




BMJ Open Exploring factors influencing uptake and adherence to a home-based prehabilitation physical activity and exercise intervention for patients undergoing chemotherapy before major surgery (ChemoFit): a qualitative study

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ABSTRACT

Objectives Preoperative exercise training can improve cardiorespiratory fitness before major surgery. However, little is known about what influences participation and adherence in high-risk patient groups. We identified barriers and facilitators to uptake, engagement and adherence to a presurgical, home-based physical activity and exercise intervention called ChemoFit delivered during chemotherapy and before major oesophagogastric surgery. **Design** A qualitative study using focus group discussions and individual semi-structured interviews was conducted. All were audio-recorded, transcribed verbatim and data thematically analysed.

Setting Northern Oesophagogastric Unit, Royal Victoria Infirmary, Newcastle upon Tyne NHS Hospitals Foundation Trust.

Participants Patients with oesophagogastric cancer who participated in the ChemoFit intervention recruited between March 2020 and January 2021.

Intervention A home-based physical activity and exercise intervention involving cardiovascular and strength exercise using resistance bands and pedometers to monitor step count. Weekly telephone calls provided feedback, support and positive reinforcement.

Results Twenty-two participants (18 men, 4 women; aged 67±8 years old) took part in a focus group discussion (n=17) or a semi-structured interview (n=5). Fifteen themes were identified from the data generated. Participants reported that the intervention was physically and mentally beneficial, and data highlighted features of the intervention that influenced uptake and adherence. An opportunity to increase the likelihood of surviving the pending operation was reported by participants as the most salient factor to engagement, and using the intervention as a distraction from illness and taking steps to positively influence the situation were the most salient factors to adherence.

Conclusions Uptake to the ChemoFit intervention was encouraged by provision of information that participation could reduce surgical risk and that participants could play

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The study was conducted in accordance with the Consolidated criteria for Reporting Qualitative research to maximise methodological quality and transparency.
- ⇒ All patients meeting the eligibility criteria for the ChemoFit intervention study were approached to take part and all but two agreed.
- ⇒ Qualitative methodology was able to capture the views of participants following completion of the intervention to provide important context to support quantitative data.

an active role in risk reduction. Adherence was facilitated by the intervention being considered a positive distraction and participants being able to do something that could ultimately provide benefit. While participants reported difficulties and avoidance with some of the exercises recommended, understanding the importance of physical activity and exercise as part of their treatment regimen led to individual adaptations to intervention components to reach individual goals.

Trial registration number NCT04194463

INTRODUCTION

Optimum treatment of locally advanced oesophageal and gastric adenocarcinoma involves neoadjuvant chemotherapy and surgical resection.^{1 2} However, patients are typically older adults and the rate of deconditioning can lead to a higher rate of morbidity and mortality.³ Evidence suggests that low level of preoperative physical fitness is a contributing factor.⁴ Furthermore, neoadjuvant chemotherapy is associated with a reduction in cardiorespiratory fitness in people with oesophagogastric cancer.^{5 6} Some studies

have demonstrated that prehabilitation increases cardio-respiratory fitness and prevents the deleterious effects of chemotherapy.⁵⁻⁷ Research has also shown a reduction in the incidence of postoperative complications⁸⁻⁹ and improved mental health of patients.¹⁰ In addition, qualitative evaluations have reported that patients enjoy participation in physical activity and exercise interventions¹¹ and find them motivating¹² and socially beneficial.¹³

The time between receiving diagnosis and entering a treatment pathway provides an opportunity for patients to participate in lifestyle interventions to increase their preparedness for treatment and surgery.¹⁴ This type of intervention, termed 'prehabilitation', is a proactive approach enabling patients to be active participants in their treatment and health.¹⁵ Despite preoperative exercise interventions being shown to improve physical fitness among patients, there is debate about the best and most effective way to achieve this. Previous research has investigated high-intensity interval training,⁴⁻¹⁶ community-based physical activity¹⁷ and home-based programmes,¹⁸ with mixed findings. The use of behavioural change theory has also been explored in the context of uptake and adherence to prehabilitation interventions. The transtheoretical model of behavioural change suggests intention and perceived behavioural control are important predictors of adherence to physical activity and exercise intervention in patients diagnosed with cancer.¹⁹⁻²⁰ However, there are significant methodological limitations and risks of bias among studies in this area.¹⁴ Specifically, an assessment of acceptability is regularly evaluated using only recruitment, retention and adherence data without exploring the views of patients to add important context. As such, factors associated with uptake, engagement and adherence to interventions are often not captured, including important barriers and facilitators that prevent optimisation and integration into care pathways.

We conducted a qualitative study involving patients who took part in the ChemoFit study to identify factors influencing uptake, engagement and adherence.

METHODS

All patients provided informed written consent prior to participation. This study was registered with ClinicalTrials.gov (NCT04194463).

Participants and intervention

A full description of the eligibility criteria and study schedule for patients participating in the ChemoFit study has been reported previously.²¹ Patients with oesophageal and gastric adenocarcinoma were identified during the multidisciplinary cancer staging process. Participants were adults aged ≥ 18 years with locally advanced operable oesophagogastric adenocarcinoma due to receive neoadjuvant chemotherapy treatment. Those with any contraindications to cardiopulmonary exercise testing (CPET), physical activity, exercise (eg, those with cardiovascular, metabolic or renal disease requiring further assessment

and medical clearance) or with planned neoadjuvant radiotherapy or chemoradiotherapy were excluded.

The home-based physical activity and exercise intervention (ie, ChemoFit) consisted of a combination of targeted daily step-based physical activity and strengthening exercises.²¹ Participants were given a pedometer (Walking Style One 2.1, Omron Healthcare UK, UK), a resistance band (BodyMax Resistance Tube, BodyMax, UK) and an exercise diary to complete each week. Each participant was advised to increase their daily step count by 2000 steps per day, 7 days per week. This increase in physical activity (step count) could be achieved by walking or jogging at moderate intensity for a target of 30 min per day and this was considered one 'bout' of moderate-intensity exercise. Participants were advised on how to achieve moderate-intensity physical activity using the modified Borg Rating of Perceived Exertion (RPE) scale aiming to achieve an RPE level between 3 and 4 (moderate to somewhat strong exertion). Participants were asked to record their daily step count at the end of every day and the RPE for the 30 min bout of exercise. The Borg scale was used as a tool to describe the intensity of home-based physical activity throughout the intervention period. Continued engagement with the programme was positively reinforced during a weekly telephone call by a researcher who was also a clinician (JC and JW). The researcher provided motivational discussions that were designed to reinforce the aims of the intervention (ie, the benefits of completing it), monitor physical activity and exercise undertaken, discuss the intensity of exercise, collect the previous week's self-monitored data (ie, strengthening exercises and physical activities undertaken, including daily pedometer steps), and provide feedback on behaviour and positive reinforcement to maximise adherence. In addition, participants were encouraged to reflect on the previous week's achievements and discuss any problems or challenges that may have prevented progress and to identify strategies to overcome those problems in the future. Participants were given the opportunity to revise their physical activity goals and increase their daily targets for the coming week if they felt that was achievable. The intervention was personalised to each participant based on their baseline level of activity (as recorded by a pedometer during the first week of observation, preintervention), age, general health and social circumstances, with the aim of achieving the greatest improvement in their cardiopulmonary fitness.

