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Original Research

Views and experiences of healthcare practitioners supporting people with COPD who have used activity monitors: “More than just steps”

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ABSTRACT

Introduction: Activity monitors (apps and wearables) are increasingly used by the general population, including people with Chronic Obstructive Pulmonary Disease (COPD). There is potential for activity monitors to support increases in physical activity for people with COPD and healthcare practitioners (HCPs) are likely to be key in supporting their use, but little is currently known about HCPs' views or experiences. This qualitative research aimed to explore HCPs' views and experiences of supporting people with COPD who have used activity monitors. **Methods:** Seventeen semi-structured telephone or online interviews were conducted with HCPs between September 2020 and May 2021. HCPs included two nurses, an occupational therapist, a physician, and 13 physiotherapists. Participants were recruited via social media advertisements. They all had experience of supporting people with COPD who had used activity monitors. Interviews were analysed using reflexive thematic analysis.

Findings: Four themes were developed highlighting the challenges and benefits of HCPs supporting patients with using activity monitors and utilising patient-collected activity data; 1) Skills and experience are needed to increase accessibility and engagement, 2) Objectively monitored physical activity can support exercise prescription, 3) Applications of activity monitors vary across different settings, and 4) Support is needed for future use of activity monitors.

Discussion: HCPs recognised the potential for activity monitors to impact patients' ability to self-manage their COPD. However, there is a lack of guidance and information to support integration within practice. Future research is needed to co-develop information and guidelines for people with COPD and HCPs.

1. Introduction

Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death globally, with 3.3 million deaths worldwide in 2019 [1]. Interventions, such as pulmonary rehabilitation, can improve health outcomes for people living with COPD with the potential to increase physical activity (PA) [2]. However, people living with COPD are often limited in PA by breathlessness.

Activity monitors (i.e., smartphone apps and wearables) have been used to obtain objective PA data in people with COPD [3,4]. Interventions using activity monitors found consistent positive effects on PA levels, such as step counts, in various populations, including people with COPD [5–9]. Activity monitors are also increasingly used at home

to monitor PA, heart health, and sleep [10].

Healthcare practitioners (HCPs) are vital in supporting people with COPD, yet insight into their perceptions and experiences of activity monitors to support self-management is limited [11–13]. Barriers to utilising monitoring technology within healthcare settings include a lack of time to review data, a lack of expertise with the technology, scepticism around its benefits and concerns around data security [12,14,15].

Activity monitors can support the delivery of personalised care and help inform decision-making for treatments by capturing longitudinal patient data [16]. However, little is understood about HCPs' views and experiences of using activity monitors in clinical and healthcare settings with people with COPD. Exploring HCPs' views and experiences of supporting patients who use activity monitors would help to understand

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how HCPs can use technology to support patients.

1.1. Aim

This study aims to explore HCPs' views and experiences of supporting people with COPD who have used activity monitors.

2. Methods

This study used a qualitative research design in which semi-structured interviews were conducted with healthcare practitioners about their experiences of supporting people with COPD who have used activity monitors.

2.1. Recruitment and participants

Purposive sampling was used to select participants based on their experience of supporting people with COPD with snowball sampling by referral through other participants. Participants were recruited via advertisements on social media (e.g., Twitter) or email through professional contacts or networks of the research team. HCPs were eligible if they had experience supporting people with COPD who had used activity monitors. One HCP who consented to participate could not be contacted to conduct the interview.

3. Procedure and data collection

Potential participants were directed to a link on JISC Online Surveys containing information about the research and to give written consent to take part in the interviews and provide personal data. Semi-structured interviews were conducted via telephone (n = 9) or online video/audio call (n = 8) using a semi-structured interview guide (Appendix A). Interviews were conducted between September 2020 and May 2021 and lasted between 31 min and 1 h and 13 min (mean length = 49 min). The interviews were mostly participant led, with broad, open-ended questions about their views and experiences. The interviewer [LW] took extra care during interviews to use non-leading questions and prompts. Other members of the team [LS, CP] reviewed the interview transcripts to provide feedback to the interviewer and address any deviations from the protocol. Demographic details, including gender, age, profession, and number of years of experience, were also collected. Interviews were audio-recorded and transcribed verbatim.

