A fresh start with high hopes: a qualitative evaluation of experiences of the Total Diet Replacement phase of the NHS Low Calorie Diet Programme pilot

CATHERINE HOMER,[1] KARINA KINSELLA,[2] KEVIN JAMES DREW,[2] JORDAN MARWOOD,[2] TAMARA BROWN,[2] SIMON ROWLANDS,[2] DUNCAN RADLEY,[3] CHARLOTTE FREEMAN,[2] ABIMBOLA OJO,[4] JENNIFER TEKE,[4] KEN CLARE,[2] CHIRAG BAKHAI,[5] LOUISA ELLS[2]

Abstract

Background: The National Health Service (NHS) Low Calorie Diet (LCD) programme in England aims to support people with type 2 diabetes (T2DM) to lose weight, improve glycaemic parameters and potentially achieve diabetes remission. The programme pilot launched in 2020 using three different delivery models: one-to-one, group and digital via an App. Service users begin the programme with 12 weeks of Total Diet Replacement (TDR). This study aims to understand the experience of this TDR phase from the service user perspective.

Methods: This was a co-produced qualitative longitudinal and cross-sectional study, underpinned by a realist informed approach using semi-structured interviews and photovoice techniques. Service users (n=45) from the NHS LCD programme were recruited across the three delivery models and 21 pilot sites in England. Data were analysed using a thematic approach.

Results: Participant demographics were representative of the overall LCD pilot population sample and included experiences from a mix of delivery models and providers. Three themes were presented chronologically. 1) life pre-LCD: the LCD programme was viewed as an opportunity to reset eating behaviours and improve quality of life; 2) experience of TDR: flexibility in allowing supplementary non-starchy vegetables and adapting the flavour and texture of TDR products supported adherence; 3) looking ahead to food reintroduction: at the end of the TDR phase, weight and glycaemia had reduced, while subjective energy levels and mobility improved. Some participants were concerned about progressing to the food reintroduction phase and the possibility of weight regain.

Conclusions: The paper reports insight from the TDR phase of the LCD programme. The co-production of this work has resulted in several recommendations for policy and practice which have informed the national roll out of the programme.

Br J Diabetes 2024;**24**:ONLINE AHEAD OF PUBLICATION
https://doi.org/10.15277/bjd.2024.435

Key words: type 2 diabetes, obesity, Low Calorie Diet, qualitative, longitudinal, Re:Mission study

[1] Sport and Physical Activity Research Centre, Sheffield Hallam University, Olympic Legacy Park, Sheffield
[2] Obesity Institute, School of Health, Leeds Beckett University, City Campus, Leeds
[3] Obesity Institute, School of Sport, Leeds Beckett University, Headingley Campus, Leeds
[4] Re:Mission Patient and Public Involvement Group, Obesity Institute, School of Health, Leeds Beckett University, Leeds
[5] Larkside Practice, Churchfield Medical Centre, Luton, Bedfordshire

Address for correspondence: Dr Catherine Homer
Sport and Physical Activity Research Centre, Sheffield Hallam University, Olympic Legacy Park, 2 Old Hall Road, Sheffield, S9 3TU
E-mail: c.homer@shu.ac.uk
https://orcid.org/0000-0003-2571-6008

Introduction

An overview of the 52-week Low Calorie Diet programme (now known as NHS Type 2 Diabetes Path to Remission Programme) has previously been reported.[1] Although clinical trials have demonstrated the clinical efficacy of Total Diet Replacement (TDR) approaches in driving weight loss, glycaemic improvements and diabetes remission in people with type 2 diabetes (T2DM) living with overweight or obesity,[2,3] there is a lack of qualitative data examining the service user journey. This is important given the wider population reach and delivery constraints within real-world implementation. It is therefore critical to explore service user experience, in order to understand what worked and what did not, for whom, why, and how the programme could be improved in the future.

This paper reports on the qualitative insights from a socio-demographically diverse range of service users after they completed the first phase of the programme. It explores their reasons for taking part in the programme, their experience of the first 12 weeks and their looking ahead to the reintroduction of food. This first phase of the programme comprises 12 weeks of following a diet composed solely of nutritionally-complete TDR products, alongside regular (a minimum of eight) behaviour change support sessions. The TDR products range in variety and can include soups, shakes and bars that provide a total energy intake of 800-900 kilocalories per day. When service users are unable to comply with full TDR, they may introduce a single meal of non-starchy vegetables, or substitute a single TDR meal for a nutritionally appropriate meal of no more than

300 calories. Fibre supplements are also provided to all service users during this phase, with advice to consume 7g per day.[4]

Methods

This article details the methodological approach taken using the COREQ guidelines, see the consolidated criteria in supplementary file 1 – online at www.bjd-abcd.com

Longitudinal interviews and photo elicitation were undertaken with 30 participants at the end of the TDR phase (12 weeks) (see participant characteristics summary table 1 in supplementary file 2 – online at www.bjd-abcd.com). An additional 15 participants were interviewed cross-sectionally at six months, to plug any gaps in terms of representativeness of the longitudinal population (see participant characteristics summary table 2 in supplementary file 2 – online at www.bjd-abcd.com). Any insights captured during the cross-sectional interviews that related to the TDR stage are also incorporated. All participants were recruited via the Re:Mission study survey or through an invitation from their service provider, and provided informed consent to participate.

Ethical approval was received from the Health Research Authority (REF 21/WM/0126) and Leeds Beckett University (REF 107887 and 79441).

