Received: 24 July 2024 | Accepted: 13 March 2025

DOI: 10.1111/dme.70032

DIABETIC Medicine

RESEARCH ARTICLE

Educational and Psychological Aspects

Understanding behaviour change maintenance after attending a self-management education and support programme for type 2 diabetes: A longitudinal qualitative study

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Abstract

Aims: This study aimed to explore behaviour change maintenance experiences of adults with type 2 diabetes over 15 months following attendance at a diabetes self-management education and support (DSMES) programme and their needs for post-programme support.

Methods: A longitudinal qualitative study using four interviews and experience sampling (written notes and photographs) was conducted. Data were analysed through a deductive analysis based on an existing framework combined with an inductive thematic analysis approach.

Results: Twenty-one adults (67% women, aged 39–74) participated; seventeen completed all interviews. Analysis resulted in the refined **S**upporting **U**nderstanding and **S**trategies for **T**ype 2 Diabetes M**ain**tenance Self-Management (SUSTAIN) framework and three themes capturing key trends and changes over time: (1) integrating the changes amidst the constant ebb and flow of life; (2) consolidating the changes: moving towards independent maintenance; and (3) building bridges to self-maintenance: the role of support post-programme.

Conclusions: People may experience difficulties in maintaining behavioural changes post-DSMES programmes. Programmes should address the role of emotions, psychological and physical resources and environmental and social influences in behaviour change maintenance and promote the development of skills for longer-term management, including self-regulation, behavioural autonomy, intrinsic motivation and habit formation. As some people may also benefit from longer-term, ongoing support, digitally delivered with occasional sessions involving peers and educators beyond 12 months should be considered. Suggestions for ongoing support include progress monitoring, expert guidance, educational updates, troubleshooting opportunities and encouragement and motivational support.

KEYWORDS
behaviour change maintenance, patient experience, qualitative research, self-management, structured education, type 2 diabetes

1 | INTRODUCTION

Type 2 diabetes (T2DM) is one of the fastest-growing chronic diseases and a leading cause of death and disability worldwide.[1] Secondary prevention programmes, such as diabetes structured education and support (DSMES) programmes, are, therefore, critical to support T2DM management and mitigate this impact. Empirical evidence indicates that DSMES programmes reduce the risk of health complications, mortality and healthcare costs while improving clinical, behavioural and psychosocial outcomes.[2,3] Consequently, international clinical guidelines recommend that DSMES programmes be offered to all people diagnosed with T2DM after initial diagnosis and at other critical junctures.[4,5]

Despite evidence of initial benefits, long-term data suggests that improvements in glycated haemoglobin (HbA_{1c}), weight, and other relevant clinical outcomes are often not sustained.[6,7] This may be because people with T2DM diabetes can struggle to maintain positive behavioural changes after DSMES participation.[8,9] In behavioural science, this process is termed behaviour change maintenance and can be broadly defined as the process of consistently maintaining behavioural changes across time and contexts following an initial intentional change at a level that significantly differs from the baseline performance in the intended direction.[10,11] The effective self-management of T2DM relies on the adoption and maintenance of a complex array of health behaviours by those living with the condition.[12] Examples of these behaviours include eating a healthy diet that is low in fat and rich in fruit, vegetables, and fibre, engaging in physical activity regularly, taking medication as prescribed, self-monitoring blood glucose as per prescribed, drinking alcohol in moderation, if at all; quitting smoking; caring for feet (e.g., regular examination and hygiene), and attending regular medical appointments (e.g., annual follow-up appointments) and health screenings (e.g., foot and eye exams).[12,13] While the health benefits of early glycaemic improvements persist despite the attenuation of programme effects, maintaining changes in behaviours and outcomes could enhance long-term benefits for individuals and healthcare systems.[14]

Therefore, the need for further research into the maintenance of self-management after DSMES programme attendance and requirements for ongoing support to mitigate the attenuation of programme effects has been highlighted.[6,7] To address this gap, in a previous systematic review, we synthesised qualitative evidence on factors influencing T2DM management after attending a self-management support intervention.[10] This review resulted in the development of an initial framework of 12 constructs and 12 sub-constructs, grouped into five theoretical themes specific to behaviour change maintenance: maintenance motives, self-regulation, habits, resources (psychological and physical assets that can be used during the process of behavioural regulation) and environmental and social influences (see Figure 1 for more detailed information).[10,11] Identified barriers include concurrent health problems, competing life demands, negative emotions, forgetfulness, non-routine environments, sociocultural norms and behavioural self-regulation.[10] Enablers include enjoyment of behaviour, satisfaction with outcomes, habit formation, self-determination and fear of negative health outcomes.[10] Support from family, friends and healthcare professionals, and access to appropriate support and materials, may also enable the maintenance of self-management behaviours, depending on availability.[10] However,

What's new?

- Type 2 diabetes structured education and support (DSMES) programmes improve outcomes. However, these improvements often fade over time.
- Maintaining behavioural changes initiated during DSMES is critical for long-term benefits, but this can be challenging.
- This study explored behaviour change maintenance and support needs over 15 months post-DSMES participation.
- Participants identified barriers commonly related to self-regulation, resources (psychological and physical) and environmental and social influences. Despite this, some reported progress towards independent maintenance driven by increased autonomy, intrinsic motivation and habit formation.
- To reinforce DSMES benefits, support beyond 12 months post-programme may be needed.

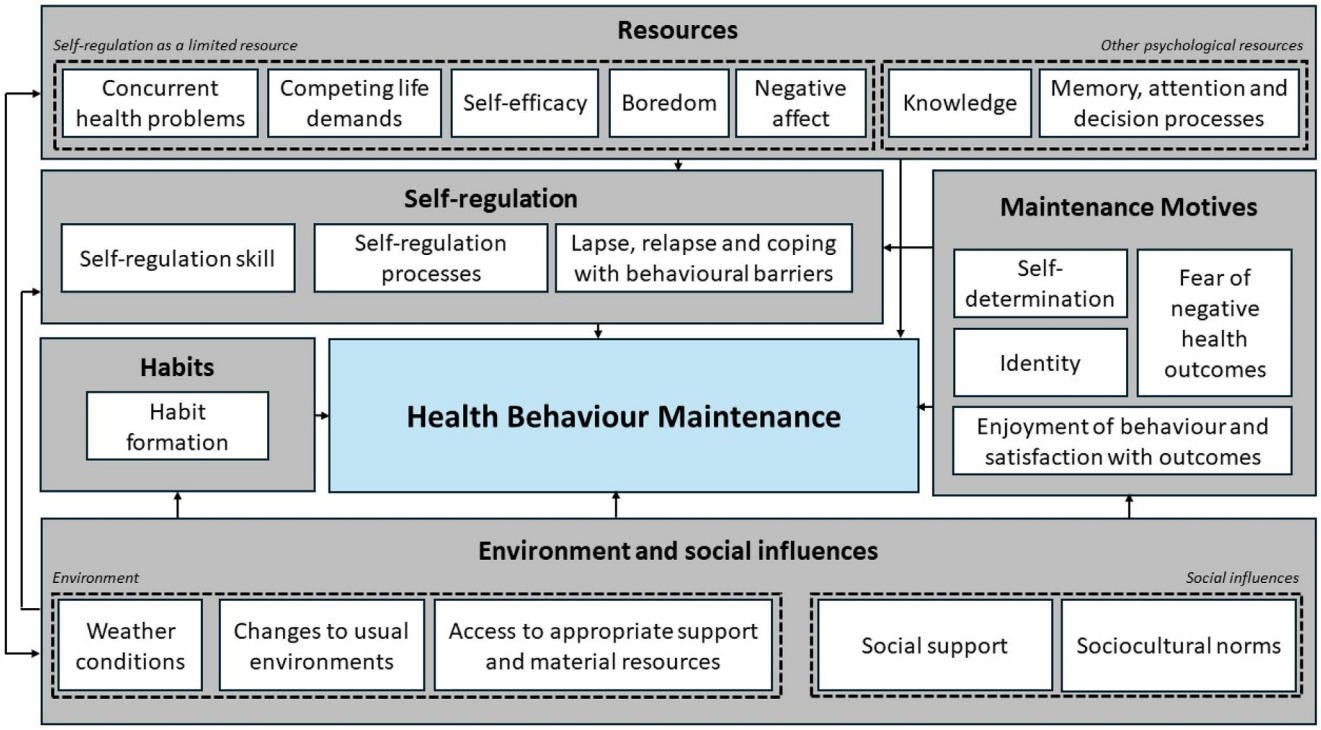

FIGURE 1 Framework resulting from the systematic review on barriers and enablers to maintain type 2 diabetes self-management behaviours after attending a self-management intervention.[10] In this figure, themes are represented in grey boxes, while constructs and sub-constructs are depicted in white boxes. Higher order constructs are represented by the names/labels over dashed lines, with their respective sub-constructs displayed inside in white boxes. Arrows indicate the directional influences among the various themes identified in the qualitative data from the systematic review.

review findings should be extrapolated to the context of DSMES programmes with caution, as just half of the included studies reported barriers and enablers to maintenance after attendance at a DSMES programme.[10] Our review highlighted that limited research has explored the maintenance of behaviour change following participation in established DSMES programmes for T2DM.[10] Limited research has also explored behaviour change maintenance over time. Studies have been mostly retrospective or of short duration (i.e. ≤6 months), offering limited insights into how factors influencing behaviour change may evolve over time.[10] Hence, there is a need for longer studies exploring behaviour change maintenance post-DSMES programmes.

