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Enhancing Intrinsic Motivation for Physical Activity among Adolescents with Cystic Fibrosis: A Qualitative Study

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Abstract

Objective: To explore the views of clinical staff from cystic fibrosis (CF) multidisciplinary teams on physical activity (PA) for adolescents with CF, the specific strategies used for PA promotion and associated challenges..

Design: In this exploratory study, in-depth qualitative interviews were conducted with 15 participants from CF multi-disciplinary teams to explore their views and clinical practice surrounding PA promotion for adolescents with CF.

Participants: Eleven physiotherapists (nine female), two consultants (both male) and two dieticians (both female) provided written informed consent and participated in the study.

Setting: CF clinics in the United Kingdom.

Results: While participants highlighted the importance of PA in the management of CF, they noted that very few patients were motivated solely by health reasons. Participants discussed the need for PA to be an enjoyable and routine part of their life, undertaken with significant others, outside the clinic whenever possible. Adopted approaches for PA promotion focused on providing individualized recommendations that suit the patient's individual needs and goals and enhance intrinsic motivation for PA.

Conclusion: Our research offers valuable information for those seeking to develop interventions to promote PA among adolescents with CF. Specifically, intervention developers should focus on developing individualized interventions that focus on enhancing intrinsic motivation and support the integration of PA into everyday life.

Keywords

Cystic fibrosis; exercise; youth; individualized; intrinsic motivation; qualitative.

ARTICLE SUMMARY

Article focus

- To explore health care providers views of physical activity for young people with CF.
- To identify the methods used to promote physical activity.

Key messages

- Participants noted that very few patients appeared to be motivated by health reasons alone.
- In order for PA to become routine, participants suggested it had to be enjoyable and undertaken with friends or family outside the clinic whenever possible.
- Methods used to promote PA focused on enhancing intrinsic (rather than controlled) motivation for PA.

Strengths and limitations of this study

- Qualitative methods generated an in-depth account of the views and practices of an understudied group of participants.
- Multiple coders, respondent validation and triangulation of findings with the existing literature enhances the trustworthiness of our data.
- Opportunity sampling may have resulted in a biased sample of participants.

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Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Research involving Human Participants

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Data statement

No additional data is available

Author contribution

The study was designed by SD with input from all authors. Data were collected and analysed by SD with considerable input from KM and MM. The manuscript was prepared by SD with considerable input from all authors. All authors approved the final manuscript.

Introduction

Cystic fibrosis (CF) is the most common life limiting genetic condition in the UK, affecting more than 10,400 people[1]. Due to advances in treatment, screening and infection control, people with CF have a greater life expectancy than in previous years[2], with the UK cystic fibrosis registry stating that the average life expectancy of individuals with CF in the UK is now 47 years[3]. However, treatment is demanding[4], and involves a complex combination of symptomatic and prophylactic daily medications, physiotherapy and airway clearance, high-calorie diets, and antibiotic therapy in the event of respiratory infection[5].

Physical activity (PA) and exercise programmes, now embedded into standards of care, are considered to be positive and important aspects of treatment[6]. Systematic reviews show that physical exercise training can improve aerobic capacity, lung function and health-related quality of life[7]. Furthermore, qualitative studies report that adolescents with CF benefit greatly from PA and exercise, and not just in terms of physiological benefits. Specifically, the literature includes examples of people with CF reporting considerable feelings of accomplishment after significant physical challenges[8], positive affect as a result of PA[9,10], an increased sense of empowerment over their condition[9] and increased opportunities for recreational activities with their peers[11]. Moreover, converse to other clinical populations, some studies[12] have reported that some youth with CF may have higher levels of PA than their peers[13].

However, irrespective of condition, there is a notable decline in PA during adolescence, with girls showing the greatest decline[12]. Reductions in PA and exercise during this period can track into adulthood, and may therefore have serious long-term implications[14,15,16]. Specifically, such declines may be associated with limiting individual's social opportunities

(e.g., not being able to take part in physically active events with peers) and a decline in pulmonary function, potentially leading to a cycle of deconditioning and reduction in aerobic fitness, which is known to be an important predictor of survival.

PA as a treatment is highly-valued by CF teams who recognise its therapeutic impact and potential to improve patients' health[17]. However, although health care providers report discussing adherence at every opportunity, and frequently use strategies to increase knowledge about adherence to treatment[18], PA is an underutilised therapeutic tool in clinical practice[17]. Understanding the challenges CF teams face when promoting PA is a key step in developing materials to better support them to achieve this.

Whilst qualitative studies have explored CF multi-disciplinary teams' (MDT) views encompassing treatment adherence for adolescents with CF, very little is known about their views about PA promotion, the strategies they have developed to promote PA, or the challenges they face. Gaining an understanding of current practice, and current barriers, is crucial if researchers are to develop effective strategies to support clinicians prescribing PA in the future[19] . Therefore, the purpose of the current study is to identify the views of MDTs on PA for adolescents with CF, the specific strategies used for PA promotion and associated challenges. This information has the potential to inform the development of educational materials to better support MDTs to promote and implement PA for adolescents with CF.

Methods

Design

In this exploratory study, in-depth qualitative interviews were held with MDTs to explore their views and clinical practice surrounding PA promotion for adolescents with CF. This work was conducted in accordance with the SRQR.

Participant sampling and data collection

Opportunity sampling was used to recruit practitioners in the UK. Information about the study was distributed via email to all physiotherapists, paediatricians, dieticians, and nurses who are currently on the Cystic Fibrosis Trust distribution list. Eleven physiotherapists (nine female), two consultants (both male) and two dieticians (both female) provided written informed consent and participated in the study. The initial interview schedule was based on a review of the literature and consultations with CF practitioners, including a paediatrician and a physiotherapist from our network. Open-ended questions were used to explore participants' views and opinions about promoting PA for adolescents with CF, the strategies they use, and any barriers they perceived. Ethical approval was obtained from the institutional Ethics Committee (161207/A/03).

Data analysis

Interviews were audio recorded and transcribed verbatim. Data were inductively analysed using a thematic approach[20]. To enhance rigour, two researchers (author one and two) independently read and coded the transcripts to produce a list of core codes. A preliminary list of themes were developed and refined[21]. In line with the six stages of thematic analysis[20], a chart was developed for each theme[21], and relevant data entered into each

chart. Charts were then used to identify narratives within cases and diversity between cases[22].

Data were stored in, and analyzed using, Nvivo 12. To ensure sensitivity to context[23], potential links to existing theories and previous research were sought and noted. Cases or themes that did not fit the developing analysis framework were actively sought and explanations discussed. To promote transparency, a record of the development of new codes, themes and patterns were kept in the form of a reflective analysis diary[23]. To enhance validity, emergent ideas and initial interpretations of the data were discussed with a third author (author three) who triangulated the data in reverse, from the themes back to the original transcripts, challenging interpretations until a consensus was reached. Furthermore, a summary of the findings were sent to all participants along with an invitation to offer any comments. Four participants responded and were in agreement with our interpretation of the data.

Patient and public involvement

A patient and public involvement group was established to inform the development and direction of our research portfolio. The group met regularly (via skype) and consisted of young people with cystic fibrosis, physiotherapists, technicians, and paediatricians. In the first instance, the group were asked to suggest research topics and questions they would like to be answered. The group were later asked to comment on our proposed methodology and semi-structured interview schedule.

Results

One author collected data between March and June 2017. All interviews were conducted over the phone. Interviews ranged in duration from 24-42 minutes, with the mean duration being 36 minutes.

The data are presented under two main headings: 1) Understanding physical activity behaviour 2) Changing physical activity behaviour. Pseudo-names and job titles are provided alongside each quote.

1) Understanding physical activity behaviour

Participants reported two main drivers of physical activity; health and enjoyment (Table 1). Whilst health care providers tend to prioritise improvements in markers of disease, such as lung function, this was rarely the main goal for the patients. Indeed, although participants suggested that improvements in health can be motivational, this was the exception rather than the rule (Quote 1). Generally, participants suggested that for the majority of patients, motivation arising from the health benefits of PA is insufficient to increase PA behaviour (Quote 2). Furthermore, highlighting the correlation between lung function and PA could result in patients interpreting physical ability as a visible marker of lung function. For those who had poorer or declining health, this could be worrying for the patient and lead to an avoidance of PA (Quote 3).

Intrinsic motivation refers to both enjoyment and feelings of accomplishment from PA. Nearly all participants emphasised the need for patients to enjoy PA. Crucially, it was consistently reported that those who enjoyed PA and felt good after PA were more motivated than those who felt it to be a chore (Quote 4). Indeed, feelings of enjoyment

were considered to be the main factor that separated those who were active (Quote 5) from those who were not (Quote 6).

Nearly all participants spoke of the importance of significant others in supporting patients to be active; usually through enhancing enjoyment. In younger patients, the role of the family was thought to be fundamental. During childhood, parents own exercise behaviour and their encouragement was considered the key predictor of activity behaviour (Quote 7). Families were seen to influence the patient's identity – either as sporty or not (Quote 8). However, family support and encouragement could help patients overcome possible barriers to being active if they were sufficiently engaged (Quote 9).

During adolescence, there is a shift from parent to peer support. Peer groups for adolescence with CF can act either as an enabler, or a deterrent. Participants described the need for peers to support the person with CF to be active, as adolescents may prioritise fitting in and socialising with peers over optimal self-care. For some, friendship groups encouraged and promoted PA (Quote 10). However, for the adolescent, for whom fitting in and being accepted is paramount, inactive peer groups could reduce activity levels of the patient (Quote 11).

Insert table 1 here

Changing physical activity behaviour

Numerous behaviour change techniques for promoting PA behaviour were mentioned for overcoming the barriers highlighted by participants. These primarily focused around (i) individualized education; (ii) enhancing enjoyment and (iii) making PA a normal part of everyday life. The theme of providing an individualized approach and enhancing intrinsic motivation by making PA fun and enjoyable, sociable, and normal ran throughout.

Participants spoke of creating a culture of exercise in which everyone is active. The need to form a united front, including all members of the multidisciplinary team, the parents, and the patients' friends was considered to be crucial. Particular behaviour change strategies are discussed below.

Individualized education

The most commonly mentioned behaviour change technique was individualized education about the benefits of physical activity, intensities and duration of PA, and about how activity can be fitted into their lives (Table 2). Education was usually verbally delivered by physiotherapists during consultations, or through recommendations of useful websites. Participants were confident that their patients were well-informed about the benefits of PA but would always reiterate the importance of PA at every session to highlight its importance. Despite the majority of participants suggesting that patients are rarely motivated by health benefits, education about the benefits of PA was still a key part of consultations – as this was seen to be crucial to allow the patient to make an informed choice about their physical activity. The majority of education provided by participants was individualized the patients' individual needs, preferences and motivation (Quote 1). Whilst participants had "ideal" or "optimal" intensities and durations of PA in mind, there was an understanding that such advice would often be ignored and individualized recommendations are needed (Quote 2 and 3). Crucially, any recommendations would be patient-led and focus on individual situations, needs and goals (Quote 4 and 5). However, the resources for such an individualized approach were often lacking (Quote 6).

Insert table 2 here

Enhancing enjoyment

In line with participants' belief that the biggest motivator is enjoyment, numerous attempts were made to make PA enjoyable to the patient; either by building intrinsic or extrinsic motivation (Table 3). Attempts to increase enjoyment included attempting to identify types of PA that the patient would engage with (Quote 1). Participants would make suggestions to encourage patients to try new things, or give patients opportunities to allow them to identify activities they enjoy (Quote 2 and 3). For some participants, it could be absolutely anything that made patients move and laugh (Quote 4). However, again, suggestions would be tailored to each individual patient in accordance with their likes, dislikes and goals (Quote 5).

Importantly, it was noted that enjoyment would be more likely to lead to sustainable PA. "Forcing" the patients to be active was never going to be effective in the longer term (Quote 6). Competitions were often used to enhance enjoyment, with some hospitals initiating leader boards, incorporating both staff and patients exercise test results (Quote 7) or developing challenges for their patients (Quote 8 and 9). However, it was noted that this would be less useful for people who are not already motivated (Quote 10).

Friends and family were often integral to attempts to make activity fun. For the younger patients, participants would attempt to encourage parents to be active (Quote 11). For the older patients, peer groups were considered to be more influential, and participants stated that they would often encourage patients to attend activity sessions with friends (Quote 12). If attempts at building intrinsic motivation were not effective, attempts were made to increase enjoyment via rewards. This could be as little as a reward at the end of a walk (Quote 13).

Insert table 3 here

Making activity normal

Participants expressed the need to make activity integral to every-day life, rather than an additional treatment (Table 4). Many participants suggested that PA was crucial for all, not just those with a chronic condition. It was suggested that we need to develop a culture of exercise, in which everyone is active, and being active just becomes routine. In this instance, individuals with CF would not stand out or be different for their relationship with PA, rather, it would be standard practice for everyone. Techniques for "making activity normal" centred around developing habits and routines, fitting PA into every-day life, outreach with schools and communities, and promoting PA as a standard, rather than a treatment. Participants attempted to encourage patients to develop habits and routines to enable PA to become part of every-day life. Early life experiences were considered to set a good foundation for viewing PA in a positive light (Quote 1 and 2).

