

ORIGINAL RESEARCH**Swimming pool-based exercise as pulmonary rehabilitation for COPD patients in primary care: feasibility and acceptability*****Susan Rae^a, Patrick White^b**^a Community Specialist Practitioner, Sydenham Green Group Practice, Sydenham, London, UK^b Senior Lecturer, Department of General Practice and Primary Care, King's College London School of Medicine, London, UK

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Abstract**Aim:** To assess the feasibility and acceptability of swimming pool-based exercise as pulmonary rehabilitation (PR) for COPD sufferers.**Method:** 101 patients with mild or moderate COPD registered with a South London general practice were invited to a swimming pool-based PR programme. Participants completed spirometry, the Chronic Respiratory Questionnaire (CRQ-SR), and the Incremental Shuttle Walk Test (ISWT) before and after the programme. A qualitative interview was used to assess participants' views.**Results:** 24 patients (24%) expressed interest; 18 were recruited and 16 (16%) completed the PR programme. Their mean age was 69 yrs, seven were female, and mean % predicted FEV1 was 59%. The mean number of sessions attended was 10.6 out of 12. Significant improvements in dyspnoea score (difference 4.9; 95% CI -8.27 to -1.48) and walking distance (difference 32 metres; 95% CI -52.63 to -11.36) were observed, and all other findings were in the direction of improvement. Most patients enjoyed being in the water, were happy to expose themselves in swimsuits, overcame their fears, valued learning about COPD and socialising with fellow sufferers, and were positive about their physical improvement.**Conclusion:** The swimming pool is a feasible and positive alternative venue for PR for COPD patients in primary care.

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Keywords COPD, pulmonary rehabilitation, exercise, swimming pool-based, feasibility, acceptability, primary health care**Introduction**

Pulmonary rehabilitation (PR) is one of the most effective interventions in improving quality of life in established chronic obstructive pulmonary disease (COPD).^{1,2} PR exercise usually consists of walking, cycling, gym work, or using weights to increase muscle mass. Gym-based exercises may be difficult for some patients with COPD – who tend to be mainly elderly and who may have other co-morbidities such as severe arthritis which may impair their ability to exercise at a high enough intensity. Experience in rheumatoid arthritis, heart failure, and fibromyalgia suggests that using water as the medium for exercise in PR may broaden its appeal, acceptability, and effectiveness.³⁻⁵ In Sweden, exercise in

water has been shown to induce a lower heart rate compared to the same exercise intensity on land.⁶ In a number of studies of hydro-therapy in a hospital setting, Kurabayashi and colleagues concluded that exercise in a hot spring-water pool may be useful in COPD.⁷⁻¹⁰ Exercise in water has characteristics that may make it beneficial in the elderly.^{11,12} These observations suggest that people with COPD may find exercise in water more suitable. Furthermore, in the UK, swimming pools may be more accessible venues for PR than gyms since they are open to the community.

In this study, therefore, we have assessed the feasibility and acceptability of using a swimming pool as the venue for PR exercise for COPD sufferers.

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Method

This was an observational study carried out in two separate groups run concurrently between January and March 2006. We used a mixed qualitative and quantitative approach. Response and participation rates were assessed, and changes were sought in lung function, exercise capacity, and quality of life. Interviews were conducted with participants to assess their views of the swimming pool-based programme.

Setting

One-hundred-and-one patients with mild to moderate COPD (NICE Guidelines criteria) were identified from the practice computer disease register; they were invited by letter to attend for interview, to learn about the project, and to be assessed for their suitability to take part – including suitability for spirometry assessment.¹³ A stamped addressed reply envelope was provided. Respondents were offered an appointment by telephone. There was no upper age limit but patients were excluded if: they had severe COPD or were on long term oxygen therapy; had cardiac or neurological problems that would interfere with their ability to exercise; or suffered oxygen desaturation to the level of 85% or lower whilst participating in the baseline exercise capacity test. At interview eligible patients who were willing to participate gave informed consent and were offered a second appointment at which baseline assessment was carried out including: self-reported respiratory specific quality of life (CRQ-SR); oxygen saturation measurement (Nonin Onyx, Nonin Medical, model 9500); and Incremental Shuttle Walk Test (ISWT).^{14,15}