Furthermore, despite calls for further research, the review revealed that current research provides limited insights into how existing self-management interventions, particularly DSMES programmes, can better support long-term behaviour change.[6,7] In recent years, digital solutions, such as apps or online communities, have been suggested as potentially helpful to support behaviour change maintenance.[7] Some well-established DSMES programmes, such as the Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) programme, are currently providing ongoing digital support after initial programme attendance,[15,16] along with follow-up sessions. However, to the best of our knowledge, participants' views of current post-programme support approaches and unmet support and care needs have not yet been explored.

Factors influencing behaviour change maintenance and people's support and care needs post-DSMES programmes for T2DM are likely to change over time. A qualitative study exploring experiences of physical activity maintenance among adults with T2DM reported changes in factors influencing behaviour enactment over time.[17] Previous research with adults with T1DM who attended a DSMES programme revealed changes in support needs over time and unmet support needs.[18,19] Longitudinal qualitative research can help understand how these may change over time and provide valuable insights into how DSMES programmes for T2DM can better support long-term behaviour change.

Accordingly, the current study aimed to explore behaviour change maintenance experiences of adults with T2DM over 15 months following attendance at a DSMES programme and their experiences of, views about, and needs for post-programme support. Additional objectives were to identify barriers and enablers to maintaining behavioural changes over time and to examine the suitability

of and refine, if necessary, the framework developed in our previous qualitative evidence synthesis.

2 | METHODS

2.1 | Study design

A longitudinal qualitative study was conducted using semi-structured interviews at four time points: within two months of DSMES programme attendance and at 5, 10 and 15 months post-attendance. The selection of these time points was influenced by evidence indicating that effects of self-management support interventions for T2DM typically diminish within 6 months to a year after participation,[3,20] as well as gaps identified in our review and pragmatic constraints. Interviews were supplemented by optional experience sampling, which included participants collecting written notes and photographs on factors relevant to behaviour change maintenance between interviews. The study is reported in accordance with the Consolidated Criteria for Reporting Qualitative Research (see Appendix S1).[21] Ethical approval was obtained from the University of Galway Research Ethics Committee (reference number 2022.02.003) and the Galway Clinical Research Ethics Committee (reference number C.A. 2783).

2.2 | Patient and public involvement

The *SUSTAIN T2DM* public advisory panel of adults with T2DM contributed to the study design, data collection, recruitment, retention strategies, participant documents, interview topics, data analysis and preparation of a summary of the findings for the participants. Appendix S2 provides further details about the panel and its contributions according to the Guidance for Reporting Involvement of Patients and the Public (GRIPP2) short-form guideline.[22]

2.3 | Participants and recruitment

Adults diagnosed with T2DM enrolled in either the Community Orientated Diabetes Education (CODE) or the DESMOND programmes in the Republic of Ireland between May and September 2022 were invited to participate in the study. Details of both programmes are provided in Table 1. Although similar in nature, the two programmes differ in their approaches to long-term support. The CODE programme includes a 10-week review phone call and an additional group session at 6 months. The DESMOND programme offers a 6-month follow-up group session and ongoing post-programme access to the digital platform MyDESMOND.[15,16]

Eligible participants were adults aged 18 years or older, with a diagnosis of T2DM, who either completed the CODE or the DESMOND programmes in the Republic of Ireland, with sufficient proficiency in English to participate in the interviews, and with the cognitive ability to understand the study information and provide written and verbal informed consent. For the purposes of this study, programme completion was defined as attendance at all programme sessions in the case of the DESMOND programme and attendance at the three initial sessions of the programme in the case of the CODE programme. The programmes, through diabetes educators, sent invitation letters to eligible participants, which introduced the research, outlined the participation criteria and compensation and included the lead researcher's contact information. Participants were also informed about the study by diabetes educators and/or the primary researcher during their attendance at the programme. Interested potential participants were asked to contact the research team within two weeks of programme completion. Twenty-seven people expressed interest in participating in the study. Upon contact, participants received a study information pack, including a participant information sheet and an informed consent form. Non-respondents received a follow-up contact after one week (see Appendix S3 for further details on recruitment). One of those who expressed interest and received the study information pack decided not to participate upon reflection, and five did not respond further. Reasons for refusing to participate at this stage were not collected. The research team subsequently contacted the twenty-one participants who returned signed consent forms via phone or email to schedule an initial interview. Recruitment continued until information power, the range and richness of data necessary to address the research question considering criteria such as study aims, sample specificity, analytical approach and use of theory to guide data analysis, number of eligible participants and practical constraints, was deemed to be achieved.[23]

2.4 | Data collection

Interviews were conducted via telephone, web-based video conferencing software (Zoom or MS Teams), or in person by the first author, a female health psychology doctoral student with prior experience in qualitative studies, from May 2022 to February 2024. Interviews were guided by topic guides developed by the research

TABLE 1 Characteristics of the DSMES programmes.

Name	Theoretical underpinnings	Duration	Mode of delivery	Intervention source	Brief description programme content	Follow-up/ongoing support
CODE	Health belief model Transtheoretical model Empowerment model Adult learning model	4×2-h sessions over 6 months and 1 phone call 10 weeks after start date	Online video conferencing[a] Printed material/ publication Phone call	One trained educator (dietitian or diabetes nurse)	Group-based sessions to educate participants on type 2 diabetes, self-management of diabetes, diet, and physical activity, assist them in developing self-management skills, setting goals, developing action plans and providing ongoing support and feedback on progress	Phone call at 10-weeks to review goals and provide ongoing support. Follow-up session at 6-months
DESMOND	Self-regulation theory Dual process theory Self-determination theory Social learning theory	6 h (whole day or two half days)	Online video conferencing[a] Printed material/ publication Website/smartphone app	Two accredited educators (either healthcare professional or lay person)	Group-based sessions to educate participants on type 2 diabetes, diabetes self-management, diet and physical activity, and to assist them in developing self-management skills, setting goals and developing action plans	Access to MyDESMOND mobile and web-based application for ongoing support after the face-to-face programme. Follow-up session at 6-months

[a]Both programmes were originally designed for in-person delivery but were delivered online at recruitment due to COVID-19 restrictions.

team based on existing literature[24-29] and input from the *SUSTAIN T2DM* advisory panel and were piloted on the first participant to ensure clarity (see Appendix S4). At the first interview, participants were asked about the maintenance of self-management behaviours in general and prompted to discuss different self-management behaviours, such as physical activity, diet, smoking, alcohol consumption, foot care and medication adherence. All participants were also invited to self-collect and submit experience samples (written notes, photographs or audio recordings on factors influencing their behaviour change maintenance) via a study email or postal address (see Appendix S3 for further details on data collection context and methods). When provided, samples were used as prompts during interviews to explore experiences and responses further. The participants themselves determined the frequency, timing and submission of the experience samples. All interviews were audio-recorded, transcribed verbatim using Otter.ai or an external service, and cross-checked for accuracy by the first author. Participants were invited to review their transcripts for accuracy and were compensated with a €15 gift voucher or bank transfer after each interview.

2.5 | Data analysis

A two-stage data analysis underpinned by a critical realist epistemology[30] was conducted using QSR NVivo v20, in line with the recommendations of Calman et al.[31] Critical realism asserts that an objective reality exists while acknowledging that interpretations of this reality are influenced by an individual's environment and personal experiences.[32] This paradigm guided data analysis and interpretation, enabling a detailed exploration of factors influencing behaviours based on participants' accounts and existing theory and how contextual factors affect behaviour change maintenance for different individuals.[32]

2.5.1 | Stage 1: Cross-sectional analysis

The first stage involved a cross-sectional analysis of data at each time point. Drawing on the approach of Graham-Rowe et al.[33], this analysis followed five steps: data familiarisation, pilot coding, deductive analysis using the framework resulting from our qualitative evidence synthesis on factors influencing the maintenance of self-management behaviours after self-management interventions,[10] inductive thematic analysis and review/refinement.