School and community involvement were considered potential avenues to support and promote PA – focusing on the generic health benefits of PA rather than illness prevention just for those with chronic conditions (Quote 3 and 4). It was acknowledged that PA should be for everyone and that everyone, irrespective of health condition, should be, and can benefit from being, active (Quote 5).

Insert table 4 here

Discussion

The present study interviewed fifteen members of various CF MDTs in the UK in order to ascertain their views on PA promotion for adolescents with CF. The present study extended previous research, by proposing possible motivational influences that participants believed to impact adolescents' PA levels, as well as presenting a range of behaviour change techniques intended to increase motivation. These findings may be used to inform the development of interventions targeting PA for young people with CF. Participants highlight the need to provide an individualized approach to PA promotion, incorporating patients needs, preferences and goals, and focus on enhancing intrinsic motivation for PA by making it an enjoyable and routine part of their day. Intervention developers should attempt to incorporate such factors into future interventions.

Of particular relevance to clinical teams is the suggestion that PA and exercise should be viewed as "fun" rather than "medicine". Indeed, participants were adamant that PA should be a pleasurable activity that the patient can enjoy with friends and/or family and not just an additional treatment. This raises significant questions regarding who is best placed to promote PA for clinical populations. In 2007, the American Medical Association and the American College of Sports Medicine launched the "Exercise is Medicine" (EIM) initiative[24], with the goal of increasing exercise assessment and promotion by clinical teams. Critically, healthcare providers in our study suggest that this may not be the best approach for achieving long-term, sustainable behaviour change. They emphasised that PA and exercise should be promoted as a fun and enjoyable part of everyday life, because patients are unlikely to be motivated to exercise for health reasons alone[25]. In fact, some patients who viewed PA as synonymous with health were less likely to be active if they noted any decline

in their ability because this was viewed as evidence of deterioration in their health. Whilst our finding does not contradict the EIM initiative *per-se*, our research does extend previous thinking by highlighting the need for healthcare providers to focus on the enjoyment, rather than solely the health benefits, of PA. This finding provides a tentative explanation as to why previous research has found that PA is not being promoted clinically, despite MDTs rating it as beneficial[17]. Given the belief that PA should be "fun" rather than medicine, clinical staff may be reluctant to make physical activity a "treatment" as this may diminish its appeal as a fun and enjoyable thing to do. Further research is needed to explore whether or not promotion of PA in clinics does reduce adolescents' enjoyment of physical activity, or indeed, change their perspective of PA from enjoyable to treatment.

In addition to identifying possible explanations for PA behaviour, the current study presents a number of strategies used to support and encourage adolescents to be active and enjoy the activity. These centred around individualized recommendations to enhance intrinsic motivation and incorporate PA into every day life. Participants discussed how they would provide individuals with options and opportunities to try a range of activities in an attempt to identify one that may resonate with each individual and encourage friends and families to participate. However, there was also an acceptance that some adolescents do not enjoy PA, do not have active friends and families. For these individuals, PA is not part of their every-day routine, and being active would just make them stand out from their peers, which adolescents are strongly motivated to avoid[26]. In such cases, participants reported attempts to make activity rewarding, either by offering rewards or treats at the end of activity sessions, or appealing to their competitive side with challenges and competitions (incentivising). Indeed, Segar and colleagues[25], discussed the need to "sell" PA to patients rather than focusing on clinicians' own goals, which are often irrelevant to their patients.

The authors exemplify this using the pharmaceutical industry, demonstrating how they increase sales by promoting a behaviour for "pleasure, happiness or quality time with family" (P.100). Participants in the current study were strongly in agreement with this and recognised the need to promote PA in a way that resonates with their individual patients. By suggesting that "enjoyment" is one of the most important factors in physical activity behaviour, our participants highlight a feasible avenue for promoting, or selling, PA to their patients. Future research may now be concerned with exploring the effectiveness of such approaches to PA promotion in future interventions.

Theories of motivation highlight the need to target patients' intrinsic motivation[27] in eliciting long-term, sustainable behavioural patterns. Self Determination Theory (SDT) has been used to explain, predict and change PA behaviour in both healthy[28] and clinical populations[29]. The theory articulates how people's motivation for a particular behaviour (i.e., PA) is either intrinsic (self-determined) or extrinsic (driven by external or internal pressure such as guilt or coercion). The theory suggests that intrinsically motivated behaviours are more likely to be sustained in the long term. Findings from the current research are consistent with this theory, and highlight the need for clinical staff to maximise intrinsic motivation for PA, given that attempts to enhance extrinsic motivation (e.g., clinical pressure), is less enjoyable and less likely to be maintained over time[30].

A large body of literature has identified behaviour change techniques that have the potential to influence self-determined motivation[31,32], and participants in the current study reported using many of these approaches, such as giving patients choice, encouraging rather than coercing, providing information, and eliciting and acknowledging patient's perspectives. This is coherent with the previous literature showing that clinicians should

identify exactly what it is that is important to patients[33], and to promote PA in a way that resonates with their goals[25,30]. The finding that clinicians are using self-determination theory, albeit unknowingly, to change PA behaviour strongly supports the development of an intervention that is underpinned by SDT and may be effective in promoting PA for this audience.

Previously, attempts have been made to link the active mechanisms of the SDT to behaviour change techniques[34,35]. For example, Michie and colleagues[34] highlight the links between the mechanisms of action (e.g., "social influences", "motivation" and "reinforcement") and behaviour change techniques (BCT) mentioned by participants (e.g., social rewards, incentives, social influences). Using a consensus approach, Teixeira and Haggar[35] identified a number of BCTs relating to aspects of SDT that correspond with practices identified by participants in the current study. For example, "facilitating discussion of clients view point." This is entirely coherent with the current study, and suggests that, although participants do not have any prior training in this area, they were able to identify similar approaches. Additional training may greatly enhance their practices.

Strengths and Limitations

The main strength of this study is the use of qualitative methods to generate an in-depth account of the views and behaviours of an understudied group: clinical staff working with adolescents with CF. Established methodologies were utilised to enhance the trustworthiness of the present study, including multiple coders and respondent validation. Findings were also triangulated with the existing literature and participants were asked to validate our findings. Whilst the study utilised opportunistic sampling, fifteen participants from three-disciplines across a large geographical area of the UK were incorporated. The use

of opportunistic sampling may have resulted in a self-selected sample of individuals who are very interested in PA, but all participants were able to recognise and discuss challenges inherent to promoting PA for adolescents with CF. Indeed, this population of interested healthcare providers offer a unique perspective regarding the motivation of their patients and their attempts to promote PA. This work may provide useful information for healthcare providers who are less interested in physical activity.

Obtaining views of clinical staff has important benefits over obtaining views of patients alone. By providing an additional perspective, we present a more complete picture of the challenges and issues likely to be faced by individuals with CF. While patients are able to discuss factors that limit and restrict their PA behaviour, it may be less apparent to patients that these barriers can be sufficiently overcome if they enjoy the activity. Clinical teams have the advantage of being able to see a range of patients in a range of situations with wide variation in their PA levels. This provides them with the unique opportunity to identify commonalities across patients in a way that patients themselves cannot.

To our knowledge, this is the first study exploring clinicians' perspectives relating to motivation and promotion strategies for PA among adolescents with CF and has important implications for research and practice. Firstly, converse to previous literature[24], our findings highlight the need for clinical staff to focus on the enjoyment element of PA, rather than its role in promoting health. Indeed, SDT may offer a useful avenue for facilitating such autonomous motivation, which future implementation strategies should consider. More specifically, eliciting social support, both family and peer, may further enhance enjoyment. The role of significant others recurred throughout the interviews, with participants suggesting that friends and family can support the person with CF to be active by branding

and marketing PA as both fun and normal. Providing such normalizing experiences for youths may enhance their sense of identity and facilitate opportunities for peer relationships to develop. Indeed, it may be that there is a role for targeting patients' significant others in future interventions to promote PA. Future research should seek to explore the perspective of adolescents with CF, as well as the views of their friends and family.

Conclusion

Taken together, all participants, irrespective of their role, felt that PA and exercise were crucial for adolescents with CF. However, factors were identified which may influence patients' motivation to engage in PA and exercise. Nonetheless, in accord with research in healthy populations, individualized recommendations to enhance fun and enjoyment and integrate PA into every day route, were consistently cited for sustainable participation. In order to present a complete picture of the complexities of PA, future research should seek to explore patients and carers perceptions of barriers and facilitators to PA. However, interventions developed around theories such as the SDT may prove beneficial. This work provides a crucial first step in the intervention development process[19]. Future work may now be concerned with utilizing the current findings to inform the development of interventions to promote PA among young people with CF.

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Table 1: Understanding physical activity behaviour

Quote 1	*"One chap who used to be a physical trainer, and he does say that the reason he enjoyed his exercise is that it made him healthy and kept his numbers good… He's the only one though" (Victoria, physio)*
Quote 2	*"So even though we're drilling it into them that it's really important to exercise and it's going to keep you well, it's going to keep you better, the fitter you are the better you're going to be - if they're not interested they're not going to do it" (Corrine, physio).*
Quote 3	*"If they can't do it as well, it might be something they might measure their lung function against. So it, if they can't achieve, you know, he can't run as far now or as far as before he knows his function isn't as good and therefore…" (Beth, physio)*
Quote 4	*"If it's part of their treatment it seems to tail off, if they just do it for that. But if there is an element of enjoyment, one of ours, she enjoys running so she carries on - as opposed to seeing it as a treatment"*
Quote 5	*"I think [the biggest motivator] is just enjoyment. People get different physical feedback from exercise and people get really good endorphins and they want to be part of a team and they want to play as part of a team and want to socialise with friends in that way and some don't" (Shannon, dietician).*
Quote 6	*"I think the biggest barrier is the thing with any adolescents I think is you've got to motivate them they've got to want to do it and say if you're not interested doing it then that's really difficult" (Peter, physio).*
Quote 7	*"I think sometimes parents [are barriers to PA]. If they don't exercise themselves, then the patients aren't enthusiastic about exercising because they don't have a positive role model" (James, paediatrician).*

Quote 8	*"I think some lads who aren't "sporty" wouldn't necessarily join in because their families aren't going 'come on let's go for a walk or a bike ride.' And allow them from an early age to be on mobile devices" (Beth, physio).*
Quote 9	*"I think if the family is focused and the patient is focused on activities they can usually overcome any financial burden" (Alice, physio).*
Quote 10	*"When you get friendship groups doing it, I think that helps, so they're just joining what their friends are doing instead of going, you know, to some hospital team saying why don't you do exercise?" (Rachel, dietician).*
Quote 11	*"If their friends don't do activities then that's really difficult, that's the biggest thing" (Peter, physio).*

Table 2: Individualised education

Quote 1	*"We talk to them about what they choose to do or not to do. It's a bit of repetition of information. Whether they choose to do anything with it or not is up to them. But I think that my sense is that if we're repeatedly giving that message, they realise the importance of it… So yeah, over time, hopefully they start to get the message that we actually think it could help them and improve their lung function" (Louis, paediatrician).*
Quote 2	"W*e do ask them every time we meet them what kind of exercise are you doing the intensity and the duration and really talk about it needs to be at half an hour at least and be high intensity" (Claire, physio).*
Quote 3	*"I think sometimes you just have to accept what they are willing to do, so it might not be optimal in terms of health, but it is a start. And it is better than not being able to do anything. It gives us something to work with. So it might not have the health benefits that we know comes with being active, but if they enjoy it, if they are still moving and being active and interacting with peers, then yes they are getting benefit from it. And it is a starting point" (Beth, physio).*
Quote 4	*"I think a lot of it is very patient led rather than sort of saying this is a sort of set programme that we're working towards" (Peter, physio).*
Quote 5	*Yeah, it's very much an individualised thing, to fit in with what that person does or wants to do and what they want to achieve. We would talk about their goals and work with them to optimise their nutrition to achieve those goals. It wouldn't be a one size fits all, it would be a very individualised thing, taking into account things like current weight and fitness levels, what they want to achieve, whether they want to lose weight or whether it's just a fitness thing, whether*

	they, what their diet currently looks like, all those sorts of things, and then we would work together to support that patient" (Rebecca, physio).
Quote 6	*"I think that we have to make individual exercise programmes for our patients depending on what their needs, their social circumstances are and we just don't have the resources" (Peter, physio).*

