIEWER NOTE]* *If telephone OR MS Teams, obtain consent on audio recording.* *Check whether participant has any questions and is happy to begin the interview.*

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START RECORDING AND TRANSCRIPTION (IF APPLICABLE) I am going to take some notes throughout our conversation, so you may hear some typing. I also may need to ask you to pause briefly whilst I write up any key points.	
BACKGROUND	
Before asking you about your HEAL-D experience, it would be great to learn a bit more about you. **Can you tell me about when you were diagnosed with type 2 diabetes?** *Prompts (pick out a selection as needed)* • When were you diagnosed with type 2 diabetes? Was it recent? • What support were you offered?	2min
SECTION 1 – BEFORE HEAL-D ONLINE	
For this set of questions, I'd like you to think about the time before you started the HEAL-D course. **Can you tell me about when you first heard about HEAL-D Online?** *Prompts*	5min

• Who told you about it / referred you? • Had you just been diagnosed with Type 2 diabetes? • What was your first impression of HEAL-D Online? • Have you done / been invited to take part in other courses like this before? • How did you feel about the course being virtual (via video call)?	2min
Can you tell me about any information you received before starting the course? *Prompts* • Did anyone from the course call you? If yes, who was it with and what did they say? • Did you receive any paperwork? • How did you find this information?	1min
Is there anything else you would you have liked to have known before you started? *Prompts* • Would you have felt any differently if you had heard from other people who had completed HEAL-D online?	
SECTION 2 – DURING HEAL-D ONLINE	
For this set of questions, I'd like you to think specifically about your experience whilst you were completing the HEAL-D online course **Can you tell me about the starter pack materials you were sent? E.g. the booklet, measuring tape and pedometer.** *Prompts* • Did you receive these before your first session? • Were they helpful? • Did you feel anything was missing? • Would you have liked the material in a different form? E.g. a different language?	2min 3min
How did you find accessing the sessions online via BlueJeans? *Prompts* • Were you able to attend all the sessions? • Did you use your mobile phone / computer / tablet / other? • Did you need any assistance to log in? • Did you have any challenges with BlueJeans?	2min
Can you tell me about your first session of HEAL-D Online?	

Prompts • How long after referral was your first session? • Was there anything that made you want to come back for future sessions?	1min
How did you find the timing of the sessions? *Prompts* • Did they fit with your lifestyle? • Were you able to attend all the sessions?	2min
How did you find the exercise component of HEAL-D Online? *Prompts* • Did you stick to the programme?	2min
How supported did you feel when you were completing HEAL-D Online? *Prompts* • Did you keep in touch with anyone from the group in-between sessions? • Did you know who to contact if you had any questions? • How did you find the facilitator and lay educator? Did they attend every session?	2min
How did you find the resources on the website? *Prompts* • If used, how useful did you find these? Was everything available that you wanted? Was there anything you felt was missing? • If not used, why not?	4min
What do you believe are the key things you learnt from HEAL-D Online? *Prompts* • What was most important to you? • What have you taken away to help you live with diabetes? • What did you learn about diet and exercise?	
SECTION 3 – AFTER HEAL-D ONLINE	
Lastly, I'd like you to think about more recently and after you completed the HEAL-D online course. **How has taking part in HEAL-D Online impacted your lifestyle?** *Prompts* • Have you kept up with the course and exercise?	3min

• If you were monitoring your waist measurements, weight and/or HbA1c as part of HEAL-D, have you continued to do this?	
Has HEAL-D Online helped you to manage your diabetes? *Prompts* • Do you use things you learnt during HEAL-D to help manage your diabetes?	2min 2min
Have you told your GP / GP surgery / who referred you about how you found HEAL-D Online? *Prompts* • Have they followed up with you since you were referred?	2min
Would you recommend HEAL-D Online to others? *Prompts* • Why?	2min
What have you gained from participating in HEAL-D online? *Prompts* • Why?	2min
Is there anything that you think would help to improve HEAL-D online? *Prompts* • Why?	
OVERALL AND ADDITIONAL INFORMATION	
Is there anything else about your HEAL-D experience that you would like to comment on that we have not discussed?	3min
Would you like a copy of the evaluation report?	1min
THANK YOU & CLOSE	
That is the end of our discussion. Thank you for your participation. Do you have any questions?	

I will now stop the recording (if applicable) **STOP RECORDING AND TRANSCRIPTION (IF APPLICABLE)** You may remember that we are offering a £15 payment for your time and contributions. You previously said you would / would not like to take this up. Is this still the case? [IF YES TO BANK TRANSFER] *go through Payment Request Form and collect bank details.* [IF YES TO VOUCHER] *either collect address for physical voucher, or confirm email address for e-voucher. Contact Sophie to arrange vouchers.*	

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Appendix iii: Topic guides for service delivery staff.