The first author began by listening to audio files and reading and re-reading transcripts from the initial interviews for data familiarisation. Sixteen transcripts were then inductively coded, and codes were compared against the framework from our evidence synthesis to examine its suitability for analysing barriers and enablers to maintaining behavioural changes.[10] This framework was subsequently applied to all transcripts and experience samples, with any data that did not fit the framework inductively analysed (see Appendix S5 for the codebook). This approach was considered suitable for building on existing theory while extending it through insights captured inductively, thus avoiding merely retrofitting the data into the framework and allowing for a richer and more comprehensive understanding of the factors that influence the maintenance of self-management behaviours.[34] Coding consistency was ensured through independent double-coding of two transcripts by a second author (EM), with discrepancies resolved through discussion. Coding consistency was also achieved through the development and consistent use of a codebook, which was refined over the course of the data analysis.

Deductive coding was followed by inductive thematic analysis within each framework construct/sub-construct to develop themes and sub-themes representing barriers and enablers to behaviour change maintenance. Specifically, the primary author (MC) analysed all data extracts relating to perceived barriers of/enablers to behaviour change maintenance, for each theoretical construct/sub-construct. Theme labels (describing broad content themes) and, where appropriate, sub-theme labels (nested within the themes, describing more detailed content) were then inductively generated for each cluster of similar data to express participants' shared views.[33] Themes/sub-themes were classified as barriers, enablers, or mixed (either barrier or enabler). During the analysis, an effort was also made to link the barriers and enablers identified to specific behavioural domains relevant to the self-management of T2DM (e.g. physical activity, diet, medication adherence) (see Appendix S6 for further details). The framework, themes and sub-themes were reviewed and refined based on data and feedback from authors EM and PD. A meeting with the public advisory panel was also held to review and refine themes and sub-themes and address uncertainties.

The revised framework was then used for the cross-sectional analyses of subsequent time points and continuously refined based on the data. In the subsequent data analysis rounds, themes and sub-themes were also reviewed, organised and reorganised based on emerging data. New inductive themes and sub-themes were also developed and incorporated into the analysis as needed. After the analysis of the final round of interviews, the resulting framework and themes and sub-themes were reviewed and refined for a final time based on feedback from EM and PD.

2.5.2 | Stage 2: Longitudinal analysis

The second stage involved a longitudinal thematic analysis inspired by trajectory analysis principles to capture group-level trends over time.[35] To facilitate the identification of temporal changes, time-ordered sequential matrices were created using Microsoft Excel to summarise coded data across themes and time points.[35] To support data summarisation and interpretation, ChatGPT (free version) was employed to facilitate the write-up of concise summaries of the data for each theme at different time points. The validity of the summaries was checked by the primary author through cross-checking with primary data. Additionally, the analytical questions from Lewis[36] and Saldaña[37] were used to facilitate the identification of changes over time and develop a better understanding of changes over time. The first author led this analysis, developing initial themes and sub-themes, which were refined with input from the remaining authors. The first author maintained a reflexive stance throughout both data analysis stages, using field notes and a journal to reflect on personal assumptions and beliefs influencing data collection and analysis.[38] After analysis, a summary of the findings was sent to the participants.

3 | RESULTS

Twenty-one participants took part in the first interview, 11 from the CODE programme and 10 from the DESMOND programme (see Table 2 for sample characteristics). Of these, 17 participants completed all four interviews; eight were from the CODE programme and nine from the DESMOND programme. The interviews lasted between 14 and 86 min and had a median duration of approximately 45 minutes.

The stage one cross-sectional analysis resulted in a refined framework, the **S**upporting **U**nderstanding and **S**trategies for **T**ype 2 Diabetes M**ai**ntenance Self-Management (SUSTAIN) framework. The SUSTAIN framework is summarised in Table 3, along with a list of the themes inductively generated for each construct/sub-construct (see Appendix S6 for full list of themes and sub-themes generated for each construct/sub-construct). For further details on the modifications to the framework, participants' contributions to each theme/sub-theme and the evolution of themes/sub-themes over time, see Appendices S7–S9.

The stage two longitudinal analysis resulted in three themes (with sub-themes). These themes are elaborated below, with supportive quotes. Additional illustrative quotes are presented in Table 4.

3.1 | Integrating the changes amidst the constant ebb and flow of life

This theme describes the challenges participants faced in integrating and maintaining behavioural changes amidst everyday life's complexity and their responses to these challenges.

3.1.1 | Gap in applying skills, and increased awareness and confidence in daily life

At the initial interview, all participants were motivated to apply newly acquired knowledge and skills in everyday life and to maintain behavioural changes, driven by a desire to improve health and prevent complications:

> I do [think will be able to maintain exercise regime]. I don't know. I wouldn't say that's a problem with that at all. I wouldn't expect to. I would be disappointed. Something, I'd be disappointed if I didn't keep it up
>
> (Interview 1, D01, Male, 70 years)

Despite anticipating future challenges, most were optimistic. However, subsequent interviews revealed that knowledge, skills, and confidence alone were often insufficient for maintaining changes:

> The amount of information I gained and it was all fairly simple information once you stuck to it. But I still don't wash my feet every day
>
> (Interview 3, C02, Female, 64 years)

This difficulty was often attributed to the complexity of everyday life.

3.1.2 | Challenges and tensions along the way

Over time, participants reported facing various challenges and tensions to integrate into their everyday lives and maintain behavioural changes. These challenges and tensions were frequently related to the SUSTAIN framework themes of *environment and social influences*, *resources* and *self-regulation*. Specifically, common barriers to maintaining changes were frequently related to the (sub)constructs self-regulation skill, sociocultural norms, physical and social environment, emotion, competing life demands, physical resources, memory, attention and decision processes, knowledge and intentions.

TABLE 2 Participant demographic characteristics ($N = 21$) and participation rates.

Characteristic	Response	*n*
DSMES programme	CODE	11
	DESMOND	10
Age groups at recruitment	20–40	1
	41–60	9
	61–80	11
Gender	Female	14
Education level	Third level	12
	Second level	9
Employment status	Employed full time	5
	Employed part time	2
	Unemployed	2
	Housewife	2
	Retired	10
Marital status	Married/co-habitating	16
	Separated/divorced	2
	Single/unmarried	3
Diabetes duration at recruitment (months)	0–6 months	12
	7–12 months	1
	>12 months	8
History of attendance at DSMES programmes	Previously attended a DSMES programme	3
	First-time attendee at a DSMES programme	18
Interview participation rates	First interview	21
	Second interview	20
	Third interview[a]	19
	Fourth interview	17
Interview format	Zoom/MS Teams interview	51
	Phone interview	25
	In-person interview	1
Experience sampling participation rates	Second interview	5
	Third interview	3
	Fourth interview	1
Experience sampling type	Photos	2
	Written notes	7

[a]One interview was excluded from the analysis due to an audio recording issue.

Some participants commonly reported difficulties implementing and maintaining behavioural changes amidst the complexities and multiple demands of their lives, such as family/work responsibilities and concurrent health problems. Female participants, in particular, expressed difficulty prioritising diabetes management amid these competing demands:

> It's harder to focus on me if there's too many other things going on, especially if it involves my children, do you know what I mean. Your focus is always going to be kind of with them
>
> (Interview 3, C04, Female, 57 years)

Participants also noted that unexpected life events and changing circumstances impacted their ability to assimilate behavioural changes into their daily lives and maintain them over time. Some participants struggled to stay focused on diabetes management during critical

TABLE 3 Barriers and enablers to maintain behavioural changes categorised according to the SUSTAIN framework.