Methods have previously been reported in full but, in brief,

Table 1. Participant characteristics at 12-week interviews

Characteristics		Longitudinal participants (n=30)	Cross-sectional participants (n=15)	Total number of participants (n=45)
Gender	Male	12 (40%)	6 (40%)	18 (40%)
	Female	18 (60%)	9 (60%)	27 (60%)
Age (years)	30-34	1 (3%)	0 (0%)	1 (2%)
	35-39	4 (13%)	2 (13%)	6 (13%)
	40-44	3 (10%)	2 (13%)	5 (11%)
	45-49	3 (10%)	2 (13%)	5 (11%)
	50-54	6 (20%)	2 (13%)	8 (18%)
	55-59	5 (17%)	3 (20%)	8 (18%)
	60-65	8 (27%)	4(27%)	12 (27%)
Service provider	SP1	1 (3%)	1 (7%)	2 (4%)
	SP2	19 (63%)	5 (33%)	24 (53%)
	SP3	7 (23%)	3 (20%)	10 (22%)
	SP4	1(3%)	4 (27%)	5 (11%)
	SP5	2 (7%)	2 (13%)	4 (9%)
Delivery model	Face-to-Face 1:1	3 (10%)	2 (13%)	5 (11%)
	Remote 1:1	2 (7%)	4 (27%)	6 (13%)
	Remote Group	22 (73%)	6 (40%)	28 (62%)
	Digital	3 (10%)	3 (20%)	6 (13%)
Ethnic group †	White British or White Mixed British	25 (83%)	10 (66%)	35 (78%)
	Asian/Asian British	3 (10%)	0 (0%)	3 (7%)
	Black/African/Caribbean/Black British	1 (3%)	2 (13%)	3 (7%)
	Mixed or Multiple Ethnic Group	1 (3%)	1 (7%)	2 (4%)
	Other Ethnic Group	0 (0%)	1 (7%)	1 (2%)
	Prefer not to say	0 (%)	1 (7%)	1 (2%)
IMD quintiles §	1 (most deprived)	11 (37%)	2 (13%)	13 (29%)
	2	4 (13%)	3 (20%)	7 (15%)
	3	6 (20%)	3 (20%)	9 (20%)
	4	3 (10%)	4 (27%)	7 (15%)
	5 (least deprived)	6 (20%)	3 (20%)	9 (20%)

† The ethnic group classification as used by the Office for National Statistics in the 2021 census

§ The Index of Multiple Deprivation (IMD) score is as absolute measure of deprivation that allows for Lower Super Output Areas (LSOAs) in England to be ranked and subsequently classified into five quintile bands. Quintile 1 is the 20% most deprived LSOAs in England, while quintile 5 is the 20% least deprived LSOAs.

semi-structured interviews were conducted online using Microsoft Teams:[1] 12-week longitudinal interviews were conducted by KD and CH, who were supported by three Patient and Public Involvement (PPI) group members (KC, JT, AO),[5] where PPI support was requested by the interviewee (n=11). Twenty-one of the 12-week interviewees shared photos, films, or audio recordings with the researcher via a secure file transfer link and explained the meaning behind the photos, films or audio recordings during the interview. KK and CF undertook the six-month cross-sectional interviews.

All interviews were transcribed verbatim and subjected to thematic analysis.[6] Researchers (CH, KD, TB, KK, JM, SR) independently familiarised themselves with five transcripts from the 12-week interviews. An initial list of codes was identified by each researcher using the interview schedule as a deductive framework and this was discussed as a group. This led to the development of an initial framework from which each researcher then inductively coded five transcripts and added any additional codes. This stage also included a focus on the narrative that accompanied any images and recordings. All researchers met again to discuss additional codes, and CH and KK revised the coding framework accordingly. Cross-sectional interviews were coded by KK and any data relevant to the TDR stage were coded and included within the 12-week framework. Data were stored and organised using NVivo Software (QS International Play Ltd. Version 12.6).

Results

Participant demographics were representative of the overall LCD pilot population sample, according to interim data presented to the advisory group in summer of 2023. Participant characteristics are shown in Table 1.

Themes from the interviews are presented chronologically through the patient journey.

Life pre–Low Calorie Diet programme (Table 2)

Interviewees were asked to reflect on what their life was like prior to starting the LCD programme. For most participants, living with obesity and T2DM severely affected their daily lives. Physical health impacts included lethargy, loss of mobility, oedema, headaches, frequent urination and other broader health conditions. One participant shared a picture of the chair they had slept in for three years as a result of their weight and health conditions (see supplementary file 3 – online at www.bjd-abcd.com). Psychosocial impacts of living with obesity led to avoidance of social situations, increased self-reported anxiety and depression. Participants reported using diet, exercise and medication to control their T2DM and manage their weight. Participants attributed their T2DM to a range of dietary habits and behaviours, from struggling to eat regular healthier meals, over- consumption of food and 'bad habits' exacerbated by the COVID-19 lockdowns. Weight cycling (losing and regaining weight) was a prominent theme in nearly all interviews. Poor mental health, lifelong emotional eating and perceived addiction to food were often cited as a response to manage anxiety or stressful situations. Exercise routines were reported to be impeded by barriers such as health problems, access, cost and work, with a lack of exercise cited as leading to further weight gain. Medications for T2DM and other co-morbidities were reported as compounding efforts to lose weight.

Most participants were prescribed medication to manage their T2DM and they reported unpleasant side effects. The aspiration of not requiring diabetes-related medication was viewed as a key driver for starting the LCD programme. Motivations for starting the programme also included the potential for improvements to current health and fear of future poor health, often linked to having seen premature morbidity in family members.