3.1. Data analysis and reflexivity

Reflexive thematic analysis (RTA; [17,50,51]) was used to iteratively analyse interview data guided by the six phases outlined by Braun and Clarke [17]. LW analysed the data inductively with input from the team (LS, CP, CC, GW) at each phase. A critical realist approach underpinned the analysis meaning that while experience is the product of interpretation and constructed, rather than determined, it is still 'real' to the person [18]. During discussions on the analysis and findings, the authors were careful to remain grounded within the data and reflective of their backgrounds and experience. NVivo 12 Plus software [19] was used to organise initial codes for each transcript. The codes were then exported, printed and organised by hand into themes and subthemes which were refined and defined in Microsoft Word to check they were faithful to the data and to practically help with reporting. Appendix B describes details of the six phases of analysis and the engagement of the researcher with the data and the analytic process.

3.2. Ethical considerations

Ethical approval was obtained from the Coventry University Ethics Committee (P105303) and the Health Research Authority (HRA; IRAS ID: 279,396). Written and verbal informed consent was obtained from

all participants involved in the study. Participants' right to withdraw at any point before, during and up to 1 month after the interview when data was anonymised was made clear in the online information, prior to the interview and at debrief. Considerations were given that participants may experience some emotional distress when thinking or talking about patients they have worked with (including those who may have died). Although, no participants seemed to express emotional distress during the interviews, the researcher was prepared to sensitively and appropriately, including pausing/stopping the interview and/or recording and sources of further support were detailed in the debrief.

4. Findings

Seventeen HCPs were between 25 and 61 years old (mean = 39.3 years old, SD = 10.7 years). Twelve HCPs were female, and five were male. HCPs' occupations were nurse (n = 2), occupational therapist (n = 1), physician (n = 1), physiotherapist (n = 10), research physiotherapist (n = 1), and respiratory physiotherapist (n = 2) (see Table 1).

Four overarching themes and 13 subthemes were developed using RTA of the experiences of 17 HCPs supporting people with COPD using activity monitors (see Table 2). The overarching themes are: 1) Skills and experience are needed to increase accessibility and engagement, 2) Objectively monitored physical activity can support exercise prescription, 3) Applications of activity monitors vary across different settings, and 4) Support is needed for future use of activity monitors. See Appendix C for additional supporting participant quotations.

4.1. Theme 1: Skills and experience are needed to increase accessibility and engagement

4.1.1. Subtheme 1.1: perceived variations in patient engagement with activity monitors

The number of patients the HCPs had supported using technology varied, although they noted most patients were not monitoring their PA. HCPs reported that 'younger patients' tended to be more engaged and familiar with technology, and 'older patients' found using technology more complex.

Because we're still serving a little bit of the older population, so that doesn't mean the age is in correlation with not being able to use technology, it's just the people that I've been serving, they don't use a lot of technology. (HCP 17)

HCPs emphasised how patient demographics, such as age, and experiences of using technology, are changing. Using technology within healthcare, like activity monitors, was anticipated to be useful for the future as 'younger' and more 'tech savvy' patients are coming through

Table 1
Healthcare practitioner occupations.

Healthcare practitioner	Occupation
1	Physiotherapist
2	Physiotherapist
3	Physiotherapist
4	Respiratory physiotherapist
5	Physiotherapist
6	Physiotherapist
7	Physician (doctor)
8	Physiotherapist
9	Research physiotherapist
10	Physiotherapist
11	Occupational therapist
12	Nurse
13	Nurse
14	Physiotherapist
15	Physiotherapist
16	Physiotherapist
17	Respiratory physiotherapist

Table 2
Table of themes.

Theme	Subtheme
1: Skills and experience are needed to increase accessibility and engagement	1.1: Perceived variations in patient engagement with activity monitors 1.2: Improving the accessibility of monitors and potential for digital poverty 1.3: Digital literacy, skills and experience of healthcare practitioners 1.4: Opening up a dialogue with patients about activity monitors
2: Objectively monitored physical activity can support exercise prescription	2.1: Monitors supporting objective and relative monitoring of physical activity 2.2: Patients' sharing objective activity data helped healthcare practitioners to monitor progress 2.3: Objective assessment of physical activity supported exercise prescription
3: Applications of activity monitors vary across different settings	3.1: Using activity monitors in research and clinical settings 3.2: Patients' use of activity monitors outside the clinical setting 3.3: Barriers and practicalities of recommending activity monitors
4: Support is needed for future use of activity monitors	4.1: Perceived benefits and future potential of activity monitors 4.2: The need for Information and education on using activity monitors 4.3: Ensuring safety and overcoming risks

clinics and pulmonary rehabilitation classes.

I think what is becoming less of a problem is kind of the phobia or technophobes, especially from a smartphone perspective. (HCP 8)

Activity monitors and using technology, such as for remote consultations, were useful during the COVID-19 pandemic. HCPs perceived COVID-19 positively influenced the accessibility, engagement and uptake of technology, including wearables, for patients.