A total of 30 participants underwent surgery and were eligible to participate in the qualitative study. All participants were informed about the qualitative substudy prior to commencing the ChemoFit intervention and reminded about the opportunity to participate once the feasibility study had reached completion. Five participants were deceased at the time of the qualitative study, two patients declined to participate and one participant was lost to follow-up due to a change in their medical circumstances. [Figure 1](#) provides a flow chart of participants throughout the ChemoFit study.

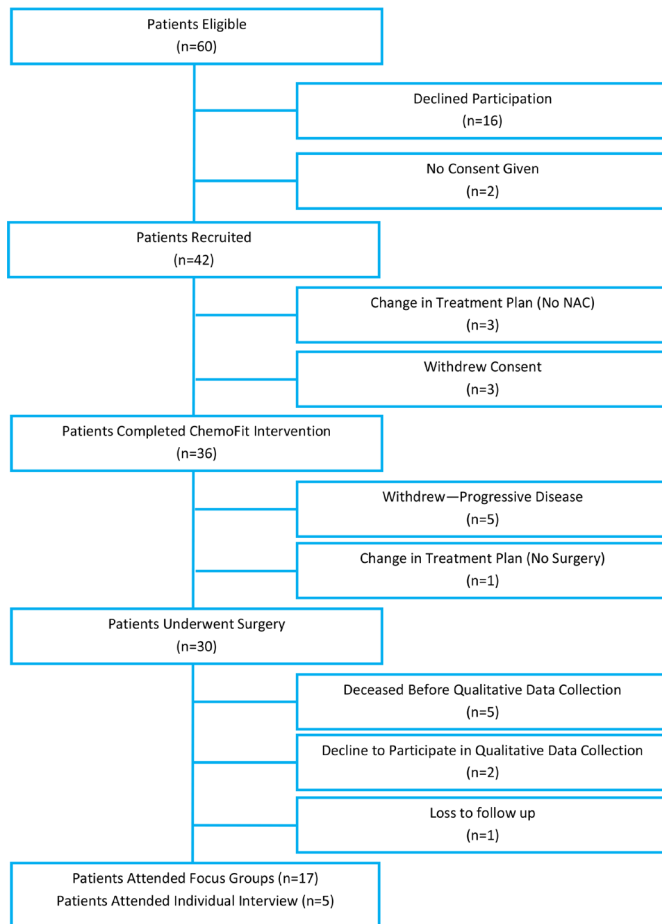


Figure 1 Patients' flow chart. NAC, neoadjuvant chemotherapy.

Qualitative data collection

Focus group discussions and semistructured one-to-one interviews were conducted following participation in the ChemoFit intervention and postsurgery (N=22). Participants were invited to take part in either one focus group or one interview. All focus group discussions were conducted by two members of the research team: a male PhD researcher and trainee health psychologist (MC) and a female chartered health psychologist (LA) with expertise in health behavioural change and qualitative research methods. All one-to-one interviews were conducted by one researcher (MC). Prior to the conduct of the focus group discussions and interviews, the researchers had not met the study participants.

An interview topic guide (online supplemental material) was developed by four members of the research team (MC, LA, JC and RCFS). Topics included motivations for taking part, expectations of the intervention, perceived barriers to adherence, strategies used to overcome barriers and support requirements to maximise adherence. All questions were open-ended and prompts were used to facilitate in-depth discussions to fully explore patient views. All focus group discussions and interviews started with a brief explanation of the aims and all were audio-recorded and transcribed verbatim.

Methodological quality and reporting

The study was conducted in accordance with the Consolidated criteria for Reporting Qualitative research to maximise methodological quality and transparency.²² Two researchers independently coded and analysed the interview transcripts, interpreted the data and agreed on theme labels (MC and LA).

Data analysis

Data were analysed using thematic analysis.²³ To maximise trustworthiness (ie, rigour of the study relating to confidence in data and interpretation) of the findings, the following procedures for analyses were undertaken: all focus group and interview transcripts were independently read and re-read by two researchers (MC and LA); both researchers independently coded segments of data from the first three transcripts to develop a coding strategy and to generate preliminary themes/subthemes. Following discussion, the same two researchers in collaboration with a third (JC) discussed and interpreted the findings. Finally, MC and LA agreed on a preliminary set of themes and subthemes. One researcher (MC) repeated this process with the remaining six transcripts and both researchers agreed on a final set of themes and subthemes that best represented the data set following discussions. Disagreements were resolved by revisiting transcripts, and when required asking the views of a third research team member (JC). Supporting direct quotes from patients were applied to the agreed thematic labels.

Patient and public involvement

Two patient and public involvement activities were undertaken to explore whether patients felt the study was worthwhile and whether various aspects of it would be acceptable. A presentation of the proposed study was delivered to a group of patients at a local Northern Oesophago-Gastric Cancer support group session held at a Maggie's Centre, a branch of a national cancer charity. Questionnaires were circulated. All patients consulted (14 of 14) believed that the proposed research was patient-centred and an important area of work. There was consensus that if awaiting surgery again they would participate in the study. The additional time required to attend additional tests and sessions to engage with the study protocol was considered acceptable. Patients recovering from resectional surgery for oesophagogastric cancer on a postoperative surgical ward were also consulted. Specifically, they were asked about the feasibility of the intervention, the associated study procedures and their willingness to participate. All patients confirmed that neoadjuvant chemotherapy had a detrimental effect on their activity levels and that they would have considered the ChemoFit intervention to address this. All patients confirmed their willingness to wear pedometers and to attend hospital for an extra CPET and an education session. Study participants will be invited to attend a session at a local Maggie's Centre where the findings will be presented.