The LCD programme was viewed as an opportunity to reset

Table 2. Theme one - Life pre–Low Calorie Diet programme

Sub theme	Illustrative quote
Impact of diabetes and excess weight on the lives of the participant	*"I started to lose sensation in my feet, and it was beginning to feel if I say more real, more life threatening I suppose, I felt very, very unwell, really, really unwell." (P18)*
	"I felt quite embarrassed over Christmas when I went to a couple of parties, and I got to a point where I stopped going. Being Asian and we have loads of family get togethers and I started looking for excuses not going. I became quite shallow, I started isolating myself. I wouldn't buy clothes because of my size. I didn't feel comfortable with the way I looked, and I was making excuses." (P28)
	"I cook healthily. I cook balanced diets, I've been cooking since I was 10 years old. But my issue with my mental health was that I, was my triggers, anxiety and stress, will trigger comfort eating and then also the medication that I've been on for, for now, for my other conditions, they basically have put the weight on. So although I was tailoring and changing and modifying meals, I was still finding I was comfort eating." (P15)
Motivation to join the LCD programme	*"I felt both motivated to do something about it, but I also felt incredibly like I'd failed miserably, I've been struggling with this disease by that stage for at least 2 ½ years I think, and I just wasn't able to control it. So, I felt like a complete failure. I felt like there was nothing I could do that could stop it or change it. Yeah it was just getting progressively worse. But I was motivated." (P16)*
	"I'm not going back on those tablets. It doesn't matter what I need to do. So, if I need to starve for three months…I will starve for three months. If I have to eat 800 calories, 600 calories for the rest of my life I will. But I'm not going back on those tablets." (P65)
	"I got to the realisation that I am essentially killing myself. You know that, that little bit of knowledge can scare you. Scare the bejesus out of you sometimes can't it…I got to the realisation that if I carry on, I am gonna kill myself. I can't keep doing this." (P56).
	"You know the programme itself will help and it will give you that good kick start, but you got to have it in your head that you're going to do this and stay positive." (P114, 6M)

Table 3. Theme two - Experience of the Total Diet Replacement

Sub theme	Illustrative quote
TDR products-adaptations	*"It was just seasoning it with garlic and then a few sort of like skinny, have you heard of Skinny co, the brand as well, they've got quite a few that are zero calorie and low sugar and things. So I've got a couple of flavourings on them, again, just to get something different and one of them was like a tikka and there was another one which is like barbecue again, just nice to put on things like that to make you feel like you're still sort of having something." (P21)*
TDR products-quality and variety	*"I needed to taste all six and then choose, but I could only have six tubs out of six. So I could have one each, or I could double on something. But then you later on think and reflect after you've already placed the order that you can't have any milk, so you have to use one of the shakes in your coffee, which is what I've done. So in hindsight, I would have chosen 2 chocolate, one banana and or one strawberry and then the three soups. So now I'm stuck basically with loads of strawberry and banana shake that I don't particularly want, but, that's the, that's the only glitch I think. I think you don't acquire understanding of what you're getting until you actually start." (P57)*
Motivation during TDR phase-individual level	*"I've probably not had the healthiest relationship with food for a number of years. So actually, to me, taking the food away was almost like the opportunity for a fresh start for an opportunity to say, OK well let's get some weight off, let's get you to a healthier place and then actually lets come back and reset." (P70)*
Motivation during TDR phase-improvements to day-to-day living	*"I couldn't even see my feet before, let alone reach them. So I've actually been able to have a pedicure, have nail varnish on my feet in quite a few years. Yeah. So that was the first time I have applied it. I've actually been able to. I can now bend down and touch my feet." (P57)*
Peer support-during and outside of the group session	*"We've all had difficult issues. There's been personal circumstances that have affected us independently and throughout, and we've been honest and candid with each other in the group to the point whereby something terrible has happened, it's it got discussed and then we offer support and we, we communicated and we, you know express words of kindness and all, we just supported each other. So I'm grateful, very grateful that we had that group because if it wasn't for that group and that communication with the other participants in our WhatsApp group, I think things would have been a lot more different. And I might not even finished the phase, the first 12 weeks." (P15)*

emotional responses and relationships with food by taking a complete break from normal food preparation and consumption. Readiness to change was perceived by participants to be essential in the run-up to starting the LCD programme. Participants shared feelings of excitement for the future, anticipation of better health, quality of life, and desperation to change their current situation. The TDR element of the programme gave rise to expectations of rapid initial weight loss accompanied by requirements to stop glucose-lowering medications.

Experience of the Total Diet Replacement (Table 3)

Participants from all delivery models were provided with four TDR products each day for 12 weeks. The perceived quality and options of products varied across the providers: some offered a wide range of flavours and options (n=97 products), while others had a more limited selection (n=6 products). The acceptability of TDR products was influenced by several factors such as taste, variety, palatability of taste and texture, and cultural familiarity. Hunger and cravings were common experiences and the addition of non-nutritive items like teas and chewing gum was common practice. Participants were provided with fibre supplements, and some reported relying on them to manage constipation. Participants often adapted the taste of TDR products by incorporating spices and sugar-free syrups (see supplementary file 3 – online at www.bjd-abcd.com – for images). Participants also found ways of adapting the form of TDR products by turning shakes into ice lollies or baking the mixture to make macaroons. Allowing supplementary foods such as non-starchy vegetables or calorie-controlled meals as a substitute for a single TDR meal provided important flexibility which helped individuals stick with the programme. One provider allowed participants to use 'joker cards' (one day of 'normal' food in the 12 weeks). Adherence was also influenced by the sense of control and convenience that the TDR products offered.

Participants reported rapid improvements in their weight and blood glucose levels during the TDR phase. Some reported significant levels of weight loss of up to 20% of starting body weight. Other reported outcome measures included feelings of increased energy, mobility, functional fitness and improved self-esteem. Participants shared pictures of things they could now do because of the weight loss such as painting their toenails (see supplementary file 3 – online at www.bjd-abcd.com). Conversely participants also reported some negative impacts such as constipation, tiredness and feeling cold.