Since the pandemic, everyone's been buying wearables to do home workouts. So, hopefully, it will make it a bit more accessible for patients. (HCP 10)

4.1.2. Subtheme 1.2: Improving the accessibility of monitors and potential for digital poverty

Some services gave patients access to pedometers and supported them in using them, mostly through research projects. HCPs discussed selecting patients to engage in digital interventions depending on the patient's experience of using technology and the HCP's perception of who would be interested or successful with activity monitors. Similarly, some patients were screened out of the possibility to engage in interventions using technology, because they did not have internet access or smart devices at home.

It gets a bit difficult for us to support their rehab needs and their technology needs so we are somewhat selective of who we offer those interventions to just because, you know, the time it takes for us... (HCP 2)

Therefore, some HCPs were aware they may have excluded patients who could benefit from activity monitors and highlighted their passion for inclusion and attempts at improving access to rehabilitation, especially for rural communities.

Actually I think this is where I think these blended approaches to pulmonary rehab and our COPD cohort are going to really come into their own. But yeah, I'm very passionate with our very rural communities, that we don't digitally exclude a huge cohort of patients. (HCP 15)

Some HCPs believed socioeconomic status affected patients' ability to afford monitors. Costs to the patients or healthcare providers were a barrier to providing more patients with access to activity monitors. One HCP suggested the National Health Service (NHS) should provide activity monitors to reduce further inequalities regarding digital poverty and believed that, in the long run, the benefits would outweigh the costs.

Obviously, there's costs that will go into development and research, but from a long-term perspective, I think that would outweigh... And also, the cost saving from a health economics point of view is likely to be huge once this is y'know up and running, and going in that sense. (HCP 8)

Another HCP suggested encouraging patients to use apps on their smartphones with no additional costs would be better than giving patients a monitor.

Encouraging them to use apps is probably a better way to go, in my opinion, because they don't have to have an additional cost to it. (HCP 14)

4.1.3. Subtheme 1.3: Digital literacy, skills and experience of healthcare practitioners

HCPs' personal knowledge and experience around technology and app use helped them to guide and support patients with using their own activity monitors. HCPs' support with activity monitoring and recommending up-to-date resources for exercise plans (e.g., YouTube links and apps) were self-driven rather than led by the NHS. One HCP said they had 'learned by osmosis', and another 'felt like it was off [their] own back rather than a... team-directed intervention'.

HCPs were personally interested and positive about technology and for some it was their area of research interest. Their attitudes influenced the service options available to patients (e.g., using activity monitors) and the possibility of having conversations about technology.

So any kind of technology that comes along we are all over it. We quite like the use of technology within our practice, clinical practice that is. We embrace it so we feel that our patients have to as well. (HCP 16)

Limited knowledge and experience of using technology affected HCPs' confidence in recommending activity monitors to patients and utilising them as part of their care.

I tend to avoid, unless I know the apps, I tend to avoid saying apps because you don't know the kind of – the monetary cost of that, a lot of the time. So apps, I have to be little bit more cautious about recommending apps. (HCP 3)

HCPs noted varying levels of technological competency among their patients. Digital literacy and technical competency were something HCPs needed to assess, often informally, to know which resources or support options to offer patients. HCPs perceived digital literacy had improved among patients during the COVID-19 pandemic, which they sometimes underestimated in the past.

I still think we look at them and think, 'Oh, they're frail, they won't be able to do this.' But actually, they can do an awful lot and I think we underestimate [patients] a little bit. (HCP 13)

HCPs deliberated how patients' understanding of PA data, such as steps, distance or speed, varied. Some patients were unable to understand or interpret data and needed more support, particularly as part of research studies, compared to patients who used their own devices.

They'll be some people who you literally have to download the app to their phone, you have to show them how to sync it... There'll be other people who you can just give it to them and they'll know exactly what you mean by downloading an app and logging in and

syncing and, and there's probably a whole spectrum somewhere in between. (HCP 6)

4.1.4. Subtheme 1.4: Opening up a dialogue with patients about activity monitors

Talking about technology and opening discussions with patients about technology were important to HCPs. Some HCPs would keep their 'eyes open' for patients that may own an activity monitor and ask them about it.

I would jump at the opportunity to discuss [their activity monitor]. (HCP 14)

HCPs perceived discussions about activity monitoring with patients were 'more clinician-led than patient-led' but helped develop rapport. Conversely, it was not routine for HCPs to ask patients about their technology use and patients did not volunteer information about using activity monitors. Consequently, HCPs believed they could miss opportunities to engage patients with activity monitors.

