Home-Based Physical Activity Program with Health Coaching for participants with Chronic Obstructive Pulmonary Disease in Sweden, A Pilot Study

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Abstract

**Background:** Home-based interventions are at the center stage of current healthcare demands. There is a clear need to translate pulmonary rehabilitation to a home-based setting. This 8-week pilot study aimed to determine the feasibility of a Home-based Physical Activity (HPA) program for 12 participants with Chronic Obstructive Pulmonary Disease (COPD) in Sweden.

**Methods:** Patients with COPD, age 40 years or older, and clinically stable in the last 3 months were recruited. The program included the use of a fitness tracker to monitor step count, weekly health coaching calls using motivational interviewing, and video-guided mindful movements (tai chi and yoga exercises).

The outcome measures were adherence to the eight-week program video-guided exercises (number of times videos were watched), adherence to health coaching calls (minimum 8), monthly and daily step count, and quality of life (QoL) using the Chronic Respiratory Questionnaire, (CRQ).

**Results:** Thirteen participants were enrolled, and one participant dropped out. Twelve participants adhered to 8-weeks of health coaching calls and step monitoring. We had a total of 643 video-exercise views, the compliance exceeded the minimum standard (576 views).

The mean difference comparing total monthly steps from baseline and the eight-week time point was 47039 steps (CI – 113625-1623.5, p=0.06). The minimal clinical improvement of 500 daily steps was found for 8 of the patients. No significant improvement was found in the QoL measures and mental health.

**Conclusions:** We found the HPA program to be a feasible intervention. Patients showed high adherence to tracking step counts, health coaching calls, and video-guided exercise. No improvements in QoL or monthly step count emerged, however, we found high compliance and a positive trend in the number of monthly step counts, and improvements of at least 500 daily step counts improved in most patients with this small sample size.

**Background**

Chronic Obstructive Pulmonary Disease (COPD) is among the most common chronic respiratory diseases (1). Regarding COPD, the World Health Organization statistics indicate around 65 million individuals have the disease (2). Globally COPD is suggested to be the top third death cause in 2030 (2). COPD is a leading cause of death and disability in high, medium, and low-income countries, and using pulmonary rehabilitation as an integral, non-pharmacological component is important in the disease management (3). COPD is a progressive lung disease that makes breathing difficult. COPD usually worsens over time and eventually may make it difficult for people to carry out regular, simple daily activities, such as walking or taking care of themselves.

Pulmonary rehabilitation (PR) is an intervention that combines the promotion of regular physical activity and self-management (4–6) (7, 8) to maintaining health and functionality in COPD patients (9, 10). It is
regarded as an essential component of care for people with COPD and is supported by strong scientific evidence (11). Among patients with COPD, a sedentary lifestyle significantly increases mortality and is a significant risk factor for exacerbation of COPD (12). COPD patients are less physically active than other populations (13, 14) (8) and regular aerobic physical activity is associated with improved health, lower risk for admissions, and lower mortality (1, 2). The low-intensity physical activity has showed less risk of COPD-related hospitalizations (15).

Despite the proven efficacy of PR, its adoption remains low. Only 20% of eligible outpatients and 2% of COPD patients post-hospitalization for exacerbation attend center-based PR (16–18). In Sweden, only 36% of COPD patients report having sufficient physical activity levels (30 minutes per day and 5–7 days a week) (19). The majority of primary care health clinics (92%) have a physical and respiratory therapist but few (25%) report having access to PR (20). The availability of PR is even lower in-hospital care and community health care in Sweden (21). Additionally, during pandemic times COPD patients avoid visiting health care units.

Transportation, accessibility, and physical and emotional frailty are the main barriers to adoption and adherence to the current center-based PR (22, 23). A home-based approach can potentially offer health benefits without the aggregated risk of exposure (24). Health care systems must adapt to the increased need for telehealth options in the COPD management (24). Multiple randomized trials have shown telehealth and virtual visits to be non-inferior to usual care regarding the prevention of exacerbations, hospitalizations, and improvements in QoL (25–29). Online and home-based PR programs seem to have a similar effect to in-person sessions (18, 30, 31) (24, 32).

