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CAN EXERCISE REPLACE AIRWAY CLEARANCE TECHNIQUES IN CYSTIC FIBROSIS? A SURVEY OF PATIENTS AND HEALTHCARE PROFESSIONALS.

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Abbreviations:

ACT: Airway Clearance Technique

HCP: Healthcare Professionals

JLA: James Lind Alliance

NIHR: National Institute for Health Research

pwCF: people with CF

PSP: Priority Setting Partnership

ABSTRACT

Airway clearance techniques (ACTs) are recommended in cystic fibrosis (CF) to prevent accumulation of secretions and lung infection. “Can exercise replace chest physiotherapy for people with CF?” is one of the CF community’s top 10 research questions. We conducted an online survey of the CF community to gather data on current ACT use, recommendations, reported adherence levels and exercise strategies used. There were 488 respondents: 194 (40%) people with CF (pwCF), 141 (29%) family and 153 (31%) healthcare professionals (HCPs) (mostly physiotherapists). Only 10/285 (4%) of pwCF do no exercise at present and 163/303 (54%) already incorporate exercise into ACTs. ACTs were omitted by 128/267 (48%) of pwCF when they exercised. Nearly all (110/129, 93%) of HCPs currently recommend exercise to support ACTs. A trial replacing some or all ACTs with exercise, was supported by 80/110 (73%) of HCPs, with an additional 9/110 (8%) willing to consider in selected patients.

KEYWORDS

Exercise. Airway clearance techniques. Cystic fibrosis. Clinical trial. Co-production. Priority setting.

INTRODUCTION

Cystic fibrosis (CF) is characterised by a failure of mucociliary clearance and accumulation of viscid secretions in the airway, leading to recurrent infection. To mitigate this process, CF treatment guidelines recommend the regular use of an airway clearance technique (ACT), with exercise as an adjunct(1). In people with CF (pwCF), exercise such as running or cycling, increases ease of sputum expectoration, minute ventilation and respiratory flow(2). A comparison of one ACT with treadmill exercise showed that these approaches performed similarly over a single session(3). These studies suggest that exercise might be a replacement rather than an adjunct to some or all of a patient's ACT programme.

In a recent patient engagement exercise, the James Lind Alliance (JLA) Priority Setting Partnership (PSP) in CF, the patient and clinical community jointly identified the top 10 questions for clinical research in CF(4). "Can exercise replace chest physiotherapy for people with CF?" was one of these research priorities. Exercise also featured as a topic of importance in the US CF Foundation's Insight CF project(5). We conducted an online survey in order to understand further how the CF community currently uses exercise to supplement or replace ACT, and to assess the acceptability to patients and healthcare professionals (HCPs) of a clinical trial to investigate replacing ACT with exercise.

