

Exploring the feasibility of an mHealth intervention delivered by an exercise physiologist within a UK Complications from Excess Weight service: qualitative findings from a randomised controlled trial- MOTIVATE-CEW

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Abstract

Background

Young people living with severe obesity face complex barriers to engaging in physical activity (PA), and the optimal delivery of exercise interventions within NHS Complications from Excess Weight (CEW) services is not yet well established. The MOTIVATE-CEW intervention was developed to support exercise and PA engagement using an exercise physiologist-led, mHealth-supported approach. Following a feasibility trial indicating good uptake but limited exercise maintenance, this study used qualitative methods to explore participant and caregiver perspectives to inform intervention optimisation.

Methods

A qualitative evaluation was conducted with participants and caregivers recruited from the intervention arm of the MOTIVATE-CEW randomised controlled feasibility trial. Data were collected using focus groups, semi-structured interviews, and a qualitative survey. Data were analysed using deductive thematic analysis, guided by five priority behaviour change techniques embedded within the intervention logic model.

Results

Twelve participants were randomised to the intervention arm; of those four provided an interview/focus group and ten responded to the survey. Four caregivers completed interviews/focus groups. Five themes aligned with the priority behaviour change techniques were identified. Personalised, graded action plans, clear instruction, self-monitoring via wearable technology, and regular feedback from an exercise physiologist were perceived as key facilitators of engagement. Suggestions for improvement included extending intervention duration and enhancing opportunities for social support.

Conclusion

These findings suggest that the behaviour change techniques underpinning MOTIVATE-CEW were acceptable and perceived as supportive of exercise and PA engagement among CEW service users. Qualitative insights will inform refinement of the intervention to enhance maintenance and scalability within future trials.

Trial registration

The protocol was prospectively registered on clinicaltrials.gov (identifier NCT04854915).

Introduction

The rising prevalence of young people living with severe obesity is a major public health concern (1). In England, the National Child Measurement Programme (NCMP) for 2023/24 revealed that 22% of 10- to 11-year-olds are living with obesity, placing them at increased risk of conditions such as asthma and type 2 diabetes mellitus (2). Obesity in childhood also tracks into adulthood, where it is associated with higher risks of cardiovascular disease (3), type 2 diabetes mellitus (4), liver disease (5) and 16 different cancers (6). In response, NHS England have established 37 Complications from Excess Weight (CEW) services, which employ a multidisciplinary team to treat obesity related conditions.

The National Institute for Health and Care Excellence (NICE) guidelines recommend lifestyle-based interventions, including increasing physical activity (PA) as a key component of treatment for young people living with obesity (7). A Cochrane Review further supports the effectiveness of PA interventions (8), however, CEW services are still in their infancy, therefore the optimal approach to implementing exercise and PA interventions for patients within their care is not yet understood (9). Severe obesity is also a complex condition and young people often face unique barriers to PA such as stigma (10–12) and additional comorbidities (2). These challenges further justify the need for individualised approaches, rather than relying on interventions developed for young people who are overweight (13).

Therefore, our team developed the MOTIVATE-CEW intervention, an exercise physiologist-led, mHealth supported, PA and exercise programme for CEW services. The design of the MOTIVATE-CEW intervention was guided by a logic model incorporating five priority behaviour change techniques (BCT) intended to underpin its delivery (14, 15). A feasibility randomised control trial was conducted to evaluate the intervention, with quantitative findings indicating promising effects on exercise behaviour (16). However, despite good initial uptake, exercise maintenance at the end of the 3-month intervention period was low, suggesting further refinement of the MOTIVATE-CEW intervention is required. Exploring the perspectives of participants and their caregivers using qualitative methods offers valuable insight into the barriers and facilitators of sustained engagement with the intervention.

Medical Research Council (MRC) guidance for the evaluation of complex interventions (17) highlights that quantitative outcomes alone are insufficient to fully understand how and why interventions work and recommends the use of qualitative or mixed-methods approaches to generate contextually rich evidence to inform intervention optimisation and implementation. Consistent with this guidance, utilising qualitative techniques may provide important insight into how BCTs (14, 15) embedded within the MOTIVATE-CEW intervention were experienced and perceived by patients and caregivers. Accordingly, this study aimed to use qualitative methods to explore the perspectives of CEW service patients and their caregivers to inform the optimisation of the MOTIVATE-CEW intervention. The specific objectives were to explore the acceptability of the original MOTIVATE-CEW intervention and study methodology, including barriers and facilitators to engagement, and to generate recommendations for refinement of the intervention components.

Methods

Design

Three qualitative methods were employed to evaluate the MOTIVATE-CEW intervention: focus groups, semi-structured interviews and a qualitative survey. All participants randomised to the intervention arm of the previously reported randomised controlled feasibility study (16) were invited to complete the qualitative survey and to participate in either a focus group or interview ($n = 12$), following completion of the intervention. To maximise participation and accommodate participant preference, patients and caregivers were offered a choice between a focus group and an interview. Separate focus groups were held for patients and caregivers to support open discussion. Full details of the MOTIVATE-CEW feasibility trial have been published elsewhere (16), including inclusion criteria. In brief, all participants were aged 12–18 years, had a BMI > 30, and were recruited from the CEW service at Alder Hey Children's Hospital.