Table 3: Enhancing enjoyment

Quote 1	*"I think it's finding something that connects with that person because there's no sort of bullet for, footballs not going to be for every boy or girl and gymnastics isn't going to be for everyone, dancing isn't going to be for everyone" (Shannon, dietician).*
Quote 2	*"We will give them ideas, we will say 'Have you tried this?' And we say 'Is there any PE that you like?' And they might say trampolining, I really enjoy it, so we will say 'well why don't you think about doing it after school?' Or 'why don't you try that?' or 'why don't you try on a weekend?' And we'll try and use whatever they're doing in school or what their friends are up to. Or we'll say 'have you heard about that park run?'" (Rebecca, physio).*
Quote 3	*"You've got to give them a grass roots introduction to a lot of different options and opportunities and then find what they engage with and what they connect with most" (Claire, physio).*
Quote 4	*"I suggest to them to do absolutely anything that would get them off their bottoms. Because obviously my idea of an exercise opportunity and what I find fun is not necessarily what somebody else finds fun so I encourage them to find something that makes them laugh, makes them have fun and that they will continue to go back to" (Victoria, physio).*
Quote 5	*"I suppose the only thing is to spend time finding out what people like, so this is something we do, for example, so this allows us perhaps to target particular exercises and match particular people to, so we have a girl who likes to do Yoga so we devised a way of using the Yoga positions for drainage and using the breathing techniques to then encourage expansion in those particular positions. So I think the fact we're lucky in the small number that we have and we can get*

	to know them well enough that we can kind of get deep, individual, personalised approach" (Claire, physio).
Quote 6	*"We need to be more proactive with trying to not force our kids into exercise but to support them with getting to know what's out there and finding something that they can engage with and then it's not just the initiation of that programme it's the continuing support" (John, physio).*
Quote 7	*"We have a 'top gear' sort of thing where people that work in the hospital have done the bike test, so that the patients can think 'oh I want to try and beat a certain staff member' so they can see that all we're asking them to do, we're not all super fit either, and they can try and beat the next person the next time" (Jessica, physio).*
Quote 8	*"Before Christmas we did a challenge of 'n' kilometres. So we set a challenge with all the children messaging in how many kilometres that they've done a week. So we have a couple that will do a park run so they say well I've done 5K this week so we add that to our tally and we want to get a thousand kilometres between us" (Beth, physio).*
Quote 9	*"It's only good for the children that actually care and think 'Oh I need to get a couple more thousand steps in.' If not it's just a number on a watch" (Peter, physio).*
Quote 10	*"We ask parents whether they as a family do any exercise and look at trying to do exercises together as part of a family so it's not a physio thing to do, it's more a fun thing that they all do together" (Victoria, physio).*
Quote 11	*"We've tried in the past going out to see somebody at home and I would get her friend there as well so the two of them would be doing like a body pump style*

	session in the house just because if she just wouldn't do it by herself but her friend was really keen to give it a go" (Claire, physio).
Quote 12	*"With the slightly older ones, we might have a walk around the hospital, sometimes it might even be a bit of a walk into town, but with a bit more of an incentive of like going to like a milkshake shop or something with them just to encourage them to get out and have it's like a bit of a treat at the end of it" (Alice, physio).*

Table 4: Making activity normal

Quote 1	*"We talk about the real importance of establishing an early routine in childhood of activity and exercise and from toddlers up to transition age we talk about developing good habits and trying to engage them with different sporting or different activities to give them the option and access to different types of activities" (James, paediatrician).*
Quote 2	*"We try to sort of make it part of their normal every day activity and explore avenues of families going for walks, bike rides, swimming or stuff like that" (Katie, physio).*
Quote 3	*"I think we need to talk more about health promotion and activity at school and potentially bring it into the school – for everyone" (John, physio).*
Quote 4	*"The daily mile they do at school… making all the children go out and run a mile a day. I think that helps as well" (James, paediatrician).*
Quote 5	*"I think the general move across NHS England and having just the generally healthier population and making sports part of everybody's life means that they don't get picked out as someone who has to exercise because of their health they're doing it the same as everybody else is doing so making a much more normalised activity. So I think there are ways of society encouraging exercise as well" (Rachel, dietician).*

Reporting checklist for qualitative study.

Based on the SRQR guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the SRQR reporting guidelines, and cite them as:

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	Reporting Item	Page Number
#1	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended	6/7
#2	Summary of the key elements of the study using the abstract format of the intended publication; typically	2

		includes background, purpose, methods, results and conclusions	
Problem formulation	#3	Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement	7
Purpose or research question	#4	Purpose of the study and specific objectives or questions	7
Qualitative approach and research paradigm	#5	Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	7
Researcher characteristics and reflexivity	#6	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research	19

		questions, approach, methods, results and / or transferability	
Context	#7	Setting / site and salient contextual factors; rationale	8
Sampling strategy	#8	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale	8
Ethical issues pertaining to human subjects	#9	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	8
Data collection methods	#10	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale	8/9
Data collection instruments and technologies	#11	Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study	8
Units of study	#12	Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	8

Data processing	#13	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts	8
Data analysis	#14	Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale	8
Techniques to enhance trustworthiness	#15	Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale	8
Syntheses and interpretation	#16	Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	10
Links to empirical data	#17	Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Tables 1-4
Intergration with prior work, implications, transferability and contribution(s) to the field	#18	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field	15

Limitations	#19	Trustworthiness and limitations of findings	15
Conflicts of interest	#20	Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed	15
Funding	#21	Sources of funding and other support; role of funders in data collection, interpretation and reporting	1

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Enhancing Intrinsic Motivation for Physical Activity among Adolescents with Cystic Fibrosis: A Qualitative Study of the views of healthcare professionals

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Enhancing Intrinsic Motivation for Physical Activity among Adolescents with Cystic Fibrosis: A Qualitative Study of the views of Healthcare Professionals

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Abstract

Objective: To explore the views of healthcare professionals from cystic fibrosis (CF) multidisciplinary teams (MDT) on physical activity for adolescents with CF, the specific strategies used for physical activity promotion and associated challenges.

Design: In this exploratory study, in-depth qualitative interviews were conducted with 15 healthcare professionals from CF multi-disciplinary teams to explore their views surrounding physical activity promotion for adolescents with CF.

Participants: Eleven physiotherapists (nine female), two consultants (both male) and two dieticians (both female) provided written informed consent and participated in the study.

Setting: CF clinics in the United Kingdom.

Results: While healthcare professionals highlighted the importance of physical activity in the management of CF, they noted that very few patients were motivated solely by (CF or general) health reasons. Healthcare professionals discussed the need for physical activity to be an enjoyable and routine part of their life, undertaken with significant others, outside the clinic whenever possible. Adopted approaches for physical activity promotion focused on providing individualized recommendations that suit the patients' individual needs and goals and enhance intrinsic motivation for physical activity.

Conclusion: Our research offers valuable information for those seeking to develop interventions to promote physical activity among adolescents with CF. Specifically, intervention developers should focus on developing individualized interventions that focus on enhancing intrinsic motivation and support the integration of physical activity into everyday life.

Keywords

Cystic fibrosis; physical inactivity; exercise; youth; individualized; intrinsic motivation; qualitative.

ARTICLE SUMMARY

Strengths and limitations of this study

- Qualitative methods generated an in-depth account of the views and practices of an understudied group of participants.
- Multiple coders, respondent validation and triangulation of findings with the existing literature enhances the trustworthiness of our data.
- Convenience sampling may have resulted in a biased sample of participants.
- Further work is needed to explore the perspectives of young people with cystic fibrosis.

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Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Research involving Human Participants

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Data statement

No additional data is available

Author contribution

The study was designed by SD with input from CAW, ARB, KAM and MAM. Data were collected and analysed by SD with considerable input from KAM and MAM. The manuscript was prepared by SD with considerable input from CAW, ARB, KAM and MAM. All authors approved the final manuscript.

Introduction

Cystic fibrosis (CF) is the most common life limiting genetic condition in the UK, affecting more than 10,400 people[1]. Due to advances in treatment, screening and infection control, people with CF have a greater life expectancy than in previous years[2], with the UK cystic fibrosis registry stating that the average life expectancy of individuals with CF in the UK is now 47 years[3]. However, treatment is demanding[4], and involves a complex combination of symptomatic and prophylactic daily medications, physiotherapy and airway clearance, high-calorie diets, and antibiotic therapy in the event of respiratory infection[5].

Physical activity and exercise programmes, now embedded into standards of care, are considered to be positive and important aspects of treatment[6]. Systematic reviews show that physical exercise training can improve aerobic capacity, lung function and health-related quality of life[7]. Furthermore, qualitative studies report that adolescents with CF benefit greatly from physical activity and exercise, and not just in terms of physiological benefits. Specifically, the literature includes examples of people with CF reporting considerable feelings of accomplishment after significant physical challenges[8], positive affect as a result of physical activity[9,10], an increased sense of empowerment over their condition[9] and increased opportunities for recreational activities with their peers[11]. Moreover, converse to other clinical populations, some studies have reported that some youth with CF may have similar or higher levels of physical activity than their peers; both with and without chronic conditions[12;1314].

However, irrespective of condition, there is a notable decline in physical activity during adolescence, with girls showing the greatest decline[12]. Reductions in physical activity and exercise during this period can track into adulthood, and may therefore have serious long-

term implications[15,16;17] . Specifically, declines in physical activity may be associated with limiting individuals' social opportunities (e.g., not being able to take part in physically active events with peers) and a decline in pulmonary function, potentially leading to a cycle of deconditioning and reduction in aerobic fitness, which is known to be an important predictor of survival. For physical activity to be integrated into the lives of young people with CF, it has to be something that they are motivated to do.

Self-determination theory[18] is often utilised to explain, predict or change physical activity behaviour among both healthy[19] and clinical populations[20]. The theory describes two main types of motivation: intrinsic and extrinsic motivation. Individuals who are intrinsically motivated to be active do so purely for the pleasure of being active. Motivation for the behaviour comes from *within* the individual and is the most autonomous form of motivation. Because motivation for the behaviour is not dependent on external forces, it is likely to be sustained – even when circumstances change. However, many individuals are active only because of what the self determination theory refers to as controlled motivation. This includes external regulation, in which a person acts to gain reward or avoid punishment, and introjected regulation, in which people are active to avoid feelings of guilt or shame, or to increase self-esteem or pride. Healthcare professionals often create controlled motivation through offering incentives for physical activity or by creating feelings of guilt if physical activity is avoided. Whilst this may lead to short-term increases in physical activity, this is unlikely to be sustained over time.

It is argued that autonomy supportive environments, in which the individual is given information and encouragement rather than instructions and choices are respected, will foster autonomous intrinsic motivation. Motivational interviewing[21] is a set of behaviour

change techniques, widely used in interventions based on the self determination theory[22;23] to enhance autonomy and promote individuals taking responsibility for their behaviour. Indeed, there is strong evidence for the effectiveness of interventions using motivational interviewing to promote physical activity among clinical populations[24].

The need to consider the perspective of all stakeholders when developing interventions is widely acknowledged[25]. As healthcare professionals are tasked with increasing physical activity levels among people with CF[1] and promote physical activity to a wide range of individuals on a daily basis, they are ideally placed to contribute to the development of interventions to support the promotion of physical activity for young people with CF. Previous research has found that physical activity as a treatment is highly-valued by CF teams who recognise its therapeutic impact and potential to improve patients' health[26]. However, although health care providers report discussing adherence at every opportunity, and frequently use strategies to increase knowledge about adherence to treatment[27], it is unclear how healthcare professionals attempt to increase motivation for physical activity among young people with CF. Gaining an understanding of current opinions and practice is crucial if researchers are to develop effective strategies to support clinicians prescribing physical activity in the future[25] . Therefore, the purpose of the current study is to identify the views of MDTs on physical activity for adolescents with CF, the specific strategies used for physical activity promotion and associated challenges. This information has the potential to inform the development of educational materials to better support MDTs to promote and implement physical activity for adolescents with CF.

Methods

Design

In this exploratory study, in-depth qualitative interviews were held with healthcare professionals from CF MDTs to explore their views surrounding physical activity promotion for adolescents with CF. This work was conducted in accordance with the Standards for Reporting Qualitative Research (SRQR).

Participant sampling and data collection

Convenience sampling was used to recruit practitioners in the UK. Information about the study was distributed via email to all physiotherapists, paediatricians, dieticians, and nurses who are currently on the Cystic Fibrosis Trust distribution list. Eleven physiotherapists (nine female), two consultants (both male) and two dieticians (both female) provided written informed consent and participated in the study. Participants were recruited from eight clinics in the South East, South West and North West England and two clinics in Scotland.

Participants were invited to take part in telephone interviews in which open-ended questions were used to explore healthcare professionals' views and opinions about promoting physical activity for adolescents with CF, the strategies they use, and any barriers they perceived. The initial interview schedule (Supplement 1) was based on a review of the literature and consultations with CF practitioners, including a paediatrician and a physiotherapist from our network. Participants were informed that interviews would last between 20-40 minutes and asked to identify a suitable time for the interview to take place. Interviews ranged in duration from 24-42 minutes, with the mean duration being 36 minutes. Whilst participants were asked specifically about their attempts to promote physical activity, many spontaneously referred to exercise; or referred to exercise and

physical activity interchangeably. Ethical approval was obtained from the University of Exeter institutional Ethics Committee (161207/A/03).

Data analysis

Interviews were audio recorded and transcribed verbatim. Data were inductively analysed using a thematic approach[28]. To enhance rigour, two researchers (author one and two) independently read and coded the transcripts to produce a list of core codes. A preliminary list of themes were developed and refined[29]. In line with the six stages of thematic analysis[20], a chart was developed for each theme[29], and relevant data entered into each chart. Charts were then used to identify narratives within cases and diversity between cases[30].