Table 1 Characteristics of all enrolled patients (including participants who later withdrew consent)

	Participants (N=22)
Average age (SD)	67.27 (8.21)
Sex, male, n (%)	18 (82)
Ethnicity (white British), n (%)	22 (100)
Index of Multiple Deprivation (deciles)	
1	2
2	3
3	3
4	1
5	1
6	3
7	2
8	1
9	3
10	3
BMI, median (SD)	29.08 (5.60)
Smoking status	
Never	6
Ex-smoker >1 year	13
Current smoker	3
Comorbidities	
Asthma/COPD	3
Diabetes mellitus	4

BMI, body mass index; COPD, chronic obstructive pulmonary disease.

RESULTS

Patient recruitment to the ChemoFit study is presented in [figure 1](#). Of the 36 patients who consented to take part in the intervention, 22 participated in the qualitative study (18 men, 4 women; average age 67 years, SD=8.21). Seventeen participants took part in a focus group discussion (focus group 1, n=6; focus group 2, n=3; focus group 3, n=5; focus group 4, n=3) and five participants took part in a one-to-one semistructured interview. The four focus groups (one group convened in person, prior to the COVID-19 pandemic, at the Maggie's Centre, Freeman Hospital, Newcastle upon Tyne, and three convened online) lasted on average 70 min (SD=19.6). Five one-to-one semistructured interviews were conducted by telephone with those who did not wish to take part in a focus group discussion or who experienced difficulties with using technology. The average duration of interviews was 20 min (SD=3.2). All those recruited to the qualitative study underwent their surgical procedure. During the conduct of focus group 1, two companions attended to assist and provide support to participants. The baseline characteristics of the participants are presented in [table 1](#).

A total of 15 themes were generated from the qualitative data. Several factors associated with uptake, engagement and adherence to the intervention were identified. In terms of data saturation, it was agreed during the analysis process that no new themes emerged following the conduct of focus group 3. However, recruitment continued to enable all participants to provide their views, and no new themes emerged. A summary of all themes and subthemes generated with supporting direct quotes is presented in [table 2](#).

Taking part in ChemoFit could increase my chance of surviving the operation and recovering thereafter

Participants consistently reported the intervention as a way of increasing their chances of surviving their operation: "That's the reason for doing it for me because I wanted to come out the other side" (FG1, P3). Specifically, they associated completion of ChemoFit with increased fitness that would facilitate an effective recovery and reduce their length of stay in hospital. A large proportion of those consulted reported their family members and friends as a motivator to taking part.

Well I just kept thinking about my husband and my son. I didn't want to leave them. (FG2, P2)

I owe it to the clinical team to increase my fitness for surgery

A common finding across focus group discussions and interviews was the participants' desire to 'play their part' by improving their fitness for surgery. By doing so they would be respecting the efforts of the clinicians involved with their care and reduce the burden on the National Health Service (NHS).

I think it's up to me to look after myself as best as I can because of all the work that the surgeons and the nurses put in. I felt at least I should try and look after myself a bit. (FG2, P1)

The money, the cost per night in the hospital, goodness knows how much that costs and the follow-up with all the doctors, the dieticians and everyone else behind, we are going through this quicker than a person who probably hasn't done any exercises. It's saving the NHS thousands and thousands of pounds of money. (FG4, P3)

Tracking progress provided an incentive to keep going with the intervention

Regarding adherence, participants reported difficulties continuing with physical activity and exercise when they were unwell or undergoing treatment. However, the majority of those interviewed reported setting activity goals as a motivator, and even if they did not reach the goal making progress towards that goal facilitated adherence.

...having to keep track of your steps gave you the added incentive to keep going... lots of times I was doing the steps I thought, 'I just feel like going home but hang on, no, I need to get these steps

Table 2 Summary of themes and subthemes derived from thematic analyses of focus group discussion and interview transcripts

Theme	Subtheme	Quotes
1. Taking part in ChemoFit could increase my chance of surviving the operation and recovering thereafter.		“That’s the reason for doing it though for me because I wanted to come out the other side.” (FG1, P3)
		“Well, it sounded like a good idea. Like, the fitter I was before the operation, the better I would become....” (Interview, P24)
	My family and friends are a motivator to surviving my operation.	“Well I just kept thinking about my husband and my son. I didn’t want to leave them.” (FG2, P2)
2. I owe it to the clinical team to increase my fitness for surgery.		“It’s the grandchildren that motivated me. That’s all I wanted to do. First of all I want to see them graduate and then I realised I was getting better so I thought, ‘I want to see them get married now.’ So that’s onwards and upwards all the way through.” (FG2, P1)
		“I think it’s up to me to look after myself as best as I can because of all the work that the surgeons and the nurses put in. I felt at least I should try and look after myself a bit.” (FG2, P1)
3. Tracking progress provided an incentive to keep going with the intervention.		“The money, the cost per night in the hospital, goodness knows how much that costs and the follow-up with all the doctors, the dieticians and everyone else behind, we are going through this quicker than a person who probably hasn’t done any exercises. It’s saving the NHS thousands and thousands of pounds of money.” (FG4, P3)
		“...having to keep track of your steps gave you the added incentive... lots of times I was doing the steps I thought, ‘I just feel like going home but hang on, no, I need to get these steps in,’ so it would give you that incentive to keep going even though at times I didn’t feel like doing it.” (FG3, P1)
	Setting realistic and achievable goals is important for adherence.	“when I’m doing alright I’m happy but if someone puts too much on me I find it dead easy to give up, I really do.” (FG2, P1)
4. Maintaining activity levels while undergoing chemotherapy is a challenge.		“I just carried on doing the standard that [the surgeon] asked me to do. Often, I exceeded it but that was because I wanted to. But if he’d set me the target, I’d have probably said, ‘I can’t do that,’ and I would have probably not done it.” (FG2, P1)
		“...as I was having the chemo, I seemed to be going downhill. I couldn’t do all the exercises that they wanted me to do.” (FG4, P2)
		“Then it [chemotherapy] hits you for three days. That’s when I struggled [to do the exercise].” (FG1, P5)
5. Strength exercises were difficult to master and maintain.		“having it written down and when you looked at it you could say, ‘Well last week I could do this, that, the other. I’m either doing better this week or I’m dropping back. Why is that?... a lot depends on the stage you’re at with your chemo.’” (FG3, P1)
		“That’s the one thing I didn’t like [resistance bands]. I slapped myself on the nose a few times.” (FG1, P3)
	If strength exercises were measurable like steps, you could monitor your progress.	“I think the walking was a lot easier than the strength exercises.” (Interview, P38) “They’re not as easy and measurable. You’re walking, you can see you’re doing a few more [steps] each time but the strengthening isn’t quite as easily measurable... It’s a lot slower improvement. You don’t relate that to what you were doing, well you can on your records but you don’t in your mind when you’re doing them..., to see how much you’ve improved as much.” (FG3, P5)