The support of family and friends was discussed positively as a source of support and motivation during TDR. However, social isolation and avoidance of social situations where food was concerned was also common. In the home environment some participants talked about their family eating in other rooms so not to tempt them with food, and others had to continue to cook meals for their family. Where available across the different delivery models, some participants found peer support from other LCD service users helpful, whether gained through WhatsApp groups (group delivery model) or online community forums (group and digital model). On some occasions, particularly in group sessions, some people reported that the peer support groups were not cohesive. The need for some form of peer support was highlighted within the 1:1 delivery model.

Looking ahead to food reintroduction (Table 4)

The second stage of the LCD programme (weeks 12-18) was food reintroduction (FR), when service users were supported in their transition from TDR products back to normal meals. Participants interviewed at 12 weeks shared their hopes and

Table 4. Theme three - Looking ahead to food reintroduction

Sub theme	Illustrative quote
Looking forward-transition anxiety around food reintroduction	*"So I'm a bit worried that it's a bit like once you pop you can't stop, but I'm just gonna keep like of an evening, right I've had dinner now, what else can I eat and just eat everything in sight." (P42)*
	"I think it's a lot of the people is we're terrified that the weight's gonna go back up again, you know. We're gonna slip into bad habits, you know, and they are sort of well, you know, I mean. I'm not too bad, but it's I know other people say it's very easy to start having munchies, like chocolate bars or something like that, you know, just, you know, to supplement your diet which you don't really need. You just take it out of habit or because it's something to do. And that's the worst thing they're worried about because the TDR diet was so strict that you know, you knew exactly what you were eating and you know what kind of. When you go back to food, it's very, very easy and you're very worried that you're gonna, you know, slip into the same old bad habits again yeah and put weight on." (P34)
Looking forward-continued TDR product use	*"I will continue using them at least for this programme. I want to carry on that way 'cause I've still I still want weight that I want to lose. I don't want to end up back on the metformin. I want to obviously lose like to say the blood pressure tablets and stuff like that. So if that's helping then I'll continue with that until next June maybe when the programme finishes and then decide then if I need to continue with them." (P54)*
	"It's supposed to be 3 TDR products and an evening meal for me at the moment. But some days, I'll be honest, I'm still just having the four products. I think I shall always, even when I introduce food, I think the way I think at the moment is I shall probably just continue to have a milkshake in the morning or porridge and a bar of an evening. Because even after an evening meal, I've just got a routine where I know I've got my bar when I'm sat down and watching the telly. And it's just something that I have to look forward to. Rather than a packet of minstrels or something." (P7)

concerns as they embarked on this next stage of the programme. Expectations around meeting weight loss targets and improving blood glucose levels were high, due to the rapid improvements experienced in the first 12 weeks of TDR. However, the prospect of reintroducing meals also drove apprehension that weight loss would slow, and there could be weight regain, thereby undoing the positive changes they had experienced. Participants discussed how the control they felt whilst using the TDR products would be removed, as they had to make choices about food again. Participants were concerned about the challenges of planning meals for themselves and others around them who might want to eat differently. Participants talked about the strategies they were planning to use to manage their diets during FR, such as spreadsheets to record calories and meals and food shop planning. Discussions also focused on the potential continued use of TDR products, with some participants indicating they might continue using TDR products (outside the programme specification) for convenience and to sustain weight loss.

Discussion

In this paper we have explored the experiences of participants who completed 12 weeks of TDR. Their experiences of living with excess weight and T2DM influenced their motivation to take part in the programme. The reset that participants sought from the TDR, and their associated expectations of changes to health and quality of life, were similar to the expectations of people seeking other weight loss interventions and bariatric surgery.[7] Participants were very focused on weight and glycaemic outcomes during the TDR phase, and many experienced immediate positive effects related to starting the TDR products. The general positivity at this early stage is perhaps not surprising given the rapid weight loss and improvement in glycaemia that are reached.[8] Participants' focus appeared not to be on weight loss per se, but on weight loss to control T2DM, which can help improve long-term weight maintenance.[9] Participants also discussed other psychosocial issues that were important, as well as personal motivation related to the desire to improve associated health outcomes related to weight loss. This finding was also reported in the qualitative evaluation of the DiRECT study,[10] and may support long-term management: this is improved when motivations are aligned with personal values and preferences,[11] and when patient-reported outcome measures are used.[12]

Personal motivation and sense of control were constantly challenged in everyday life, with adaptations to home life and social situations commonplace whilst undertaking TDR. These findings reflect the importance of recognising the wider environment and systems that influence behaviour.[13] Placing behaviour inside the system rather than just on the individual allows us to identify how the individual and system interact,[14] and to move away from an individual focus to more holistic person-centred care.[15] The identified importance of peer support also aligns with evidence from other peer support interventions that are associated with significant short-term weight loss.[16,17]

Participants reported that using TDR gave them a sense of control over their energy consumption that they struggled to manage within their standard diet. Participants reported feeling anxious about food reintroduction, with some participants planning to continue using TDR products outside the programme specification. A person-centred approach which seeks to understand the intentions and motivations of individuals who plan to continue to use TDR products could reduce anxiety and provide strategies to discourage longer-term TDR usage. Previous analyses have shown binge eating and emotional eating to be prevalent in this population.[18] Although it is recognised that extreme restriction and control over food are risk factors and symptoms of disordered eating,[19] the long-term impact of TDR programmes in this context is not yet well established and is a key area for future research.