MOTIVATE-CEW Intervention

The MOTIVATE-CEW intervention was an exercise physiologist facilitated, self-care support service, which used biometrics from wearable technologies to support a home-delivered, personalised PA and exercise programme for patients within the Alder Hey Children's Hospital CEW service. Participants co-designed a 3-month individualised PA and exercise programme with the aim of gradually increasing purposeful exercise of moderate-to-vigorous intensities and increasing lifestyle PA of any intensity. Exercise was individualised by allowing participants to choose the mode, type, initial duration, and intensity of sessions, as well as the rate of progression. Lifestyle PA was encouraged through targets and tips within their routine.

To support the development and delivery of the PA and exercise programmes, the MOTIVATE-CEW service utilised three integrated core components: (1) regular virtual (Microsoft Teams) behavioural exercise counselling sessions for patients and their caregivers; (2) an mHealth package, including a wrist worn fitness watch, synced to an online coaching platform and a smartphone App for participants; and (3) a mechanism for providing regular remote feedback on data captured by the wearable technologies through the Microsoft Teams App. Together, these components were designed to target five priority BCTs (14, 15) (Table 1). These BCTs sought to enhance competence to engage in purposeful exercise and lifestyle PA, support autonomous motivation for exercise and PA and foster relatedness with healthcare professionals, with the aim of improving uptake and maintenance of exercise and PA. The key components and five priority behaviour change techniques were mapped within a logic model (Fig. 1).

Table 1

Priority Behaviour Change Technique categories embedded within the intervention and the activities employed to achieve this.

Priority BCT category	Activities	Target basic psychological need
Information about health consequences	• Initial counselling sessions aimed to help participants understand the value and benefits of lifestyle PA and purposeful exercise	Autonomy
Creation of graded action plan with specific behavioural goal	• Participants, their caregivers and exercise physiologists co-designed individualised graded action plans with specific behavioural goals • Action plans were built by exercise physiologists within the coaching platform, using the participants co-developed programme to specify what type and mode of purposeful exercise was to be completed when	Competence
Instructions on how to perform behaviour and biofeedback to assist this	• Instructions on how to perform purposeful exercise sessions were provided by the fitness watch with pre-set sessions prescribing the duration of phases within each session (i.e., warm up, workout and cool-down) • Biofeedback (heart rate) provided guidance to participants on the appropriate intensity for each phase • Videos were available to participants on the trial website with pre-set sessions on the watch matched the videos format • Participants could view biofeedback from the fitness watches accelerometer, providing information on progress towards a daily lifestyle PA goal	Competence
Self-monitoring of behaviour and review of behavioural goals	• Participants could modify their programme to fit with their lifestyle and self-monitor progress towards their behavioural goals in the participant App • Participants could also provide comments on purposeful exercise sessions within the app, informing the exercise physiologist about the appropriateness of the session's duration and intensity, as well as their enjoyment of the session and PA type	Autonomy
Regular feedback on behaviour	• The exercise physiologist used the biofeedback captured by the fitness watch (heart rate during purposeful exercise and progress towards the lifestyle PA target) and participant comments to develop personalised feedback for participants • Feedback was delivered to participants and their caregivers through messages within the Microsoft	Relatedness

Priority BCT category	Activities	Target basic psychological need
	Teams App, initially after each purposeful exercise session (0-1 month), then weekly (2–3 months) • Participants could respond to this feedback and together reassess goals and adapt future schedules where necessary • Biofeedback was also used to create a dialogue between the participant, their caregivers and exercise physiologist in later counselling meetings.	

PA, Physical Activity

PA, Physical Activity; CEW, Complications from excessive weight; BCTs, Behaviour Change Techniques; mHealth, Mobile Health; HCPs, Healthcare Professionals

Data Collection

Focus Groups and Interviews

All intervention arm participants (n = 12) and their caregivers (n = 12) were invited to attend a virtual focus group or semi-structured interview (Teams, Microsoft Corporation). A pre-defined topic guide was developed (*Supplementary 1&2*) and focus groups/interviews were led by a member of the research team (AC) who did not interact with participants during other trial components to allow for open and honest critique. The focus group/interview discussed: (1) experiences of exercise; (2) experience of the exercise counselling; (3) experience of mHealth technology (fitness watch and app); and (4) experiences of feedback (text messages and exercise counselling). Participants were encouraged to openly express their views and probed further to facilitate deeper understanding throughout the focus groups and interviews.

Qualitative Survey

Post-intervention all intervention arm participants (n = 12) were invited to complete an anonymous online survey exploring barriers and facilitators to purposeful exercise and lifestyle PA (*Supplementary Table 3*). Questions were developed, piloted within, and revised by the research team using appropriate literature (18).

Data Analysis

Focus groups and interviews were recorded and transcribed verbatim, and qualitative survey responses were collated. Thematic analysis (19) was used to deductively analyse transcripts and survey responses based on the five-priority BCT categories outlined in the logic model (Fig. 1). Primary analysis was

conducted by AD with frequent debriefing sessions with the research team (MC, KH & FK) who acted as “critical friends” during the analytical process (20). The analysis consisted of coding survey responses and statements from the focus groups and interviews according to the logic model priority BCT categories. Each of the codes was critically discussed, refined, and challenged before being grouped into the relevant themes that present the existing barriers/facilitators and areas for improvement within MOTIVATE-CEW. This information was used to reach a consensus on the relevance of each priority BCT category to adherence behaviour for participants. A priority group was agreed to be ‘relevant’ if it was coded more than once and the content linked directly to the behaviour of interest. The researcher also conducted disconfirming analysis where focus group and interview discussions and survey responses were reviewed to specifically look for cases that did not fit within the BCT categories. This entire analytical process resulted in 5 themes being developed as well as comments on future directions for the intervention, barriers to exercise and methods of overcoming these barriers. Quotes were selected from focus group, interview, and qualitative survey data to illustrate the themes and ensure each qualitative data source was represented in the results.