METHODS

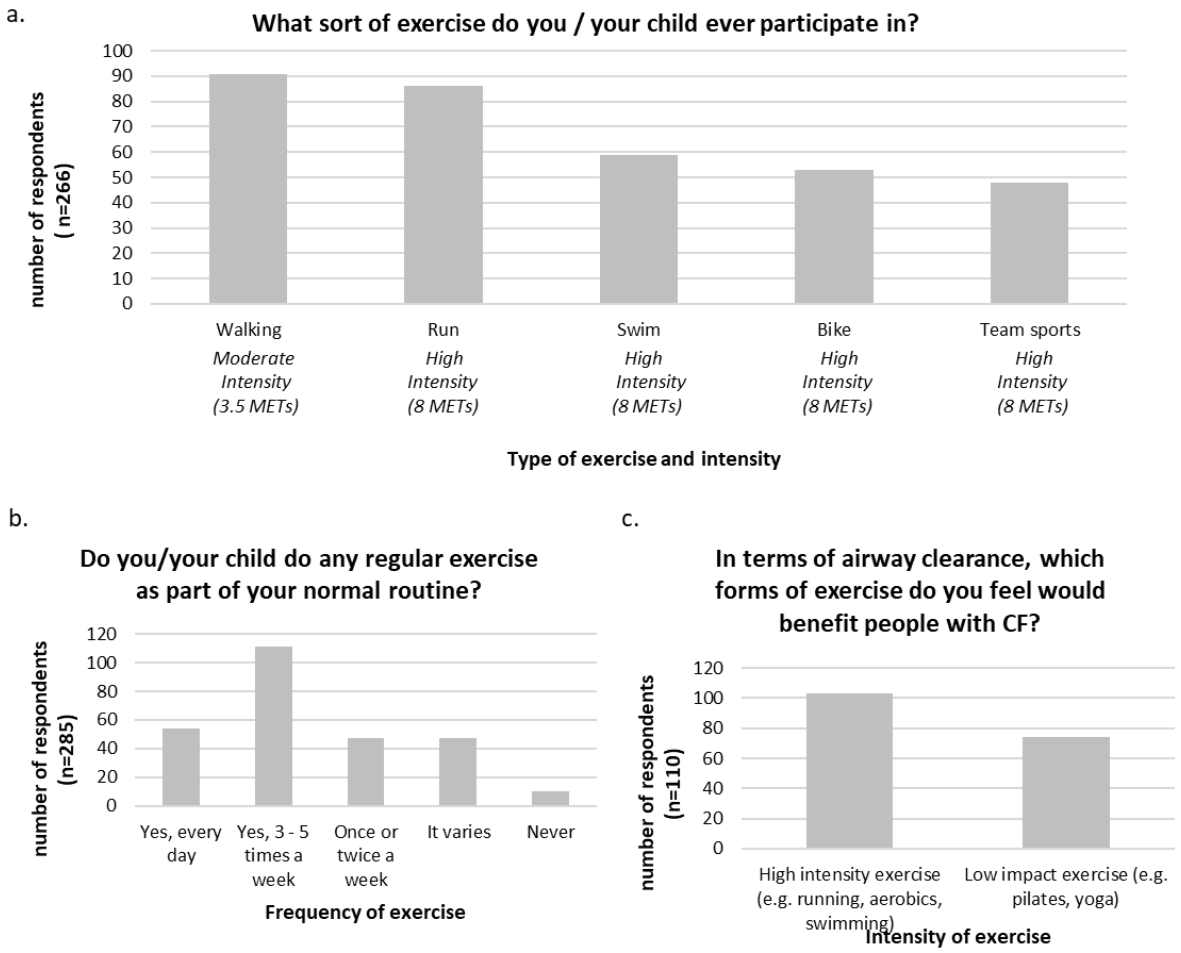
This work was led by a steering group representative of the CF community (lay and professional) and supported by the UK National Institute for Health Research (NIHR) under the title "James Lind CF2". An online questionnaire was co-produced using SurveyMonkey™ to help us understand which ACTs are currently undertaken by people with CF and recommended by HCPs, current levels of reported adherence and exercise strategies used (See online supplement 1). The survey was designed to be inclusive, with no minimum age or restrictions on location, and was open over 5 weeks in December 2018-January 2019. There were separate streams for lay and professional respondents to complete. It was promoted via our Twitter™ account (@questionCF), professional networks, UK CF Trust, US CF Foundation Community Voice group and the NIHR. The survey data were downloaded to Excel for quantitative analysis (closed questions) and NVivo for thematic analysis (free text comments) in order to generate topics which represented recurring themes.

RESULTS

There were 488 respondents, with 335 (69%) from the lay community. Of these 194 (58%) were people with CF and 141 (42%) family of people with CF. Of the HCPs, 63% were physiotherapists. The greatest number of respondents were from the UK (n = 220, 45%) followed by North America (n=134, 28%). Median age of respondents with CF was 33 years (range 14-74 years) and median age of those whose parents or family answered on their behalf was 8 years (range 1 – 33 years). Survey respondent characteristics are summarised in appendix table 1. Not all respondents answered every question so denominators will vary (supplement 2).