Overall, the evidence generated from the interviews shows

the importance of taking a person-centred approach if we truly want to help people living with obesity and T2DM to maintain a healthy lifestyle.

Strengths and limitations

This is the first qualitative study to explore the lived experiences of service users who have attended the NHS LCD programme. Despite repeated efforts to engage service users from all service providers, this was challenging as the level of engagement in the evaluation process varied hugely between providers. A limitation of the data reported in this paper was the low number of participants from diverse minoritised ethnic groups. Barriers to compliance with the programme disproportionately impact people from minoritised ethnic groups. We have some understanding of how ethnicity and socioeconomic status intersect. This was presented in the paper by Dhir,[20] which interviewed 12 services users identifying as South Asian ethnicity and through the perceptions of the commercial providers.[21] Representation was however strengthened by the addition of reflections from the cross-sectional data. This paper presents outcomes at 12 weeks into a 52-week programme and, as such, the positive outcomes experienced at this point may not be reflective of outcomes reported at the end of the LCD programme. The use of photovoice methodology gave power to the participants in the research process as they used prepared visual methods and audio recordings to illustrate their points.

Recommendations for policy and practice

1. Opportunities to encourage peer support in different forms (web-based, online) should be routinely promoted by providers.
2. TDR sessions need to be person-centred, recognising that a one-size-fits-all approach is not readily amenable to meeting the individual needs of service users.
3. Including Patient Reported Outcome Measures (such as increased energy, feeling happier) as well as clinical outcome measures in service monitoring and data collection may aid motivation and expectation of outcomes from the service user perspective.
4. Coaching sessions during the TDR phase should prioritise supporting readiness for food reintroduction, including support for behaviour change, targeted support regarding emotional or disordered eating, managing expectations and addressing fears regarding weight gain and loss of control.

Conclusions

Reducing the biopsychosocial impacts of living with T2DM and excess weight are a motivator for people starting the LCD programme. The experiences of people at the end of the TDR phase are largely positive, with service users reporting significant weight loss, improved glycaemia and better quality of life. TDR provides control and structure for people who seek to change their eating behaviours. As participants begin to transition from TDR, some reported experiencing anxiety regarding reintroducing food and how this may impact on weight and blood glucose. This co-produced study sought to explore the experience of service users at the end of the first 12 weeks of the LCD programme. Several of the recommendations for policy and practice have already informed the national roll out of the programme and have been incorporated into its new specification.

Key messages

- Previous experiences of living with excess weight and type 2 diabetes can influence motivation to take part in the Low Calorie Diet programme.
- The prospect of food reintroduction following the 12-week Total Diet Replacement phase is concerning for individuals.
- Importantly, a person-centred approach is required across all delivery models to understand the context of individuals' experiences of weight and type 2 diabetes both before and during the programme

Copyright ownership The author(s) retain copyright.
Conflict of interest The authors declared the following potential conflicts of interest with respect to the research, authorship and/or publication of this article: CB is a primary care adviser to the national diabetes programme for NHS England.
Funding This work was supported by the National Institute for Health Research, Health Services and Delivery Research [NIHR 132075]. The NHS LCD programme is funded by NHS England. For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) licence to any author accepted manuscript version arising. The views expressed in this publication are those of the author(s) and not necessarily those of the MRC, NIHR or the Department of Health and Social Care.
Acknowledgements The authors would like to acknowledge Clare Helm from NHS England, who has worked on the coproduction of this study, identification of study aims and who provided feedback on an earlier draft of this manuscript.
The authors would also like to acknowledge the Patient and Public Involvement team that have worked on the coproduction of the Re:Mission study, including Mike Willis, Gulsoom Akhtar, Beth Clegg and Clair Goddard. Members of the steering and oversight groups are also acknowledged by the authors for their input and involvement in the Re:Mission study, including the clinical lead Dr Mark Ashton.
The Re:Mission study includes a multidisciplinary team of academics from across the North of England. The authors would like to acknowledge the team, including Dr Jamie Matu, Prof Jim McKenna, Dr Maria Maynard, Pat Watson, Dr Susan Jones, Dr Tanefa Apekey, Dr Stuart Flint, Prof Janet Cade, Dr Adam Martin, Dr Tayamika Kamwanja, Dr Maria Bryant, Dr Wendy Burton, Mick Martson, Pooja Dhir and Tamla Evans.
Ethical approval Ethical approval was received from the Health Research Authority (REF 21/WM/0126) and Leeds Beckett University (REF 107887 and 79441). Participants provided informed consent to participate in the Re:Mission study, including consent for publication. All

participant data were anonymised and where photos have been used in publications or presentations, permission was sought from each participant.