Construct/ Sub-construct	Inductive theme	Direction of influence	Illustrative quotations
Environment and social influences			
Environment			
Physical environment	Availability and accessibility of (un)healthy food	Mixed	'Sometimes there is very little or nothing on the menu or in a shop that you can actually buy that will not send your sugars a bit high' (T3 D03)
	Seasons and weather conditions	Mixed	'The only difficulty would be regards the exercise, it's the weather' (T2 D01)
	Non-routine environments	Barrier	'It definitely requires more thought and more management when you're out of home' (T3 D03)
	Sedentary work	Barrier	'Challenges is time and circumstances. So take for example, as I said I work in IT. So I'm sitting at a desk a lot' (T3 D06)
Support and guidance	Availability and accessibility of ongoing support	Mixed	'I would say another follow up would be great, you know, a bit longer' (T3 C11)
Resources	Financial resources	Mixed	'Now, the problem I found with myself, I start to buy more processed food because it was cheap, and much to my regret, I started doing it because that's when I put the weight on' (T2 D09)
	Availability and accessibility of supportive resources	Mixed	'Definitely being offered, getting the glucose monitor is a great thing, because it's handy to have that. And if you do feel or want to get off piste, it's handy to have it to be able to check your morning bloods and see if they haven't gone mad' (T3 D03)
Social influence			
Sociocultural norms	Social norms, pressure and expectations	Barrier	'But the problem is, when I go down to my sister, she'll make a cup of tea and she'll say, "Here's two biscuits", and you're like, "Oh no, no, no, no". "Take the two biscuits, for God's sake", and that's, I do take them' (T2 D09)
	Stigma	Barrier	'I don't know if this is a common thing but this is something that that's really I've really struggled with is feelings of guilt, feelings that I've done this to myself so that's something that's been quite a common feature' (T2 C03)
	Discomfort managing diabetes in social or public situations	Mixed	'I don't even want people to know I'm taking a tablet and it's not that, I'm not embarrassed about it or anything like that. I just, I just don't want the question like' (T3 C04)
Social environment	Social events/situations	Barrier	'It's all just been social, all social acts, it's harder' (T4 C11)
	Household structure and dynamics	Mixed	'I'd say a barrier would definitely be having teenage kids now because, you know, you can't just say to them, "Sorry now, you can't have sweets at all", you know, so' (T2 C06)
Social support	Support from others	Mixed	'There is nothing like encouragement to help you move forward, you know, and my biggest encourager actually is my husband' (T3 C02)
Relationship and communication with healthcare providers	Rapport, trust and quality of communication with healthcare professional	Mixed	'I suppose the mixed messages that I have received between CODE between my doctor and my practice nurse. And I suppose that mixed messages are the hardest thing because you kind of go okay, what's the right thing to be doing on here? Because it's all very different.' (T2 C05)

(Continues)

TABLE 3 (Continued)

Construct/ Sub-construct	Inductive theme	Direction of influence	Illustrative quotations
Habits			
Habit formation	Habit development	Mixed	'It's just habit at this stage. My, I'm used to it so (...) it's, it's second nature now at this stage. It's not a chore to maintain it' (T4 C10)
	Previous habits	Mixed	'I used to work nights all the time. So, I was used to eating at nighttime, you know. So I just kind of, I don't know, did it for about ten years working nights, so it's a very hard habit to try and get out of' (T1 C06)
Self-regulation			
Self-regulation skill	Behavioural self-regulation	Mixed	'Or if I go shopping, I noticed that if I go shopping hungry, I will buy rubbish, I will buy chocolate bars and stuff and even though I'd say to myself, today, I'm not buying any chocolate bars' (T02 C01)
Self-regulation processes	Self-regulation strategies/ practices	Mixed	'I write down the food I eat and then, I look at it and I go, 'Mm, yeah. That was fine. That day was okay. Yes, I didn't do anything wrong', and then another day I'll go, 'I didn't actually do that right. I must look at that again now and just take note not to do that', em so writing my food down helps.' (T3 C02)
	Coping with behavioural barriers, lapse and relapse	Mixed	'Ever since the end of February I have been meaning to get back to it [walking] and I haven't, and here it is, the end of June. So I have a bad report there' (T3 C08)
Resources			
Knowledge	Knowledge/awareness of type 2 diabetes and its management	Mixed	'I think that since the CODE programme, I cannot say that I've been doing everything right, but what I can say is I, when I've been doing things wrong, I have known that I have been doing wrong things. (...) So I will say that I've been educated. I feel, I feel more empowered in that even if, even if I make the wrong choice, I know it's the wrong choice' (T3 C03)
	Ongoing self-management education	Enabler	'Em, I think, I mean, I was very lucky to do the course twice and I would recommend that to everybody. I think, you know, maybe you do it once and three years later or two years later, you do it again because, you know, when you're at different stages of your understanding of it yourself and you have to come to terms with so much that the stages are, you can't control those stages. You've got to go through them, you know. So if you were invited back to another one, I think that would be really good, really helpful' (T4 C09)
Memory, attention and decision processes	Diabetes acceptance/denial	Mixed	'Eh the head comes out of the sand every now and again and then goes back in because I don't, you know, the head doesn't know what to do when it's out of the sand, you know. It feels like I'm doing what I can and I don't know what else to do and I don't want to go round being worried and miserable all the time so, you know' (T3 C08)
	Attention to diabetes management	Barrier	'I suppose it brought, I sort of pushed diabetes away for a while, ignored it, like, okay, we can just pretend it doesn't exist' (T2 C11)

TABLE 3 (Continued)

Construct/ Sub-construct	Inductive theme	Direction of influence	Illustrative quotations
	Forgetfulness	Mixed	'Because I think over time you do, as I mentioned, last time, you do forget some of the learnings that you have, and you only really think of them again, when you see the blood results coming back' (T3 D06)
	Increased consciousness and deliberated effort to apply learned information in daily life and decision-making	Mixed	'Like if I really want a bar of chocolate and I've stopped at a garage for petrol. It's just hard not to buy one. But do I say to myself, 'no, you're never allowed chocolate? Is this bar, you know, is this bar really important [laughs]? Is it is it fine? You know. Is it really important that you don't have this particular bar of chocolate, or not? It's those that's, that's, one thing, I think is, is, is, what's, what's the relative importance of all those little tiny decisions you have to make from you know, from time to time, maybe every day or every whenever' (T2 C08)
Emotion	Negative emotions	Barrier	'The hardest part of it all was I got very, very, very, very depressed with myself' (T2 D09)
	Stress	Barrier	'Yeah. I suppose, the biggest thing that affects, that affects any of it is stress' (T3 C05)
	Diabetes distress	Mixed	'It, I think it was the thing of having to watch bloods, having to do this, you can't have this, you can't... you know this thing where I don't like if you can't do this or you can't do that. The authority of like no you can't eat that now, you can't eat this and you can't eat, so I said look, 'I may as well not bother eating', and I did that now for more than a couple of days' (T4 D09)
	General emotional state/ mood	Mixed	'How do they [moods] affect it? Em ... I just have less interest in organising myself, I suppose, organising meals. It's a constant battle, kind of' (T3 C05)
Self-efficacy	Confidence in ability to manage diabetes	Mixed	'Something I'm battling in at the moment I would say to you is I'm not as confident in my managing of diabetes, as I was when I saw you last' (T2 C03)
Competing life demands	Competing demands	Mixed	'So, you know, sometimes, yeah, just, I'm not going to be getting up at five to go for a walk, walk, if I have to be in work at eight, and then sometimes I don't finish until eight. You know, I'm like, yesterday, I was in from eight o'clock in the morning till eight o'clock at night. I was too tired to go for a...' (T2 C08)
	Disruptive life events	Barrier	'Well, eh, that's the main thing, I suppose, the, the, that is the main thing, I suppose, do you know and I suppose when you do reflect back, I suppose, the death of a loved one puts everything else in context, isn't it, do you know' (T4 D10)
Physical resources	Physical ability, symptoms and limitations	Mixed	'Now, one factor would be tiredness, because I've noticed, I can get through a day, maybe up to 10 o'clock [laughs]. And then I could certainly go into the kitchen and raid the place you know, and just where if I could just get upstairs, get into my bed and switch the light off [laughs]' (T2 C01)

(Continues)

TABLE 3 (Continued)