Continued

Table 2 Continued

Theme	Subtheme	Quotes
6. Barriers to walking make achieving the step targets difficult.		“The trouble is finding out where to go for the steps because you get bored after a while doing the same circuits.” (FG1, P2)
		“The weather, that was a big problem for me. The rain wasn’t very nice.” (FG1, P8)
7. Exercising at home helps overcome barriers including time and travel.		“By doing it at home it has the advantage you can do it when you want to do it and fit it in with other things you want to do or don’t want to do. I mean it doesn’t take very long, the exercises.” (FG4, P1)
		“I would say, just do it at home. You don’t need to be coming into the hospital. Plus, it’s the inconvenience of getting there... you know, the travel.” (Interview, P24)
	Home-based programmes eliminate competitiveness and self-consciousness.	“...I don’t want to do it in a hospital because I think it then becomes really competitive. And people are, like, if they can’t do it, they feel Oh, I’m not strong enough...’ It might depress them. Whereas if you do it in the house, you can do it at your own pace, there’s nobody watching over you and everything.” (Interview, P34)
		“I think you’re more relaxed at home which helps your cardio.” (FG3, P5)
	Home-based programmes enable your partner or friends to join in and provide support.	“My wife did the same ones with me so there were two of us doing the same stuff. We did the walks together. Then we would both do the exercises. So that was good company. So I suppose it’s a bit like going to your own gym in effect.” (FG4, P1)
		“I live by myself. People who are living by themselves do need some extra help. I had my grandson ring me up after he’d come home from school to see if I’d done my exercises.” (Interview P24)
8. The programme motivated me to engage in other physical activities and exercises which meant I sometimes did more than required.		“I went to the gym is to push myself a little bit further... I found it really beneficial by doing that little bit extra.” (FG1, P6)
		“I’ve got some dumbbells that I use for upper body.” (FG2, P1)
		“We ended up getting the Wii Fit out and doing that. That was a bonus. It [ChemoFit] reminded you to do something else.” (FG4, P1)
9. Cardiopulmonary exercise testing on a static bike proved challenging.		“It’s like a contraption where you pedalled as fast as you could, which I did but the next day I suffered. I was ill. I didn’t realise it would take it all out of me.” (FG2, P3)
		“...if you’ve got arthritis or you’ve got knee problems, the bike is a problem.” (FG3, P4)
	Greater explanation of the aim of the exercise test would have reduced anxiety.	“I thought that I had to get to a certain standard to be accepted into the programme.” (FG3, P3)
		“I think if I failed the day before [the cycling test] I wouldn’t have had the operation.” (FG1, P1)
		“They wouldn’t do the operation if you couldn’t pass the test, simple as that.” (FG2, P2)
10. Completing the exercise programme was a welcome distraction from my illness.		“psychologically it helped because it also took your mind off the cancer. You were busy thinking about the fitness.” (FG3, P2)
		“It really did take your mind off things. You didn’t think you were doing these exercises for the illness if you like, in preparation. You just felt you were doing something. It took your mind off things.” (FG2, P1)

Continued

Table 2 Continued

Theme	Subtheme	Quotes
11. Having someone with you when the intervention is described is beneficial.		“we were lucky that my wife came in with me at the beginning.... She sat and made notes because after we had the meeting and the talk and what people had said about what’s going to happen, you’ve basically forgot it....” (FG4, P1)
		“I think it [ChemoFit] needs to be taken out of the situation... where they sit down and explain it [ChemoFit] to you....” (FG1, P1)
12. Ongoing support from the clinical team is vital to maintain motivation and adherence.		“You never feel alone when you know you’re on a little programme and you’re going to get a phone call. And you’re trying your best because if you doing something for yourself to get through what you’ve got to go through, it all helps.” (Interview, P32)
		“...The specialist nurse telephoning up and talking to you, that has been a real bonus. You’ve always got the feeling you’ve got someone you can contact and talk through and sort out any odd problems you have....” (FG4, P1)
13. Self-monitoring my physical activity levels including reasons why I had not achieved my goals was beneficial.		“it helped you having to mark down what you were doing... It was something you never thought about before until you had to do it. The fact that you had to write it down and keep a record of it, I think that gave you more motivation to keep doing it.” (FG3, P1)
		“I was going to say I always used to jot down as well if I hadn’t done as many steps, the reason why, whether I’d been vomiting that day because of the chemo or whatever. I would write down what had stopped me doing it.” (FG3, P2)
14. Peer support would have been beneficial for adherence.		“it might have been a good idea then that they introduce you to people who are doing the same and you could meet up and have a chat or do some exercises.” (FG1, P7)
		“If somebody is at the beginning of the programme, the first week... and somebody is at the end of the weeks, they can say, ‘Yes, I was like that at the beginning. Just keep going. In another week or two you’ll get over that and you’ll feel a lot better.’” (FG3, P1)
	Meeting with others who were taking part in the programme could have helped overcome barriers.	“It would be motivational. Again, it’s giving encouragement amongst the fellow peers. Like I say, if somebody was having a down period or wasn’t keen to do it, the other people would probably give them encouragement to do so.” (FG3, P3)
		“The main important thing is that whilst you’re doing it you have the ability to speak to someone who can say, ‘Look, I’m having difficulty with this,’ or, ‘This bit doesn’t work for me.’” (FG4, P1)
15. ChemoFit provided a means of doing something meaningful during the COVID-19 pandemic lockdown.		“I thought it was a great programme. It made me go out and walk and do more than I had done previously. With the lockdown, the gym was closed so there was no other method of doing any other exercises. It’s one of the things that kept me going.” (FG4, P3)
		“I think the lockdown had just started, having an excuse to still go out otherwise I would think if I wasn’t on then ChemoFit then, I’d have been stuck in the house.” (FG3, P1)
		“When I first started, it was a little tiring. But obviously, when Covid came along I’m thinking, ‘Wow. This is the best thing I can do. Stop and have some exercise.’” (Interview, P34)
	COVID-19 created barriers to fully engaging with ChemoFit.	“When we had the lockdown, because of your age, [you were advised to] stay at home, don’t go out. Yet [for this programme] we were asked to ‘Get out and walk.’ You’ve got these two conflicting orders.” (FG3, P4)
	“I don’t go out much... because I can’t... the things they are telling you to... I just stay, as much as I can, near home.” (Interview, P38)	

in,' so it would give you that incentive to keep going even though at times I didn't feel like doing it. (FG3, P1)

Recording activity provided participants with a means to look back and recognise improvements; however, this was favoured by a small minority (n=4) of those consulted.