Results and Discussion

Study participants

The flow of participants through the MOTIVATE-CEW study and subsequent qualitative analysis is shown in Fig. 2. Between July 2022 and June 2023, 12 participants were randomised to the intervention arm. Qualitative data were collected from the intervention group only. Two focus groups were conducted, one with patients and one with caregivers (n = 3 patients and n = 3 caregivers), alongside two individual interviews (n = 1 patient and n = 1 caregiver). Qualitative survey responses were obtained from 10 of the 12 intervention group participants (*Supplementary Table 3*). Participant characteristics are summarised in Table 2.

CEW, Complications from excessive weight; mHealth, Mobile Health

Table 2
Participant Characteristics

Age mean ± SD	MOTIVATE-CEW Study (n = 25) n (%)	Intervention Participants (n = 12) n (%)	Focus Group & Interview Participants (n = 4) n (%)	Qualitative Survey Respondents (n = 10) n (%)
	15 ± 1	15 ± 1	16 ± 1	15 ± 1
12–15	16 (64)	7 (58)	1 (25)	5 (50)
16–18	9 (36)	5 (42)	3 (75)	5 (50)
Sex				
Male	12 (48)	4 (33)	0 (0)	3 (30)
Female	13 (52)	8 (67)	4 (100)	7 (70)
Ethnicity				
White	21 (84)	11 (92)	4 (100)	9 (90)
Other	1 (4)	0 (0)	0 (0)	0 (0)
Not Stated	3 (12)	1 (8)	0 (0)	1 (10)
IMD Quintile				
1	18 (75)	11 (92)	3 (75)	9 (90)
2	1 (4)	0 (0)	0 (0)	0 (0)
3	2 (8)	0 (0)	0 (0)	0 (0)
4	2 (8)	0 (0)	0 (0)	0 (0)
5	1 (4)	1 (8)	1 (25)	1 (10)

SD, Standard Deviation; IMD, Index of Multiple Deprivation

BCT 1: Information about health consequences.

Changes in perceptions of the impact of activity on health and wellbeing

Focus group and interview discussions highlighted changes in how participants perceived the benefits of a physically active lifestyle. At the start of the programme many families were focussed on weight loss alone, but discussions revealed that after the intervention participants possessed a wider understanding of the benefits of PA including improved confidence and better mental health. Person-centred

counselling sessions, in which the exercise physiologist emphasised the role of purposeful exercise and lifestyle PA in supporting overall health, appeared to motivate participants to engage in exercise and PA.

"[The exercise physiologist] spoke all about wellbeing and it was about your health and [the exercise physiologist] didn't focus on weight... it's also engaged [the participant] more because it was the first time that someone had suggested something, and it wasn't revolving around [the participant's] weight so [the participant] wanted to give it a go." (Caregiver 1)

Providing participants with a focus beyond weight loss alone appeared to be beneficial. Both participant and caregiver highlighted the positive impact of purposeful exercise and lifestyle PA on participants mental health, with several participants reporting that they had previously been unaware of these benefits. Some participants also reported improvements in fitness and glucose control.

"It's helped me continue [exercising] even now and put me in a better lifestyle and better attitude towards exercise and better mental health" (Participant 1)

This shift in how the benefits of PA were perceived is supported by existing research in young people with obesity, where a wider understanding of the health benefits of PA has previously been shown to enhance motivation for engagement in exercise and PA (21, 22). Moving away from an exclusive focus on weight-related outcomes, particularly when wider health benefits valued by participants are emphasised, may promote autonomy and support sustained behaviour change. However, evidence suggests that information provision alone may be insufficient to alter exercise and PA behaviours. A systematic review of digital interventions for improving diet and PA in young people found that although most interventions included educational components (23), less than half resulted in significant improvements in behaviours. This suggests that while information about health consequences is unlikely to be enough in isolation, it remains an important component of a complex intervention.

Perception of no benefit from activity

Despite a greater understanding of the health benefits associated with purposeful exercise and lifestyle PA, some parents reported that the absence of weight loss led them to perceive the intervention as having little or no benefit.

"It didn't have an impact on her weight at the end of the programme, but again, maybe that's where it falls down." (Parent/ Guardian 2)

This perception was only expressed in the caregivers focus group and was not shared by all. Some caregivers believed the programme had achieved the desired effect by improving wellbeing, and in one instance, the intervention had contributed to a reduction in weight.

"[The participant] did get all the tests at the beginning and then at the end, we didn't really know any different and then [the participant] happened to have an appointment with the Doctor and they confirmed that [the participant] had actually had the benefit of losing weight." (Caregiver 1)

Previous literature has shown that young people participating in lifestyle interventions for obesity often view weight loss as the primary outcome of interest (24). Consequently, a lack of visible weight change may contribute to participants dropping off from exercise routines. Incorporating education on the wider benefits of exercise and PA, could counteract this and encourage long-term engagement in activity.

There was limited participant response from the qualitative questionnaire that could be related to information about health consequences.

BCT 2: Graded action plans with specific behavioural goals.

Structured, pre-programmed exercise to inspire accountability

The development of structured action plans within the intervention was identified as a facilitator for purposeful exercise.