Construct/ Sub-construct	Inductive theme	Direction of influence	Illustrative quotations
Maintenance motives			
Self-determination	Intrinsic motivation, autonomy and personal responsibility	Mixed	'So I think the I'd be the driving force behind sticking to the diet and continuing to change, and continuing to stay on the programme' (T2 C10)
	External motivation, accountability, and structure	Mixed	'If someone had come out with a stick and beat me every morning, that might have been helpful but see, no, because I wasn't taking personal, like the information's all there, the support is there. But part of me was like, 'Oh, I don't want to do it. I want to buy chocolate', you know' (T3 C01)
Enjoyment of behaviour and satisfaction with outcomes	Enjoyment of behaviour	Mixed	'I'd still stayed the same and do the exercises and stick to the diet, I couldn't anyway I think I like the diet better that I'm on now. Yeah. I do like plain foods' (T1 D07)
	Positive reinforcement from positive outcomes	Mixed	'So yeah, em it's all, the, the improved blood results and weight loss, of course, it makes it easier. You can see the progress. You can see, I can see I'm doing well' (T3 D10)
	Negative reinforcement from negative outcomes	Enabler	'Oh, I think they're hugely important. I think they're what keep you going actually, you know. I know if I don't get out and walk today, both psychologically and physically, I'll be disappointed, I'll be upset and I'll, my, physically will feel groggy. Whereas if I go out for a walk, I'll feel refreshed, my mind is cleared and I'm pretty pleased with myself, do you know' (T4 C09)
Beliefs about consequences	Positive outcome expectancies	Enabler	'So as I said when I go in next week. I'm hoping my levels will be good. I'd be very disappointed if they are not, you know, kind of' (T1 D05)
	Beliefs about health consequences of maintaining behaviours	Enabler	'Very, because I certainly don't want to go. That's another thing that the Facebook page about the obesity code is good for. I don't want to go down the route of where some of those people are. It is quite scary. So that's a great motivating factor to keep it up and not go completely off piste' (T3 D03)
	Beliefs about the necessity to engage in behaviours	Mixed	'I continue to, you know, just use the self-tests daily, test my blood sugar for no other reason than for me personally, it's something I need to do to bring diabetes into my daily life. I need to consider my diabetes and for me, doing that, just that little prick test, is, it's something I need to do to keep myself aware of the fact that em [semaglutide] is kind of a, it's almost like a kind of masking the diabetes. That's how I look at it, but I still have diabetes' (T4 C03)
Goals	Goals/targets	Enabler	'I don't want to go back on that medication, I don't want to go back on medication. So that's a big motivator to do something' (T2 C11)
	Goal priority	Enabler	'They, they're [children] a constant reminder, because I mean, let's face it, it's more I'm doing it for me... For them, because I want to be here for them as they get older'(T2 D06)

TABLE 3 (Continued)

Construct/ Sub-construct	Inductive theme	Direction of influence	Illustrative quotations
Intentions	Intentions, commitment and readiness for maintenance	Mixed	'So, for the next couple of months, it's similar to what I said to you last time. I know I'm starting from tomorrow with it's great, it's always tomorrow, tomorrow. It's the exercise part is a big one to really incorporate now' (T2 D06)
	Difficulty sustaining motivation and commitment to maintain changes over time	Barrier	'I would say that I have lacked motivation to make good food choices in the last weeks (...). When I first started, I had motivation because this was a new thing.' (T2 C03)
Identity	Perception of self	Enabler	'So I think that and my own competitive nature of trying to meet the target for next blood test, that kind of keeps me on track' (T2 C10)

Note: 'T' stands for time, representing the specific time point at which the data was collected (i.e. T1: interview time point 1; T2: interview time point 2; T3: interview time point 3; T4: interview time point 4).

moments such as illness, financial hardship or the loss of a loved one, as these challenges disrupted their routines and diverted their energy away from diabetes management.

Concurrently, many participants faced challenges in implementing and maintaining changes across various social and environmental contexts in their daily lives. Examples of barriers included seasonal weather, inadequate infrastructure (e.g. footpaths) and sedentary nature of their jobs. Participants also commonly reported challenges to maintain changes in non-routine situations (e.g. travelling) and social situations, particularly those involving food: '*it's all [barriers] just been social, all social acts, it's harder*' (Interview 4, C10, Male, 53 years) and '*it definitely requires more thought and more management when you're out of home*' (Interview 3, D03, Female, 57 years).

Environmental and social factors were often intertwined, as participants noted that the prevalence of unhealthy food options, limited access to healthy alternatives and social influences and/or pressure to conform to prevailing norms made it difficult to maintain changes in certain situations and contexts. For a few participants, the stigma associated with diabetes created discomfort in publicly managing their condition, leading to a feeling of not belonging in supportive environments (e.g. exercise facilities):

> I felt like I don't belong in a place [swimming pool] where there is people that are healthy, when I am someone who welcomed in illness, welcomed in diabetes
>
> (Interview 2, C03, Female, 59 years)

This often invoked feelings of guilt and self-blame for the diabetes diagnosis. Emotional factors were also significant in sustaining behavioural changes, as some noted that stress and fluctuating moods affected their self-management practices: '*I find low moods really affect whether I want to or whether I don't want to exercise*' (Interview 2, C05, Female, 63 years). For a few, their emotional states were influenced by the perceived burden of managing diabetes:

> It, I think it was the thing of having to watch bloods, having to do this, you can't have this, you can't... you know this thing where I don't like if you can't do this or you can't do that. The authority of like no you can't eat that now, you can't eat this and you can't eat, so I said look, 'I may as well not bother eating', and I did that [stage of not wanting to eat at all] now for more than a couple of days.
>
> (Interview 4, D09, Female, 57 years)

Participants also frequently described tensions arising from the need to break ingrained behaviours and coping responses (e.g. comfort eating), as well as to maintain discipline and resist temptations and food cravings. Several participants noted that impulsive reactions to tempting foods and ingrained behaviours and coping habits hindered their ability to maintain changes, and often led them to unconsciously revert to old behavioural patterns: '*I mean, it's not conscious, it's not deliberate, it's just bad habits. Bad habits.*' (Interview 4, C01, Male, 62 years). Their ability to regulate behaviour was influenced by various cognitive and motivational factors, with older behavioural patterns often re-enacted during busy periods, or by competing demands, stress or emotional lows.

These challenges remained relatively stable but varied in intensity and influence over time, with festive seasons, such as Christmas and Easter, and the lifting of COVID-19

TABLE 4 Themes and sub-themes with illustrative quotations.

Themes/sub-themes	Additional illustrative quotations
Theme: Integrating the changes amidst the constant ebb and flow of life	
Navigating challenges and tensions	***Example of description of self-regulatory strategy*** '*So I stopped buying things that I wouldn't eat myself. So it makes it a little bit easier for them [family relatives] then and, and of course, for me*' (T4 D07) ***Consequences of not employing self-regulatory practices*** '*Well, if I'm out and I have, if I don't plan my food, I just rather go for stuff. I look for the nearest quick food*' (T2 C01) ***Improved self-regulation ability*** '*Yes, it's very, much easier, much, it's much easier* [do not think about dessert and to cope with the temptation] *now for me than it was two years ago or whenever I was identified first, yeah. Much easier*' (T4 D02) ***Diabetes medication impact on self-regulation ability*** '*[*semaglutide*] definitely helped and that really helped get cravings under control and helped me come off a lot of sugar and that em, and like that, made me feel full to stop me snacking and sort of gave me a eh disinterest in food. Food isn't as exciting now which is great. It's no longer in my mind all the time em and that's sort of the biggest thing to help me keep on track eh since the CODE programme*' (T4 C11) ***Diabetes medication side effects*** '*So that* [semaglutide] *is helping me to lose weight, I feel better, I feel stronger. But I also strangely enough, feel sick. And so it's hard to weigh the two up. But I feel if I don't keep to the* [semaglutide] *is, you know, I feel my hope is gone. So I want to stay on that*' (T2 C03)
Theme: Consolidating the changes: Moving towards independent maintenance	
Building behavioural autonomy and intrinsic motivation	***Enhanced personal responsibility for diabetes management*** '[So what did you feel that made it harder or stopped you during these five months to maintain the changes you have been trying to make to your lifestyle?] *Not taking proper responsibility for myself, I suppose*' (T3 C08) ***Internal drivers*** '*I don't want to go down the route of where some of those people are [*i.e. *experiencing symptoms and complications]. It is quite scary. So that's a great motivating factor to keep it up and not go completely off piste*' (T2 D03) ***Impact on post-programme support needs and need for external motivators*** '[anything that CODE programme could have done or provided to you during this time?] *Eh, not really, no. It was a great place to start and eh, just after that, you kind of have to do things yourself, if you know what I mean, so 90% of most of it is self-discipline and stuff like that, so*' (T2 C06) '[So, overall, do you feel you have been getting the support you need to maintain the changes to your lifestyle?] *Well, I could do with a parent telling me...[laughs]. I could do with a boss saying, "yes, you can do this", and "no, you can't do that*"' (T2 C08)
Developing automaticity	***Strategies to develop/disrupt habits*** '*Well, the, the food end of it, isn't difficult really, it isn't, now I'm so used to it that it's easier to have that than have something that will not going to do you any good. I really and truly because I've my cupboards cleaned out now and I have all this sweet, sweet stuff that I used to make, even for the kids, grandkids here. I used to make chocolate Krispies and chocolate bones and toppings on them and you know, these kind of things and I dumped every one of them, now, I said you know, no more of that, because, if there's one leftover, you know, how you'd be tempted to eat it?*' (T1 D07) ***Enabler role of behavioural automaticity*** *'I started the routine and pretty much, I'm sticking to it, without even thinking about it, you know, so it's kind of an automatic, an automatic thing'* (T3 C06) ***Difficulties maintaining behavioural changes in non-routine environments*** '*I found myself out of my comfort zone, out of where I'd normally be. So while I was walking, I probably didn't do as much, do you know, so that em. But then, when I came home, it was easier to get back into, do you know, we all do things within our comfort zone. Em I have em, my routine here*' (T3 D10) ***Impact of behavioural automaticity on the role of motivation in behaviour change maintenance*** '*when we say motivated, I'd say not really because it's now normal*' (T3 C06)