References

1. Homer C, Kinsella K, Marwood J, *et al*. The Re:Mission study: Evaluating the NHS Low Calorie Diet pilot - an overview of service user data collection. *Br J Diabetes* 2024;**24**:ONLINE AHEAD OF PUBLICATION. https://doi.org/10.15277/bjd.2024.433
2. Lean MEJ, Leslie WS, Barnes AC, *et al*. Durability of a primary care-led weight-management intervention for remission of type 2 diabetes: 2-year results of the DiRECT open-label, cluster-randomised trial. *Lancet Diabetes Endocrinol* 2019;**7**(5):344-55. https://doi.org/10.1016/S2213-8587(19)30068-3
3. Astbury NM, Aveyard P, Nickless A, *et al*. Doctor Referral of Overweight People to Low Energy total diet replacement Treatment (DROPLET): pragmatic randomised controlled trial. *BMJ* 2018;**362**:k3760. https//doi.org/10.1136/bmj.k3760
4. England N. NHS Low Calorie Diet Programme – face to face [one to one/group] delivery model - Service Specification. 2019.
5. Clare K, Ojo A, Teke J, *et al*. 'Valued and listened to': the collective experience of patient and public involvement in a national evaluation. *Perspectives in Public Health* 2022;**142**(4):199-201. https://doi.org/10.1177/17579139221103184
6. Braun V, Clarke V, Weate P. Using thematic analysis in sport and exercise research. Routledge handbook of qualitative research in sport and exercise 2016; pp191-205.
7. Homer CV, Tod AM, Thompson AR, Allmark P, Goyder E. Expectations and patients' experiences of obesity prior to bariatric surgery: a qualitative study. *BMJ Open* 2016;**6**(2):e009389. https://doi.org/10.1136/bmjopen-2015-009389
8. Thomas DM, Martin CK, Redman LM, *et al*. Effect of dietary adherence on the body weight plateau: a mathematical model incorporating intermittent compliance with energy intake prescription. *American Journal Clin Nutr* 2014;**100**(3):787-95. https://doi.org/10.3945/ajcn.113.079822
9. Silva MN, Vieira PN, Coutinho SR, *et al*. Using self-determination theory to promote physical activity and weight control: a randomized controlled trial in women. *Journal Behavior Med* 2010;**33**:110-22. https://doi.org/10.1007/s10865-009-0239-y
10. Rehackova L, Rodrigues AM, Thom G, *et al*. Participant experiences in the Diabetes REmission Clinical Trial (DiRECT). Diabetic Medicine 2022;39(1):e14689. https://doi.org/10.1111/dme.14689
11. Hall KD, Kahan S. Maintenance of lost weight and long-term management of obesity. *Medical Clinics of North America* 2018;**102**(1):183-97. https://doi.org/10.1016/j.mcna.2017.08.012
12. Carroll P, Mygind V, Anderson J, Khot F, Simpson J. Patient reported outcome measures in weight management service evaluation. *Journal Human Nutrition Dietetics* 2011;**24**(4):381-2. https://doi.org/10.1111/j.1365-277X.2011.01177_9.x
13. Griffiths C, Ells L, Gilthorpe M, Clare K, Coggins A. A complex systems approach to obesity: a transdisciplinary framework for action. 2022. https://doi.org/10.1177/17579139231180761
14. Nguyen-Trung K, Saeri AK, Zhao K, Boulet M, Kaufman S. A brief introduction to a Socio-Ecological COM-B (SeCOM-B): a behaviour change framework response to wicked problems. 2023. https://doi.org/10.31219/osf.io/4x6wa
15. Ells LJ, Ashton M, Li R, *et al*. Can we deliver person-centred obesity care across the globe? *Current Obesity Reports* 2022;**11**(4):350-5. https://doi.org/10.1007/s13679-022-00489-7
16. Chen Y, Li Z, Yang Q, *et al*. The effect of peer support on individuals with overweight and obesity: a meta-analysis. *Iranian Journal Public Health* 2021;**50**(12):2439. https://doi.org/10.18502/ijph.v50.12.7926
17. Ufholz K. Peer support groups for weight loss. *Current Cardiovascular Risk Reports* 2020;**14**:1-11. https://doi.org/10.1007/s12170-020-00654-4
18. Marwood J, Radley D, Evans TS, *et al*. Cross-sectional analysis of emotional and binge eating in UK adults enrolled on the NHS Low-Calorie Diet Pilot for Type 2 Diabetes (under review); 2023.
19. Elran-Barak R, Sztainer M, Goldschmidt AB, *et al*. Dietary restriction behaviors and binge eating in anorexia nervosa, bulimia nervosa and binge eating disorder: trans-diagnostic examination of the restraint model. *Eating Behaviors* 2015;**18**:192-6. https://doi.org/10.1016/j.eatbeh.2015.05.012
20. Dhir P, Maynard M, Drew KJ, Homer CV, Bakhai C, Ells LJ. South Asian individuals' experiences on the NHS low-calorie diet programme: a qualitative study in community settings in England. *BMJ Open* 2023;**13**(12):e079939. https://doi.org/10.1136/bmjopen-2023-079939
21. Jones S, Brown TJ, Watson P, *et al*. Commercial provider staff experiences of the NHS low calorie diet programme pilot: a qualitative exploration of key barriers and facilitators. *BMC Health Services Research* 2024;**24**(1):53. https://doi.org/10.1186/s12913-023-10501-y

Supplementary file 1: Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No. Item	Guide questions/description	Reported on Page #
Domain 1: research team and reflexivity		
Personal characteristics		
1. Interviewer/facilitator	Which author/s conducted the interview or focus group?	pp. 4
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Additional File 1
3. Occupation	What was their occupation at the time of the study?	Additional File 1
4. Gender	Was the researcher male or female?	Additional File 1
5. Experience and training	What experience or training did the researcher have?	Additional File 1
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	Reported in Homer C *et al* (2024). The Re:Mission study: Evaluating the NHS Low Calorie Diet pilot - an overview of service user data collection. *British Journal of Diabetes*, In review.[1]
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Reported in Homer C *et al* (2024). The Re:Mission study: Evaluating the NHS Low Calorie Diet pilot - an overview of service user data collection. *British Journal of Diabetes*, In review.[1]
8. Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	n/a
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis,	Reported in Homer C *et al* (2024). The

	ethnography, phenomenology, content analysis	Re:Mission study: Evaluating the NHS Low Calorie Diet pilot - an overview of service user data collection. *British Journal of Diabetes*, In review.[1]
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	pp.3
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	pp.3
12. Sample size	How many participants were in the study?	pp.4
13. Non-participation	How many people refused to participate or dropped out? Reasons?	n/a
Setting		
14. Setting of data collection	Where were the data collected? e.g. home, clinic, workplace	pp.4
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	pp.4
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	pp.3 and 4 and additional file 3
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	pp.4
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	n/a
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	pp.4
20. Field notes	Were field notes made during and/or after the interview or focus group?	n/a
21. Duration	What was the duration of the interviews or focus group?	pp.4
22. Data saturation	Was data saturation discussed?	n/a
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	n/a
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	pp.4
25. Description of the coding tree	Did authors provide a description of the coding tree?	pp.5
26. Derivation of themes	Were themes identified in advance or derived from the data?	pp.5
27. Software	What software, if applicable, was used to manage the data?	pp.5