"It gave me the motivation to be able to actually get out and do it and get on the app and be like, ok, well now I'm going to do this at this time and actually do it... I had the motivation to be like, no, you're doing it today, you're doing it at this time and that's it." (Patient 3)

Participants discussed the benefits of following a clear plan that had been collaboratively developed with them. The inclusion of structured, achievable goals, within the programme provided a sense of accountability and motivated engagement in the sessions. These findings are consistent with previous literature, including a scoping review of stakeholder perspectives on clinic-based obesity services, which identified personalised action plans as a facilitator of increased exercise and PA adherence (9). Goal setting has also been shown to promote health behaviour change in people with obesity when combined with other intervention components (25), highlighting the value of action plans based off structured, achievable goals. This effect may reflect the role of action plans in creating implementation intentions (specific plans linking a situation to a goal-directed behaviour) to achieve the goals established with the exercise physiologist. In a population of inactive adults with obesity, implementation intentions were shown to support engagement in PA (26, 27).

Personalised, progressive programme to encourage participant enjoyment, reduce barriers and promote uptake of exercise

The ability to personalise the programme to individual preferences was identified as a key factor promoting engagement. During discussions with the exercise physiologist, participants were able to select exercise types they found enjoyable, which were incorporated into their action plan.

"It's made me see what I prefer...it was good, so it made me learn that not all exercise is awful, you know you can enjoy it." (Patient 2)

Caregivers also valued this flexibility.

"I liked the variety [the exercise physiologist] offered in the way [the exercise physiologist] honed in on [the participants] likes and dislikes so [the exercise physiologist] wasn't like you've got to go for a run, because [the participant] hated running, there was lots of different options for them to choose from" (Parent/Guardian 2)

Personalisation also helped participants overcome barriers to exercise. Most barriers reported related to external factors such as limited time, weather, illness and access to facilities, rather than the intervention itself. Despite these challenges, participants described how the flexibility of their action plans, combined with support from the exercise physiologist to adapt their programme, enabled them to maintain engagement.

"I really struggled with the certain amount of length it would be and the amount of cool down I'd have so then when I mentioned it to [the exercise physiologist] during those meetings, I mentioned how I was having a problem with this. Then we changed it to fast walking instead of the running and it definitely opened my eyes that I can still do it in a different way that makes me happy and [the exercise physiologist] definitely listened and changed and amended it and I think it was very good rather than just sticking with the same, you could change it up." (Patient 1)

These findings are consistent with previous reviews by Roberts, Binns (9) and Jones, Al-Khudairy (24) which highlight the importance of designing personalised action plans that consider barriers such as financial constraints and limited family time. By allowing participants to choose exercises they enjoy, personalisation may also support autonomy, a key mechanism identified in Self-Determination Theory (28) as facilitating sustained engagement in behaviour change. A feasibility study of a mobile app adopting a personalised approach found that increased personalisation strengthened user autonomy, further reinforcing this theoretical perspective (29).

Participants also identified the progressive nature of the action plan as a key benefit of the intervention. They valued being able to start at a level that matched their current ability and increase the intensity and duration as their fitness improved.

"The thing for me is how it progressed so you started with not doing as much and then you'd build up that fitness and then you're able to do more and more and I think that made it a lot easier for me." (Patient 2)

Progressive, or graded, action plans have previously been shown to enhance self-efficacy and competence in young people with obesity (30) and have also been shown to improve adherence to PA guidelines in other clinical populations (31).

BCT 3: Instruction on how to perform behaviours.

Following Resources to replicate behaviours

Participants were given an exercise instruction booklet and access to online videos that demonstrated how to complete exercises. A few participants cited the booklet as a useful tool for ensuring correct technique, while others highlighted the videos as valuable in supporting them to complete their personalised exercise plans.

"[The exercise physiologist] showed me some of the videos and how to get on them and, a few booklets and it was just great really... I liked the videos, I felt that they were useful for when you couldn't go to the gym and you could do them in your own home, you didn't need a lot of space, you didn't need a lot of equipment" (Patient 4)

The videos also supported flexibility, enabling participants to engage in exercise at home and adapt their routines as needed, complementing the personalised action plans discussed earlier. While previous literature has shown the success of utilising videos to guide behaviours in adults with excess weight (32), there is limited evidence in young people with obesity. Findings from the present study suggest such resources may represent a valuable component of future interventions targeting this population.

Participants also valued the exercise videos because *"it was almost as if, I'm not the only one doing it, so if I'm watching it, at least there's more people doing it"* (Participant 2). This suggests that this instructional platform fostered a sense of social support, which provided an additional motivation to take up exercise.

Use of biofeedback to instruct behaviours and instil confidence

Instructions from the exercise physiologist were complemented by biofeedback from the fitness watch, received both during and upon completion of each exercise sessions. The real-time heart rate guidance enabled participants to personalise exercise intensity, allowing them to engage at a level they felt confident they could sustain.

"I don't push myself to the limit where I don't want to do it anymore. I'm just in the right limit and I feel better in myself and physically." (Patient 1)

Providing participants with the tools to guide their exercise intensity resulted in improved attitudes towards exercise and an increased sense of competence to complete their exercise. Although research in this area among young people with obesity is limited, previous work from our group assessing the feasibility of an mHealth intervention to increase exercise and physical activity in sedentary adults highlighted participants positive experiences of incorporating live heart rate feedback to guide exercise sessions (33).