So you know maybe we're missing, missing that opportunity with some patients because we don't routinely screen or ask people you know, do you have an app, do you use a phone and if they're not volunteering that information then we might be missing some people, some people might be coming through rehab with it, without us knowing, but I wouldn't have thought that'd be very many (HCP 5)

Some patients asked HCPs about their monitors, whereas some HCPs had never been asked.

4.2. Theme 2: Objectively monitored physical activity can support exercise prescription

4.2.1. Subtheme 2.1: Monitors supporting objective and relative monitoring of physical activity

Utilising patients' objectively monitored PA in clinical practice was 'not routine' for some HCPs. However, HCPs had objectively measured patients' activity levels within research studies as a research outcome. Compared to manual activity diaries and self-report measures, they felt that objectively recording activity was 'much easier', less 'wishy-washy' and more reliable.

It's lot easier than diarising everything, so having to write down what you doing, where you going... (HCP 3)

Additionally, while in pulmonary rehabilitation classes, HCPs 'set the speed' of walking, patients must rely on 'feeling the speed' to replicate this at home.

So when they're in their class we support them at that speed so then they know how quick to walk and they kind of know what it feels like so when-when they're at home they can kind of gauge whether or not that's feels the right speed. It's not very precise way of doing things but once we're in the class we can have an idea if they're going too slow or too quick. But, once they're at home we just and tell them to mimic that... (HCP 2)

HCPs recognised that limitations in the accuracy of activity monitor data could be problematic for research studies, but less concerning for clinical practice and monitoring in everyday life. However, HCPs recognised that technology was constantly advancing, and the devices' accuracy was improving. Nevertheless, in clinical practice, one HCP highlighted that if activity levels are being underestimated by a device every day, then it would still be 'comparing like with like' which is 'better than nothing'.

It's likely that their steps will be underestimated because they haven't carried [the phone around with them all day], but it's still a baseline. If it's underestimated every day, then you're comparing

like with like... I know there's lots of people might say, 'Well, they're not 100% accurate.' Y'know it's better than nothing. (HCP 12)

4.2.2. Subtheme 2.2: patients' sharing objective activity data helped healthcare practitioners to monitor progress

Some HCPs' experiences included patients sharing their activity data with them outside of research studies, either verbally sharing step counts or by showing data from their devices, but most patients did not share at all. Some patients shared their PA data with HCPs through paper diaries, as suggested by the HCP. For some research studies, HCPs accessed synchronised activity data via an online portal.

I say it's a very it's a small number of people we're talking about generally they're anecdotally, you know I'll say oh what's your typical step count you know and they'll tell me rather than getting the data up. (HCP 5)

HCPs noted patients preferred activity monitors providing immediate feedback to increase their motivation. One HCP shared activity data with a research participant who was using a blind activity monitor (not displaying activity levels) despite it not being part of the protocol.

The wearables data was for research purposes and it wasn't in the protocol to review the physical activity data with [patients] at the follow-up assessment. So... after their initial assessment, you'd have their pre-printout of their physical activity, days of the week, and METs [metabolic equivalents], step count you'd have that post-program physical activity... but again, that wasn't in the protocol to review that with patients. I just thought it was an important thing to do. (HCP 14)

4.2.3. Subtheme 2.3: Objective assessment of physical activity supported exercise prescription

During the COVID-19 pandemic, HCPs could not conduct face-to-face exercise tests. Objective activity levels from activity monitors gave HCPs insight into a patient's exercise tolerance and activity level.

We don't want to prescribe exercise without having done a maximal exercise test from a safety perspective and assume that we're prescribing at an appropriate level, so the step count means that we can do some kind of personalised and individualised exercise prescription, or activity prescription rather than exercise prescription... but it means we can still do some kind of aerobic element of a programme without having done a walk test. (HCP 6)

Some HCPs utilised patient activity monitor data to guide exercise prescription, create tailored step count goals for patients and help patients understand energy conservation and pacing.

Another day [a patient] did significantly more so he like he'd overdone it and was able to say that was too many steps so then brought it back, it can be helpful for pacing as well, so he knows to pace himself by not going out to the seventeen hundred that he done that day as well. (HCP 3)

One HCP discussed using heart rate training zones as a measure of activity or intensity level.

So what we actually did, lots of them had heart rate monitors and they wanted to know what was safe and levels for their heart rate. Actually we started incorporating working out their training ranges for their heart rates. So then we could make it safe for them to be able to do a walk-in program by them for that second bit of activity and stuff for them to be- some parameters to work within so it made it a safer approach... (HCP 15)

However, some HCPs were uncomfortable setting goals for or with patients, especially if baseline assessments had not been completed (e.g., during COVID-19 restrictions).