However, a proportion of those consulted reported their goals as being unattainable. For some it meant they gave up.

when I'm doing alright I'm happy, but if someone puts too much on me I find it dead easy to give up, I really do. (FG2, P1)

Maintaining activity levels while undergoing chemotherapy is a challenge

Participants experienced the side effects of chemotherapy while participating in the ChemoFit intervention and found it a challenge to maintain motivation, effort and activity levels against their set goals: "Then it [chemotherapy] hits you for three days. That's when you've still got to do exercise, or for me, that's when I struggled" (FG1, P5). During this time participants felt they had regressed and reported feeling it took them longer to get back to where they were after each session of chemotherapy.

One thing I found out is when I went in for the day treatment at the [hospital] for the chemo, after that, depending on the stage I was at, it took me longer to build myself back up. (FG3, P3)

Participants were given a diary to record their physical activity and exercise levels and this generated a pattern which highlighted the effects of chemotherapy on their progress and prompted them to develop strategies to 'keep going' and maintain a higher than baseline level of activity even when they were not able to reach their goals. This was reported as mentally and physically beneficial and rewarding and as such a significant motivator that helped support adherence.

Well last week I could do this, that, the other. I'm either doing better this week or I'm dropping back. Why is that? Then you would think, 'Yes.' A lot depends on the stage you're at with your chemo. (FG3, P1)

The diary itself was considered a 'strategy' to keep going (ie, self-monitoring and identifying and recording valid reasons for not reaching goals on a specific day were reported to prevent a reduction in motivation).

it helped you having to mark down what you were doing... It was something you never thought about before until you had to do it. The fact that you had to write it down and keep a record of it, I think that gave you more motivation to keep doing it. (FG3, P1)

Strength exercises were difficult to master and maintain

Participants found the strengthening exercises to be more challenging than increasing everyday levels of physical activity, particularly in situations where this was new to them. The strength exercises involved using resistance bands, which participants consistently reported as difficult to use: "That's the one thing I didn't like [elastic bands]. I slapped myself on the nose a few times" (FG1, P3). Increasing everyday walking was easier to achieve and participants reported being able to record and monitor it more effectively than the strength exercises and this was considered important when the intervention became a challenge. In this regard, progress could be 'seen' and reviewed each week, whereas participants felt their strength took more time to build and improvements were much slower to see. This highlighted the importance of being able to see progress.

They're not as easy and measurable as when you walk. You're walking, you can see you're doing a few more each time but the strengthening isn't quite as easily measurable... It's a lot slower improvement. (FG3, P5)

Barriers to walking make achieving the step targets difficult

Despite everyday physical activity being the preference for most participants consulted, some barriers were reported. A physical activity goal involving a set number of steps to achieve each day meant some participants found the intervention 'boring' due to the difficulty in identifying new places to walk.

The trouble is finding out where to go for the steps because you get bored after a while doing the same circuits. (FG1, P2)

During bad weather participants reported their walks as 'not as enjoyable'.

The weather, that was a big problem for me. The rain wasn't very nice. (FG1, P8)

Exercising at home helps overcome barriers including time and travel

ChemoFit was designed to facilitate flexibility and enable participants to fit physical activity and exercise into their daily routine at home and avoid time travelling and expenses. It also enabled participants to tailor the intervention to their individual needs and preferences, while achieving goals helped improve fitness. By completing the intervention at home, it also gave those who lived with the participant an opportunity to take part, which in turn motivated participants to continue.

My wife did the same ones with me so there were two of us doing the same stuff. We did the walks together. Then we would both do the exercises. So that was good company. So I suppose it's a bit like going to your own gym in effect. (FG4, P1)

Completing the intervention at home enabled participants to feel more comfortable to complete the exercises in their own environment, or an environment of their choice, on their terms and to modify the intervention to suit their needs, a lot of which would not have been possible with a centre-based intervention. This removed the concerns of some participants that group exercise could create a competitive environment, which was not helpful.

...I don't want to do it in a hospital because I think it then becomes really competitive. And people are, like, if they can't do it, they feel... they would feel like, 'Oh, I'm not strong enough...' you know what I mean. It might depress them. Whereas if you do it in the house, you can do it at your own pace, there's nobody watching over you and everything. (Interview, P34)

The programme motivated me to engage in other physical activities and exercises which meant I sometimes did more than required

Supporting participants to complete the intervention in their own time and space gave them confidence to adjust their goals accordingly. For some this meant the use of alternative equipment, including free weights at a gym.

I went to the gym to push myself a little bit further... I found it really, really beneficial by doing that little bit extra coming out of the gym twice a week. (FG1, P6)

Although participants were not encouraged to complete physical activities and exercise beyond the intervention, there were those who felt they could do more and by having that freedom they could push themselves further if they needed to. For those who did this, ChemoFit had given them the confidence to do so.

Cardiopulmonary exercise testing on a static bike proved challenging

A CPET was conducted as part of routine clinical (baseline) assessment. The ChemoFit study protocol added a second CPET following completion of the intervention to measure changes in cardiorespiratory fitness as part of the secondary outcomes of the intervention study. However, due to the COVID-19 pandemic, the CPET facility was closed²⁴; therefore, some participants (n=3) did not complete the second CPET. Participants reported the CPET (static bicycle test) difficult to complete and reported feeling unwell for a number of days thereafter.

It's like a contraption where you pedalled as fast as you could, which I did but the next day I suffered. I was ill. I didn't realise it would take it all out of me. (FG2, P3)

Some participants felt they could not perform to their full fitness ability due to musculoskeletal issues such as arthritis.

...if you've got arthritis or you've got knee problems, the bike is a problem. (FG3, P4)

Participants felt anxious about the CPET because they believed a predefined level of fitness was required to be accepted into the ChemoFit intervention. In addition, participants understood that if they were not fit enough or their fitness had not improved, they would not receive their operation.

I think if I failed the day before (the cycling test) I wouldn't have had the operation. (FG1, P1)

Completing the ChemoFit intervention was a welcome distraction from my illness

The ChemoFit intervention provided participants with a means of taking some control over their health and treatment and providing something else to focus on would be beneficial. A large proportion of participants reported this as a distraction from other aspects of their situation that were out of their control.

I definitely think psychologically it helped because it also took your mind off the cancer.... Because you were thinking about trying to get fit, it took your mind off the cancer. (FG3, P2)

Having someone with you when the intervention is described is beneficial

When participants were given information about the ChemoFit study, it was provided alongside other clinical information about their diagnosis and treatment. For some this became overwhelming. The majority of those consulted said they found it beneficial to have someone with them to help make sense of the information provided. Retention of information was considered a barrier.

we were lucky that my wife came in with me at the beginning.... She sat and made notes because after we had the meeting and the talk and what people had said about what's going to happen, you've basically forgot it.... (FG4, P1)

Furthermore, it was felt that the information about ChemoFit could have been kept separate. Once the information about diagnosis and treatment had been digested, information about ChemoFit, the benefits and its place in the treatment plan would have been beneficial.