BCT 4: Self-Monitoring of behaviours

Self-Monitoring behaviours via the App to promote autonomy in exercise behaviours

The ability to self-monitor behaviour and assess progress towards behavioural goals was perceived as a benefit by all participants. In addition to real-time feedback, participants were able to review previously completed exercise sessions using the participant app. Caregivers commented that the use of technology felt appropriate and engaging for the adolescent population, a view echoed by participants, who valued the ability to review past sessions and preview upcoming pre-planned exercise sessions. Overall, the use of this technology appeared to support a sense of autonomy in participants' exercise and activity behaviours.

"I think it was good for me to see because I actually realised how many classes I actually went to a week and then it was, I just felt quite proud that I'd stuck to that as well... it was nice that you could sync it up and I could see exactly how my heart rate zones were the whole way through my exercise. And [the exercise physiologist] planned the sessions in so that I knew I had something to complete, so it was nice to see that." (Patient 4)

Self-monitoring progress towards PA goals using mobile apps has been consistently supported by young people with obesity (34–36). In addition, previous literature has highlighted young people's acceptance of technology within broader lifestyle obesity treatment interventions, suggesting that young people with obesity are able to engage with and use mHealth technologies with ease (24).

BCT 5: Regular feedback on behaviour by HCP's

Feedback from a credible source to encourage purposeful exercise and PA

The exercise physiologist conducted monthly exercise consultations with participants and sent regular, personalised messages to provide participants with feedback on their exercise and PA. Feedback from HCP's was viewed as the most popular element of the intervention from the qualitative survey and discussions from the focus groups and interviews also revealed that the exercise consultations were viewed as a beneficial pathway to receive feedback. Having an exercise physiologist that cared about their activity and was able to discuss this was highlighted as a facilitator within exercise consultations.

"I think for me it was the fact that there was somebody on the other end of the line wanting me to do this." (Patient 2)

All parents described the exercise physiologist as a friendly and approachable figure whose role in the programme meant their guidance was valued by participants. This facilitated strong rapport without participants feeling judged. As a result, there appeared to be less resistance to engaging in purposeful exercise when support was provided by the exercise physiologist rather than by caregivers.

"I felt [the participant] listened more to [the exercise physiologist] and I don't think it was done in like a controlled way, it was just the way they seemed to be able to read [the participant] and what their needs were and spoke to [the participant] at the level they required and that encouraged [the participant] to want to

it. I ask her to exercise all the time and it's like "yeah, ok, whatever." But [the participant] was actually the one to say, "come on, let's get out."" (Caregiver 1)

Reports that participants listened to the exercise physiologist suggest that the credibility of the individual providing feedback and support is important, and that motivation may be influenced by the delivery agent. This aligns with evidence from adult exercise referral schemes, where the provider of support has been shown to affect participant motivation (37), and with a qualitative systematic review indicating that professional support is perceived as more valuable than peer or family support when attempting to lose weight (24). Consistent with this, participants and caregivers perceived a HCP with specialist expertise in exercise as the most appropriate person to support engagement and deliver feedback.

"I had a physio at one point, and I wouldn't say the advice I got was as useful as the advice I got from [the exercise physiologist] ... I think [the exercise physiologist's] knowledge helped a lot in that way and helped me continue [exercising]." (Patient 1)

Feedback on behaviours via Messages to reinforce positive habits and support participants

The personalised feedback messages were sent to participants via the Microsoft Teams app after each exercise session during the first month of the intervention, and weekly during months two and three. Feedback was tailored using biofeedback recorded by the fitness watch, with heart rate data informing exercise intensity during purposeful sessions and accelerometry data tracking progress towards daily physical activity targets. All participants and caregivers spoke positively about the feedback messages, noting that they provided additional motivation to continue engaging with the programmed exercise sessions.

"I thought it was really positive. [The messages] were one of the most motivating things. Even if I'd felt like I'd not done as good this week, [the exercise physiologist] always made me feel better for what I'd done. I just thought [the exercise physiologist] was really nice, that's what you want." (Patient 2)

Participants were able to respond to messages or contact the exercise physiologist with questions at any time via the Microsoft Teams App, which was also seen as a facilitator of engagement. Many participants and caregivers noted that responses were timely and appropriate, helping to build trust while clearly explaining expectations and exercise requirements in an accessible and understandable manner.

"If there was something that [the participant] wanted to ask there was the freedom to get in touch with [the exercise physiologist]. [The participant] felt confident enough that they could message [the exercise physiologist] and [the participant] was understanding what [the exercise physiologist] was saying back to [the participant]." (Caregiver 3)

Focus group and interview data suggest that the personalised, data-driven feedback messages effectively embedded practical support within the intervention. This finding is consistent with previous research demonstrating the value of feedback messages in providing practical support for young people with obesity (38), however, the tone, content and timing of such messages are critical to ensure they are positively received (39). Notably, participants appeared to perceive the messages as a form of emotional social support, despite this component not being designed to deliver this BCT. This suggests that the supportive nature of the messages was as important as the informational feedback they contained and that they supported the basic psychological need for relatedness (28). To the authors knowledge, this is the first study to show that messages sent by a healthcare professional can be perceived as social support by young people with obesity and, in turn, enhance motivation to engage in exercise. Evidence from studies in overweight and sedentary adults further supports this interpretation showing that social support from healthcare professionals can aid motivation for PA (40)

Link with the wider multi-disciplinary team to provide wider knowledge on behaviours

The link to other HCPs within the Alder Hey CEW multidisciplinary team was deemed to be a beneficial aspect of the intervention. Previously patients had been referred to external partners offering exercise and PA support. It was mentioned that these services do not have the same ability to provide feedback to the multidisciplinary team and therefore inform participants care plan. Integrating an exercise physiologist into the CEW multidisciplinary team enabled timely communication with other team members about participants' engagement in purposeful exercise and lifestyle PA. This was seen as a positive by both participants and caregivers with both focus groups and interviews, praising the idea that all members of the CEW service were accurately informed on activity levels of the participant.