Figure 1a shows the type of exercise most popularly undertaken by people with CF and grading of intensity using metabolic equivalent of tasks (METs)(6), with walking (moderate intensity) and running (high intensity) the most popular. The majority of people with CF exercise 3-5 times a week with only 10/285 (4%) of lay respondents reporting no exercise (figure 1b). Almost all (110/129, 93%) HCPs currently recommend exercise as a way of supporting ACTs and recommend all intensities of exercise (figure 1c). A full list of the top 20 exercises with METs are in appendix table 2.

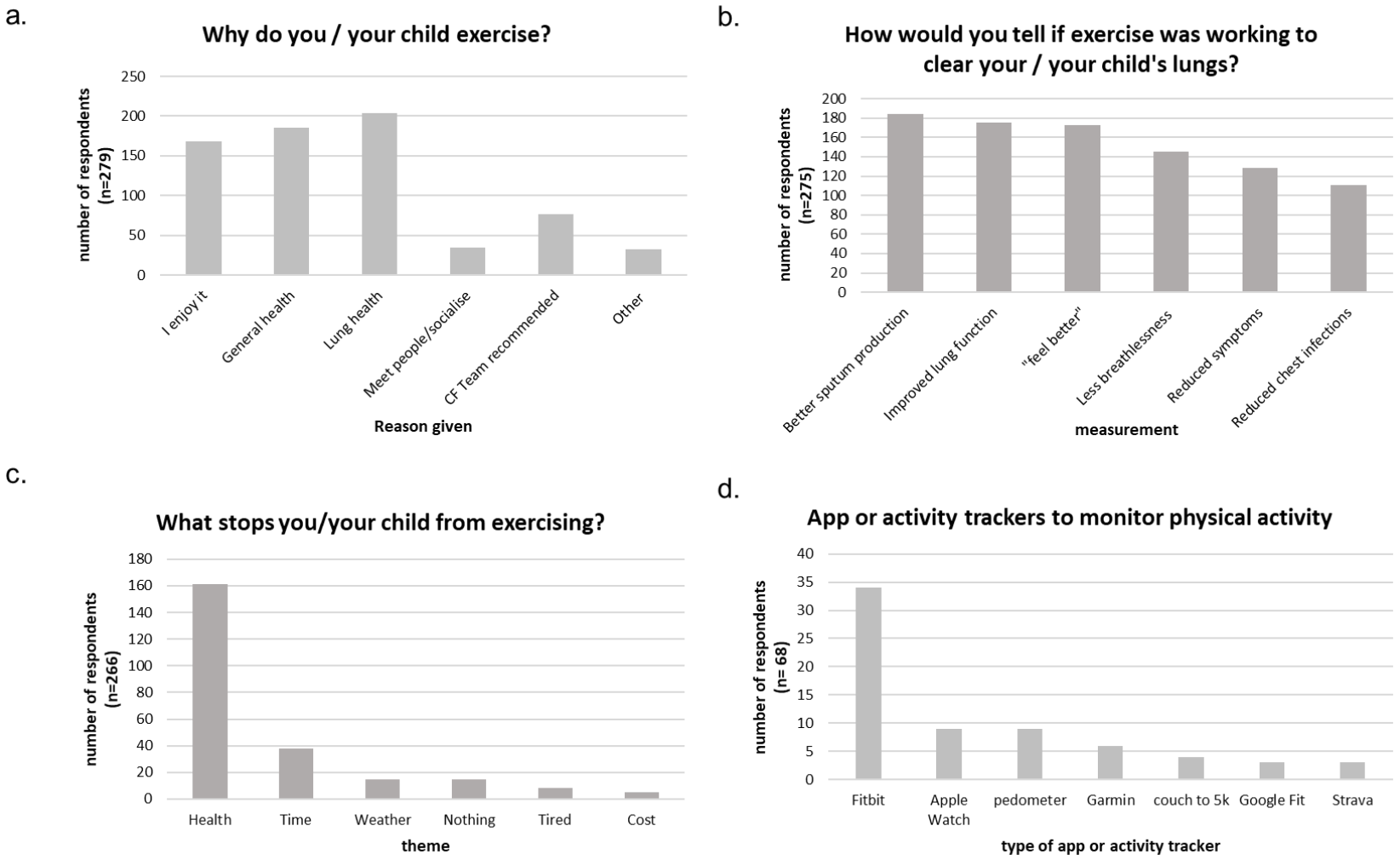
Figure 1. Current exercise habits and intensity in CF. a) The top five types of exercise currently undertaken by people with CF as indicated by the survey respondents. Corresponding exercise intensity with metabolic equivalence values (METs) (6) shown for each type of exercise. Cut offs for exercise intensity (in METs) were as follows: light = <3, moderate = 3-5.9, high = >6(6). **b)** Frequency of exercise undertaken at present by survey respondents. **c)** Intensity of exercise believed to be beneficial by HCPs.