Data were stored in, and analyzed using, Nvivo 12. To ensure sensitivity to context[31], potential links to existing theories and previous research were sought and noted. Cases or themes that did not fit the developing analysis framework were actively sought and explanations discussed. To promote transparency, a record of the development of new codes, themes and patterns were kept in the form of a reflective analysis diary[31]. To enhance validity, emergent ideas and initial interpretations of the data were discussed with a third author (author three) who triangulated the data in reverse, from the themes back to the original transcripts, challenging interpretations until a consensus was reached. Furthermore, a summary of the findings were sent to all participants along with an invitation to offer any comments. Four healthcare professionals responded and were in agreement with our interpretation of the data.

Patient and public involvement

A patient and public involvement group was established to inform the development and direction of our research. The group met regularly (via skype) and comprised six individuals with CF, two parents, two physiotherapists, one technician and one paediatrician. This group were distinct from our research participants, and their main role was to inform the direction of the research that we conduct. In the first instance, the group were asked to suggest research topics and questions relating to physical activity and CF that they would like to be answered. The group were later asked to comment on our proposed methodology, information and materials for participants, and semi-structured interview schedule.

Results

The data are presented under two main headings: 1) Drivers of physical activity behaviour 2) Changing physical activity behaviour. Pseudonyms and job titles are provided alongside each quote.

1) Drivers of physical activity behaviour

Healthcare professionals reported two main drivers of physical activity; health and enjoyment (Table 1). Whilst health care providers tend to prioritise improvements in markers of disease, such as lung function, this was rarely the main goal for the patients. Indeed, although healthcare professionals suggested that improvements in health can be motivational, this was the exception rather than the rule (Quote 1). Generally, healthcare professionals suggested that for the majority of patients, motivation arising from the health benefits of PA is insufficient to increase physical activity behaviour (Quote 2). Furthermore, highlighting the correlation between lung function and PA could result in patients interpreting physical ability as a visible marker of lung function. For those who had poorer or declining health, this could be worrying for the patient and lead to an avoidance of physical activity (Quote 3).

Intrinsic motivation refers to both enjoyment and feelings of accomplishment from physical activity. Nearly all healthcare professionals emphasised the need for patients to enjoy physical activity. Crucially, it was consistently reported that those who enjoyed physical activity and felt good after physical activity were more motivated than those who felt it to be a chore (Quote 4). Indeed, feelings of enjoyment were considered to be the main factor that separated those who were active (Quote 5) from those who were not (Quote 6).

Nearly all healthcare professionals spoke of the importance of significant others in supporting patients to be active; usually through enhancing enjoyment. In younger patients, the role of the family was thought to be fundamental. During childhood, parents own exercise behaviour and their encouragement was considered the key predictor of activity behaviour (Quote 7). Families were seen to influence the patients' identity – either as sporty or not (Quote 8). However, family support and encouragement could help patients overcome possible barriers to being active if they were sufficiently engaged (Quote 9).

During adolescence, there is a shift from parent to peer support. Peer groups for adolescence with CF can act either as an enabler, or a deterrent. Healthcare professionals described the need for peers to support the person with CF to be active, as adolescents may prioritise fitting in and socialising with peers over optimal self-care. For some, friendship groups encouraged and promoted physical activity (Quote 10). However, for the adolescent, for whom fitting in and being accepted is paramount, inactive peer groups could reduce activity levels of the patient (Quote 11).

Insert table 1 here

Changing physical activity behaviour

Numerous behaviour change techniques for promoting PA behaviour were mentioned for overcoming the barriers highlighted by healthcare professionals. These primarily focused around (i) individualized education; (ii) approaches used to enhance enjoyment; and (iii) approaches used to make physical activity a normal part of everyday life. The theme of providing an individualized approach and enhancing intrinsic motivation by making physical activity fun and enjoyable, sociable, and normal ran throughout. Healthcare professionals spoke of creating a culture of exercise in which everyone is active. The need to form a

united front, including all members of the team, the parents, and the patients' friends was considered to be crucial. Particular behaviour change strategies are discussed below.

Individualized education

The most commonly mentioned behaviour change technique was individualized education about the benefits of physical activity, intensities and duration of physical activity, and about how activity can be fitted into their lives (Table 2). Education was usually verbally delivered by physiotherapists during consultations, or through recommendations of useful websites. Healthcare professionals were confident that their patients were well-informed about the benefits of physical activity but would always reiterate the importance of physical activity at every session to highlight its importance. Despite the majority of healthcare professionals suggesting that patients are rarely motivated by health benefits, education about the benefits of physical activity was still a key part of consultations – as this was seen to be crucial to allow the patient to make an informed choice about their physical activity. The majority of education provided by healthcare professionals was individualized the patients' individual needs, preferences and motivation (Quote 1). Whilst healthcare professionals had "ideal" or "optimal" intensities and durations of physical activity in mind, there was an understanding that such advice would often be ignored and individualized recommendations are needed (Quote 2 and 3). Crucially, any recommendations would be patient-led and focus on individual situations, needs and goals (Quote 4 and 5). However, the resources (time and skill) for such an individualized approach were often lacking (Quote 6).

Insert table 2 here

Approaches to enhance enjoyment

In line with healthcare professionals' belief that the biggest motivator is enjoyment, numerous attempts were made to make physical activity enjoyable to the patient; either by building intrinsic or extrinsic motivation (Table 3). Attempts to increase enjoyment included attempting to identify types of physical activity that the patient would engage with (Quote 1). Healthcare professionals would make suggestions to encourage patients to try new things, or give patients opportunities to allow them to identify activities they enjoy (Quote 2 and 3). For some healthcare professionals, it could be absolutely anything that made patients move and laugh (Quote 4). However, again, suggestions would be tailored to each individual patient in accordance with their likes, dislikes and goals (Quote 5).

Importantly, it was noted that enjoyment would be more likely to lead to sustainable physical activity. "Forcing" the patients to be active was never going to be effective in the longer term (Quote 6). Competitions were often used to enhance enjoyment, with some hospitals initiating leader boards, incorporating both staff and patients exercise test results (Quote 7) or developing challenges for their patients (Quote 8). However, it was noted that this would be less useful for people who are not already motivated (Quote 9).

Friends and family were often integral to attempts to make activity fun. For the younger patients, healthcare professionals would attempt to encourage parents to be active (Quote 10). For the older patients, peer groups were considered to be more influential, and healthcare professionals stated that they would often encourage patients to attend activity sessions with friends (Quote 11). If attempts at building intrinsic motivation were not effective, attempts were made to increase enjoyment via rewards. This could be as little as a reward at the end of a walk (Quote 12).

Insert table 3 here

Approaches used to make activity normal

Healthcare professionals expressed the need to make activity integral to every-day life, rather than an additional treatment (Table 4). Many healthcare professionals suggested that physical activity was crucial for all, not just those with a chronic condition. It was suggested that we need to develop a culture of exercise, in which everyone is active, and being active just becomes routine. In this instance, individuals with CF would not stand out or be different for their relationship with physical activity, rather, it would be standard practice for everyone. Techniques for "making activity normal" centred around developing habits and routines, fitting physical activity into every-day life, outreach with schools and communities, and promoting PA as a standard, rather than a treatment. Healthcare professionals attempted to encourage patients to develop habits and routines to enable physical activity to become part of every-day life. Early life experiences were considered to set a good foundation for viewing physical activity in a positive light (Quote 1 and 2).

School and community involvement were considered potential avenues to support and promote physical activity – focusing on the generic health benefits of physical activity rather than illness prevention just for those with chronic conditions (Quote 3 and 4). It was acknowledged that physical activity should be for everyone and that everyone, irrespective of health condition, should be, and can benefit from being, active (Quote 5).

Insert table 4 here

Discussion

The present study interviewed fifteen members of various CF MDTs in the UK in order to ascertain their views on physical activity promotion for adolescents with CF. The present study extended previous research, by discussing possible motivational influences that

healthcare professionals believed to impact adolescents' physical activity levels, as well as presenting a range of behaviour change techniques intended to increase motivation. Within the current study, healthcare professionals highlight the need to provide an individualized approach to physical activity promotion, incorporating patients' needs, preferences and goals, and focus on enhancing intrinsic motivation for physical activity by making it an enjoyable and routine part of their day. If supported by data obtained from other stakeholders (e.g., young people with CF), intervention developers could attempt to incorporate such factors into future interventions.

Of particular relevance to clinical teams is the suggestion that physical activity and exercise should be viewed as "fun" rather than "medicine". Indeed, healthcare professionals were adamant that physical activity should be a pleasurable activity that the patient can enjoy with friends and/or family and not just an additional treatment. This raises significant questions regarding who is best placed to promote physical activity for clinical populations. In 2007, the American Medical Association and the American College of Sports Medicine launched the "Exercise is Medicine" (EIM) initiative[32], with the goal of increasing exercise assessment and promotion by clinical teams. Critically, healthcare professionals in our study suggest that this may not be the best approach for achieving long-term, sustainable behaviour change. They emphasised that physical activity and exercise should be promoted as a fun and enjoyable part of everyday life, because patients are unlikely to be motivated to exercise for health reasons alone[33]. In fact, some patients who viewed physical activity as synonymous with health were less likely to be active if they noted any decline in their ability because this was viewed as evidence of deterioration in their health. Whilst our finding does not contradict the EIM initiative *per-se*, our research does extend previous thinking by highlighting the need for healthcare professionals to focus on the enjoyment, rather than

solely the health benefits, of physical activity. This finding provides a tentative explanation as to why previous research has found that physical activity is not being promoted clinically, despite MDTs rating it as beneficial[27]. Given the belief that physical activity should be "fun" rather than medicine, healthcare professionals may be reluctant to make physical activity a "treatment" as this may diminish its appeal as a fun and enjoyable thing to do. Further research is needed to explore whether or not promotion of physical activity in clinics does reduce adolescents' enjoyment of physical activity, or indeed, change their perspective of physical activity from enjoyable to treatment.

In addition to identifying possible explanations for physical activity behaviour, the current study presents a number of strategies used to support and encourage adolescents to be active and enjoy the activity. These centred around individualized recommendations, and approaches used to enhance intrinsic motivation and incorporate physical activity into everyday life. Healthcare professionals discussed how they would provide individuals with options and opportunities to try a range of activities in an attempt to identify one that may resonate with each individual and encourage friends and families to participate. However, there was also an acceptance that some adolescents do not enjoy physical activity, and do not have active friends and families. For these individuals, physical activity is not part of their every-day routine, and being active would just make them stand out from their peers, which adolescents are strongly motivated to avoid[34]. In such cases, healthcare professionals reported attempts to make activity rewarding, either by offering rewards or treats at the end of activity sessions, or appealing to their competitive side with challenges and competitions (incentivising). Indeed, Segar and colleagues[33], discussed the need to "sell" physical activity to patients rather than focusing on clinicians' own goals, which are often irrelevant to their patients. The authors exemplify this using the pharmaceutical industry,

demonstrating how they increase sales by promoting a behaviour for "pleasure, happiness or quality time with family" (P.100). Healthcare professionals in the current study were strongly in agreement with this and recognised the need to promote physical activity in a way that resonates with their individual patients. By suggesting that "enjoyment" is one of the most important factors in physical activity behaviour, our healthcare professionals highlight a feasible avenue for promoting, or selling, physical activity to their patients. Future research may now be concerned with exploring the effectiveness of such approaches to physical activity promotion in future interventions.

Social prescribing refers to attempts by healthcare professionals to link patients with non-clinical sources of support in the community[35] and is advocated for people with chronic conditions[36]. Within the current study, social prescribing (e.g., suggesting young people attend park run) was utilized by healthcare professionals in an attempt to de-medicalise physical activity and make it a normal part of life. Whilst further research into the effectiveness of social prescribing is needed, there is emerging evidence that it may lead to improvements in quality of life and emotional wellbeing[35;37]. Indeed, social prescribing may be particularly relevant for young people with CF who are aiming to exercise for benefits that reach beyond lung function. Further research exploring the potential of social prescribing for increasing physical activity among young people with CF is therefore required.

Theories of motivation highlight the need to target patients' intrinsic motivation[35] in eliciting long-term, sustainable behavioural patterns. The theory articulates how motivation for a particular behaviour (i.e., physical activity) is either intrinsic (self-determined) or extrinsic (driven by external or internal pressure such as guilt or coercion). The theory suggests that

intrinsically motivated behaviours are more likely to be sustained in the long term. Findings from the current research are consistent with this theory, and suggest that healthcare professionals could focus on attempts to maximise intrinsic motivation for physical activity, given that attempts to enhance extrinsic motivation (e.g., clinical pressure), is less enjoyable and less likely to be maintained over time[38].

A large body of literature has identified behaviour change techniques that have the potential to influence self-determined motivation[32;39,40], and healthcare professionals in the current study reported using many of these approaches, such as giving patients choice, encouraging rather than coercing, providing information, and eliciting and acknowledging patients' perspectives. These approaches, consistent with both self determination theory and motivational interviewing, highlight the need for healthcare professionals to identify exactly what it is that is important to patients[41], and to promote physical activity in a way that resonates with their goals[33,38]. The finding that clinicians are using self-determination theory, and motivational interviewing albeit unknowingly, to change physical activity behaviour strongly supports the development of an intervention that is underpinned by self determination theory, incorporating elements of motivational interviewing may be effective in promoting physical activity for this audience.