Health coaching is increasingly used in home-based lifestyle programs (33). Health coaching has demonstrated effectiveness in facilitating patient improvement in various aspects of health by affecting patients’ knowledge, skill, self-efficacy, and behavior change (34–37). Health coaching can utilize motivational interviewing and goal setting to empowers patients to take on an active role in managing their health conditions and making important health behavior changes.

To be able to translate PR to current real-life conditions, there is a need for more home-based programs (38). Home-based programs have shown to be well-tolerated, accepted, and adopted by patients and improve the QoL (39). Additionally, several small studies suggest that COPD patients can utilize electronic monitors and computing technology to support their exercise regimen (24, 40, 41). This novel Home-based Physical Activity (HPA) program is based on integrative movement techniques (Tai Chi and yoga), to create equality in health so it can easily be available to everyone in a home-based setting. The HPA program allows COPD participants to perform physical activity at home and promote behavior change through health coaching that leads to a more active lifestyle. Our goal was to determine the feasibility of the HPA program with COPD patients in Sweden and determine its impact on disease-specific QoL and step count.

**Methods**
Study design

We performed an 8-week pilot study that evaluated both process and scientific feasibility (42) to a novel HPA program on COPD participants in Sweden. Based on an earlier feasibility study in the US (16) a sample size of 10+ is sufficient to evaluate the feasibility of implementing an intervention program. This pilot study preceded the future randomized control trial, Trial registration: Clinical trials NCT04820257, date 29/03/2021.

Selection and Enrollment of Participants

The target population consisted of participants diagnosed with COPD receiving outpatient care at university hospitals referred by healthcare staff, healthcare units, recruitment websites, primary care units, and lung facilities in Stockholm, Sweden. Written and oral informed consent was collected from all participants before enrolment. The consent includes permission to publish research results. All data were treated in accordance with the Swedish Personal Data Act.

Inclusion Criteria

All voluntary participants (N = 13) met the inclusion criteria to participate in this study. All genders, age 40 years and older; FEV1 < 80% (forced expiratory volume in one second) as documented by pulmonary function; medical diagnosis of COPD; access to a smartphone or computer tablet with internet connection.

Exclusion Criteria

Patients were excluded if they were unable to perform a low-intensity exercise; inability to follow commands (participants with disorientation or severe neurologic or psychiatric condition). Any additional chronic diseases with potential safety implications were evaluated individually for each participant.

Intervention with video guided exercise practice

The participants completed video-guided exercises for 8 weeks. The program was based on tai chi and yoga movements with pursed-lip breathing and yogic breathing techniques. Participants were instructed to complete one flexibility and two balance practices per day (approximately a minimum of 24 minutes daily, 6 days per week) they could also choose to practice a pre-recorded 55-minute yoga program including basic yoga evaluated previously for COPD participants (43). The selected exercises coordinated movements with breaths to benefit the strength and flexibility of the thorax thus improving pulmonary function and breathing. The exercise videos are based on previous studies adapted to COPD (39, 43). The two Tai chi-based exercise practices involved flexibility and balance. The twelve-minute flexibility practice (10 movements) includes upper extremities and trunk movement (performed either seated or standing). The balance practice included mindful walking for six minutes. The yoga exercises used both standing and sitting poses and breathing exercises with emphasis on extended exhalation, props were used as chairs and blocks.
Please see the full version of the video guided tai chi and yoga exercise programs available online (44).

**Intervention with fitness tracker**

For the daily step count an activity monitor was worn (Garmin vivofit 4, Garmin, Schaffhausen, Switzerland) for 8 weeks. This was synced via blue tooth to an app (connect) on the participant's smartphone. An account was created with de-identified data using the participant’s study ID for the health coaches and participants to review. The health coach reviewed the daily step data from the online fitness tracker activity monitoring system (data were on duration, frequency, and time of the walking) and discussed this information with participant in the health coaching call.

**Intervention Health Coaching**

The participants received a scheduled weekly health coaching call during the 8 weeks. The health coaching sessions were designed to increase awareness of the physical activities completed and ignite inner motivation for healthy behaviors.

Each participant was asked in the first health coaching call to define a particular place and time in which they can perform the video-guided exercises and walk. The calls were structured using motivational interviewing and followed the protocol published by Benzo et. al (34). Collaboratively, goals for exercise practice (walking and the videos) for the following week were set, based on the information gathered and participants' personal preferences. Health coaching calls lasted from 10 to 30 minutes. Adherence was considered when the participant completed eight phone calls with a health coach.