TABLE 4 (Continued)

Themes/sub-themes	Additional illustrative quotations
Theme: Building bridges to self-maintenance: The role of support post-programme	
Importance of support from social networks	***Family and friends support as an enabler*** *'My wife is the best person in the world for that because she tells me I shouldn't be doing this. She's very encouraging, very helpful and you know, she, she keeps an eye on my diet. She's working with me on it as well and she brings me for walks so that's the most helpful part of the whole lot, to be honest, my family and my wife especially. She brings me on, she minds me'* (T4 D04)
Limited healthcare professionals support and access to care and resources	***Barriers to access care*** *'The follow on has been very disappointing not from DESMOND now, just generally from my own doctor's side, I was to be referred for both my eyes, my feet, what else (...). It hasn't happened. What with respect to them, with the present ways, the pandemic is coming back again, the doctors are under severe pressure. So I haven't been pushing it, I would say, I leave it, I would expect to be called for my bloods again within the next month. And if I haven't heard about both my feet and my eye, I will bring it up with them again'* (T2 D05) ***Influence of service access experiences and healthcare support on post-programme support views and needs*** *'So at least with the MyDESMOND, there is somewhere that you can have instant access to. It should and when, and if and when em I've needed it where you can go back and just check, do you know, if you're concerned about, I don't know, just a reminder or refresher in terms of thing. Em I suppose, in the absence of something, I suppose, tangible, you know, where you have physical support like a dietitian, here in the real world, do you know'* (T3 D10)
Current programme support	***Challenges accessing current supports*** '*The thing I would say is, from my point of view, I'm not great on the technology side. So the fact that the follow on was to be done online, as a want of a better way of describing it, and I am not good at that, so I didn't do it*' (T2 D05) ***Mixed views on social components MyDESMOND*** '*I've done all of them [refreshers on MyDESMOND] but, as regards interacting with other people, I really just don't, I'm not comfortable with it*' (T2 D04)
Additional support needs	***Regular check-ins*** *'I suppose the ideal one would be eh like someone from say the DESMOND programme reaching out to, say by phone call maybe once a month to see how, how things are going and maybe just need that bit of a gee up'* (T4 D01) ***Additional follow-up sessions*** *'Yeah em, I would say another follow up would be great, you know, a bit longer. Like I would love that sort of em... eh just sort of a meeting to see people again, to hear people, do you know, that type of thing, I think would be really nice'* (T3 C11) ***Ongoing support beyond one year after initial programme attendance*** '*So I was wondering maybe if say, with the code course, if like, there could be a follow up session, say after 12 months, just to maybe keep people on track*' (T3 C10) ***Educator/healthcare professional, group and peers*** '*I'd love more follow ups. You know, if that group met again, was [educator's name], or with somebody every few months or whatever. I think that might help*' (T1 C08) ***Synchronous online sessions*** *'Realistically, online meeting, I would love it an in person meeting, but logistics, I don't know if there's enough, certain areas and stuff and time and space and that. Yeah, so, do you know, I think online is really good, as well. Because it really sort of brought [initial programme] people from different areas, you know, that couldn't have come maybe before, so yeah, so I thought that was good'* (T2 C11) *'Well, the site (MyDESMOND), it's already there, and all the forum and people talking and asking questions, and that kind of thing, which is good, but an actual one off, one off sort of zoom call with maybe about 12 to 20 participants and a nutritionist, and the nutritionist could sort of talk, and then sort of chair a chat between the people so that they can exchange ideas and information, I think would be a good thing'* (T2 D03) ***Programme repetition*** *'I was very lucky to do the course twice and I would recommend that to everybody. I think, you know, maybe you do it once and three years later or two years later, you do it again because, you know, when you're at different stages of your understanding of it yourself and you have to come to terms with so much that the stages are, you can't control those stages. You've got to go through them, you know. So if you were invited back to another one, I think that would be really good, really helpful'* (T4 C09)

(Continues)

TABLE 4 (Continued)

Themes/sub-themes	Additional illustrative quotations
	Progress monitoring *'You would have the original* one [follow-up session] *and one about four, five, six months later to see have you made any changes, how is it going, are you settling in, and then maybe, a second one another six to eight months later to see have you kept up the changes, have you any more questions, is there anything else, because it's hard to assimilate everything all at once'* (T4 D03) ***Expert guidance, advice and trouble-shooting opportunities*** '*It'd will really be like kind of an expert view on progress. Because I'm like, although I kind of research and kind of try and educate myself as much as possible. I have hit that kind of a plateau in the last six months where there's nothing, no progress has been made. Just kind a bit of expert guidance really'* (T3 C10) *'So, I think it'd be interesting for everybody to have a little booklet with a variety of low carb, relatively easy recipes. Just because if there are ones you get at the DESMOND follow up programme, I think you'd be more likely to try them'* (T3 D3) ***Encouragement, motivation, and focus boost*** '*Some people I suppose, kind of, as they call, fall off the wagon and a Zoom meeting might help to bring them back on track, especially younger people*' (T2 D01) ***Refreshers, reminders and nudges*** '*Well, I suppose to give us a reminder, you know, because it's a good while ago and you're kind. Things, you kind of forgetting*' (T2 D07) ***Educational updates*** '*So, I could maybe do with more information, learning more*' (T2 C08) ***Social learning and modelling*** '*Possibly maybe if there was a follow on. Aside from you, we'll say, there was the group of us that did the initial thing. How are the rest of them getting on. Should we not have had a gathering, for the want of a better way, to say, "Look, I'm getting on fine because I'm doing this or I'm getting on fine because I'm doing the other". We might have picked up some more tips from one another. Maybe that would be an idea. I don't know, because they would, we were all diagnosed more or less, as far as I remember, at the one time. So it would be interesting to compare how people have done*' (T3 D05) **Social support (especially peer support)** '*Would have helped to be able to talk to people or I don't know like having a meeting for diabetics. Anything like that, where you can... I don't know if there is anything, something like that, where we're able to talk to people and check in, or have that sort of community...'* (T2 C11)

Note: 'T' stands for time, representing the specific time point at which the data was collected (i.e. T1: interview time point 1; T2: interview time point 2; T3: interview time point 3; T4: interview time point 4).

restrictions perceived as particularly challenging due to increased social events:

> Now that people are less scared of COVID and there's more mixing, I'm meeting friends a bit more...And it can be a bit difficult to try and stick to plan when you're going out eating
>
> (Interview 2, D03, Female, 57 years)

3.1.3 | Navigating challenges and tensions

Over time, participants described how they employed several self-regulatory and coping strategies to mitigate these challenges and maintain changes, including behaviour and outcome monitoring, planning, preparation and organisation, behaviour/food substitution, flexible restraint often with compensatory behaviours and restructuring their physical environment (see Appendix S4 for further details):

> So I stopped buying things that I wouldn't eat myself. So it makes it a little bit easier for them then and, and of course, for me
>
> (Interview 4, D07, Female, 74 years)

Other strategies described by some included proactive behaviour, not giving in to peer pressure to eat more or food offers, avoid high risk situations and tempting foods and promptingly return to behavioural changes after lapse (see Appendix S4). A few also reported learning from past/current experiences, accepting them and reframing them with a flexible, self-compassionate attitude (see Appendix S4). When participants did not use these practices, they often reported a greater degree of struggle with behaviour change maintenance.

As well as reporting applying different strategies to deal with challenges and tensions, a few participants observed how, over time, they became more aware of influences on behaviours and ingrained coping/behavioural patterns, which enabled them to adopt alternative coping strategies:

> As I said before, if there was problems, it was comfort eating. Now I have trained myself, if that's the right word to use, to try and do something else
>
> (Interview 3, D05, Female, 68 years)

Some further noted that their self-regulation ability improved over time, often crediting medication (e.g. semaglutide), although a few described difficulties with side effects.