"That's one of the things I did like about the trial that [the exercise physiologist] did have communication with Alder Hey and the team because they got to understand what I do because [the exercise physiologist's] seen it and because [the exercise physiologist's] got all the stuff recorded. But I think it was good that Alder Hey got to see that too, because it proves that I am really active, and I don't just like sit about and do nothing kind of thing." (Patient 4)

"[The participant] could actually prove that I am active and yet I'm still big." (Caregiver 3)

Future Directions

In addition to reviewing the current MOTIVATE-CEW intervention, focus group and interview participants were encouraged to provide feedback on areas that could be developed within the intervention; these areas were identified through the disconfirming analysis conducted by the research team.

The most suggested improvement was extending the duration of the intervention. Both patients and caregivers felt that a longer intervention could help establish routines and increase the likelihood of sustained exercise post-intervention.

“I’d make it longer though, so we had more time to be able to get into the routine and then when it stopped to be able to finish and keep going with that routine” (Patient 3)

Although participants perceived that a longer intervention may support habit formation and post-intervention maintenance, extending intervention duration does not necessarily improve adherence in isolation. Evidence from behavioural trials targeting childhood obesity suggests that greater intervention dose or contact time is generally associated with stronger effects on outcomes, but this must be balanced against the practical demands placed on families and services (41). These issues are particularly relevant in CEW services, where families may already experience substantial social, health and logistical complexity. Extending MOTIVATE-CEW may therefore provide a longer period of support for behaviour change but would also increase the burden on health services due to increase in exercise physiologist time and monitoring requirements. Previous work has also shown that family-based child weight-management interventions can impose time and monetary costs on families, which may be under-recognised when considering intervention feasibility (42). Therefore, future refinement should examine whether the potential benefits of a longer intervention justify the additional participant burden and service-level resource requirements.

It was suggested by some that having more face-to-face contact for exercise consultations, or purposeful exercise sessions, may have further enhanced their experience. However, some felt that the virtual approach made the intervention more accessible due to reductions in cost for transport, and the ability to schedule consultations at times that were convenient around caregivers work obligations and participants education.

“I think the fact that you're not hospital based as well, we have to go through the tunnel to go to the hospital. We live on the Wirral and it's at Alder Hey, so then you have to pay for parking, so really, before you've even got there, it's cost you £10 before your petrol” (Caregiver 2)

The time and monetary costs associated with participation in family-based child weight-management interventions are also relevant when interpreting this recommendation. Although additional in-person contact may be beneficial for some families, this should be balanced against participant burden and the service-level resources required to deliver further face-to-face support (42).

Caregivers discussed the potential value of a community group to facilitate shared experiences and mutual encouragement. However, this was not raised by participants themselves.

“I don't know whether she would have done, but whether it would have been nice to have contact with other young people who are in the same position” (Caregiver 4)

The presence of a community group within the intervention would add further social support in addition to the support provided by the HCP (Section BCT 5). Prior research has shown that young people with obesity value peer networks in lifestyle interventions, as they provide a sense of belonging and shared understanding (24). Given the overrepresentation of neurodevelopmental conditions among CYP

receiving care from CEW services (43), the feasibility and acceptability of peer support groups should be considered carefully. Although peer support may provide social connection and shared understanding for some patients, group-based approaches may not be suitable or desirable for all CYP. Further patient and caregiver consultation is therefore required to determine whether peer support should be included in future iterations of the intervention and how it could be delivered in a flexible and inclusive way.

Finally, caregivers suggested that the ability to complete the intervention with the use of other fitness watches may have been beneficial. Many patients already owned devices capable of tracking exercise and heart rate, and integration could improve feasibility while reducing the burden of wearing multiple devices.

Clinical Implications

The qualitative findings from this study suggest that the BCTs embedded within the intervention were indeed perceived as facilitators of engagement in exercise and PA by patients and their caregivers. Given the complex, multicomponent nature of the intervention, it is not possible to isolate the individual effects of each BCT. However, previous research in young people with obesity has shown that incorporating goal-setting, self-monitoring and text message support, within an mHealth based PA intervention, can significantly increase daily active minutes and daily steps (44). The successful implementation and positive reception of these techniques within the MOTIVATE-CEW intervention therefore adds weight to their clinical relevance, supporting their potential to enhance engagement in exercise and PA in this population.

Strengths and Limitations

The study included several strengths. This is the first study to obtain the qualitative perspectives of patients and caregivers on the design and delivery of an exercise intervention delivered within a CEW service. The use of three qualitative research methods generated contextually rich data, providing deeper insight into participants' views of the intervention. In addition, the focus groups and interviews were conducted by a researcher independent of the intervention development and delivery, reducing the risk of leading responses.