HEAL-D
Sign up template and form

Use the email template below to invite staff:

Title: HEAL-D Service Evaluation – we want to speak to you

Text:

Dear [NAME],

My name is [NAME] and I am [role] at the Health Innovation Network, a NHS organisation hosted by Guy's and St Thomas' Hospital. I am getting in touch as we are in the process of evaluating the HEAL-D service in order to collect information on how the service is currently working, providing evidence for future commissioning as well as suggestions for improvement.

We would be really grateful to speak to you about your role in HEAL-D. We call this an 'interview', but please be assured that this is just a conversation! The conversation will take about 30 minutes in total. Please see the attached information sheet for more information.

We are looking to conduct these interviews over Microsoft Teams (we can use another platform if preferred) during January 2023. Can you please let me know when you would be available for the interview and I can send you a calendar invite with the link.

Please do let me know if you have any questions at all and I look forward to hearing from you.

Best wishes / Many thanks etc….

Name	
Date & time of interview	
Interviewer Name	
Interview method	☐ Telephone ☐ MS Teams video ☐ MS Teams conference call ☐ Zoom
Email address / number to call on	
Any special requirements	☐ None ☐ Interpreter ☐ Equipment Details (if applicable):

Interview Topic Guide

INTRODUCTION	Time
Introduction Hi, I am [INTRODUCE SELF] Before we start, can you please confirm your name? **Purpose of discussion:** Thank you for agreeing to talk to me today. This discussion is expected to last approximately 30-40 minutes dependent on your responses. The purpose of this discussion is to understand your experience as a someone who has supported the delivery of the HEAL-D online course. **Consent:** Have you read the information sheet and consent form which was emailed to you? Do you have any questions? Run through consent. *[INTERVIEWER NOTE]* *If telephone OR MS Teams, obtain consent on audio recording.* *Check whether participant has any questions and is happy to begin the interview.*	

START RECORDING AND TRANSCRIPTION (IF APPLICABLE)	
I am going to take some notes throughout our conversation, so you may hear some typing. I also may need to ask you to pause briefly whilst I write up any key points.	
SERVICE EXPERIENCE	
First I'd like to ask a bit about your background just to get to know you. How long have you been working on HEAL-D and have you delivered any other similar courses before? *Prompts*	

- What were your first impressions of HEAL-D when you first heard about it?
- [If working on HEAL-D since it was implemented/the start] How were you involved in the implementation of HEAL-D Online in south London?

What is your role in the HEAL-D service?

Prompts

- Do you have direct contact with service users?
- What parts of HEAL-D are you involved in?
- Has your role changed over time?

To you, what are the core elements of HEAL-D?

Prompts

- What makes HEAL-D different from any other courses?
- What are the key stages in the HEAL-D process?

How have you found delivering HEAL-D virtually?

Prompts

- Have you ever delivered it in person? If yes, what were the differences?
- How have you found the technology?
- Have any service users ever provided you with feedback on the digital model?
- How does a digital model affect service user participation? / What implications does a digital model of delivery have on participation?

What impact do you believe HEAL-D provides for service users?

Prompts

- What positive impacts do you think there are for service users? How does HEAL-D benefit service users?
- What negative impacts do you think there are?

What impact do you believe HEAL-D provides for the service?

Prompts

- What positive impacts do you think there are for the service (HEAL-D and diabetes provision more generally)?
- What negative impacts do you think there are?
- What impact do you think HEAL-D has on service outcomes?

What impact do you believe HEAL-D provides for the health system?

Prompts

• What positive impacts do you think there are for the health system in south London? • What negative impacts do you think there are? **Overall, can you please tell me about how you have found delivering HEAL-D online?** *Prompts* • What has worked well? • What hasn't worked so well? **Is there anything that you think would help to improve HEAL-D online?** *Prompts* • Why?	
CLOSING REMARKS	
Is there anything else about your HEAL-D experience that you would like to comment on that we have not discussed?	3 mins
THANK YOU & CLOSE	
That is the end of our discussion. Thank you for your participation. Do you have any questions? I will now stop the recording (if applicable) **STOP RECORDING AND TRANSCRIPTION (IF APPLICABLE)**	

Appendix iv: HEAL-D Online - Fidelity Checklist

The purpose of this checklist is to assess fidelity to the core components and principles underpinning HEAL-D online.

Core components

Timeframe	Component	Metric	Data source
Prior to HEAL-D	Initial phone call	All HEAL-D service users to have had initial phone call with HEAL-D team prior to starting HEAL-D course	Self-reporting from service users during interviews and post course questionnaire
Prior to HEAL-D	Starter pack	HEAL-D starter pack delivered to all service users prior to starting HEAL-D course	Self-reporting from service users during interviews and post course questionnaire
During HEAL-D	Delivery	All HEAL-D sessions delivered virtually, using BlueJeans platform Sessions delivered to a cohort Minimum number of X service users per cohort	Self-reporting from service users during interviews and post course questionnaire. Observations.
During HEAL-D	Attendance	Service users attend X% of sessions Service users attend X% of each two-hour session	Self-reporting from service user and staff interviews – including reasoning for dropping out of sessions (or joining late) eg. technical issues GST spreadsheet
During HEAL-D	Structure	7 HEAL-D sessions, which include: • 5 exercise classes • 1 cooking session • 7 education sessions • Activity cards at each session, and feedback at the following one	Self-reporting from service user and staff interviews – ask them to describe the format of HEAL-D. Observations.
During HEAL-D	Waist measurements	All service users requested to take waist measurements	Self-reporting from patients and staff interviews and post course questionnaire
During HEAL-D	Resources	All resources available on website	Self-reporting from service user and staff interviews
After HEAL-D	Post-course questionnaire	Post course questionnaire completed with all service users who started the course	Post course questionnaire analysis