28. Participant checking	Did participants provide feedback on the findings?	n/a
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	pp.7,9,10
30. Data and findings consistent	Was there consistency between the data presented and the findings?	pp/5-13
31. Clarity of major themes	Were major themes clearly presented in the findings?	pp.6-11
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	pp.6-11

Developed from:
Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care* 2007; **19**: 349 – 57.

Personal characteristics of interviewers:
Dr Catherine Homer PhD (Female). Associate Professor of Obesity and Public Health with experience working in academia and extensive experience working in public health.

Karina Kinsella MRes (Female). Research Officer for the Re:Mission Study with extensive experience of evaluating interventions.

Dr Kevin J Drew PhD (Male). Post-doctoral Research Fellow with 7 years' experience of conducting qualitative evaluations of health-based interventions.

Dr Jordan Marwood PhD (Female). Research Fellow with extensive experience conducting obesity research with particular focus on disordered and emotional eating.

Dr Tamara Brown PhD (Female). Reader in Obesity, with 5 years' experience of focus groups and research in weight management.

Dr Simon Rowlands PhD (Male). 25 years' experience in public health practice, research and education with specialist interest in obesity and men's health.

Dr Duncan Radley PhD (Male). Reader with 25 years' experience conducting obesity research, and previously research manager in weight management service providers.

Charlotte Freeman (Female). Research Officer for the Re:Mission Study with experience of evaluating interventions in academia and experience of working in public health.

Dr Abimbola Ojo PhD (Female). Member of the Patient and Public Engagement team for Re:Mission and Local Authority Public Health Specialist.

Dr Jennifer Teke (PhD) (Female) Member of the Patient and Public Engagement team for Re:Mission and Hospital Trust Research Manager.

Ken Clare (Male) Patient and Public Engagement Lead (Obesity Institute at Leeds Beckett University) and Director of Operations (Obesity UK) and chair of Board of Directors European Coalition for People Living with Obesity.

Dr Chirag Bakhai (Male). General Practitioner, Clinical Lead on the Re:Mission Study Oversight group and Primary Care Adviser to the NHS Diabetes Programme.

Dr Louisa Ells (Female). Professor of Obesity with a specialist interest in multi-disciplinary, cross-sector applied obesity research, with extensive experience of leading programme evaluations.

Supplementary file 2: Participant characteristics

Table 1: 12-Week participant demographics (n=30)

Participant *[1]	Age	Gender	Ethnic group[2]	Provider	Delivery model	IMD quintiles[3]	Participated in photo elicitation
P7	50-54	Female	White British or white Mixed British	SP3	Group	5	N
P9	60-65	Male	White British or white Mixed British	SP3	Group	1	Y
P15	45-49	Male	White British or white Mixed British	SP3	Group	3	Y
P16	50-54	Male	White British or white Mixed British	SP3	Group	1	Y
P17	50-54	Female	White British or white Mixed British	SP3	Group	1	Y
P18*	50-54	Female	White British or white Mixed British	SP2	1-to-1	5	Y
P19*	55-59	Female	Any other black background	SP3	Group	1	N
P21*	30-34	Female	White British or white Mixed British	SP2	Group	1	Y
P25	55-59	Male	White British or white Mixed British	SP5	1-to-1 Face-to-Face	5	N
P28	45-49	Male	Asian or Asian British	SP5	1-to-1 Face-to-Face	4	N
P34	60-65	Male	White British or white Mixed British	SP2	Group	1	Y
P35	60-65	Female	Asian or Asian British	SP2	Group	1	Y
P36*	40-44	Female	White British or white Mixed British	SP2	Group	3	N
P40*	60-65	Male	White British or white Mixed British	SP2	Group	3	Y
P42	35-39	Female	White British or white Mixed British	SP2	1-to-1 Face-to-Face	3	Y
P43*	45-49	Female	Mixed or Multiple ethnic group	SP2	Group	2	Y
P45	40-44	Male	White British or white Mixed British	SP2	Group	1	N
P48*	35-39	Female	White British or white Mixed British	SP2	Group	5	Y
P50	60-65	Female	White British or white Mixed British	SP2	Group	5	Y
P51	60-65	Male	White British or white Mixed British	SP2	Group	2	N
P54	60-65	Male	White British or white Mixed British	SP2	Digital	1	Y
P56	35-39	Female	White British or white Mixed British	SP2	Group	1	N
P57*	55-59	Female	White British or white Mixed British	SP2	Group	3	Y
P58	50-54	Female	White British or white Mixed British	SP2	Group	2	Y
P65*	35-39	Female	Any other white background	SP3	Group	1	Y
P66*	55-59	Female	White British or white Mixed British	SP2	Group Face-to-Face	4	Y
P70*	50-54	Female	White British or white Mixed British	SP4	Digital	5	Y
P71	55-59	Male	Asian or Asian British	SP2	Digital	4	Y
P76	40-44	Female	White British or white Mixed British	SP1	1-to-1	2	Y
P82	60-65	Male	White British or white Mixed British	SP2	Group	3	N

[1] *Interviews supported by members of the Re:Mission patient and public involvement team.