Despite a good response rate for the qualitative survey (83%), the focus groups and interviews included only four patients that participated in the intervention and four caregivers. Although this sample size is comparable to that of other qualitative studies in young people with excess weight (45, 46), the small sample size made it difficult to obtain a representative sample of intervention participants (Table 2). All participants were female, had engaged with the intervention, and consented to take part in additional qualitative analysis. As a result, the focus groups and interviews did not capture the perspectives of male patients or those who disengaged from, or dropped out of, the intervention. Consequently, data saturation across all areas of enquiry was unlikely to have been achieved, and additional interviews may have identified further barriers, facilitators, or alternative perspectives regarding intervention acceptability. Nevertheless, the qualitative evaluation provided valuable insights from patients and

caregivers who had direct experience of the intervention, and these findings were used to inform recommendations for future refinement.

Conclusion

This study utilised the perspectives of CEW service patients and their caregivers to evaluate the MOTIVATE-CEW intervention. Participants valued the inclusion of personalised, graded action plans based on exercise and PA goals. Clear instructions on how to carry out these behaviours, opportunities for self-monitoring, and regular feedback from an exercise physiologist were all perceived as facilitators of engagement. Participants also recognised the value of increasing understanding of the health consequences of exercise and PA, though this component could be strengthened in future iterations. While refinements to specific intervention elements should be considered in order to further optimise their delivery, participants also generated specific suggestions for improvement including extending the duration of the intervention and enhancing opportunities for social support to encourage higher levels of activity. Future research should look to further utilise service user and stakeholder perspectives to refine the MOTIVATE-CEW intervention and promote sustained engagement in structured exercise and daily PA among patients receiving treatment from CEW services.

Abbreviations

BCT; Behaviour Change Technique, BMI; Body Mass Index, CEW; Complications from Excess Weight, CYP; Children and Young People, HCP; Healthcare Professional, IMD; Index of Multiple Deprivation, mHealth; Mobile Health, MRC; Medical Research Council, NCMP; National Child Measurement Programme, NHS; National Health Service, NICE; National Institute for Health and Care Excellence, PA; Physical Activity, SD; Standard Deviation.

Declarations

Ethics approval and consent to participate

The study was approved by the East Midlands - Derby NHS Research Ethics Committee (21/EM/0030) and conformed to the Declaration of Helsinki. Written informed consent or assent (with parent/guardian consent) was obtained. The protocol was prospectively registered on clinicaltrials.gov (identifier: NCT04854915).

Consent for publication

Not applicable

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Author Contributions

APD, KLH, HJ, FK, SS, and MC, conceived and designed research; APD, AC, performed experiments; APD, KLH, FK and MC analysed data; APD, KLH, FK and MC interpreted results of experiments; APD, KLH and MC prepared figures; APD and MC drafted manuscript; All authors, edited and revised manuscript; All authors approved final version of manuscript.