Previously, attempts have been made to link the active mechanisms of the self determination theory to behaviour change techniques[42,43]. For example, Michie and colleagues[42] highlight the links between the mechanisms of action (e.g., "social influences", "motivation" and "reinforcement") and behaviour change techniques (BCT) mentioned by healthcare professionals (e.g., social rewards, incentives, social influences). Using a consensus approach, Teixeira and Haggar[43] identified a number of BCTs relating to aspects

of self determination theory that correspond with practices identified by healthcare professionals in the current study. For example, "facilitating discussion of clients view point." This is entirely coherent with the current study, and suggests that, although healthcare professionals do not have any prior training in this area, they were able to identify similar approaches. Additional training in motivational interviewing for example, may greatly enhance their practices.

Strengths and Limitations

The main strength of this study is the use of qualitative methods to generate an in-depth account of the views of an understudied group: healthcare professionals working with adolescents with CF. The perspective brought to the analysis is largely psychological and may have been influenced by the lead author's prior training in health psychology. However, established methodologies were utilised to enhance the trustworthiness of the present study, including multiple coders and respondent validation[31]. Findings were also triangulated with the existing literature and healthcare professionals were asked to validate our findings[31].

Whilst the study utilised opportunistic sampling, fifteen healthcare professionals from three-disciplines across a large geographical area of the UK were incorporated. The use of opportunistic sampling may have resulted in a self-selected sample of individuals who are very interested in physical activity, and we were unable to collect data on the number of years' experience of our participants. Despite these limitations, all healthcare professionals were able to recognise and discuss approaches used to promote physical activity for adolescents with CF. Indeed, this population of interested healthcare professionals offer a unique perspective regarding the motivation of their patients and their attempts to

promote physical activity, and may provide useful information for healthcare professionals who are less interested in physical activity.

The importance of considering the perspective of all stakeholders when developing interventions is recognised[25]. Healthcare professionals have the advantage of being able to see a range of patients with wide variation in their physical activity levels and in a range of situations. This provides healthcare professionals with the unique opportunity to identify commonalities across patients in a way that patients themselves cannot. For example, while people with CF may be able to discuss factors that limit and restrict their physical activity behaviour, they would not be able to spot commonalities or patterns between individuals. Furthermore, healthcare professionals are able to discuss their experiences of using different strategies to increase motivation for physical activity. We suggest that future studies should be concerned with obtaining data from patients themselves, as this would complement the data we present in this study, and provide a comprehensive assessment of the situation. Integration of data obtained from multiple sources (e.g., young people with CF) is crucial for the development of effective interventions targeting physical activity for young people with CF[25].

To our knowledge, this is the first study exploring clinicians' perspectives relating to motivation and promotion strategies for physical activity among adolescents with CF, and has important implications for research and practice. Firstly, converse to previous literature[27], our findings suggest that healthcare professionals could focus on the enjoyment element of physical activity, rather than its role in promoting health. Indeed, self determination theory and motivational interviewing may offer a useful avenue for facilitating such autonomous motivation. In addition, eliciting social support, both family

and peer, may further enhance enjoyment. The role of significant others recurred throughout the interviews, with healthcare professionals suggesting that friends and family can support the person with CF to be active by branding and marketing physical activity as both fun and normal. Providing such normalizing experiences for youths may enhance their sense of identity and facilitate opportunities for peer relationships to develop. Indeed, it may be that there is a role for targeting patients' significant others in future interventions to promote physical activity. Future research should seek to explore the perspective of adolescents with CF, as well as the views of their friends and family and subsequently assess the effectiveness of the collective strategies proposed.

Conclusion

Taken together, all healthcare professionals, irrespective of their role, felt that physical activity and exercise were crucial for adolescents with CF. Factors were identified which may influence patients' motivation to engage in physical activity and exercise; and in accord with research in healthy populations, individualized recommendations to enhance fun and enjoyment and integrate physical activity into every day route, were consistently cited for sustainable participation. In order to present a complete picture of the complexities of physical activity, future research should seek to explore perceptions of barriers and facilitators to physical activity from the perspective of young people with CF and their support teams. However, this work provides preliminary evidence for the suggestion that interventions developed around theories such as the self determination theory may prove beneficial. This work provides a crucial first step in the intervention development process[25]. Future work may now be concerned with exploring the views of stakeholders; including

young people with CF, and utilizing data from multiple perspectives to inform the development of interventions to promote physical activity among young people with CF.

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Table 1: Drivers of physical activity behaviour

Quote 1	*"One chap who used to be a physical trainer, and he does say that the reason he enjoyed his exercise is that it made him healthy and kept his numbers good… He's the only one though" (Victoria, physio)*
Quote 2	*"So even though we're drilling it into them that it's really important to exercise and it's going to keep you well, it's going to keep you better, the fitter you are the better you're going to be - if they're not interested they're not going to do it" (Corrine, physio).*
Quote 3	*"If they can't do it as well, it might be something they might measure their lung function against. So it, if they can't achieve, you know, he can't run as far now or as far as before he knows his function isn't as good and therefore…" (Beth, physio)*
Quote 4	*"If it's part of their treatment it seems to tail off, if they just do it for that. But if there is an element of enjoyment, one of ours, she enjoys running so she carries on - as opposed to seeing it as a treatment"*
Quote 5	*"I think [the biggest motivator] is just enjoyment. People get different physical feedback from exercise and people get really good endorphins and they want to be part of a team and they want to play as part of a team and want to socialise with friends in that way and some don't" (Shannon, dietician).*
Quote 6	*"I think the biggest barrier is the thing with any adolescents I think is you've got to motivate them they've got to want to do it and say if you're not interested doing it then that's really difficult" (Peter, physio).*
Quote 7	*"I think sometimes parents [are barriers to PA]. If they don't exercise themselves, then the patients aren't enthusiastic about exercising because they don't have a positive role model" (James, paediatrician).*
Quote 8	*"I think some lads who aren't "sporty" wouldn't necessarily join in because their*

	families aren't going 'come on let's go for a walk or a bike ride.' And allow them from an early age to be on mobile devices" (Beth, physio).
Quote 9	*"I think if the family is focused and the patient is focused on activities they can usually overcome any financial burden" (Alice, physio).*
Quote 10	*"When you get friendship groups doing it, I think that helps, so they're just joining what their friends are doing instead of going, you know, to some hospital team saying why don't you do exercise?" (Rachel, dietician).*
Quote 11	*"If their friends don't do activities then that's really difficult, that's the biggest thing" (Peter, physio).*

NB. All names provided are pseudonyms

Table 2: Individualised education

Quote 1	*"We talk to them about what they choose to do or not to do. It's a bit of repetition of information. Whether they choose to do anything with it or not is up to them. But I think that my sense is that if we're repeatedly giving that message, they realise the importance of it… So yeah, over time, hopefully they start to get the message that we actually think it could help them and improve their lung function" (Louis, paediatrician).*
Quote 2	"W*e do ask them every time we meet them what kind of exercise are you doing the intensity and the duration and really talk about it needs to be at half an hour at least and be high intensity" (Claire, physio).*
Quote 3	*"I think sometimes you just have to accept what they are willing to do, so it might not be optimal in terms of health, but it is a start. And it is better than not being able to do anything. It gives us something to work with. So it might not have the health benefits that we know comes with being active, but if they enjoy it, if they are still moving and being active and interacting with peers, then yes they are getting benefit from it. And it is a starting point" (Beth, physio).*
Quote 4	*"I think a lot of it is very patient led rather than sort of saying this is a sort of set programme that we're working towards" (Peter, physio).*
Quote 5	*Yeah, it's very much an individualised thing, to fit in with what that person does or wants to do and what they want to achieve. We would talk about their goals and work with them to optimise their nutrition to achieve those goals. It wouldn't be a one size fits all, it would be a very individualised thing, taking into account things like current weight and fitness levels, what they want to achieve, whether they want to lose weight or whether it's just a fitness thing, whether they, what their diet currently looks like, all those sorts of things, and then we would work together*

	to support that patient" (Rebecca, physio).
Quote 6	*"I think that we have to make individual exercise programmes for our patients depending on what their needs, their social circumstances are and we just don't have the resources" (Peter, physio).*

NB. All names provided are pseudonyms

Table 3: Approaches used to enhance enjoyment

Quote 1	*"I think it's finding something that connects with that person because there's no sort of bullet for, footballs not going to be for every boy or girl and gymnastics isn't going to be for everyone, dancing isn't going to be for everyone" (Shannon, dietician).*
Quote 2	*"We will give them ideas, we will say 'Have you tried this?' And we say 'Is there any PE that you like?' And they might say trampolining, I really enjoy it, so we will say 'well why don't you think about doing it after school?' Or 'why don't you try that?' or 'why don't you try on a weekend?' And we'll try and use whatever they're doing in school or what their friends are up to. Or we'll say 'have you heard about that park run?'" (Rebecca, physio).*
Quote 3	*"You've got to give them a grass roots introduction to a lot of different options and opportunities and then find what they engage with and what they connect with most" (Claire, physio).*
Quote 4	*"I suggest to them to do absolutely anything that would get them off their bottoms. Because obviously my idea of an exercise opportunity and what I find fun is not necessarily what somebody else finds fun so I encourage them to find something that makes them laugh, makes them have fun and that they will continue to go back to" (Victoria, physio).*
Quote 5	*"I suppose the only thing is to spend time finding out what people like, so this is something we do, for example, so this allows us perhaps to target particular exercises and match particular people to, so we have a girl who likes to do Yoga so we devised a way of using the Yoga positions for drainage and using the breathing techniques to then encourage expansion in those particular positions. So I think the fact we're lucky in the small number that we have and we can get*

	to know them well enough that we can kind of get deep, individual, personalised approach" (Claire, physio).
Quote 6	*"We need to be more proactive with trying to not force our kids into exercise but to support them with getting to know what's out there and finding something that they can engage with and then it's not just the initiation of that programme it's the continuing support" (John, physio).*
Quote 7	*"We have a 'top gear' sort of thing where people that work in the hospital have done the bike test, so that the patients can think 'oh I want to try and beat a certain staff member' so they can see that all we're asking them to do, we're not all super fit either, and they can try and beat the next person the next time" (Jessica, physio).*
Quote 8	*"Before Christmas we did a challenge of 'n' kilometres. So we set a challenge with all the children messaging in how many kilometres that they've done a week. So we have a couple that will do a park run so they say well I've done 5K this week so we add that to our tally and we want to get a thousand kilometres between us" (Beth, physio).*
Quote 9	*"It's only good for the children that actually care and think 'Oh I need to get a couple more thousand steps in.' If not it's just a number on a watch" (Peter, physio).*
Quote 10	*"We ask parents whether they as a family do any exercise and look at trying to do exercises together as part of a family so it's not a physio thing to do, it's more a fun thing that they all do together" (Victoria, physio).*
Quote 11	*"We've tried in the past going out to see somebody at home and I would get her friend there as well so the two of them would be doing like a body pump style session in the house just because if she just wouldn't do it by herself but her*

	friend was really keen to give it a go" (Claire, physio).
Quote 12	*"With the slightly older ones, we might have a walk around the hospital, sometimes it might even be a bit of a walk into town, but with a bit more of an incentive of like going to like a milkshake shop or something with them just to encourage them to get out and have it's like a bit of a treat at the end of it" (Alice, physio).*

NB. All names provided are pseudonyms

Table 4: Approaches used to make activity normal

Quote 1	*"We talk about the real importance of establishing an early routine in childhood of activity and exercise and from toddlers up to transition age we talk about developing good habits and trying to engage them with different sporting or different activities to give them the option and access to different types of activities" (James, paediatrician).*
Quote 2	*"We try to sort of make it part of their normal every day activity and explore avenues of families going for walks, bike rides, swimming or stuff like that" (Katie, physio).*
Quote 3	*"I think we need to talk more about health promotion and activity at school and potentially bring it into the school – for everyone" (John, physio).*
Quote 4	*"The daily mile they do at school… making all the children go out and run a mile a day. I think that helps as well" (James, paediatrician).*
Quote 5	*"I think the general move across NHS England and having just the generally healthier population and making sports part of everybody's life means that they don't get picked out as someone who has to exercise because of their health they're doing it the same as everybody else is doing so making a much more normalised activity. So I think there are ways of society encouraging exercise as well" (Rachel, dietician).*

NB. All names provided are pseudonyms

Supplement 1: Semi structured interview schedule

1. How important do you think physical activity is for adolescents with CF?
    a. Why?
2. Who should be promoting physical activity for adolescents with CF?
3. What do you think the biggest barriers are to adolescents with CF being physically active?
    a. How would you help them overcome this?
4. How do you encourage adolescents to be physically active?
    a. What information or issues do you consider when promoting physical activity?
    b. How do you encourage those who are not motivated?
    c. How effective do you think these approaches are? Why?
5. Can you give me an example of how you encourage adolescents to be physically active?
6. In which situations / for which patients (if any) are you least likely to promote PA?
    a. Why?
7. Is there anything you feel you need to improve physical activity promotion?
    a. Is there any more information / training that would be useful?
8. Would any organisational or cultural changes facilitate the promotion of physical activity?
9. Is there anything else you want to say?