Swimming pool-based exercise programme

This was a pulmonary rehabilitation programme of 12 sessions of exercise over six weeks (two sessions per week), which included education and social interaction. Participants were divided into two groups of nine and the two groups ran concurrently. A warm-up session was provided on land at the beginning of each exercise programme based on the British Lung Foundation (BLF) exercise diary.¹⁶ Participants then changed into swimming costumes and entered the pool to complete a half-hour exercise session. The pool temperature was 29° centigrade, the standard leisure use temperature. After a further warm-up in the pool, exercises were adapted to individual participants' capacities and included upper and lower limb exercises, resistance exercises using elevation and movement against water, and endurance. A cool-down exercise was undertaken at the end. An education session covering a range of topics including disease pathology, self-management, treatment, diet, breathing techniques, energy conservation, and relaxation, was given after each exercise session. Education was provided by a multidisciplinary team including a physiotherapist, doctor, specialist nurses and exercise instructor. Participants were encouraged to exercise

at home in line with their individual capacities. The BLF diary was used to record their activities at home.

At the end of the final exercise session a group evaluation was conducted for each group. The group discussions were audio taped. Three questions were asked: What were the best things about the course? What was liked least about the course? What could be done differently? The interview was semi-structured with questions on perception of value of the course, swimming as exercise, participation in group activity in a swimming costume, role of education, and role of social interaction. Participants were given an appointment to attend the surgery within two weeks to repeat the shuttle walk test, the CRQ-SR, spirometry, and to complete an individual taped evaluation interview.

Analysis

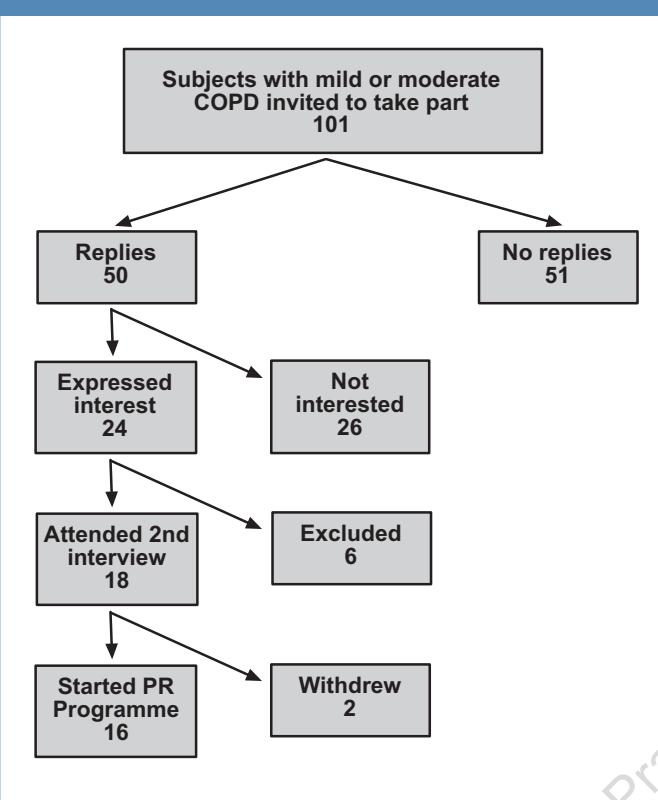
The feasibility of swimming as the exercise part of the PR was assessed from the recruitment rates, participation throughout the PR programme, and from the views of the participants before and after the programme. Participants' suitability was assessed from their lung function (electronic spirometry) and respiratory specific quality of life questionnaire responses. The questionnaire assessed four domains – dyspnoea, fatigue, emotion and mastery. The results are presented as mean scores per question in each dimension. The threshold for a clinically significant change for each dimension has been previously identified as 0.5.¹⁷ Qualitative interviews conducted after the programme were audio taped, transcribed and analysed using the Framework Approach.¹⁸ Initial thematic analysis was conducted by SR. Transcripts were then read independently by PW and the themes verified.