People with CF do exercise for many reasons (figure 2a), with the most popular being for lung health (204/279, 73%) followed by general health (185/279, 66%) and enjoyment (168/279, 60%). Only two of 277 respondents felt that exercise does not help clear their lungs. Better sputum production (184/275, 67%), better lung function (175/275, 64%) and "feeling better" (173/275, 63%) were the top three ways that people with CF believe exercise is working to clear their lungs (figure 2b). Poor health (161/266, 61%), time (38/266, 14%) and weather (15/266, 6%) were the top three factors that stopped people with CF from exercising. Six percent (15/266) replied that nothing ever gets in the way of exercise (figure 2c).

Only 35% of respondents with CF (98/284) reported using an App or tracker to monitor physical activity and 68 reported the type of device used. Wearable devices were used by 85% (58/68) and Apps by 15% (10/68). Of the wearable devices, Fitbit™ was the most popular (figure 2d).

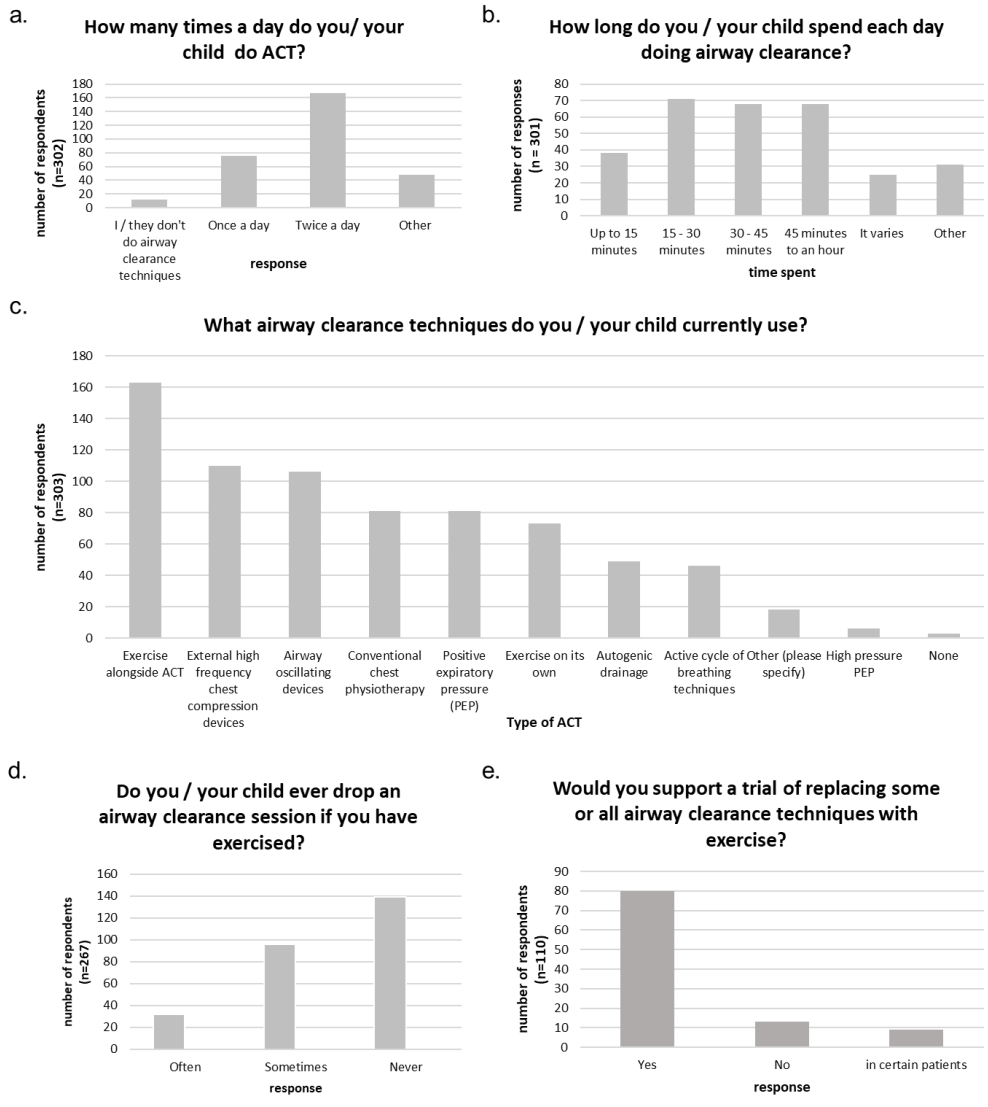
Figure 2. Drivers behind exercise. **a)** Reasons why people with CF exercise. **b)** Effects of exercise **c)** Factors that stop people with CF from exercising. **d)** Current app/technology use to aid exercise in people with CF..



Time spent on ACTs varied among respondents, with, on average, people with CF spending 30mins-one hour a day over two sessions (figure 3a and 3b) (range 0-3 hours a day over 0-5 sessions a day). Over half of people with CF (163/303, 54%) already incorporate exercise into their ACTs and almost a quarter (73/303, 24%) already do exercise alone for their ACT (figure 3c). Almost 60% (180/302) of respondents admit to skipping their ACTs, with "life", "how I feel" and "time" being the main explanatory themes given for this.

Almost half (128/267, 48%) of all respondents may drop their prescribed ACT if they have exercised (figure 3d) (including 49% (80/163) of those who incorporate exercise into their ACT). Nearly three quarters (80/110 , 73%) of HCPs would support a trial of replacing some or all airway clearance techniques with exercise, with an additional 8% (9/110) willing to consider supporting a trial in selected patients (figure 3d). Online supplement 3 shows trial suggestions collected from the CF community.

Figure 3. Current ACT practice and views on future trials. **a)** Average number of sessions spent daily on ACT. **b)** Average time spent daily on ACT. **c)** The use of exercise, ACT and combinations of the two in survey respondents. **d)** Numbers reporting dropping an ACT session when they have exercised. **e)** Support for a trial of replacing ACT with exercise.



DISCUSSION

Here we have explored current exercise use in people with CF and the influence it has on their ACT regimens. Most people with CF already incorporate exercise into their lives. Activity levels are higher than the general population. Around 20% of the UK population are classed as "inactive"(7) whereas only 4% of our CF population claimed to do no exercise. Almost half of people with CF regularly omit their prescribed ACT if they have exercised. This level of adherence is consistent with previous studies that have estimated adherence levels with CF physiotherapy to be 40-50%(8, 9) .