I think it needs to be taken out of the situation that I was in... where they sit down and explain it to you, what the exercises are all about. (FG1, P1)

Ongoing support from the clinical team is vital to maintain motivation and adherence

Throughout the timeline of the ChemoFit intervention, there were regular calls made by members of the clinical team (JC and JW) to provide support to participants, encourage them to complete their physical activity and exercise diaries, and discuss progress. Although these

calls had a practical purpose (data collection), they were also intended and reported as a source of support to participants. Participants consistently described this as a means of support and a way of reducing their anxiety.

You never feel alone when you know you're on a little programme and you're going to get a phone call. And you're trying your best because if you are doing something for yourself to get through what you've got to go through, it all helps. (Interview, P32)

Self-monitoring my physical activity levels including reasons why I had not achieved my goals was beneficial

In addition to monitoring their activity levels, some participants found it useful to record reasons for not being able to reach their goals. This information was helpful to them personally and to the research team to provide context and help to develop strategies to overcome barriers.

I was going to say I always used to jot down as well if I hadn't done as many steps, the reason why, whether I'd been vomiting that day because of the chemo or whatever. I would write down what had stopped me doing it. (FG3, P2)

Participants reported recording this information acted as a reminder to themselves why a goal was not met on a particular day or week and because they were keen to provide an honest account of adherence.

If you lie about it, you're not doing yourself any favours. You tell the truth... Because well, why lie? You're not helping yourself and you're not helping the programme. If you've only done fifteen steps one day, you've done fifteen. It's been a bad day or whatever. The following day, you could do 30. (Interview, P34)

The desire to provide a truthful account of physical activity levels and adherence to the exercises was consistent and prominent across all interviews with participants.

Peer support would have been beneficial for adherence

Throughout participation in the ChemoFit study, participants had no contact with other participants. When asked about possible improvements to the intervention, they suggested peer support.

It would be motivational. Again, it's giving encouragement amongst the fellow peers. Like I say, if somebody was having a down period or wasn't keen to do it, the other people would probably give them encouragement to do so. So, I think it would definitely be beneficial. (FG3, P3)

Specifically, it was suggested peer support could provide an opportunity for sharing of experiences with those who have either completed the intervention or those who have progressed further and could serve as a motivator and means of support.

If somebody is at the beginning of the programme, the first week, second week and somebody is at the end of the weeks, they can say, 'Yes, I was like that at the beginning. Just keep going. In another week or two you'll get over that and you'll feel a lot better'. (FG3, P1)

Participants indicated knowing others who were taking part could have facilitated the formation of physical activity and exercise groups, or simply an opportunity to meet or make contact to provide and receive support.

it might have been a good idea then that they introduce you to people who are doing the same and you could meet up and have a chat or do some exercises. (FG1, P7)

ChemoFit provided a means of doing something meaningful during the COVID-19 pandemic lockdown

The COVID-19 pandemic affected access to community gyms, face-to-face support and to the CPET at the hospital for a small number of study participants. Despite these challenges, participants reported ChemoFit as a mechanism for doing something at home that had the potential to make a real difference. Without it, participants reported they would not have done anything else.

I thought it was a great programme. It made me go out and walk and do more than I had done previously. With the lockdown, the gym was closed so there was no other method of doing any other exercises apart from doing them in my own house or doing it outside. So that's one of the things that kept me going. (FG4, P3)

The pandemic also gave participants time they might not otherwise have had, which meant they could focus on physical activity and exercise.

When I first started, it was a little tiring. But obviously, when COVID came along I'm thinking, 'Wow, this is the best thing I can do. Stop and have some exercise'. (Interview, P34)

When lockdown restrictions first commenced, some participants considered the ChemoFit intervention as "an excuse to still go out" (FG3, P1), while others found it difficult to interpret the rules.

When we had the lockdown, because of your age, you were advised to stay at home, [you] don't go out. Yet [for this intervention] we were asked to 'Get out and walk.' You've got these two conflicting orders. (FG3, P4)

DISCUSSION

The primary aim of this qualitative study was to identify the factors influencing uptake, engagement and adherence to the ChemoFit intervention and to establish whether it

was acceptable and feasible to use. The findings provide evidence that ChemoFit was feasible and acceptable to all of those who participated in the ChemoFit intervention and the subsequent qualitative study, and the participants provided important context in terms of how and why they used the intervention. The primary motivator influencing uptake was the opportunity to do something that could impact positively on clinical outcomes. Linked to this was participants' desire to survive their operation to be around for family members. Participants were also keen to 'play their part' in their treatment and reported taking part in ChemoFit as being a way of thanking the clinical team for their expertise and efforts throughout the course of treatment. Many of the participants consulted attributed their recovery and survival from cancer directly to the intervention.

A major benefit of the ChemoFit intervention was that it was designed to be completed at home. Despite some individuals suggesting integration of peer support, this was most often suggested as a means of receiving social support during difficult times rather than an opportunity to take part in activities with others. A home-based programme facilitated integration of physical activity and exercise into participants' daily routine, they could involve partners and friends, and they could engage at a time most convenient to them. The flexibility of the intervention meant participants could adapt it to suit their own capabilities and how they were feeling on a given day and these features facilitated adherence. This was considered important because participants reported not wanting the additional pressure of having to keep up with others.

There are a number of well-documented barriers to attending centre-based programmes. These include travel time and expense, concerns about capabilities, and hesitancy about joining group-based activities.^{25 26} Participants reported the ChemoFit intervention was a welcome solution to these barriers.

A component of the ChemoFit intervention was a weekly telephone call from a member of the research team who worked with each participant to agree physical activity and exercise goals and ensure they were realistic and capable of improving fitness. Those research team members were also clinicians and provided ongoing support and positive reinforcement. This approach meant any challenges encountered were discussed and, where possible, overcome. Despite consistent comments that the strengthening exercises were difficult to master, all participants reported attempting to complete them. The primary difficulty encountered was with using equipment, specifically the CPET due to the difficulty of the task and the resistance bands due to problems with mastery. However, to maintain strength-based exercises, a proportion of participants reported using additional exercise equipment to reach their goals.