[2] The ethnic group classification as used by the Office for National Statistics in the 2021 census.

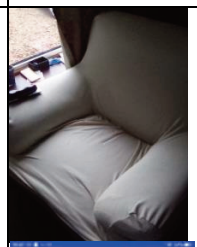
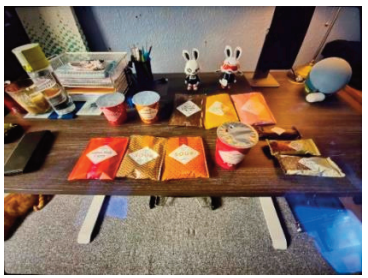
[3] The Index of Multiple Deprivation (IMD) score is as absolute measure of deprivation that allows for Lower Super Output Areas (LSOAs) in England to be ranked and subsequently classified into five quintile bands. Quintile 1 is the 20% most deprived LSOAs in England, while quintile 5 is the 20% least deprived LSOAs.

Supplementary file 2: Participant characteristics - Table 2

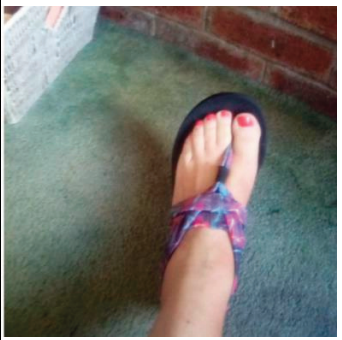
Table 2: Cross-sectional- Participant demographics (n=15)

Participant	Age	Gender	Ethnic group[2]	Provider	Delivery model	IMD quintiles[3]
P4	50-54	Male	White British or white Mixed British	SP4	Digital	4
P5	40-44	Female	White British or white Mixed British	SP5	1-to-1 Face-to-Face	2
P84	35-39	Male	White British or white Mixed British	SP5	1-to-1	3
P85	35-39	Female	White British or white Mixed British	SP3	Group	1
P87	60-65	Male	White British or white Mixed British	SP3	Group	5
P88	55-59	Female	White British or white Mixed British	SP1	1-to-1	3
P91	66-70	Female	Black/African/Caribbean/Black British	SP2	Group	2
P96	50-54	Male	Black/African/Caribbean/Black British	SP4	Group	1
P114	55-59	Female	White British or white Mixed British	SP2	1-to-1	3
P125	60-65	Female	White British or white Mixed British	SP2	Group	5
P129	55-59	Male	White British or white Mixed British	SP4	Digital	4
P133	45-49	Female	Prefer not to say	SP2	1-to-1 Face-to-Face	4
P142	60-65	Male	Mixed or Multiple ethnic group	SP2	1-to-1	5
P144	45-49	Female	Other ethnic group	SP3	Group	4
P156	40-44	Female	White British or white Mixed British	SP4	Digital	2

Supplementary file 3: Photovoice and quotes

Participant number	Theme	Photo	Quote
P57 P70	Impact on everyday life	 	“The recliner chair that I have used for the past three years to sleep on. Because I couldn't sleep in bed anymore. I couldn’t because of my weight. I couldn't breathe properly. I would have bad back. Whereas the recliner didn't recline completely, so I was a bit more elevated and that would help with my breathing help. So me and my husband have just resumed now to be to sleeping to sleep together. We haven't been sleeping together for three years.” “So over the years my, my knees have hurt quite a lot coming down stairs to the point that I'd come down sideways like a crab. Which sounds really silly but didn't seem to put quite as much stress on my knees.”
P15 P16	Experience of the TDR phase – TDR products	 -	“there's an extensive choice of TDR products on [product] website […] Now the shakes are fantastic because they're great because you can just make shake in the morning etcetera, no problem. Lunch there was some there was some meals like Indian Curry, Indian Daal, Thai Curry, soups etc blah blah blah. They were great. However, things like the reconstituted meals like spaghetti carbonara or cottage pie or sweet and sour noodles, they lack flavour, and they were not very pleasant at all. A lot of people found that certain products weren't to their tastes. Obviously everybody's got different tastes and different flavours. But I really liked the spice, I really liked the Indian and the Thai and the soups. They're really nice so those photo, that photo of those items were pretty much my favourite selection of shakes I would have.”

Supplementary file 3: Photovoice and quotes - continued

P48 P65	Experience of the TDR phase – adaptations	 	"When I found I was getting a bit bored of it, I was, the lady suggested to add the skinny company food and it's called a syrup with zero calories. So that changed the flavours of them. So that helped." "It's much easier to eat. Bringing it to I don't know known tastes because would have been spices I used for cooking, normal cooking, spices and herbs and now adding those into the product makes them more familiar, and familiar to tastes I'm used to and I would have normally cooked with."
P42	Experience of the TDR phase-challenges around witnessing other people eat solid food	 	"It's just a bit like everyone else is stuffing their faces and you've got your shake. It's a bit, it's that bit's hard. Like I think maybe if I lived on my own, I just wouldn't have the food in the house and the temptation wouldn't be there. And it's, it's hard when people are eating a McDonald's in front of you and you, you're sitting there with your milkshake."
P43 P57	Motivation during TDR-weight loss, compliments, more confident and happier.	 - 	"With wearing the makeup at home. It's like more, more care for myself, more honouring of who I've become, more love for myself. So that, that's why I took a photo of that. Because there obviously are these different associations with renewed life and feeling better in myself and enjoying life". "I couldn't even see my feet before, let alone reach them. So I've actually been able to have a pedicure, have nail varnish on my feet in quite a few years. So that was the first time"