I don't set- I would never set specific targets for a patient at the moment because I don't know what would be safe and what would be achievable, or helpful. (HCP 7)

4.3. Theme 3: Applications of activity monitors vary across different settings

4.3.1. Subtheme 3.1: Using activity monitors in clinical practice

HCPs believed activity monitors have a role within healthcare, including before pulmonary rehabilitation (e.g., for measuring baseline PA), during (e.g., for monitoring improvements, feedback, and motivation), and after (e.g., for maintenance and goal setting). Some HCPs had used activity monitors within healthcare services. In one case, including activity monitors were in response to patient questions and feedback.

It was what the patients already had, so we were getting asked the questions lots. So we were just trying to incorporate that in so that they could use their own bits of equipment... (HCP 15)

However, HCPs noted difficulties and barriers to adopting and implementing activity monitors within clinical services including cost, accuracy, engagement, data protection, patient safety, and usability (e.g., unexpected updates, synchronising devices and uploading data).

I think, intuitively it feels like a good idea and the right thing to do but, just from experience, I don't think it works in practice as well as we would like it to. (HCP 2)

There were concerns among HCPs about activity monitors replacing a therapist. However, some thought activity monitors could be a valuable addition to therapy.

Kind of replacing the need for physio, especially in those stable, non-exacerbating patients at that point in time. (HCP 8)

Ease of use is crucial when implementing technology and offering technical support. One HCP suggested support is 'down to the manufacturers to ensure patients are supported', including offering helplines. HCPs noted providing technical support in clinics was time intensive. However, one HCP said the time they spent supporting patients with activity monitors reduced over time.

Initially we set it up, yeah we would introduce it to them and show them how to use it. But then as weeks went on they'd need less and less support, if that. (HCP 2)

4.3.2. Subtheme 3.2: patients' use of activity monitors outside the clinical setting

Activity monitors were perceived to be suitable for everyday life as patients related their steps to activities, such as walking to the paper shop.

With the activity monitor, you actually relate it to their life more. They'll say, 'I know it's so and so steps down to the paper shop and back'. So it becomes more real to them. They can relate it much more to their life than a six-minute walking distance or a shuttle that's totally unrelatable because you've never get people walk the speed that they do in a shuttle walking test in real life. (HCP 13)

HCPs felt daily step count targets could be inflexible as people with COPD experience 'good days' and 'bad days'. As patients with COPD 'deteriorate over time', HCPs felt improving quality of life and encouraging patients to experience life and engage in social activity was more important than 'just getting steps in' and increasing patients' steps or exercise capacity.

What are they doing with those number of steps? If they're just physically able to walk up and down a little bit more but they're sitting in their chair and still feeling exactly the same and it hasn't changed kind of the mastery where it hasn't changed their

emotional, their emotional, kind of, their frustrations, or the anger, or the, kind of sadness that comes with that socialisation ... success is quality of life, from my point of view rather than the number on the dial. (HCP 3)

Similarly, some HCPs did not want to recommend activity monitors because increasing step counts may not always align with adherence to an exercise prescription. For example, the 'difference between exercising and being active' and the classification of activity moderate-to-vigorous PA.

Not all steps are equal necessarily so you might have a step target that you want to work to, but, not but,... the acknowledging that when you're exercising that will record steps, when you're not exercising that will record steps, and you may have an overall target. (HCP 1)

4.3.3. Subtheme 3.3: Barriers and practicalities of recommending activity monitors

For most HCPs, it was 'not routine' to recommend activity monitors to patients unless the patient mentioned it first. Some HCPs wanted to understand the patient's needs, motivations, and desires from the activity monitors to inform their recommendations.

So you know patients are different, what they want to do or what they need from it is different, so you know on that basis the recommendations are likely to be different. (HCP 5)

Some HCPs recommended specific apps, such as the Couch to 5K app, MapMyRun, Strava, Apple Health and Google Health inbuilt apps, or wearables, such as Fitbit, Garmin, Apple Watch, or pedometers.

They usually come with something that they've already got, got access to ... I don't know if recommend is a strong word but obviously the free apps like the Health app on the iPhone which'll do steps (HCP 1)

Some HCPs recommended 'low-tech' or 'old-school' ways of monitoring activity, such as using a stopwatch, or something 'simple to use' like a Fitbit. However, HCPs were also uncomfortable giving recommendations due to concerns of costs to patients, having time to discuss options, having the NHS or services endorsing recommendations, patient safety and data security, needing to provide IT support, and evidence for their effectiveness.