There were no significant barriers reported with regard to increasing everyday physical activity levels and there was a clear preference for this when compared with strength exercises. The benefits experienced with walking were

consistently reported, for example a reason to be outside more often (ie, the intervention encouraged participants to be active outdoors more regularly) into the open air and gaining clarity, which impacted positively on mental as well as physical health and well-being. This is something that has been widely reported by other studies.²⁷⁻²⁹ Poor weather conditions were the most frequently reported barrier to non-adherence, and again this finding is consistent with similar intervention studies.²⁶

Regular telephone contact between a research clinician and each participant worked well to develop a relationship that those consulted described as a friendship. The telephone calls provided reassurance about care planned and received and provided an opportunity to ask questions and to modify goals. As such, this was reported to reduce anxiety. This contact also positively influenced motivation and increased determination for goal attainment. These findings support those reported in the context of other intervention studies and highlight the importance of telephone support and frequent contact¹¹ to address patient uncertainties and anxieties.³⁰

Although the response to participation in ChemoFit was largely positive, participants felt there was a lot of detailed information provided during the first consultation which left them feeling overwhelmed. As such, participants talked about the benefits of taking someone along with them to listen and make notes to avoid missing important information. Although this is routinely suggested to patients by members of the clinical team and within appointment invitation letters, participants considered it important in the context of ChemoFit in order to absorb and understand the additional information provided. This also provides friends and family members with an opportunity to understand the aims of ChemoFit, what it involves and ways in which they can provide support. This finding was consistent with a similar intervention study, Active-at-Home-HF for patients with heart failure, where participants reported friends and family members often being a barrier to goal attainment unless they were present during the consultation.²⁶ Participants who were accompanied by a friend or family member commented they were essential for retention of information and that discussion afterwards facilitated understanding and confidence about what would happen next.

Reasons for refusing participation were largely attributed to travel and frequency of visits, although a proportion of those recruited suggested a separate visit could be provided for the purpose of the ChemoFit intervention to avoid information overload. This is perhaps something that should be explored in more detail to identify the optimal way of integrating the ChemoFit intervention into patients' treatment plan. It is possible patients felt overloaded with information and as such chose not to participate.

The desire for peer support was a consistent theme identified. Participants felt that being linked with their

peers at different stages of the intervention would have been beneficial to maintain motivation and adherence, particularly at challenging times. Although adherence to the ChemoFit intervention was good (ie, exercises were completed ~70% of the time, there was 99% compliance with recording physical activity and exercise, and there was 100% compliance with a weekly telephone consultation) and the rates observed were better than those reported in other similar prehabilitation interventions,^{11 31} participants did report challenges. These included adherence to the intervention during chemotherapy, bad weather conditions and staying motivated when the intervention became repetitive (eg, walking the same routes). It was evident during focus group discussions that benefits could be derived from participants being able to share experiences and ideas for increasing and maintaining physical activity and exercise levels. This is also a consistent finding from other physical activity and exercise intervention studies.^{32 33}

Participants were asked to complete a CPET prior to commencing the ChemoFit intervention to assess baseline fitness levels as part of usual clinical care. However, it was identified the majority of those who completed the test did not enjoy it and some reported feeling 'unwell' for several days following completion of the test. Furthermore, the test was reported by some as a stressor, that is, a proportion of patients believed that if they did not reach a specific fitness threshold they would not receive their surgery. While the aim of the CPET is to assess fitness levels and determine suitability for treatment, it is also used to assess for other medical problems that could be improved prior to surgery. Participants are made aware of this; however, it is possible the source of anxiety is the belief they might not reach the fitness thresholds required to proceed. Therefore, a greater explanation of the aims and objectives of testing was consistently reported as a requirement to reduce anxiety, with an emphasis on how 'fitness' for surgery could be improved. Conversely, for those who did not receive the follow-up exercise test, they felt they had missed out on an opportunity to see how much their fitness had improved as a result of the intervention. For some, the CPET was a factor influencing adherence. Therefore, the outcome of the test could be used as a motivator if patients/participants are able to track their progress. In the case of the ChemoFit study, the CPET was not considered by the research team as an intervention component initially because it constitutes part of usual clinical care; however, it was evident participants perceived it to be an intervention component and would inform clinical decision-making.

Although ChemoFit was designed to be a home-based intervention, its conduct was affected by the COVID-19 pandemic. Participants reported barriers and conflicting advice about whether they should continue to go outdoors or self-isolate given their

health state. Specifically, participants were concerned about contracting COVID-19 and their pending surgery being postponed. However, the consensus was ChemoFit provided those who participated with a distraction from their diagnosis and provided a means of doing something positive which could be maintained under COVID-19 restrictions, and these were significant benefits of the home-based nature of the intervention and highlight the flexible and scalable nature of it.

This study was able to capture important views and provided evidence that ChemoFit was acceptable to those who took part in the intervention and the subsequent qualitative study and was feasible for them to incorporate into their everyday lives despite their treatment regimen. However, the findings should be interpreted with some limitations in mind. First, the data capture the views of those who met the eligibility criteria and were approached by members of the clinical team to take part. Therefore, the data do not represent those who met the eligibility criteria who did not take part, although of those approached only two did not participate (ie, they did not respond to the invitation). Participants were predominantly male (80%) and white British (100%); therefore, it could be assumed that the sample is not representative. However, the male to female ratio of oesophageal and gastric carcinoma in the UK is 5:1 and 2:3, respectively, and the North East of England has a low prevalence of people from ethnic minority groups; therefore, the sample shows good representation of those within the geographical location in which the tertiary centre is situated. Data also show good representation in terms of Index of Multiple Deprivation, with representation across the 10 deciles. Although future research should explore the views of a more representative group of surgical patients from across the UK to assess the acceptability of the intervention more widely, the current study reports on the acceptability and feasibility in terms of what influenced participation, engagement and adherence, including barriers and facilitators of uptake and adherence. This does address all aspects of feasibility and acceptability; however, we have another paper under review that reports on other aspects of acceptability and feasibility as detailed in our published protocol.²¹ Third, participants were interviewed following completion of the intervention and not during the intervention. If participants were interviewed during challenging times, responses may have been different. Finally, not all participants taking part in ChemoFit were interviewed; therefore, the data do not represent the whole sample and include only one participant who withdrew during the intervention. However, reasons for dropout were recorded and these did not indicate dissatisfaction with the intervention. Furthermore, the characteristics of participants reported in [table 1](#) closely match those of the whole sample.

CONCLUSIONS

The findings of our qualitative study suggest that ChemoFit was feasible and acceptable to patients with

oesophagogastric cancer who were approached and recruited to take part in the intervention. We identified ways in which the ChemoFit intervention and the associated study procedures could be optimised (eg, improving the way in which information about ChemoFit is integrated into a discussion about the treatment plan without overwhelming patients, provision of peer support and clarity about CPET outcomes), and these will be implemented ahead of a future larger scale evaluation of the ChemoFit intervention.