**Potential risks**

Risk associated with completing the daily routine was minimal to low with the exercises being of low intensity. Other report no morbidity or mortality after a similar program that is investigated here (16).

**Outcomes**

We considered the feasibility measures to be the adherence rate, defined by the completion of 8 weeks of health coaching, the drop-out rate, the use of the fitness tracker, and the compliance to the video-guided exercises.

**Questionnaires**

Participants’ measures were completed before and after the 8-week intervention. Demographic and patient characteristic information was retrieved at baseline. Two measures were used to assess general health. A Visual Analog Scale was used ranging from 0—to 100, a higher number indicated better health. The second tool to report perceived health used one question – how do you perceive your health today? with 4 options, very high/high/moderate/low/very low.

The Chronic Respiratory Disease Questionnaire Self-Administered Standardized (CRQ-SAS) was used to measure QoL in individuals with chronic obstructive lung disease (45). CRQ-SAS consists of 20 items across four dimensions (dyspnea, fatigue, emotion, mastery).
Dyspnea in daily living is evaluated by the modified Medical Research Council Scale (mMRC) (46, 47). A higher score indicates more dyspnea (0–4). Is usually divided 0–2, 3–4.

COPD Assessment Test (CAT) is a 5-item questionnaire (range 0–40, higher score worse dyspnea) (48). It is designed to measure the impact of COPD on a patient’s life.

Mental health was measured using the Generalized Anxiety Disorder 7-item scale (GAD-7) (49). It measures the severity of generalized anxiety disorder (scoring from 0 (not at all) to 3 (daily), with a total score of 0–21). The cut-off for mild anxiety is 5, 10 for intermediate, and 15 for severe anxiety. A score above 10 is usually indicating anxiety.

**Data collection and management**

The total monthly steps were collected from all 12 participants during the first and second months. The daily step count from the fitness tracker website (Garmin.com) was imported and stored encrypted and de-identified into a secure computer. The fitness tracker account had the participant’s ID and prevented personal information to be disclosed, and the number of steps was securely stored. The fitness tracker was worn on the wrist. The participants were informed that the tracker is waterproof and does not need to be removed during the 8-week intervention. We informed the participants that if they walked holding a purse, walking stick, or shopping cart their steps could be inaccurate. The paper questionnaires were mailed to the participants and were handled and de-identified by the principal investigator (M.P) for data entry. The health coaching calls used mobile phones and were not recorded.

**Statistics**

The difference between total monthly steps for the two-time points (first month and the second month) were not normally distributed. Therefore, the non-parametric Wilcoxon test was used. All the average differences were calculated from 8-week scores minus baseline scores. The average difference between the time points was divided by 28 days (4 weeks) to get a daily difference for each participant. The CRQ scores were normally distributed thus a paired t-test was used to see if there is a significant difference between time points, R Core Team (2021). The Shapiro-Wilk method was used to test for normality. CAT and mMRC were skewed therefore we used the Wilcoxon test. The level of significance was set at $p \leq 0.05$. All analyses were performed using STATA 14 (Stata Corp, TX, USA) and R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing (Vienna, Austria, https://www.R-project.org)

**Results**

In total 13 eligible participants were enrolled through queries from September to December 2021 and 12 participants completed 8 weeks (Fig. 1).

The baseline and 8-week parameters are shown in Table 1. The drop-out rate was 7.6% (one patient). All participants that started the program completed 8 weeks of health coaching calls (minimum 8) and used
the fitness tracker. The compliance to the video-guided exercise was determined by the number of times the videos were watched on the online platform (KI play- link). We advised the participants to engage in the program 6 days per week, a total of 48 days of completing the video-guided exercises. Based on our recommendation, we expected to have at least 576 views. Our data shows a total of 643 views (excluding pursed-lip breathing) (Table 2) exceeding our minimum standard.

Additionally, changes from baseline to follow-up (8 weeks) in QoL are shown in Table 3. Perceived health, mMRC, CAT, and GAD scores are shown in Table 4. Total monthly steps were analyzed (Table 5), we averaged the steps during the first 4-weeks of intervention to compare to the second 4-week period (total 8-weeks). Individual monthly step counts for each participant are shown in Fig. 2. Eight out of twelve participants improved at least 500 daily steps after 8-weeks.