3.2 | Consolidating the changes: Moving towards independent maintenance

Despite ongoing challenges, some participants' accounts pointed to a gradual shift towards independent maintenance over time, facilitated by the development of behavioural autonomy, intrinsic motivation and automaticity. Progress, however, varied among participants.

3.2.1 | Building behavioural autonomy and intrinsic motivation

This sub-theme pertains to the growing perception of personal endorsement for behavioural changes over time and/or engagement in behavioural changes driven by internal goals, values and/or the inherent satisfaction or enjoyment they provide. Over time, some participants experienced a change in motivation sources, which positively impacted their ability to maintain changes. Specifically, they reported an emerging sense of personal responsibility for diabetes management and a shift to intrinsic motivation, marked by increased enjoyment of new behaviours and internal drivers, such as a desire to improve health outcomes and prevent complications. This shift often coincided with a change in sources of motivation to satisfaction with outcomes. For instance, post-programme outcome goals initially served as incentives but later became rewards reinforcing motivation:

> It was an incentive to keep up the changes in lifestyle to see would that work on affecting the HbA_{1c}, and bringing it down, and it did ... it meant that it worked. The incentive now is obviously, ... I want to try and keep the HbA_{1c} down
>
> (Interview 2, D03, Female, 57 years)

While some participants mentioned the risk of complacency, many described this positive feedback loop as reinforcing their motivation and confidence. However, perceived failure to achieve goals or lack of progress disrupted this loop, leading to frustration and reduced motivation:

> If, if say if I slipped and I felt nauseous or whatever, immediately, the fact that like, I have no symptoms, I've never had symptoms of any kind from it. So yeah, it's kind of I'm stuck in a quandary where like, if when I stick to the diet, and nothing happens, and if I don't stick to the diet, nothing happens anyway, either. So it's just yeah, it's kind of a difficult place at the moment just trying to keep moving forward, keep progressing, when like things stood still now for the last six months
>
> (Interview 3, C10, Male, 53 years)

Progress towards behavioural autonomy and intrinsic motivation differed, however, among participants, affecting their ability to maintain changes and need for external support.

3.2.2 | Developing automaticity

This sub-theme relates to the gradual, automatic enactment of behavioural changes over time, with a lower perceived conscious awareness and/or less cognitive effort. Over time, particularly at the 10- and 15-month interviews, some participants described having developed behavioural automaticity, which enabled the consolidation of changes. This was facilitated by the integration of changes into daily routines, behaviour repetition and strategies, such as environmental restructuring and self-reminders.

While awareness and cognitive effort remained important in certain situations, such as non-routine ones, participants described a shift from conscious effort to automaticity, which reduced the need for cognitive resources and self-regulation, enabling long-term maintenance: *I started the routine and pretty much, I'm sticking to*

it, without even thinking about it, you know, so it's kind of an automatic, an automatic thing (Interview 3, C06, Male, 42 years). As behaviours became habitual, motivation also played a lesser role in maintenance.

Those who did not develop automaticity often described a constant need for self-vigilance, which was deemed hard to sustain over time. A few further observed that their inability to transform changes into habits contributed to difficulties in maintenance:

> So I can't use eh unavailability of time as an excuse for no exercise. I've had plenty of time but it's either been too hot or too rainy or too, you know, too something or I just don't think of it. I haven't made a habit eh which is what I need to do
>
> (Interview 3, C08, Female, 65 years)

3.3 | Building bridges to self-maintenance: The role of support post-programme

Although to varying degrees, the support provided by others, including families, friends, colleagues, healthcare professionals and programmes was considered important to maintain behavioural changes. Some participants, however, described a need for longer term ongoing programme support.

3.3.1 | Importance of support from social networks

For most participants, sustained practical and emotional support from others, particularly family and friends, was an important enabler to maintain changes, while conversely, the lack of support was perceived as a barrier:

> I am my own support...That's when problems start... because, you know, it's very hard to be your own support all the time
>
> (Interview 2, C05, Female, 63 years)

This influence varied, however, among participants and over time, in some cases even for the same participant. Such variations often stemmed from participants' (in)ability to disclose their diagnosis or seek help, as well as others' understanding of diabetes and their ability to adapt behaviours to support participants and sustain those adjustments:

> It's hard for me to ask for help, I suppose. I think I have to do it by myself
>
> (Interview 2, C11, Female, 39 years)

3.3.2 | Limited healthcare professionals support and access to care and resources

Participants emphasised the importance of supportive relationships with healthcare professionals and access to diabetes specialist services, and supportive resources such as exercise equipment and medication, to maintain behavioural changes post-programme. However, access to care and resources was often hampered by long waiting lists, high costs and a lack of specialised services. Some also expressed ongoing dissatisfaction with the support received from healthcare professionals, citing inconsistent advice, limited guidance and a lack of understanding of the experience of living with diabetes:

> I said to you before, I don't find my doctor very supportive from the point of view of diabetes. ... So I know he's excellent. He's excellent in other ways.... But he's not, he just doesn't seem to ... I don't know, even concern himself regarding diabetes, you know
>
> (Interview 3, C09, Female, 62 years)

These challenges and dissatisfaction persisted for some, influencing their post-programme support needs. To improve access, particularly to supportive resources, a few participants suggested government incentives, such as concessionary rates for exercise classes, but noted challenges in accessing existing ones.

3.3.3 | Current programme support and additional support needs

Participants generally found the initial programme beneficial but had mixed views on post-programme support. Some appreciated follow-up sessions, phone calls and ongoing access to MyDESMOND for progress monitoring, feedback, knowledge consolidation, peer learning and educator troubleshooting:

> I was saying that the modules [MyDESMOND] are good and it's handy to have them there to refresh because over time, you sort of keep the key points but you sort of, others slip a bit so it's no, it's very handy to have the modules

there to go back and go over it again, and just check what you're doing right and maybe pull up on some of the things that are slipping a bit, yes

(Interview 4, D03, Female, 57 years)

And just to get CODE, just have that final session and [educator's name] and hear it all back, she just like kind of did an overview and we kind of went back over the major issues rather than the day-to-day difficulties like the ones I'm kind of struggling with. I found that was good. That was a good refresher to have

(Interview 2, C10, Male, 53 years)

The option to contact educators with questions and to access programme materials on demand to refresh memory and consolidate knowledge were also valued. However, others faced challenges such as an unawareness of available supports due to communication issues or forgetfulness, lack of information about follow-up sessions, and difficulties in accessing support, which led to feelings of being forgotten or unsupported. Opinions on the value of post-programme support, particularly MyDESMOND, also varied; while generally found to be acceptable and helpful, there were mixed views among participants on its social component. In addition, a few older participants struggled with limited internet access or digital skills, and suggested telephone follow up as an alternative:

The DESMOND programme again, as I said, I just feel that wasn't the follow on, on that, because I didn't go in online. But it's not everybody who has access, I don't have access to the internet here at the moment. (...) So I just think with the DESMOND, a phone call, even, for the follow on would have been a help

(Interview 2, D05, Female, 68 years)

Over time, particularly by the third and fourth interviews, some participants felt confident managing their diabetes independently and described no further support needs, whereas many expressed a desire for additional support. Participants specifically described a need for more regular check-ins, education refreshers and further follow-up sessions beyond 1-year post-programme. Participants from both programmes expressed a desire for more follow-up sessions, with DESMOND participants suggesting a combined approach of MyDESMOND with occasional group sessions to facilitate peer interaction. Desired supports included progress monitoring, expert guidance, encouragement, refreshers, reminders and educational updates and opportunities for troubleshooting, and peer support. Preferences for the delivery of follow-up support varied, with some favouring personalised one-to-one support and in-person sessions, while many preferred or were open to digitally delivered synchronous group sessions for reasons of convenience and peer learning/support. Furthermore, those who had attended a DSMES programme for a second time, recommended such repeat attendance to refresh memory and better maintain changes.

4 | DISCUSSION

This qualitative study aimed to explore the behaviour change maintenance experiences of adults with T2DM over a 15-month period and their needs for post-programme support following attendance at a DSMES programme. To the best of our knowledge, this is the first longitudinal qualitative study exploring these experiences and needs beyond 12 months. The study findings provide an important evidence base for the development and refinement of DSMES programmes for better behaviour change maintenance support and offer valuable insights into how programmes can best provide ongoing support after initial attendance.