I'm always quite reluctant to recommend things that are going to be at an expense to patients. (HCP 2)

Furthermore, HCPs believed recommending activity monitors were inappropriate or not their responsibility. Some felt they would be held personally responsible for any adverse events. One HCP noted recommending monitors 'doesn't feel like physiotherapy' and was 'not [their] place to do that'.

[Activity monitoring has] got its role, definitely got its role, but it just doesn't feel like physiotherapy at the minute, you don't feel like you're actually doing rehabilitation, but I think in this current climate I think if you had like your Fitbits if you have an activity monitor it would really, really help our cause. (HCP 4)

Another barrier to recommending activity monitors to patients was trusting the app or device to be suitable and safe for patient use. HCPs highlighted how it would benefit the NHS to have an official app or wearable they could recommend, a list of trusted apps that were 'vetted' for use in NHS services, or one NHS gold-standard app with everything all in one place.

Taking part in the interviews prompted HCPs to 'think about' the use of technology and activity monitors during the COVID-19 pandemic.

Yeah, if someone came to me, I suppose, even maybe after our conversation, I might think about this a little bit more in that I might

be more forward with recommending an app if we were kind of talking about how they would record their exercise because normally we're just getting to record in a kinda diary format. (HCP 9)

4.4. Theme 4: Support is needed for future use of activity monitors

4.4.1. Subtheme 4.1: perceived benefits and future potential of activity monitors

HCPs believed activity monitors benefitted patients with COPD. Some perceived benefits were improving patient interaction and dialogue, observing patients' progress more easily and objectively, and helping to motivate PA (i.e., through goal setting and feedback). Notifications and reminders helped motivate patients to be active and gave them a sense of achievement when they made progress.

Some people said 'I did some extra steps because my watch hadn't buzzed', so like that feedback of being able to know that they'd hit a target is quite helpful for some people... for other people it was just knowing what their trends looked like was almost enough to stimulate a change. (HCP 6)

HCPs also noticed that social support and engaging with others, such as sharing activity data through the apps, motivated patients, including being 'aware someone is looking at what they're doing'.

[Patients] do seem quite motivated by it, once they've started, they seem to really enjoy tracking it. And I think it's that tracking, and then occasionally, they're kind of following each other on different apps and that's quite nice thing kind of keep in touch that way as well. (HCP 9)

Additionally, HCPs believed activity monitors helped patients self-manage their health condition. They noted there was potential for monitors to help patients in the future, for example, for oxygen saturation monitoring and to facilitate the adoption of healthy behaviours through applying behaviour change techniques.

I think it's going to have a really important place to play in the future. (HCP 16)

4.4.2. Subtheme 4.2: The need for information and education on using activity monitors

HCPs suggested they should have information to support patients with activity monitors and recommend devices. Suggestions included: research evidence and data on its benefits; a list of apps and devices with a 'pros and cons list'; data protection or privacy; costs of devices or apps; and where to seek help should they need it (e.g., help centre).

I mean, first of all, just a general overview because I might be missing apps that I don't know about, so that would be a good starting point. (HCP 9)

HCPs thought information for patients should include the benefits of using activity monitors, particularly for self-management and breathlessness, what's available and associated costs, and what features might be beneficial (e.g., monitoring heart rate). They suggested information should be accessible and easy to read, like a poster, leaflet, or NHS webpage.

So it's almost like having an easy-read version, almost like a leaflet or something that's easy to read and like really basic information and just saying this is what you want... (HCP 10)

4.4.3. Subtheme 4.3: Ensuring safety and overcoming risks

Some HCPs expressed concerns about patients monitoring their activity, including patients getting 'too focussed' on the numbers and not paying attention to how they feel or what their body is telling them. Also, experiences with 'more anxious patients' found monitoring

activity could reduce anxiety, but could also increase anxiety.

There's a very definite cohort of patients that worked really, really well with their... bits of kit. I think some of our more anxious patients, it doesn't work quite so well with. Although on the flip side of that, some of our anxious patients have become less anxious because they know they've got a heart rate range that they can be working within. (HCP 15)

Some HCPs were concerned about the safety and security of data. However, experiences of data protection and privacy concerns among patients were minimal and did not often arise as an issue. One HCP felt privacy issues and concerns were 'often overplayed'.

The privacy and the data concerns that some people have. I don't actually think people have that- I think it's often overplayed. I think that a lot of patients, as long as it's all explained to them and it's upfront and they trust the person that's asking them to use it, I think a lot of those things are fairly easily surmountable. (HCP 7)

Most HCPs felt the benefits outweighed the potential adverse effects and risks, and generally, activity monitors were 'more of a help' than a 'hindrance'.