We found that most HCPs would support a trial replacing ACT with exercise. A recent Cochrane review looking at exercise for CF found 15 studies assessing the effect of exercise on people with CF but all included control groups who were not exercising rather than omitting any ACT (10). A systematic review comparing current clinical trials with the JLA top 10 did find two trials that loosely matched with "Can exercise replace physiotherapy?"(11). One is a feasibility study evaluating whether those who adhere to an exercise programme can then drop their ACT(12). The other is a crossover study looking at the effect of mucus clearance from exercise, ACT or sitting still(13). These studies aim to enrol small numbers (17 and 25 patients respectively) and results are, as yet, unpublished. A larger, adequately powered, multicentre trial is needed.

As with all anonymous online surveys, there are limitations. What people self-report and what they actually do can be quite different. However, an advantage of anonymity is that it allows respondents to be more honest without worry of repercussions. People with CF may be more conscious of things they can do to improve their health or it may be that the subsection of the CF population taking part in our survey are more interested in exercise, leading to response bias.

The data presented here will allow us to design clinical studies which will begin to answer the question of whether exercise can replace some ACT. Although most of our respondents were from the UK and US over a quarter were from elsewhere in the world. It is therefore reasonable to conclude that the themes and trends noted are applicable to the global CF population.

CONCLUSIONS

Many people with CF omit ACT if they have exercised. There is support amongst professionals for a trial of replacing current ACT with exercise.

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Declarations

Conflict of Interests Statement

NJR has given lectures at meetings sponsored by TEVA. AS has provided consultancy for Vertex and holds a current unrestricted research grant from Vertex. He has taken part in clinical trials sponsored by Vertex, Raptor and Insmed. He has given lectures at meetings sponsored by Teva and Vertex. GD has given lectures at meetings sponsored by Chiesi.

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Authors' contributions

All authors were involved in the study design process and contributed in preparation of the manuscript.

Appendix Table 1. Survey participant characteristics

Characteristic		n	%
Total survey participants		488	-
Category of Respondent			
Lay persons		335	69%
	Person with CF	194	(58%)
	A parent of a child or children with CF	130	(39%)
	Spouse or partner of a person with CF	2	(1%)
	Other relative or friend of a person with CF	9	(3%)
Professionals		153	31%
	Physiotherapist	93	61%
	Dietitian	22	14%
	Respiratory Paediatrician	11	7%
	Nurse	9	6%
	Researcher	5	3%
	Respiratory Physician	5	3%
	Pharmacist	2	1%
	Exercise therapist	2	1%
	Junior Doctor	1	1%
	Psychologist	1	1%
	Physiologist	1	1%
	Healthcare professional occupation unknown	1	1%
Geographical location			
UK		220	45%
North America		134	27%
Europe (non UK)		19	4%
Australia and New Zealand		7	1%
South America		1	-
Asia		1	-
Africa		1	-
Participant location unknown		105	22%

Age of survey participants	
Median age (all participants), years (range)	37 (14-74)
Median age of respondents with CF or those answering on their behalf, years (range)	15.5 (1-74)
Median age of respondents with CF (range)	33 (14-74)
Median age of people with CF whose parents or family answered on their behalf, years (range)	8 (1-33)

Appendix Table 2. Top 20 most popular exercise activities for people with CF

Activity	number of respondents	% of total respondents	Mets
Walking	91	34%	3.5
Run	86	32%	8
Swim	59	22%	8
Bike	53	20%	8
Team sports	48	18.%	8
Strength training	46	17%	8
Gym	40	15%	5.5
Trampolining	33	12%	4.5
Dance	31	12%	6.5
Yoga	26	10%	2.5
Gymnastics	19	7%	4
Martial Art	10	4%	10
HIIT	9	3%	8
Cross Fit	8	3%	8
Exercise Class	8	3%	6.5
Pilates	8	3%	3.5
Climbing	5	2%	11
Horse riding	4	2%	4
Rowing	4	2%	7
Skiing	4	2%	7

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