Reporting checklist for qualitative study.

Based on the SRQR guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the SRQR reporting guidelines, and cite them as:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. Acad Med. 2014;89(9):1245-1251.

	Reporting Item	Page Number
#1	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended	6/7
#2	Summary of the key elements of the study using the abstract format of the intended publication; typically	2

		includes background, purpose, methods, results and conclusions	
Problem formulation	#3	Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement	7
Purpose or research question	#4	Purpose of the study and specific objectives or questions	7
Qualitative approach and research paradigm	#5	Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	7
Researcher characteristics and reflexivity	#6	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research	19

		questions, approach, methods, results and / or transferability	
Context	#7	Setting / site and salient contextual factors; rationale	8
Sampling strategy	#8	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale	8
Ethical issues pertaining to human subjects	#9	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	8
Data collection methods	#10	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale	8/9
Data collection instruments and technologies	#11	Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study	8
Units of study	#12	Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	8

Data processing	#13	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts	8
Data analysis	#14	Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale	8
Techniques to enhance trustworthiness	#15	Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale	8
Syntheses and interpretation	#16	Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	10
Links to empirical data	#17	Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Tables 1-4
Intergration with prior work, implications, transferability and contribution(s) to the field	#18	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field	15

Limitations	#19	Trustworthiness and limitations of findings	15
Conflicts of interest	#20	Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed	15
Funding	#21	Sources of funding and other support; role of funders in data collection, interpretation and reporting	1

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Enhancing Intrinsic Motivation for Physical Activity among Adolescents with Cystic Fibrosis: A Qualitative Study of the views of healthcare professionals

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Enhancing Intrinsic Motivation for Physical Activity among Adolescents with Cystic Fibrosis: A Qualitative Study of the views of Healthcare Professionals

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Abstract

Objective: To explore the views of healthcare professionals from cystic fibrosis (CF) multidisciplinary teams (MDT) on physical activity for adolescents with CF, the specific strategies used for physical activity promotion and associated challenges.

Design: In this exploratory study, in-depth qualitative interviews were conducted with 15 healthcare professionals from CF multi-disciplinary teams to explore their views surrounding physical activity promotion for adolescents with CF.

Participants: Eleven physiotherapists (nine female), two consultants (both male) and two dieticians (both female) provided written informed consent and participated in the study.

Setting: CF clinics in the United Kingdom.

Results: While healthcare professionals highlighted the importance of physical activity in the management of CF, they noted that very few patients were motivated solely by (CF or general) health reasons. Healthcare professionals discussed the need for physical activity to be an enjoyable and routine part of their life, undertaken with significant others, outside the clinic whenever possible. Adopted approaches for physical activity promotion focused on providing individualized recommendations that suit the patients' individual needs and goals and enhance intrinsic motivation for physical activity.

Conclusion: Our research offers valuable information for those seeking to develop interventions to promote physical activity among adolescents with CF. Specifically, intervention developers should focus on developing individualized interventions that focus on enhancing intrinsic motivation and support the integration of physical activity into everyday life.

Keywords

Cystic fibrosis; physical inactivity; exercise; youth; individualized; intrinsic motivation; qualitative.

ARTICLE SUMMARY

Strengths and limitations of this study

- Qualitative methods generated an in-depth account of the views and practices of an understudied group of participants.
- Multiple coders, respondent validation and triangulation of findings with the existing literature enhances the trustworthiness of our data.
- Convenience sampling may have resulted in a biased sample of participants.
- Further work is needed to explore the perspectives of young people with cystic fibrosis.

Acknowledgements

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Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Research involving Human Participants

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Data statement

No additional data is available

Author contribution

The study was designed by SD with input from CAW, ARB, KAM and MAM. Data were collected and analysed by SD with considerable input from KAM and MAM. The manuscript was prepared by SD with considerable input from CAW, ARB, KAM and MAM. All authors approved the final manuscript.

Introduction

Cystic fibrosis (CF) is the most common life limiting genetic condition in the UK, affecting more than 10,400 people[1]. Due to advances in treatment, screening and infection control, people with CF have a greater life expectancy than in previous years[2], with the UK cystic fibrosis registry stating that the average life expectancy of individuals with CF in the UK is now 47 years[3]. However, treatment is demanding[4], and involves a complex combination of symptomatic and prophylactic daily medications, physiotherapy and airway clearance, high-calorie diets, and antibiotic therapy in the event of respiratory infection[5].

Physical activity and exercise programmes, now embedded into standards of care, are considered to be positive and important aspects of treatment[6]. Systematic reviews show that physical exercise training can improve aerobic capacity, lung function and health-related quality of life[7]. Furthermore, qualitative studies report that adolescents with CF benefit greatly from physical activity and exercise, and not just in terms of physiological benefits. Specifically, the literature includes examples of people with CF reporting considerable feelings of accomplishment after significant physical challenges[8], positive affect as a result of physical activity[9,10], an increased sense of empowerment over their condition[9] and increased opportunities for recreational activities with their peers[11]. Moreover, converse to other clinical populations, some studies have reported that some youth with CF may have similar or higher levels of physical activity than their peers; both with and without chronic conditions[12;1314].

However, irrespective of condition, there is a notable decline in physical activity during adolescence, with girls showing the greatest decline[12]. Reductions in physical activity and exercise during this period can track into adulthood, and may therefore have serious long-

term implications[15,16;17] . Specifically, declines in physical activity may be associated with limiting individuals' social opportunities (e.g., not being able to take part in physically active events with peers) and a decline in pulmonary function, potentially leading to a cycle of deconditioning and reduction in aerobic fitness, which is known to be an important predictor of survival. For physical activity to be integrated into the lives of young people with CF, it has to be something that they are motivated to do.

Self-determination theory[18] is often utilised to explain, predict or change physical activity behaviour among both healthy[19] and clinical populations[20]. The theory describes two main types of motivation: intrinsic and extrinsic motivation. Individuals who are intrinsically motivated to be active do so purely for the pleasure of being active. Motivation for the behaviour comes from *within* the individual and is the most autonomous form of motivation. Because motivation for the behaviour is not dependent on external forces, it is likely to be sustained – even when circumstances change. However, many individuals are active only because of what the self determination theory refers to as controlled motivation. This includes external regulation, in which a person acts to gain reward or avoid punishment, and introjected regulation, in which people are active to avoid feelings of guilt or shame, or to increase self-esteem or pride. Healthcare professionals often create controlled motivation through offering incentives for physical activity or by creating feelings of guilt if physical activity is avoided. Whilst this may lead to short-term increases in physical activity, this is unlikely to be sustained over time.

It is argued that autonomy supportive environments, in which the individual is given information and encouragement rather than instructions and choices are respected, will foster autonomous intrinsic motivation. Motivational interviewing[21] is a set of behaviour

change techniques, widely used in interventions based on the self determination theory[22;23] to enhance autonomy and promote individuals taking responsibility for their behaviour. Indeed, there is strong evidence for the effectiveness of interventions using motivational interviewing to promote physical activity among clinical populations[24].

The need to consider the perspective of all stakeholders when developing interventions is widely acknowledged[25]. As healthcare professionals are tasked with increasing physical activity levels among people with CF[1] and promote physical activity to a wide range of individuals on a daily basis, they are ideally placed to contribute to the development of interventions to support the promotion of physical activity for young people with CF. Previous research has found that physical activity as a treatment is highly-valued by CF teams who recognise its therapeutic impact and potential to improve patients' health[26]. However, although health care providers report discussing adherence at every opportunity, and frequently use strategies to increase knowledge about adherence to treatment[27], it is unclear how healthcare professionals attempt to increase motivation for physical activity among young people with CF. Gaining an understanding of current opinions and practice is crucial if researchers are to develop effective strategies to support clinicians prescribing physical activity in the future[25] . Therefore, the purpose of the current study is to identify the views of MDTs on physical activity for adolescents with CF, the specific strategies used for physical activity promotion and associated challenges. This information has the potential to inform the development of educational materials to better support MDTs to promote and implement physical activity for adolescents with CF.

Methods

Design

In this exploratory study, in-depth qualitative interviews were held with healthcare professionals from CF MDTs to explore their views surrounding physical activity promotion for adolescents with CF. This work was conducted in accordance with the Standards for Reporting Qualitative Research (SRQR).

Participant sampling and data collection

Convenience sampling was used to recruit practitioners in the UK. Information about the study was distributed via email to all physiotherapists, paediatricians, dieticians, and nurses who are currently on the Cystic Fibrosis Trust distribution list. Eleven physiotherapists (nine female), two consultants (both male) and two dieticians (both female) provided written informed consent and participated in the study. Participants were recruited from eight clinics in the South East, South West and North West England and two clinics in Scotland.

Participants were invited to take part in telephone interviews in which open-ended questions were used to explore healthcare professionals' views and opinions about promoting physical activity for adolescents with CF, the strategies they use, and any barriers they perceived. The initial interview schedule (Supplement 1) was based on a review of the literature and consultations with CF practitioners, including a paediatrician and a physiotherapist from our network. Participants were informed that interviews would last between 20-40 minutes and asked to identify a suitable time for the interview to take place. Interviews ranged in duration from 24-42 minutes, with the mean duration being 36 minutes. Whilst participants were asked specifically about their attempts to promote physical activity, many spontaneously referred to exercise; or referred to exercise and

physical activity interchangeably. Ethical approval was obtained from the University of Exeter institutional Ethics Committee (161207/A/03).

Data analysis

Interviews were audio recorded and transcribed verbatim. Data were inductively analysed using a thematic approach[28]. To enhance rigour, two researchers (author one and two) independently read and coded the transcripts to produce a list of core codes. A preliminary list of themes were developed and refined[29]. In line with the six stages of thematic analysis[20], a chart was developed for each theme[29], and relevant data entered into each chart. Charts were then used to identify narratives within cases and diversity between cases[30].

Data were stored in, and analyzed using, Nvivo 12. To ensure sensitivity to context[31], potential links to existing theories and previous research were sought and noted. Cases or themes that did not fit the developing analysis framework were actively sought and explanations discussed. To promote transparency, a record of the development of new codes, themes and patterns were kept in the form of a reflective analysis diary[31]. To enhance validity, emergent ideas and initial interpretations of the data were discussed with a third author (author three) who triangulated the data in reverse, from the themes back to the original transcripts, challenging interpretations until a consensus was reached. Furthermore, a summary of the findings were sent to all participants along with an invitation to offer any comments. Four healthcare professionals responded and were in agreement with our interpretation of the data.

Patient and public involvement

A patient and public involvement group was established to inform the development and direction of our research. The group met regularly (via skype) and comprised six individuals with CF, two parents, two physiotherapists, one technician and one paediatrician. This group were distinct from our research participants, and their main role was to inform the direction of the research that we conduct. In the first instance, the group were asked to suggest research topics and questions relating to physical activity and CF that they would like to be answered. The group were later asked to comment on our proposed methodology, information and materials for participants, and semi-structured interview schedule.

Results

The data are presented under two main headings: 1) Drivers of physical activity behaviour 2) Changing physical activity behaviour. Pseudonyms and job titles are provided alongside each quote.

1) Drivers of physical activity behaviour

Healthcare professionals reported two main drivers of physical activity; health and enjoyment (Table 1). Whilst health care providers tend to prioritise improvements in markers of disease, such as lung function, this was rarely the main goal for the patients. Indeed, although healthcare professionals suggested that improvements in health can be motivational, this was the exception rather than the rule (Quote 1). Generally, healthcare professionals suggested that for the majority of patients, motivation arising from the health benefits of PA is insufficient to increase physical activity behaviour (Quote 2). Furthermore, highlighting the correlation between lung function and PA could result in patients interpreting physical ability as a visible marker of lung function. For those who had poorer or declining health, this could be worrying for the patient and lead to an avoidance of physical activity (Quote 3).

Intrinsic motivation refers to both enjoyment and feelings of accomplishment from physical activity. Nearly all healthcare professionals emphasised the need for patients to enjoy physical activity. Crucially, it was consistently reported that those who enjoyed physical activity and felt good after physical activity were more motivated than those who felt it to be a chore (Quote 4). Indeed, feelings of enjoyment were considered to be the main factor that separated those who were active (Quote 5) from those who were not (Quote 6).

Nearly all healthcare professionals spoke of the importance of significant others in supporting patients to be active; usually through enhancing enjoyment. In younger patients, the role of the family was thought to be fundamental. During childhood, parents own exercise behaviour and their encouragement was considered the key predictor of activity behaviour (Quote 7). Families were seen to influence the patients' identity – either as sporty or not (Quote 8). However, family support and encouragement could help patients overcome possible barriers to being active if they were sufficiently engaged (Quote 9).