But I can't see any huge concern with doing that really. I think the benefits probably outweigh any risk. (HCP 9)

HCPs noticed activity monitors were able to increase patients' self-efficacy and confidence with activity and exercise. HCPs felt activity monitors gave patients a 'sense of control' and a 'safety net knowing that actually, it was ok'.

I think it helps the self-efficacy because it gives them that sense of control because they can read it, but... it can have the opposite effect that they become too dependent on it you know. (HCP 13)

Some HCPs were not concerned about patients using activity monitors.

I don't have concerns about them ever over-exercising because most COPD patients are limited by breathlessness... I think that there is a bigger risk of patients doing less than they can. (HCP 7)

5. Discussion

This qualitative study is the first to explore HCPs' views and experiences of supporting people with COPD who have used activity monitors. Generally, HCPs believed activity monitors were beneficial to patients with COPD increasing PA, motivation, and self-management. Additionally, utilising patients' objectively monitored activity data guided remote exercise prescription and tailored activity goals, especially during COVID-19. HCPs in the current study believed the benefits of monitoring, such as increasing awareness, control, self-efficacy, self-management, and outweighed the risks. Previous research highlights the importance of ownership and setting achievable activity goals in partnership with healthcare staff [20]. Tailored and individual care for people with long-term health conditions, including health coaching, self-management education and peer support, can increase health and well-being and have positive financial and economic impacts on the healthcare system [21,22]. However, considering practical resource barriers, tailored support may be difficult to implement in person, and activity monitors may be useful to support goal setting and self-management remotely alongside clinical practice.

HCPs believed technical issues, including navigating updates, logging in, and internet connectivity issues, were surmountable and could be overcome with experience and time. Technical difficulties are the most reported barrier to telehealth pulmonary rehabilitation interventions [23]. However, despite concerns, previous research has highlighted patients attempts to overcome technical issues or seek adjustments within a telerehabilitation programme [24]. Furthermore, the

current research found HCPs have limited consultation time and may not be able to provide extensive technical support for patients' use of activity monitors, aligning with previous research [25–27]. Nevertheless, the current study noted the time HCPs spent supporting patients with activity monitors reduced over time. Additionally, HCPs perceived technology use among patients is increasing and the demographics of patients with COPD are changing. Over time, more patients may show an interest in using technology and exploring devices to understand activity and health data [28]. Future research should investigate the cost-benefit of HCPs supporting patients to use activity monitors to increase self-management practices and consequently increase positive health outcomes and reduce the burden on HCPs and NHS services.

Although HCPs were concerned about activity monitors replacing a therapist, they recognised their usefulness alongside treatment. Before COVID-19, Slevin et al. [26] found that HCPs highlighted the need for face-to-face contact in healthcare, especially for encouraging the use of digital health technology. COVID-19 restrictions meant face-to-face contact stopped and there was no choice to adopt alternative methods for COPD healthcare services. The NHS Long Term Plan aims to offer remote consultations beyond primary care, yet questions remain about future digital healthcare delivery and challenges integrating technology into existing clinical workflows [29,30]. Patients choosing web-video conferencing as an acceptable method of PR did not increase from 2020 to 2021 [23]. Face-to-face contact is still valuable within COPD treatment, though technology could reduce costs, improve accessibility, and support patients remotely and at home [31,32]. Furthermore, evidence during the COVID-19 pandemic suggests that technology-enabled healthcare delivered alongside face-to-face care may increase access to healthcare and satisfaction with care [33]. Future research and clinical practice should consider the potential of activity monitors for people with COPD in everyday life to use alongside current healthcare services to support the adoption of healthy behaviours through behaviour change techniques and coaching for better self-management of COPD.

HCPs expressed they were learning from personal experience rather than guided by the NHS, their organisation, or any specific guidelines. Without experience using monitors, HCPs were less confident supporting patients with activity monitors and understanding their data. Previous findings support HCPs feeling they needed to increase their digital literacy to answer patients' growing questions about activity monitors within clinical settings [26]. This research provided insight where they recognise the potential for this technology but are apprehensive to fully make use of devices due to the lack of support and guidance. Therefore, future work should co-develop information and guidelines for people with COPD and healthcare practitioners on using activity monitors.

Similarly, HCPs observed patients' technological competence and digital literacy varied. HCPs questioned some patients' abilities to understand and interpret activity monitor data, similar to previous studies (i.e., [26]). Although digital access, confidence and skills among people with COPD are increasing, Martinez et al. [34] cautioned whether increases are equal across the population or related to the widening 'digital divide'. Some HCPs in the current study noted some patients might be missing out on opportunities to engage in technology-related research due to a perceived lack of interest, previous experience, or likelihood of success. Hence, innovative research may contribute to the widening digital gap between those who are already engaging with digital self-management technologies and those who are not or do not have internet access [26,35,36]. Without an awareness of recruiting patients to digital research and offering digital support to all patients, the digital divide gap could increase following the COVID-19 pandemic [37]. Similarly, HCPs may miss opportunities to talk to patients already engaging with activity monitors at home. Related to the Making Every Contact Count initiative to improve health behaviours, open discussions may positively affect PA levels and self-management of COPD [38].