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Figures

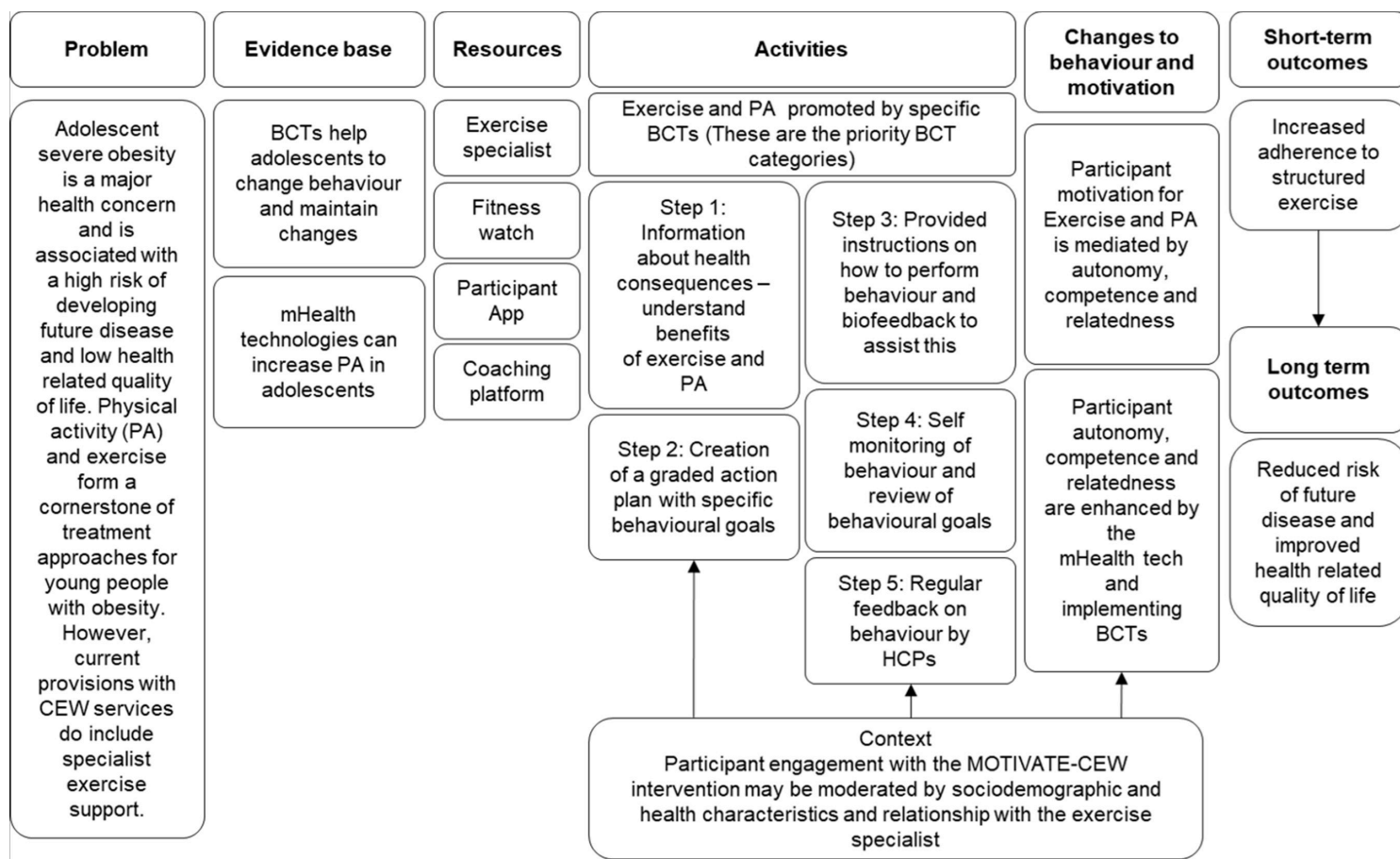


Figure 1

MOTIVATE-CEW Logic Model

PA, Physical Activity; CEW, Complications from excessive weight; BCTs, Behaviour Change Techniques; mHealth, Mobile Health; HCPs, Healthcare Professionals

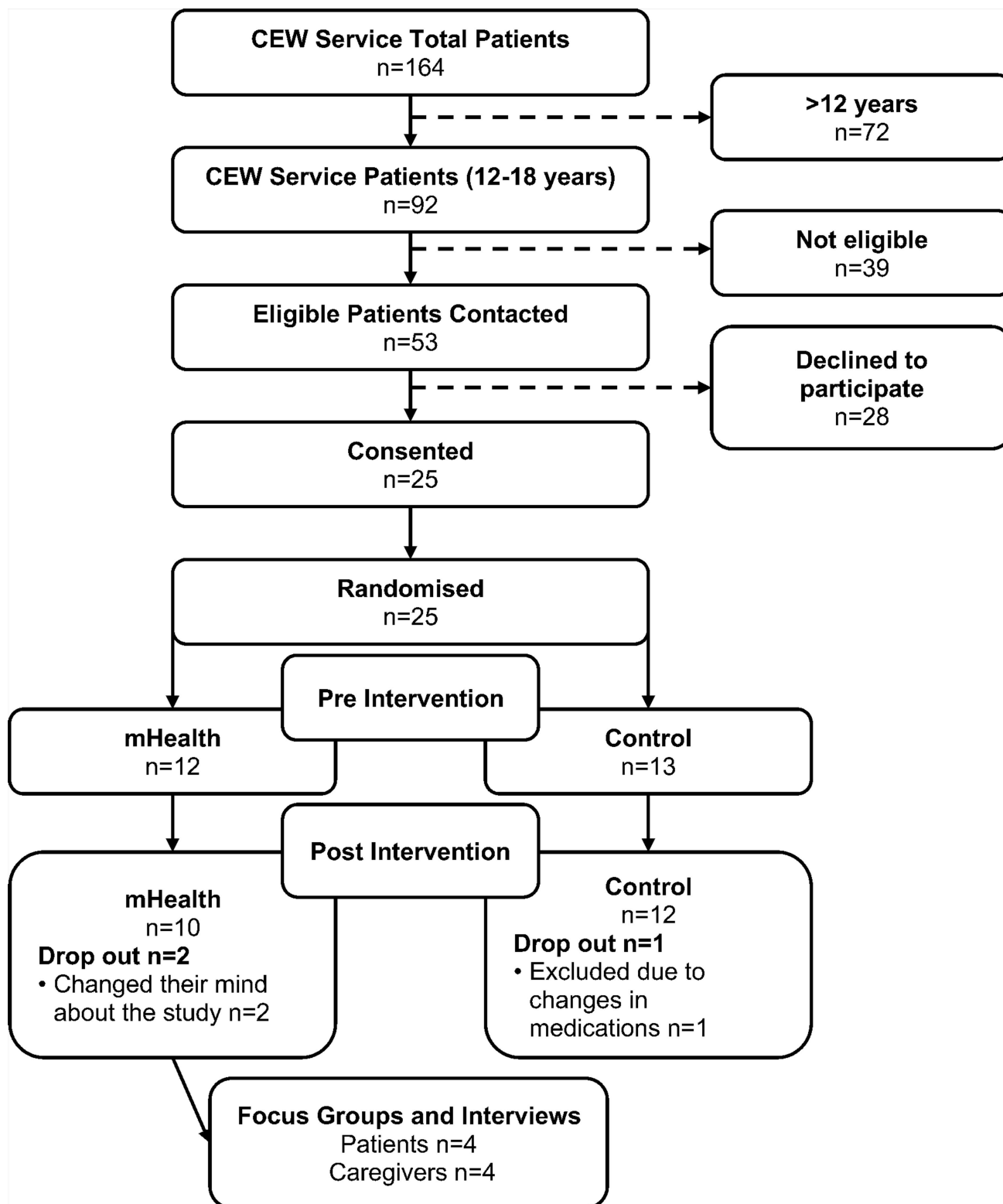


Figure 2

Participant consort diagram

CEW, Complications from excessive weight; mHealth, Mobile Health

Supplementary Files

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