Consistent with prior research, our findings indicate that education, skills training, confidence, and intentions alone are insufficient for long-term behaviour change maintenance, highlighting the need for programmes to extend beyond educational strategies and incorporate or strengthen behaviour change support.[39]

While participants initially felt knowledgeable and empowered and cited intentions to maintain changes post-programme, various factors influenced their ability to integrate and maintain behavioural changes over time. Overall, the study findings complement our review, strengthening the evidence base with additional empirical data and expanding on the identified factors, while addressing gaps in the literature.[10] More specifically, the study identifies new *environmental and social* factors, such as food availability, stigma, social events and relationship and communication with healthcare professionals. Furthermore, it extends factors pertaining to *habits*, *resources* and *maintenance motives* by identifying new barriers/enablers related to previous habits, memory, attention and decision processes, emotion, intention and goals (see Appendix S7 for further details). The longitudinal analysis also provided greater insights into the importance and processes of developing behavioural autonomy, intrinsic motivation and behavioural automaticity to maintain behavioural changes in the long term, as well as the

use of self-regulatory strategies to deal with barriers and maintain changes over time.

Barriers to maintaining T2DM self-management behaviours were often related to *environmental and social influences*, *resources* and *self-regulation*. The importance of *environmental and social influences* related barriers and their nature suggests that efforts to better support sustained changes should be supplemented with addressing environmental, social and system-level barriers (e.g. availability/accessibility of unhealthier food on the environment, diabetes stigma, and access to specialised diabetes care). This finding and the social and environmental factors identified are largely consistent with prior research on weight maintenance.[40-42] Notably, some of the barriers identified in this study were related to emotional influences, including diabetes stigma (internalised and social), negative emotions, stress, diabetes distress and overall emotional state. This finding aligns with previous research on sustained self-management in the context of type 1 diabetes,[43] which highlighted the role of emotional factors, and indicates that psychosocial support strategies can be an important target for programmes and future research.

Conversely, common enablers were frequently related to the themes *maintenance motives* and *habits*. Specifically, our findings suggest that developing behavioural autonomy, intrinsic motivation and automaticity may be particularly important for long-term maintenance. This aligns with previous literature, which suggests that while extrinsic motivation and goal-setting may be more important in the initial stages of behaviour adoption, internalising motivation and developing behavioural automaticity are key for sustaining those changes over time.[17,27,40-43] Intrinsic motivation and some of the self-regulation strategies described by participants to deal with barriers and maintain changes over time, such as flexible eating restraint, have also been reported by a previous systematic review to be mediators for long-term weight management.[44] Similarly, a previous study highlighted the importance of the adoption of self-regulatory strategies in the transition from weight loss to weight maintenance in the context of an intervention for diabetes remission.[28] The development of intrinsic motivation and behavioural automaticity may, therefore, be important targets for programmes, along with self-regulation skills (e.g. skills in impulse control and emotion regulation). Available research on the content of DSMES programmes suggests that techniques for breaking undesirable habits and promoting habit formation may represent a particularly important missed opportunity for improving maintenance support.[45] Future studies should thus explore the feasibility and effectiveness of habit-changing techniques in these programmes. Given the impact of novel diabetes medications on behavioural self-regulation, further research should also investigate people's perceptions of these drugs and their psychosocial and behavioural impact.

Furthermore, participants frequently emphasised the importance of access to services, resources, and support networks for maintaining behavioural changes. They also described unmet needs for emotional/practical support, clinical support, ongoing education and self-management support and better understanding and awareness of diabetes among their support networks. These findings align with previous research on support needs for diabetes self-management[18,19,39,46] and suggest that better support of behaviour change maintenance may require education of families and significant others about people's support needs; education and training of health professionals on T2DM self-management, effective patient communication and behaviour change support; and an investment in improving access to resources and care, especially specialised diabetes services. Regarding ongoing education and self-management support, our data empirically support international guidelines, suggesting that some participants may benefit from support beyond the typical 12-month post-programme. Our data also corroborate previous research offering initial evidence that ongoing digitally delivered education and self-management support can be a feasible and acceptable complement to traditional DSMES programmes.[6,7] Our findings also suggest that occasional group-based sessions with peers and educators delivered in-person or online may maximise the impact of support. However, alternative delivery modes, like telephone calls, should be considered for those unable to access digital support. Further research, including qualitative studies with educators and programme managers and health economic analyses are, however, needed to examine the resource implications of different post-programme support approaches.

In addition, our findings extend existing research by identifying desired features for ongoing support, including progress monitoring, expert guidance, advice and troubleshooting, encouragement and motivation support, refreshers, reminders and nudges, educational updates, social modelling/learning and peer support. However, the role of social learning/modelling and peer support should be further investigated, as some participants expressed limited interest/appreciation for this type of support. In the absence of resources, our findings suggest that raising awareness of existing supports and the encouragement of repeated programme attendance during challenging times or when programme learnings fade may be beneficial.

4.1 | Strengths and limitations

The present study has several strengths, including its duration, the inclusion of public and patient involvement in design and data analysis, robust and novel data analysis methods and high participant retention. However, some limitations must be acknowledged. First, participants from the DESMOND programme were exclusively recruited from a single central hospital. Second, at recruitment, although originally designed for face-to-face delivery, both programmes were delivered online due to COVID-19 restrictions, which may have led to programme adjustment with an impact on participants' experiences and subsequent needs. Third, one interview was excluded from the analysis due to a recording issue, potentially leading to the loss of valuable insights into that participant's behaviour change journey. Fourth, the study's sample was ethnically homogeneous, predominantly female and made up of individuals recently diagnosed with T2DM, potentially limiting the generalisability of the findings. Finally, participation in the study may have influenced participants' behaviour change processes.

5 | CONCLUSION

Environment and social influences, self-regulation, resources (psychological and physical), habit and motivation are key factors in maintaining behavioural changes after participating in T2DM DSMES programmes. Common barriers to maintaining changes were frequently related to the physical and social environment, sociocultural norms, self-regulation skills, emotion, competing life demands, physical resources, intentions, knowledge, memory, attention and decision processes. Key enablers include behavioural autonomy, intrinsic motivation and habit development. Participants also reported several unmet emotional/practical, clinical and ongoing educational and self-management support needs. Our findings suggest that extended support beyond 12 months post-programme may benefit some participants. To address people's needs and preferences, this support may combine digitally delivered ongoing support with occasional sessions involving peers and educators and include progress monitoring, expert guidance, troubleshooting opportunities, motivational support, refreshers, reminders and nudges, educational updates, social learning/modelling and peer support.

AUTHOR CONTRIBUTIONS

Márcia Carvalho: funding acquisition, conceptualization, methodology, investigation, formal analysis, writing—original draft preparation. **Eimear Morrissey:** formal analysis, writing—review and editing. **Pauline Dunne:** formal analysis, writing—review and editing. **Amanda Drury:** methodology, writing—review and editing. **Molly Byrne:** conceptualization, methodology, supervision, writing—review and editing. **Jenny McSharry:** conceptualization, methodology, supervision, writing—review and editing.

ACKNOWLEDGEMENTS

We would like to thank the education programme teams and diabetes educators who contributed to the design of the study and facilitated the recruitment. We would also like to thank the study participants who made time to take part in this study and kindly shared their personal experiences and perspectives with us over 15 months. Finally, we would like to thank the *SUSTAIN T2DM* public advisory panel for their invaluable contributions to the design of this study and analysis of its findings.

FUNDING INFORMATION

This study was funded by the University of Galway through a Hardiman Research Scholarship awarded to Márcia Carvalho. The funders had no role in the study design, data coding and analysis, the decision to publish or the manuscript preparation. The views expressed in this paper are those of the authors and do not necessarily reflect those of the University of Galway.

CONFLICT OF INTEREST STATEMENT

No authors have any conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Data have been included in this manuscript and appendices via verbatim transcripts extracted quotes. The dataset analysed in this study is not publicly available due to ethical reasons. However, additional data supporting the findings of this study is available, via the corresponding author, on reasonable request.

CONSENT TO PARTICIPATE AND FOR PUBLICATION

All study participants provided written informed consent, including for quotes to be published in this article. In addition, the study was conducted in accordance with the Declaration of Helsinki ethical principles for medical research involving humans.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Carvalho M, Morrissey E, Dunne P, Drury A, Byrne M, McSharry J. Understanding behaviour change maintenance after attending a self-management education and support programme for type 2 diabetes: A longitudinal qualitative study. *Diabet Med*. 2025;42:e70032. doi:10.1111/dme.70032