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REFERENCES

- Cunningham D, Allum WH, Stenning SP, *et al*. Perioperative chemotherapy versus surgery alone for resectable gastroesophageal cancer. *N Engl J Med* 2006;355:11–20.
- MRCOC W. Surgical resection with or without preoperative chemotherapy in oesophageal cancer: a randomised controlled trial. *The Lancet* 2002;359:1727–33.
- Vermillion SA, James A, Dorrell RD, *et al*. Preoperative exercise therapy for gastrointestinal cancer patients: a systematic review. *Syst Rev* 2018;7:1–10.
- West MA, Loughney L, Lythgoe D, *et al*. Effect of prehabilitation on objectively measured physical fitness after neoadjuvant treatment in preoperative rectal cancer patients: a blinded interventional pilot study. *Br J Anaesth* 2015;114:244–51.
- Jack S, West MA, Raw D, *et al*. The effect of neoadjuvant chemotherapy on physical fitness and survival in patients undergoing oesophagogastric cancer surgery. *Eur J Surg Oncol* 2014;40:1313–20.
- Navidi M, Phillips AW, Griffin SM, *et al*. Cardiopulmonary fitness before and after neoadjuvant chemotherapy in patients with oesophagogastric cancer. *Br J Surg* 2018;105:900–6.
- West MA, Loughney L, Barben CP, *et al*. The effects of neoadjuvant chemoradiotherapy on physical fitness and morbidity in rectal cancer surgery patients. *Eur J Surg Oncol* 2014;40:1421–8.
- Barakat HM, Shahin Y, Khan JA, *et al*. Preoperative supervised exercise improves outcomes after elective abdominal aortic aneurysm repair: a randomized controlled trial. *Ann Surg* 2016;264:47–53.
- Barberan-Garcia A, Ubré M, Roca J, *et al*. Personalised prehabilitation in high-risk patients undergoing elective major abdominal surgery: a randomized blinded controlled trial. *Ann Surg* 2018;267:50–6.
- Mayo NE, Feldman L, Scott S, *et al*. Impact of preoperative change in physical function on postoperative recovery: argument supporting prehabilitation for colorectal surgery. *Surgery* 2011;150:505–14.
- Ferreira V, Agnihotram RV, Bergdahl A, *et al*. Maximizing patient adherence to prehabilitation: what do the patients say? *Support Care Cancer* 2018;26:2717–23.
- Missel M, Pedersen JH, Hendriksen C, *et al*. Exercise intervention for patients diagnosed with operable non-small cell lung cancer: a qualitative longitudinal feasibility study. *Support Care Cancer* 2015;23:2311–8.
- Banerjee S, Semper K, Skarparis K, *et al*. Patient perspectives of vigorous intensity aerobic interval exercise prehabilitation prior to radical cystectomy: a qualitative focus group study. *Disabil Rehabil* 2021;43:1084–91.
- Santa Mina D, Clarke H, Ritvo P, *et al*. Effect of total-body prehabilitation on postoperative outcomes: a systematic review and meta-analysis. *Physiotherapy* 2014;100:196–207.
- Wynter-Blyth V, Moorthy K. Prehabilitation: preparing patients for surgery. *BMJ* 2017;358:j3702.
- Bhatia C, Kayser B. Preoperative high-intensity interval training is effective and safe in deconditioned patients with lung cancer: a randomized clinical trial. *J Rehabil Med* 2019;51:712–8.
- Loughney L, Cahill R, O'Malley K, *et al*. Compliance, adherence and effectiveness of a community-based pre-operative exercise programme: a pilot study. *Peroper Med* 2019;8:1–11.
- Gillis C, Li C, Lee L, *et al*. Prehabilitation versus rehabilitation: a randomized control trial in patients undergoing colorectal resection for cancer. *Anesthesiology* 2014;121:937–47.
- Husebø AML, Dyrstad SM, Søreide JA, *et al*. Predicting exercise adherence in cancer patients and survivors: a systematic review and meta-analysis of motivational and behavioural factors. *J Clin Nurs* 2013;22:4–21.
- Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. *Physical activity and cancer* 2010:367–87.
- Chmelo J, Phillips AW, Greystoke A, *et al*. A feasibility study to investigate the utility of a home-based exercise intervention during and after neo-adjuvant chemotherapy for oesophago-



- gastric cancer—the ChemoFit study protocol. *Pilot Feasibility Stud* 2020;6:1–8.
- 22 Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19:349–57.
- 23 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;3:77–101.
- 24 POETTS. Guidance on perioperative cardiopulmonary exercise testing during the COVID-19 pandemic, 2020. Available: https://poetts.co.uk/downloads/POETTS_cpet%20and%20covid.pdf [Accessed October 2021].
- 25 Syed ST, Gerber BS, Sharp LK. Traveling towards disease: transportation barriers to health care access. *J Community Health* 2013;38:976–93.
- 26 Okwose NC, O'Brien N, Charman S, et al. Overcoming barriers to engagement and adherence to a home-based physical activity intervention for patients with heart failure: a qualitative focus group study. *BMJ Open* 2020;10:e036382.
- 27 Trøstrup CH, Christiansen AB, Stølen KS, et al. The effect of nature exposure on the mental health of patients: a systematic review. *Qual Life Res* 2019;28:1695–703.
- 28 van den Bosch M, Ode Sang Å. Urban natural environments as nature-based solutions for improved public health - A systematic review of reviews. *Environ Res* 2017;158:373–84.
- 29 Pretty J, Peacock J, Sellens M, et al. The mental and physical health outcomes of green exercise. *Int J Environ Health Res* 2005;15:319–37.
- 30 Ream E, Hughes AE, Cox A, et al. Telephone interventions for symptom management in adults with cancer. *Cochrane Database Syst Rev* 2020;6:CD007568.
- 31 Santa Mina D, Hilton WJ, Matthew AG, et al. Prehabilitation for radical prostatectomy: a multicentre randomized controlled trial. *Surg Oncol* 2018;27:289–98.
- 32 Emslie C, Whyte F, Campbell A, et al. 'I wouldn't have been interested in just sitting round a table talking about cancer'; exploring the experiences of women with breast cancer in a group exercise trial. *Health Educ Res* 2007;22:827–38.
- 33 Okwose NC, Avery L, O'Brien N, et al. Acceptability, feasibility and preliminary evaluation of a novel, personalised, home-based physical activity intervention for chronic heart failure (Active-at-Home-HF): a pilot study. *Sports Med Open* 2019;5:1–9.