Results

Twenty-four patients (24%) expressed an interest in taking part. Twenty-six (26%) did not wish to take part. Replies were not received from the remainder (50%). Six of the 24 were excluded. Four did not meet the criteria for inclusion, one dropped out at first interview, and one was admitted to hospital. Eighteen subjects started the project, but two dropped out after the interview and assessments, leaving 16 participants (7 female) to start the PR program. The process of recruiting is shown in Figure 1. Mean age was 68.9 years (57-85). Mean forced expiratory volume in the first second (FEV1)% predicted was 58.5% (range 41-74; standard deviation 11.6). Mean FEV1/forced vital capacity (FEV1/FVC) was 0.57 (0.44-0.70; 8.7). The mean number of sessions attended was 10.6 (4-13; 2.6). The participants were randomly assigned to two groups; the first group consisted of 3 females and 5 males (mean age 67.5 years) and the second 4 females and 4 males (mean age 71.6 years).

There were significant improvements in dyspnoea scores and walking distance between the beginning and end of the

Figure 1. Flow diagram of recruitment to study of swimming pool-based exercise for pulmonary rehabilitation



project (Table 1). All other measures were in the direction of improvement.

Interview data/views of the participants.

Being in the water - Most people who took part in the PR programme enjoyed being in the water because of the freedom the water gave them compared to the exercise they were doing on land (the warm-up), the feeling of weightlessness, and the ease of exercising in the water.

"Umm, well actually I suppose it was the camaraderie in the water, the social side, but apart from that, it didn't seem so strenuous to have to do the exercise, the exercise that we done in the water like stretching and things like that, you know, the water seems to take the weight." (Male, aged 74).

"The buoyancy, the way the umm, all your pains went away, you know, and umm, cause especially with my hip and my wrist, I found that the arthritis was gone, you know." (Female, aged 73).

Exposure in a swimsuit - Trepidation about getting into a swimming costume or a swimming pool after many years was not borne out by the experience.

"At first I was very embarrassed because I haven't been swimming, the last time I went swimming I think was when I was about 23, and I had quite a nice trim body (both laughing), so yes, I was embarrassed the first time, with all me blabber hanging around, and that yes, but after that it was fine." (Female, aged 58).
"I am not a body beautiful and all that, I am not a nice sight sometimes with the scars and things but then again you know, as long as a lot of people don't mind, I don't mind." (Male, aged 79).

"No problem, to start off with, I mean, when I got me bathing costume and I put it on and I looked at myself in the mirror, I thought no way, people would see me looking like that but then when I did put it on, and I went down to the water and I saw what other people looked like, I thought, no problem." (Female, aged 73).

Fear of the water - A few of the participants who had a fear of the water before they started the course overcame these fears.

"Umm, exercise is very good, swimming, very good but I panic a bit, I still do, occasionally, I mean, I did yesterday."

Table 1. Outcome of pulmonary rehabilitation using a swimming pool-based exercise programme (paired t-tests; n=16).

	Before	After	Difference	95% confidence interval
FEV ₁	1.6	1.6	-0.03	- 0.16 to - 0.1
FEV ₁ /FVC	2.8	2.9	-1.58	- 0.34 to 0.02
Quality of life (CRQ-SR)				
Dyspnoea	15.6	20.3	-4.9	- 8.27 to - 1.48
Emotion	30.5	34.5	-4.31	- 10.56 to 1.94
Fatigue	14.9	16.8	-1.88	- 4.63 to 0.88
Mastery	17.8	20.2	-2.44	- 6.19 to 1.31
ISWT * (n=15)	292	324	-32.00	-52.63 to -11.36

*One of the participants had injured his back, could not complete the ISWT following the PR program and was excluded from this element of the analysis.

Six months after the end of the programme 8 participants continued to swim twice-weekly at the leisure centre.

"Yes, yes it does, I mean when I first went, I couldn't put my face in the water, but now I can put my head in the water." (Female, aged 68)

"I used to swim before the course but I stopped because I had a bad chest I panicked in the water." (Male, aged 78).

Education - the educational component of PR was acknowledged as a useful element.

"Only if you get all you know, excited and something when your breathing is bad is to more or less sit and breathe very steady like." (Female, aged 73).

"I think I could cope with it having listened to different talks that we had and I can cope with it in as much as now I wouldn't panic, whereas before I would probably get all scared and start doing silly breaths instead of deep breaths but umm, I don't think I would have any problems, no." (Female, aged 73).

"Umm, I enjoyed, as I said earlier about being told how to breathe correctly and to do these exercises, I mean, it was very informative and I really feel that lots of other people will benefit by this." (Male, aged 59).

Socialising - Meeting others with COPD benefited most participants.

"Well because you can talk about it different things that we didn't know before, go over, I think one says, "oh I didn't realise that", you can, you know, one remembers one thing and somebody else would remember something else, that was quite good." (Female, aged 73).