### Table 1
Baseline and 8-week parameters in COPD participants performing home-based pulmonary rehabilitation (N = 12)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>8 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender F/M</td>
<td>8/4</td>
<td></td>
</tr>
<tr>
<td>Age years, median (range)</td>
<td>70.5 (55–83)</td>
<td></td>
</tr>
<tr>
<td>COPD school, Yes/No</td>
<td>3/9</td>
<td>3/9</td>
</tr>
<tr>
<td>Perceived health</td>
<td>0/7/2/3</td>
<td>2/6/2/2</td>
</tr>
<tr>
<td>very high/high/moderate/low/very low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self rated health (VAS) mean, median (range) *</td>
<td>66.8, 68.5 (45–91)</td>
<td>65.2, 71 (40–85)</td>
</tr>
<tr>
<td>No smoking habits/former smoker/ current smoker, n</td>
<td>12 /11/0</td>
<td>12 /11/0</td>
</tr>
<tr>
<td>Alcohol use, every day/once a week/once a month/once a year/less than once a year/no alcohol, n</td>
<td>3/5/3/0/0/1</td>
<td>3/4/4/0/0/1</td>
</tr>
<tr>
<td>Number of participants taking more than 3 medications, n</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>mMRC numbers for code value: 0/1/2/3/4, n</td>
<td>0/5/3/2/2</td>
<td>0/8/1/2/1</td>
</tr>
<tr>
<td>CAT mean, median (range)</td>
<td>14.7,15 (5–24)</td>
<td>13.2, 12.5 (5–24)</td>
</tr>
</tbody>
</table>

F = female, M = male; mMRC = Modified Medical Research Council Scale, CAT = COPD assessment test. * 100 = maximal health
Table 2
Compliance with video-guided exercises during the 8-week intervention, in participants with COPD (N = 12)

<table>
<thead>
<tr>
<th>Type of exercise</th>
<th>Number of times video was watched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seated and standing flexibility</td>
<td>316</td>
</tr>
<tr>
<td>Pursed lip breathing</td>
<td>80</td>
</tr>
<tr>
<td>Balance practice</td>
<td>187</td>
</tr>
<tr>
<td>Yoga program</td>
<td>140</td>
</tr>
<tr>
<td>Total views */expected views</td>
<td>643/576</td>
</tr>
</tbody>
</table>

*Excluding pursed-lip that is a breathing exercise

Table 3
Baseline and 8 weeks data on Quality of life (QoL) using Chronic Respiratory Disease Questionnaire (CRQ), in participants with COPD (N = 12).

<table>
<thead>
<tr>
<th>CRQ</th>
<th>Baseline Average (SD)</th>
<th>8-week Average (SD)</th>
<th>Average Difference</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnea</td>
<td>5.31 (1.91)</td>
<td>5.48 (1.53)</td>
<td>0.17</td>
<td>(-0.41, 0.76)</td>
<td>0.53</td>
</tr>
<tr>
<td>Fatigue</td>
<td>4.48 (1.91)</td>
<td>4.27 (1.53)</td>
<td>-0.21</td>
<td>(-0.93, 0.52)</td>
<td>0.54</td>
</tr>
<tr>
<td>Emotion</td>
<td>4.87 (1.91)</td>
<td>5.11 (1.53)</td>
<td>0.24</td>
<td>(-0.43, 0.9)</td>
<td>0.45</td>
</tr>
<tr>
<td>Mastery</td>
<td>5.71 (1.91)</td>
<td>5.79 (1.53)</td>
<td>0.08</td>
<td>(-0.76, 0.93)</td>
<td>0.83</td>
</tr>
<tr>
<td>Total</td>
<td>5.03 (1.91)</td>
<td>5.17 (1.53)</td>
<td>0.14</td>
<td>(-0.46, 0.73)</td>
<td>0.62</td>
</tr>
</tbody>
</table>