Perceptions of inaccuracies with monitoring activity reported by HCPs, however, patients were still able to estimate and make sense of their PA levels. Regardless of accuracy, reliability and validity, activity

monitors are becoming increasingly utilised and integrated into the everyday lives of people with COPD and useful for self-management [39, 40]. HCPs in the currently study found patient activity levels which were objectively collected at home were useful for HCPs to understand patients' baseline activity remotely to support exercise prescription when exercise tests were unable to be conducted. However, some HCPs were concerned with safety and exercise prescription with activity monitors and whether step goals could potentially restrict patients' activities. Monitoring at home may enable HCPs to understand better the ups and downs of exacerbations for people with COPD which seems important as monitoring technology alone and automatic goal setting is unable to account for this. Supporting Vorrink et al. [41], activity monitors can be a tool to enable HCPs to obtain an objective account of activity levels outside the clinical setting, compared to relying on patient recall and calculation. Objective monitoring has potential to help exercise prescription for people with COPD, however further research is needed to help inform decision making in clinical practice.

HCPs in the current study were apprehensive about recommending activity monitors as information and guidelines are unavailable. Consequently, they believed any adverse consequences would be their responsibility. Concerns about patient safety, including potential frustrations and increased health anxiety, have been previously reported [3, 26,42]. However, a lack of formal guidelines on supporting patients with technology allows HCPs to flexibly practice what they know, understand and believe in [43]. A disadvantage of this flexibility is that experience and knowledge vary between HCPs and care is not standardised or evidence-based [26]. Currently, HCPs communicate with patients about technology while being careful not to confuse or mislead patients [26]. Training and professional development opportunities for HCPs on digital technology, digital literacy and digital communication would be beneficial [26,44,45]. Additionally, further work is needed to develop safety procedures and protocols to mitigate risks and reduce concerns for practitioners to support patients with activity monitoring and co-creating activity goals.

5.1. Limitations and considerations

Because of our inclusion criteria, the main limitation is that the perspectives of HCPs without experience of supporting patients using activity monitors have not been captured. It is possible that HCPs, outside this research study, may have different experiences of supporting patients with COPD. As most HCPs were physiotherapists, they might have more experience working with patients and technology than other HCPs, and therefore, best placed to engage with patients in this way. Conversely, the timing of the COVID-19 pandemic may have affected study recruitment where HCPs may have wanted to take part but were unable due to redeployment in other NHS services reflecting the workloads and responsibilities of HCPs during COVID-19. Nevertheless, other HCPs including occupational therapists, a nurse, and a physician, believed technology had a place in healthcare.

The interviews were conducted early into the COVID-19 pandemic online or via telephone. COVID-19 affected services available to patients, and health technology use rapidly increased [46–49]. HCPs in the current study discussed their experiences before and during COVID-19 reflecting on the fast-moving change and uncertainty with patients' motivations and engagement. As attending hospital appointments and rehabilitation following the pandemic is possible again, technological and remote practices may be different. Some HCPs may continue to adopt new technological ways of monitoring patients' PA and supporting goal setting. Further research is needed to understand how learnings from the COVID-19 pandemic can be translated into current care and practices.

6. Conclusion

This research provides knowledge about the experiences of HCPs

supporting patients with COPD using activity monitors. HCPs perceived activity monitors are useful to patients, motivating them to be active and helping them self-manage their COPD. However, support for patients is led by the HCPs' self-directed knowledge and personal experiences of technology with limited information and/or guidance about their use for people with COPD. Without such guidance, the capacity for HCPs to support patients with activity monitors is questionable. Additionally, HCPs need to be careful around excluding patients from opportunities to engage in digital health interventions which may contribute to the widening of the digital divide. Co-created information, guidelines, and training on activity monitors are necessary to assign responsibility for care, increase HCPs' self-efficacy and confidence with utilising technology within person-centred treatment, and reduce potential risks and adverse effects.

Data availability statement

The data supporting this study's findings are available on request from the corresponding author.

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CRedit authorship contribution statement

L.J. Wilde: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration. **C. Percy:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision. **C. Clark:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision. **G. Ward:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision. **P.A. Wark:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision. **L. Sewell:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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