"You find that there is other people with the same problems as you, you are able to talk to each other about them, and it makes you feel less isolated, umm, you know, that sort of thing" (Female, aged 58).

"Yes I did, I mean it just proved to me, I mean, cause it's very isolating, I mean, you go to your doctor, your doctor says you got this, what's that, and you go away and you are kind of, you are on your own, you have got your friends that you socialise with and they don't talk about it, you don't talk about it and suddenly you are thrown with 8 or 10 other people who are suffering the same as you are, yes I enjoyed that, I think that's very important for fellow sufferers especially if they are local because we are all local too actually, you can see them bonding and they are still bonding today." (Male, aged 59).

Impact on well being - Many reported an improvement in physical well being.

"Oh I feel a lot better physically, yes; at least I don't get so tired." (Male, aged 74).

"I feel fitter and brighter." (Male, aged 78).

"I still need the medication, I have felt ever such a lot

better with me breathing, I walk about the house more, and I walk up and down stairs more." (Female, aged 73).

"A bit more energy, a bit more awake." (Female, aged 58).

"Even after the first day, I was feeling I had been using something that I hadn't use in yonks." (Male, aged 64).

Discussion

This study shows that a swimming pool is a feasible and acceptable venue for the exercise component of pulmonary rehabilitation for patients with mild or moderate COPD in primary care. One in six primary care patients with mild or moderate COPD from one general practice completed the swimming pool-based exercise programme after one in four patients had expressed interest in the programme. Significant improvement in dyspnoea scores and walking distance were observed and all other findings were in the direction of improvement. All participants evaluated the programme as good or very good. They enjoyed meeting other people with COPD, learnt more about their condition, and felt better about it. Half of the people who attended had continued to exercise in water twice-weekly six months after the programme ended.

This study was conducted in one large general practice in the UK. The findings cannot be generalised to all primary care teams. However, one of the strengths of this feasibility study lies in the inclusion of all patients with mild or moderate COPD on the practice's COPD register and the use of the local swimming pool. The conduct of the full range of interventions and assessments normally used in studies of pulmonary rehabilitation confirm the suitability of this approach for a clinical trial. It is not known if the participation rate was more or less than might be expected in conventional pulmonary rehabilitation in such a population. There is no comparable study of pulmonary rehabilitation offered to every subject with mild or moderate COPD on a practice's list. Jones *et al* recruited 14 (47%) of 30 subjects (FEV₁ less than 60% predicted) who were more severely affected than subjects in this study.¹⁹ In an even more severely affected group (FEV₁ 30-50% predicted) Ward *et al* recruited 28 of 34 subjects invited of whom 27 (79%) completed the programme.²⁰ In neither of these studies were all potentially suitable subjects identified from the participating practices' registers and used as the baseline denominator.

The inclusion of a qualitative study of the experience of participants is a notable strength of this study. The standard components of pulmonary rehabilitation (exercise, education, and social interaction) were well received. The exceptional circumstances of the exercise, including exercise in swimming costumes in a group, entry into the water, and immersion in

water, were all welcomed and noted as significant elements of the sense of achievement associated with participation.

The effect of exercise in a swimming pool was not compared with conventional pulmonary rehabilitation. However, the significant improvement in dyspnoea score after the programme, and the positive trend in all the evaluations support the conduct of a rigorous randomised controlled trial of swimming pool-based pulmonary rehabilitation.

There is a growing interest in PR in primary care and this study confirms the potential for recruiting subjects with mild and moderate COPD. The evidence of benefit from PR in COPD is undisputed. Early intervention may be important in improving quality of life and education about this chronic disease. However, there is a relatively poor understanding of the particular role of the exercise component, the elements of exercise that are essential to maximising the effect of PR, and how those elements can be interchanged with other approaches or modified by them.²¹⁻²³ A small body of research has examined the physiological effects of exercise in water for people with respiratory diseases.^{6,10} Reported benefits need to be assessed in greater depth, but they are supported by the findings of this study.

In summary, exercise in water is a feasible alternative form of pulmonary rehabilitation for sufferers of mild to moderate COPD in primary care.

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Ethical Approval

Ethical approval was given by The Lewisham Hospital NHS Trust Research Ethics Committee.

Competing interests

None declared.

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