* average differences were calculated from 8-week scores minus baseline scores
Table 4
Perceived Health, dyspnea, anxiety, and depression baseline and after the 8-week intervention in participants with COPD (N = 12)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Baseline</th>
<th>8-week</th>
<th>Average difference</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived health</td>
<td>0/7/2/3</td>
<td>2/6/2/2</td>
<td>-0.08</td>
<td>-0.87, 0.70</td>
<td>0.82</td>
</tr>
<tr>
<td>very high /high/ moderate/ low/very low</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-rated health (VAS) mean, median (range)</td>
<td>66.8, 68.5 (45–91)</td>
<td>65.2, 71 (40–85)</td>
<td>1.58</td>
<td>-4.85, 8.01</td>
<td>0.60</td>
</tr>
<tr>
<td>mMRC scores: 0/1/2/3/4</td>
<td>0/5/3/2/2</td>
<td>0/8/1/2/1</td>
<td>0.42</td>
<td>-0.16, 0.99</td>
<td>0.08</td>
</tr>
<tr>
<td>CAT mean, median (range)</td>
<td>14.7, 15 (5–24)</td>
<td>13.2, 12.5 (5–24)</td>
<td>1.50</td>
<td>-1.41, 4.41</td>
<td>0.66</td>
</tr>
<tr>
<td>GAD total score mean, median (range)</td>
<td>3.5, 2.5 (0–9)</td>
<td>2.6, 3 (0–6)</td>
<td>0.92</td>
<td>-0.70, 2.53</td>
<td>0.24</td>
</tr>
</tbody>
</table>

* average differences were calculated from 8-week scores minus baseline scores

Table 5
Average monthly step count in participants (N = 12) with COPD

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Month 1 Average (SD)</th>
<th>8-week Average (SD)</th>
<th>Average Difference</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Monthly Steps</td>
<td>136348 (80429)</td>
<td>183387 (108983)</td>
<td>47039</td>
<td>(-113625, 1623.5)</td>
<td>0.06</td>
</tr>
</tbody>
</table>

* average differences were calculated from 8-week scores minus baseline scores

Discussion

In this study, we evaluated the feasibility of a novel HPA for COPD patients in Sweden. The intervention was feasible with respect to adherence to the health coaching calls, tracking steps, and the video-guided exercise. The HPA had a low dropout rate given that 12 out of 13 participants completed the program. A positive trend in the monthly steps count was found.

Aligning with current publications we believe that remote monitoring by the health coach and self-monitoring may influence participants to be more physically active (33). Regular feedback on a participant daily's step count is central to the self-awareness that leads to behavior change and
appropriate coaching (8, 12, 50). In this pilot there were no significant changes in QoL, step counts, self-rated health, and mental health that could be related to power. Others report with larger samples, improvement and maintenance of daily step counts in COPD (51). The difference between the total steps in the first month compared to the second month showed an upward trend but did not reach statistical significance. However not significant, we observed a recommended minimal clinical improvement in steps in eight out of twelve participants based on a 500 steps cutoff (52, 53). Larger studies demonstrated a significant increase in the daily steps of COPD participants with the use of a pedometer together with health coaching, using individualized goals and personalized motivational messages (12, 54, 55). The daily number of steps is the most sensitive measure of physical activity in COPD participants.

We had based our home-based intervention on the Mindful Breathing Laboratory at Mayo Clinic exercise videos that are currently and previously used in their trials (blinded for review authors 2022). A more comprehensive home-based PR program recently published (blinded for review authors 2021) has shown effective improvements in QoL in COPD patients (blinded for review authors, 2021). Other comprehensive studies support our hypothesis that low-intensity exercise can improve health outcomes in COPD. The Copenhagen City Heart Study found that subjects reporting low levels of exercise (light physical activity for 2 hours a week), compared to very low levels of exercise (none) had a significantly lower risk of COPD admissions and mortality (9). In the context of the COVID-19 pandemic, a home-based program, like the one tested in this pilot, may alleviate the accessibility barrier of center-based PR and allow these vulnerable patients to gain the benefit from practicing regular physical activity without an additional risk from exposure to COVID-19 infection.

**Strengths And Limitations**

The study has several limitations that should be acknowledged. The health care providers were collaborators and did not receive any extra time to be involved in the health coaching which could have limited the intervention delivery.

Regarding the recruitment of the participants, we used mainly online platforms, and we assume the sample was wide.

Most of the coaches had valid MI training however some of the coaches were not certified. Coaches were invited to lectures, and workshops and provided reading material by the Mindful Breathing Laboratory at Mayo clinic, but no evaluation was determined, and no fidelity process of the health coaching was done.