During adolescence, there is a shift from parent to peer support. Peer groups for adolescence with CF can act either as an enabler, or a deterrent. Healthcare professionals described the need for peers to support the person with CF to be active, as adolescents may prioritise fitting in and socialising with peers over optimal self-care. For some, friendship groups encouraged and promoted physical activity (Quote 10). However, for the adolescent, for whom fitting in and being accepted is paramount, inactive peer groups could reduce activity levels of the patient (Quote 11).

Insert table 1 here

Changing physical activity behaviour

Numerous behaviour change techniques for promoting PA behaviour were mentioned for overcoming the barriers highlighted by healthcare professionals. These primarily focused around (i) individualized education; (ii) approaches used to enhance enjoyment; and (iii) approaches used to make physical activity a normal part of everyday life. The theme of providing an individualized approach and enhancing intrinsic motivation by making physical activity fun and enjoyable, sociable, and normal ran throughout. Healthcare professionals spoke of creating a culture of exercise in which everyone is active. The need to form a

united front, including all members of the team, the parents, and the patients' friends was considered to be crucial. Particular behaviour change strategies are discussed below.

Individualized education

The most commonly mentioned behaviour change technique was individualized education about the benefits of physical activity, intensities and duration of physical activity, and about how activity can be fitted into their lives (Table 2). Education was usually verbally delivered by physiotherapists during consultations, or through recommendations of useful websites. Healthcare professionals were confident that their patients were well-informed about the benefits of physical activity but would always reiterate the importance of physical activity at every session to highlight its importance. Despite the majority of healthcare professionals suggesting that patients are rarely motivated by health benefits, education about the benefits of physical activity was still a key part of consultations – as this was seen to be crucial to allow the patient to make an informed choice about their physical activity. The majority of education provided by healthcare professionals was individualized the patients' individual needs, preferences and motivation (Quote 1). Whilst healthcare professionals had "ideal" or "optimal" intensities and durations of physical activity in mind, there was an understanding that such advice would often be ignored and individualized recommendations are needed (Quote 2 and 3). Crucially, any recommendations would be patient-led and focus on individual situations, needs and goals (Quote 4 and 5). However, the resources (time and skill) for such an individualized approach were often lacking (Quote 6).

Insert table 2 here

Approaches to enhance enjoyment

In line with healthcare professionals' belief that the biggest motivator is enjoyment, numerous attempts were made to make physical activity enjoyable to the patient; either by building intrinsic or extrinsic motivation (Table 3). Attempts to increase enjoyment included attempting to identify types of physical activity that the patient would engage with (Quote 1). Healthcare professionals would make suggestions to encourage patients to try new things, or give patients opportunities to allow them to identify activities they enjoy (Quote 2 and 3). For some healthcare professionals, it could be absolutely anything that made patients move and laugh (Quote 4). However, again, suggestions would be tailored to each individual patient in accordance with their likes, dislikes and goals (Quote 5).

Importantly, it was noted that enjoyment would be more likely to lead to sustainable physical activity. "Forcing" the patients to be active was never going to be effective in the longer term (Quote 6). Competitions were often used to enhance enjoyment, with some hospitals initiating leader boards, incorporating both staff and patients exercise test results (Quote 7) or developing challenges for their patients (Quote 8). However, it was noted that this would be less useful for people who are not already motivated (Quote 9).

Friends and family were often integral to attempts to make activity fun. For the younger patients, healthcare professionals would attempt to encourage parents to be active (Quote 10). For the older patients, peer groups were considered to be more influential, and healthcare professionals stated that they would often encourage patients to attend activity sessions with friends (Quote 11). If attempts at building intrinsic motivation were not effective, attempts were made to increase enjoyment via rewards. This could be as little as a reward at the end of a walk (Quote 12).

Insert table 3 here

Approaches used to make activity normal

Healthcare professionals expressed the need to make activity integral to every-day life, rather than an additional treatment (Table 4). Many healthcare professionals suggested that physical activity was crucial for all, not just those with a chronic condition. It was suggested that we need to develop a culture of exercise, in which everyone is active, and being active just becomes routine. In this instance, individuals with CF would not stand out or be different for their relationship with physical activity, rather, it would be standard practice for everyone. Techniques for "making activity normal" centred around developing habits and routines, fitting physical activity into every-day life, outreach with schools and communities, and promoting PA as a standard, rather than a treatment. Healthcare professionals attempted to encourage patients to develop habits and routines to enable physical activity to become part of every-day life. Early life experiences were considered to set a good foundation for viewing physical activity in a positive light (Quote 1 and 2).

School and community involvement were considered potential avenues to support and promote physical activity – focusing on the generic health benefits of physical activity rather than illness prevention just for those with chronic conditions (Quote 3 and 4). It was acknowledged that physical activity should be for everyone and that everyone, irrespective of health condition, should be, and can benefit from being, active (Quote 5).

Insert table 4 here

Discussion

The present study interviewed fifteen members of various CF MDTs in the UK in order to ascertain their views on physical activity promotion for adolescents with CF. The present study extended previous research, by discussing possible motivational influences that

healthcare professionals believed to impact adolescents' physical activity levels, as well as presenting a range of behaviour change techniques intended to increase motivation. Within the current study, healthcare professionals highlight the need to provide an individualized approach to physical activity promotion, incorporating patients' needs, preferences and goals, and focus on enhancing intrinsic motivation for physical activity by making it an enjoyable and routine part of their day. If supported by data obtained from other stakeholders (e.g., young people with CF), intervention developers could attempt to incorporate such factors into future interventions.

Of particular relevance to clinical teams is the suggestion that physical activity and exercise should be viewed as "fun" rather than "medicine". Indeed, healthcare professionals were adamant that physical activity should be a pleasurable activity that the patient can enjoy with friends and/or family and not just an additional treatment. This raises significant questions regarding who is best placed to promote physical activity for clinical populations. In 2007, the American Medical Association and the American College of Sports Medicine launched the "Exercise is Medicine" (EIM) initiative[32], with the goal of increasing exercise assessment and promotion by clinical teams. Critically, healthcare professionals in our study suggest that this may not be the best approach for achieving long-term, sustainable behaviour change. They emphasised that physical activity and exercise should be promoted as a fun and enjoyable part of everyday life, because patients are unlikely to be motivated to exercise for health reasons alone[33]. In fact, some patients who viewed physical activity as synonymous with health were less likely to be active if they noted any decline in their ability because this was viewed as evidence of deterioration in their health. Whilst our finding does not contradict the EIM initiative *per-se*, our research does extend previous thinking by highlighting the need for healthcare professionals to focus on the enjoyment, rather than

solely the health benefits, of physical activity. This finding provides a tentative explanation as to why previous research has found that physical activity is not being promoted clinically, despite MDTs rating it as beneficial[27]. Given the belief that physical activity should be "fun" rather than medicine, healthcare professionals may be reluctant to make physical activity a "treatment" as this may diminish its appeal as a fun and enjoyable thing to do. Further research is needed to explore whether or not promotion of physical activity in clinics does reduce adolescents' enjoyment of physical activity, or indeed, change their perspective of physical activity from enjoyable to treatment.

In addition to identifying possible explanations for physical activity behaviour, the current study presents a number of strategies used to support and encourage adolescents to be active and enjoy the activity. Whilst healthcare professionals may view some young people as lacking motivation for physical activity, previous qualitative research suggests that adolescents are often very active in managing their behaviours[34,35]. Indeed, Hughes et al highlight the challenges faced by young people living with chronic conditions when attempting to live their lives, and how young people struggle to accommodate these interruptions. The role of moderating influences (e.g., parents and healthcare professionals) in supporting the young person to develop behaviours to manage their illness alongside their everyday life is highlighted, alongside the need to develop interventions tailored to the needs and circumstances of individuals. Indeed, many of the approaches used by healthcare professionals centred around individualized recommendations, and approaches used to enhance intrinsic motivation and incorporate physical activity into everyday life. Healthcare professionals discussed how they would provide individuals with options and opportunities to try a range of activities in an attempt to identify one that may resonate with each individual and encourage friends and families to participate. However, there was also an

acceptance that some adolescents do not enjoy physical activity, and do not have active friends and families. For these individuals, physical activity is not part of their every-day routine, and being active would just make them stand out from their peers, which adolescents are strongly motivated to avoid[36]. In such cases, healthcare professionals reported attempts to make activity rewarding, either by offering rewards or treats at the end of activity sessions, or appealing to their competitive side with challenges and competitions (incentivising). Indeed, Segar and colleagues[33], discussed the need to "sell" physical activity to patients rather than focusing on clinicians' own goals, which are often irrelevant to their patients. The authors exemplify this using the pharmaceutical industry, demonstrating how they increase sales by promoting a behaviour for "pleasure, happiness or quality time with family" (P.100). Healthcare professionals in the current study were strongly in agreement with this and recognised the need to promote physical activity in a way that resonates with their individual patients. By suggesting that "enjoyment" is one of the most important factors in physical activity behaviour, our healthcare professionals highlight a feasible avenue for promoting, or selling, physical activity to their patients. Future research may now be concerned with exploring the effectiveness of such approaches to physical activity promotion in future interventions.

Social prescribing refers to attempts by healthcare professionals to link patients with non-clinical sources of support in the community[37] and is advocated for people with chronic conditions[38]. Within the current study, social prescribing (e.g., suggesting young people attend park run) was utilized by healthcare professionals in an attempt to de-medicalise physical activity and make it a normal part of life. Whilst further research into the effectiveness of social prescribing is needed, there is emerging evidence that it may lead to improvements in quality of life and emotional wellbeing[37;39]. Indeed, social prescribing may

be particularly relevant for young people with CF who are aiming to exercise for benefits that reach beyond lung function. Further research exploring the potential of social prescribing for increasing physical activity among young people with CF is therefore required.

Theories of motivation highlight the need to target patients' intrinsic motivation[37] in eliciting long-term, sustainable behavioural patterns. The theory articulates how motivation for a particular behaviour (i.e., physical activity) is either intrinsic (self-determined) or extrinsic (driven by external or internal pressure such as guilt or coercion). The theory suggests that intrinsically motivated behaviours are more likely to be sustained in the long term. Findings from the current research are consistent with this theory, and suggest that healthcare professionals could focus on attempts to maximise intrinsic motivation for physical activity, given that attempts to enhance extrinsic motivation (e.g., clinical pressure), is less enjoyable and less likely to be maintained over time[40].

A large body of literature has identified behaviour change techniques that have the potential to influence self-determined motivation[32;41,42], and healthcare professionals in the current study reported using many of these approaches, such as giving patients choice, encouraging rather than coercing, providing information, and eliciting and acknowledging patients' perspectives. These approaches, consistent with both self determination theory and motivational interviewing, highlight the need for healthcare professionals to identify exactly what it is that is important to patients[43], and to promote physical activity in a way that resonates with their goals[33,40]. The finding that clinicians are using self-determination theory and motivational interviewing, albeit unknowingly, to change physical activity behaviour strongly supports the development of an intervention underpinned by self determination theory. Moreover, incorporating elements of motivational interviewing may be effective in promoting physical activity

for this audience. Existing research highlights the evidence for the effectiveness of interventions using motivational interviewing to promote physical activity among other clinical populations[24]. Indeed, in the National Institute of Health and Care Excellence's guidance for "making every contact count, they recommend that all healthcare professionals should be encouraged to deliver brief advice to motivate individuals for physical activity. It is therefore a potentially useful approach for motivating physical activity among people with CF.

Previously, attempts have been made to link the active mechanisms of the self determination theory to behaviour change techniques[44,45]. For example, Michie and colleagues[44] highlight the links between the mechanisms of action (e.g., "social influences", "motivation" and "reinforcement") and behaviour change techniques (BCT) mentioned by healthcare professionals (e.g., social rewards, incentives, social influences). Using a consensus approach, Teixeira and Haggar[45] identified a number of BCTs relating to aspects of self determination theory that correspond with practices identified by healthcare professionals in the current study. For example, "facilitating discussion of clients view point." This is entirely coherent with the current study, and suggests that, although healthcare professionals do not have any prior training in this area, they were able to identify similar approaches. Additional training in motivational interviewing for example, may greatly enhance their practices.

Strengths and Limitations

The main strength of this study is the use of qualitative methods to generate an in-depth account of the views of an understudied group: healthcare professionals working with adolescents with CF. The research team comprises researchers from multiple disciplines and with variable experience in qualitative research, and we acknowledge that our role in the research process will have influenced the direction of the research in terms of the questions

we asked and, in our expectations, and interpretation of the data. Whilst the perspective brought to the design and analysis is largely psychological and may have been influenced by the lead author's prior training in health psychology, every effort was made to enhance the trustworthiness of the present study. This included multiple coders (from multiple disciplines), the keeping of a reflective diary, and respondent validation[31]. Findings were also triangulated with the existing literature and healthcare professionals were asked to validate our findings[31]. Despite this we acknowledge that researchers with different experiences and expectations may have reached different conclusions.

Whilst the study utilised opportunistic sampling, fifteen healthcare professionals from three-disciplines across a large geographical area of the UK were incorporated. The use of opportunistic sampling may have resulted in a self-selected sample of individuals who are very interested in physical activity, and we were unable to collect data on the number of years' experience of our participants. Despite these limitations, all healthcare professionals were able to recognise and discuss approaches used to promote physical activity for adolescents with CF. Indeed, this population of interested healthcare professionals offer a unique perspective regarding the motivation of their patients and their attempts to promote physical activity, and may provide useful information for healthcare professionals who are less interested in physical activity.