Core principles

Principle	Metric	Data source
Staff	All service delivery staff trained in how to deliver HEAL-D All sessions delivered by a facilitator and a lay educator	Self-reporting from service user and staff interviews Observations
Adherence	All service users to have attended x% of course No. of service users per cohort No. of sessions attended by service users No. DNAs No. of completers	Service delivery staff data collection (spreadsheet) Observations
Cultural sensitivity / competence	Opportunity for service users to ask questions Questions answered by educators	Self-reporting from service user and staff interviews Observations
Underpinning theory - social connectedness	Facilitator and participant interaction Participant and participant interaction	Self-reporting from service user and staff interviews Observations
Underpinning theory – behaviour change	Behaviour change theory utilised (see appendix for details)	Self-reporting from service user and staff interviews Observations
HEAL-D ethos and behaviours	Interaction with service delivery staff Interaction with peers Perceptions on relevance Perceptions on acceptability	Self-reporting from service user and staff interviews Observations

Observation checklist

The purpose of this checklist is to provide a structure for observations where fidelity to the core components and principles underpinning HEAL-D online are being assessed.

Core Components

Delivery

☐ Delivered virtually (via BlueJeans)

Structure

☐ Feedback on previous activity card at the start of the session (*except session 1*)

☐ Education session (*except at cooking session*)

☐ Exercise class (*except at session 1 or cooking session*)

Core Principles

Staff

Cultural sensitivity / competence

☐ Culturally specific elements are raised / addressed

Underpinning theory – behaviour change

HEAL-D ethos and behaviours

☐ Interaction with service delivery staff

☐ Interaction with peers

CHECKLIST TOTAL

Session 1		Cooking session		All other sessions
/10		/12		/13

Description of the intervention components to support each behavioural change technique

Behaviour Change Theory	Intervention component
Social support (unspecified)	Social connectedness will be fostered within the group by the discursive nature of the sessions and through shared engagement in activities and structured exercise sessions
Social comparison	The '*homework'* activities will give participants opportunity to try the lifestyle targets and come back to discuss with the group and with educators. Participants will be encouraged to share their successes to encourage comparison within the group. In addition, role models will be featured in the case study video
Credible sources	Videos will be used as part of the intervention which include advice and tips from community leaders, healthcare practitioners and patients from the community that have successfully changed their habits
Information about health consequences	The educational curriculum will cover health consequences and benefits of various key lifestyle behaviours A video will explain the mechanisms of type 2 diabetes
Feedback on outcomes, self-monitoring of behaviour	Programme will start with personal measurements and blood results, and updated outcome measures will be given at the end of the programme. They will be encouraged to monitor their waist measurement through the course by completing their programme booklets.
Self-monitoring of behaviour, action planning	Participants will be given pedometers to measure their steps and will be taught to develop action plans and measure their progress against them.
Instruction on how to perform the behaviour	The curriculum will communicate health guidance clearly using culturally relevant examples.
Demonstration	Practical games, the weekly discussion tasks, a cooking session and structured exercise sessions will provide guided demonstration. An exercise DVD will be provided for participants to follow at home.
Graded tasks	Physical activity sessions and targets will be graded for ability to boost chances of success hence confidence and self-efficacy.
Goal setting (behaviour)	Participants will be guided through setting their own goals for the lifestyle targets that are important for them

Behaviour Change Theory	Intervention component
Problem solving	The '*homework'* activities will be discussed at the beginning of each session, challenges will be identified and the group will problem solve collectively. Problem solving will also form part of the education sessions about lifestyle habits.
Action planning	Participants will be guided through how to develop and adjust action plans for each of the target behaviours and for their personal objectives, to help keep them motivated.

Appendix v: Fidelity ratings of the 7 HEAL-D Online sessions.

Session	Fidelity ratings (%) Observer 1	Fidelity ratings (%) Observer 2	Fidelity ratings Combined observers (1&2)
1	10/10 (100)	-	10/10
2	12/13 (92)	-	12/13
3	13/13 (100)	13/13 (100)	26/26
4	13/13 (100)	-	13/13
5	13/13 (100)	13/13 (100)	26/26
6	11/12 (92)	-	11/12
7	10/13 (77)	10/13 (77)	20/26
Total fidelity scores	82/87 (94)	36/39 (92)	118/126 (94%)