The delivery of the questionnaires could have been improved with a link that can easily be accessed and filled in online to speed up the process, this is required in further larger studies. However, a strength is that the questionnaire battery validated but not extensive, and a maximum of 15 minutes was to complete it.

The tracker was liked due to its small size and ease to handle, however, some did not like the aesthetic look of it and perhaps did not wear it during special occasions. We suggest the use of a mobile apps in
further studies targeting COPD patients, as we had a good experience with the fitness tracker mobile app.

The season was commonly reported as a barrier by participants, the colder weather limited them from being more active outside of their homes. We believe that a limitation in this procedure was starting the intervention in the fall of 2021 and ending in wintertime when for climate reasons, participants were spending less time outdoors.

Regarding the exercise videos, they have the audio in English and subtitled in Swedish which created a language barrier for some participants and difficulties to read while doing the movements. This might have been a hindering factor that made their decision not to continue the practice. Some of the participants did not like the videos and preferred to do their exercises mainly by walking outside. Further research should include exercise videos in Swedish to hopefully create even higher engagement and this is planned in an upcoming RCT.

We suggest continuing this line of research with the home-based approach in future trials with a larger sample.

In all, this HPA program is feasible for participants with COPD in Sweden. This is a novel intervention that opens the field to implementing more home-based exercise options for patients with COPD. We suggest further research on different types of home-based exercise programs for this patient population. We acknowledge several limitations of this pilot and with this preliminary data, future research interventions could be informed.

**Conclusions**

This HPA program was found to be a feasible intervention. Patients showed high adherence to coaching calls, video-guided exercise, and tracking of step counts. However, since pilot design, no improvements in QoL and monthly step counts emerged. Nevertheless, we found a positive trend in monthly step counts. This scientific feasibility study might provide valuable information as we have described in the limitations for further research and implementation of self-management home-based programs.

**Declarations**

**Ethics approval and consent to participate**

Ethics approval was attained from the regional ethical review authority in Uppsala, Sweden number DNR 2021-01151. All participants signed consent and received oral and written information about the study. All methods were performed in accordance with the relevant guidelines and regulations (Declaration of Helsinki). Researchers included in the consent form permission to disseminate and publish the study results using de-identified data. All participants agreed to this clause.

**Consent for publication**
Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to the small sample size but are available from the corresponding author on reasonable request.

Competing interests

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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Authors contributions

MP, MB, PB, MNB, MH were involved in planning of the study, MP and MB performed the study, MP and MB wrote the first versions of the manuscript. MP, MH, MB, MNB, PB wrote the manuscript, MP performed the statistical analysis, MP and MB educated the coaches. All authors read and approved the final manuscript. All authors give their consent for publication

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List of abbreviations:

COPD Chronic Obstructive Pulmonary disease

HPA Home-based Physical Activity Program

Authors information

Not applicable

References


Figures
Figure 1

Consort Diagram

- Assessed for eligibility (n= 13)
- Excluded (n= 1)
  - Declined to participate (n=1)
- Allocated to intervention (n=12)
- Completed follow-up measures (n= 12)
**Figure 2.** Step counts for each COPD participant during month 1 and month 2, and the daily step improvement

<table>
<thead>
<tr>
<th>Month 1</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54000</td>
<td>228748</td>
<td>137423</td>
<td>50433</td>
<td>174501</td>
<td>213332</td>
<td>104812</td>
<td>70100</td>
<td>278164</td>
<td>212246</td>
<td>77811</td>
<td>38564</td>
</tr>
<tr>
<td>2</td>
<td>70000</td>
<td>259578</td>
<td>166055</td>
<td>66369</td>
<td>299781</td>
<td>216540</td>
<td>69333</td>
<td>282746</td>
<td>215306</td>
<td>415496</td>
<td>147200</td>
<td>71538</td>
</tr>
<tr>
<td>Daily step count improvement</td>
<td>500</td>
<td>1101</td>
<td>1022</td>
<td>384</td>
<td>1260</td>
<td>115</td>
<td>-1138</td>
<td>7591</td>
<td>-1958</td>
<td>7616</td>
<td>2478</td>
<td>1185</td>
</tr>
</tbody>
</table>

* average differences were calculated from 8-week scores minus baseline scores