The importance of considering the perspective of all stakeholders when developing interventions is recognised[25]. Healthcare professionals have the advantage of being able to see a range of patients with wide variation in their physical activity levels and in a range of situations. This provides healthcare professionals with the unique opportunity to identify commonalities across patients in a way that patients themselves cannot. For example, while

people with CF may be able to discuss factors that limit and restrict their physical activity behaviour, they would not be able to spot commonalities or patterns between individuals. Furthermore, healthcare professionals are able to discuss their experiences of using different strategies to increase motivation for physical activity. We suggest that future studies should be concerned with obtaining data from patients themselves, as this would complement the data we present in this study, and provide a comprehensive assessment of the situation. Integration of data obtained from multiple sources (e.g., young people with CF) is crucial for the development of effective interventions targeting physical activity for young people with CF[25].

To our knowledge, this is the first study exploring clinicians' perspectives relating to motivation and promotion strategies for physical activity among adolescents with CF, and has important implications for research and practice. Firstly, converse to previous literature[27], our findings suggest that healthcare professionals could focus on the enjoyment element of physical activity, rather than its role in promoting health. Indeed, self determination theory and motivational interviewing may offer a useful avenue for facilitating such autonomous motivation. In addition, eliciting social support, both family and peer, may further enhance enjoyment. The role of significant others recurred throughout the interviews, with healthcare professionals suggesting that friends and family can support the person with CF to be active by branding and marketing physical activity as both fun and normal. Providing such normalizing experiences for youths may enhance their sense of identity and facilitate opportunities for peer relationships to develop. Indeed, it may be that there is a role for targeting patients' significant others in future interventions to promote physical activity. Future research should seek to explore the perspective of

adolescents with CF, as well as the views of their friends and family and subsequently assess the effectiveness of the collective strategies proposed.

Conclusion

Taken together, all healthcare professionals, irrespective of their role, felt that physical activity and exercise were crucial for adolescents with CF. Factors were identified which may influence patients' motivation to engage in physical activity and exercise; and in accord with research in healthy populations, individualized recommendations to enhance fun and enjoyment and integrate physical activity into every day route, were consistently cited for sustainable participation. In order to present a complete picture of the complexities of physical activity, future research should seek to explore perceptions of barriers and facilitators to physical activity from the perspective of young people with CF and their support teams. However, this work provides preliminary evidence for the suggestion that interventions developed around theories such as the self determination theory may prove beneficial. This work provides a crucial first step in the intervention development process[25]. Future work may now be concerned with exploring the views of stakeholders; including young people with CF, and utilizing data from multiple perspectives to inform the development of interventions to promote physical activity among young people with CF.

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Table 1: Drivers of physical activity behaviour

Quote 1	*"One chap who used to be a physical trainer, and he does say that the reason he enjoyed his exercise is that it made him healthy and kept his numbers good… He's the only one though" (Victoria, physio)*
Quote 2	*"So even though we're drilling it into them that it's really important to exercise and it's going to keep you well, it's going to keep you better, the fitter you are the better you're going to be - if they're not interested they're not going to do it" (Corrine, physio).*
Quote 3	*"If they can't do it as well, it might be something they might measure their lung function against. So it, if they can't achieve, you know, he can't run as far now or as far as before he knows his function isn't as good and therefore…" (Beth, physio)*
Quote 4	*"If it's part of their treatment it seems to tail off, if they just do it for that. But if there is an element of enjoyment, one of ours, she enjoys running so she carries on - as opposed to seeing it as a treatment"*
Quote 5	*"I think [the biggest motivator] is just enjoyment. People get different physical feedback from exercise and people get really good endorphins and they want to be part of a team and they want to play as part of a team and want to socialise with friends in that way and some don't" (Shannon, dietician).*
Quote 6	*"I think the biggest barrier is the thing with any adolescents I think is you've got to motivate them they've got to want to do it and say if you're not interested doing it then that's really difficult" (Peter, physio).*
Quote 7	*"I think sometimes parents [are barriers to PA]. If they don't exercise themselves, then the patients aren't enthusiastic about exercising because they don't have a positive role model" (James, paediatrician).*
Quote 8	*"I think some lads who aren't "sporty" wouldn't necessarily join in because their*

	families aren't going 'come on let's go for a walk or a bike ride.' And allow them from an early age to be on mobile devices" (Beth, physio).
Quote 9	*"I think if the family is focused and the patient is focused on activities they can usually overcome any financial burden" (Alice, physio).*
Quote 10	*"When you get friendship groups doing it, I think that helps, so they're just joining what their friends are doing instead of going, you know, to some hospital team saying why don't you do exercise?" (Rachel, dietician).*
Quote 11	*"If their friends don't do activities then that's really difficult, that's the biggest thing" (Peter, physio).*

NB. All names provided are pseudonyms

Table 2: Individualised education

Quote 1	*"We talk to them about what they choose to do or not to do. It's a bit of repetition of information. Whether they choose to do anything with it or not is up to them. But I think that my sense is that if we're repeatedly giving that message, they realise the importance of it… So yeah, over time, hopefully they start to get the message that we actually think it could help them and improve their lung function" (Louis, paediatrician).*
Quote 2	"W*e do ask them every time we meet them what kind of exercise are you doing the intensity and the duration and really talk about it needs to be at half an hour at least and be high intensity" (Claire, physio).*
Quote 3	*"I think sometimes you just have to accept what they are willing to do, so it might not be optimal in terms of health, but it is a start. And it is better than not being able to do anything. It gives us something to work with. So it might not have the health benefits that we know comes with being active, but if they enjoy it, if they are still moving and being active and interacting with peers, then yes they are getting benefit from it. And it is a starting point" (Beth, physio).*
Quote 4	*"I think a lot of it is very patient led rather than sort of saying this is a sort of set programme that we're working towards" (Peter, physio).*
Quote 5	*Yeah, it's very much an individualised thing, to fit in with what that person does or wants to do and what they want to achieve. We would talk about their goals and work with them to optimise their nutrition to achieve those goals. It wouldn't be a one size fits all, it would be a very individualised thing, taking into account things like current weight and fitness levels, what they want to achieve, whether they want to lose weight or whether it's just a fitness thing, whether they, what their diet currently looks like, all those sorts of things, and then we would work together*

	to support that patient" (Rebecca, physio).
Quote 6	*"I think that we have to make individual exercise programmes for our patients depending on what their needs, their social circumstances are and we just don't have the resources" (Peter, physio).*

NB. All names provided are pseudonyms

Table 3: Approaches used to enhance enjoyment

Quote 1	*"I think it's finding something that connects with that person because there's no sort of bullet for, footballs not going to be for every boy or girl and gymnastics isn't going to be for everyone, dancing isn't going to be for everyone" (Shannon, dietician).*
Quote 2	*"We will give them ideas, we will say 'Have you tried this?' And we say 'Is there any PE that you like?' And they might say trampolining, I really enjoy it, so we will say 'well why don't you think about doing it after school?' Or 'why don't you try that?' or 'why don't you try on a weekend?' And we'll try and use whatever they're doing in school or what their friends are up to. Or we'll say 'have you heard about that park run?'" (Rebecca, physio).*
Quote 3	*"You've got to give them a grass roots introduction to a lot of different options and opportunities and then find what they engage with and what they connect with most" (Claire, physio).*
Quote 4	*"I suggest to them to do absolutely anything that would get them off their bottoms. Because obviously my idea of an exercise opportunity and what I find fun is not necessarily what somebody else finds fun so I encourage them to find something that makes them laugh, makes them have fun and that they will continue to go back to" (Victoria, physio).*
Quote 5	*"I suppose the only thing is to spend time finding out what people like, so this is something we do, for example, so this allows us perhaps to target particular exercises and match particular people to, so we have a girl who likes to do Yoga so we devised a way of using the Yoga positions for drainage and using the breathing techniques to then encourage expansion in those particular positions. So I think the fact we're lucky in the small number that we have and we can get*

	to know them well enough that we can kind of get deep, individual, personalised approach" (Claire, physio).
Quote 6	*"We need to be more proactive with trying to not force our kids into exercise but to support them with getting to know what's out there and finding something that they can engage with and then it's not just the initiation of that programme it's the continuing support" (John, physio).*
Quote 7	*"We have a 'top gear' sort of thing where people that work in the hospital have done the bike test, so that the patients can think 'oh I want to try and beat a certain staff member' so they can see that all we're asking them to do, we're not all super fit either, and they can try and beat the next person the next time" (Jessica, physio).*
Quote 8	*"Before Christmas we did a challenge of 'n' kilometres. So we set a challenge with all the children messaging in how many kilometres that they've done a week. So we have a couple that will do a park run so they say well I've done 5K this week so we add that to our tally and we want to get a thousand kilometres between us" (Beth, physio).*
Quote 9	*"It's only good for the children that actually care and think 'Oh I need to get a couple more thousand steps in.' If not it's just a number on a watch" (Peter, physio).*
Quote 10	*"We ask parents whether they as a family do any exercise and look at trying to do exercises together as part of a family so it's not a physio thing to do, it's more a fun thing that they all do together" (Victoria, physio).*
Quote 11	*"We've tried in the past going out to see somebody at home and I would get her friend there as well so the two of them would be doing like a body pump style session in the house just because if she just wouldn't do it by herself but her*

	friend was really keen to give it a go" (Claire, physio).
Quote 12	*"With the slightly older ones, we might have a walk around the hospital, sometimes it might even be a bit of a walk into town, but with a bit more of an incentive of like going to like a milkshake shop or something with them just to encourage them to get out and have it's like a bit of a treat at the end of it" (Alice, physio).*

NB. All names provided are pseudonyms

Table 4: Approaches used to make activity normal

Quote 1	*"We talk about the real importance of establishing an early routine in childhood of activity and exercise and from toddlers up to transition age we talk about developing good habits and trying to engage them with different sporting or different activities to give them the option and access to different types of activities" (James, paediatrician).*
Quote 2	*"We try to sort of make it part of their normal every day activity and explore avenues of families going for walks, bike rides, swimming or stuff like that" (Katie, physio).*
Quote 3	*"I think we need to talk more about health promotion and activity at school and potentially bring it into the school – for everyone" (John, physio).*
Quote 4	*"The daily mile they do at school… making all the children go out and run a mile a day. I think that helps as well" (James, paediatrician).*
Quote 5	*"I think the general move across NHS England and having just the generally healthier population and making sports part of everybody's life means that they don't get picked out as someone who has to exercise because of their health they're doing it the same as everybody else is doing so making a much more normalised activity. So I think there are ways of society encouraging exercise as well" (Rachel, dietician).*

NB. All names provided are pseudonyms

Supplement 1: Semi structured interview schedule

1. How important do you think physical activity is for adolescents with CF?
    a. Why?
2. Who should be promoting physical activity for adolescents with CF?
3. What do you think the biggest barriers are to adolescents with CF being physically active?
    a. How would you help them overcome this?
4. How do you encourage adolescents to be physically active?
    a. What information or issues do you consider when promoting physical activity?
    b. How do you encourage those who are not motivated?
    c. How effective do you think these approaches are? Why?
5. Can you give me an example of how you encourage adolescents to be physically active?
6. In which situations / for which patients (if any) are you least likely to promote PA?
    a. Why?
7. Is there anything you feel you need to improve physical activity promotion?
    a. Is there any more information / training that would be useful?
8. Would any organisational or cultural changes facilitate the promotion of physical activity?
9. Is there anything else you want to say?

Reporting checklist for qualitative study.

Based on the SRQR guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the SRQR reporting guidelines, and cite them as:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. Acad Med. 2014;89(9):1245-1251.

	Reporting Item	Page Number
#1	Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended	6/7
#2	Summary of the key elements of the study using the abstract format of the intended publication; typically	2

		includes background, purpose, methods, results and conclusions	
Problem formulation	#3	Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement	7
Purpose or research question	#4	Purpose of the study and specific objectives or questions	7
Qualitative approach and research paradigm	#5	Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	7
Researcher characteristics and reflexivity	#6	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research	19

		questions, approach, methods, results and / or transferability	
Context	#7	Setting / site and salient contextual factors; rationale	8
Sampling strategy	#8	How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale	8
Ethical issues pertaining to human subjects	#9	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	8
Data collection methods	#10	Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale	8/9
Data collection instruments and technologies	#11	Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study	8
Units of study	#12	Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	8

Data processing	#13	Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts	8
Data analysis	#14	Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale	8
Techniques to enhance trustworthiness	#15	Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale	8
Syntheses and interpretation	#16	Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	10
Links to empirical data	#17	Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Tables 1-4
Intergration with prior work, implications, transferability and contribution(s) to the field	#18	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field	15

Limitations	#19	Trustworthiness and limitations of findings	15
Conflicts of interest	#20	Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed	15
Funding	#21	Sources of funding and other support; role of funders in data collection, interpretation and reporting	1