The effect of nurse-led problem-solving therapy on coping, self-efficacy and depressive symptoms for patients with chronic obstructive pulmonary disease: a randomised controlled trial

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Abstract

Objective: to examine the effects of nurse-led, problem-solving therapy (PST) on coping, self-efficacy and depressive symptoms for patients with chronic obstructive pulmonary disease (COPD) using a randomised controlled trial.

Subjects: a total of 254 patients with COPD were recruited, screened and randomly allocated into the intervention group with nurse-led PST or the comparison group with usual care. A total of 151 patients (intervention = 78 and comparison = 73) completed the study for 6 months.

Methods: the nurse-led PST was an individualised and patient-centred intervention to improve patients’ problem-solving skills related to symptom management and lifestyle modification. Twelve telephone-based PST sessions were provided to the intervention group, while the control group received usual care from their primary care providers.

Results: there were no group differences of post-test scores in problem-oriented coping, self-efficacy and depressive symptoms between the two groups. However, despite the lack of group differences, the nurse-led PST was effective for clinically depressed patients with COPD, who experienced decreased depressive symptoms (mean difference = 6.8, P = 0.009) and increased self-efficacy (mean difference = −0.6, P = 0.041) in the intervention group (n = 12).

Conclusion: the nurse-led PST offered to patients with COPD did not demonstrate any different effects compared with usual care over 6 months; however, a subgroup analysis with clinically depressed subjects showed improved self-efficacy and decreased depressive symptoms in the intervention group.

Keywords: COPD, problem-solving therapy, depressive symptoms, self-efficacy, coping, older people

Introduction

Approximately 40% of patients with chronic obstructive pulmonary disease (COPD) experience depressive symptoms [1]. Depressive symptoms in patients with COPD tend to negatively affect their functional health and to decrease their health-related quality of life [2]. Patients with higher levels of depressive symptom are more likely to experience far worse COPD symptoms, more hospital admission days and higher mortality [2, 3]. Therefore, to achieve better health outcomes in patients with COPD, depressive symptom need to be carefully assessed and effectively treated [4]. To manage...
depressive symptoms for patients with COPD, pulmonary rehabilitation programmes [5] and self-management programmes [6] have been widely used; however, it was unclear which components are effective or how these programmes work to alleviate depression.

Problem-solving therapy (PST) is a cognitive-behavioural intervention that trains patients to employ problem-solving attitudes and skills, and it has been shown to be an effective intervention in managing depressive symptoms for a variety of populations [7]. Although PST is known to be an effective strategy to decrease depressive symptoms and enhance self-efficacy for patients with chronic diseases such as diabetes [8], its effectiveness has not been examined in patients with COPD.

A recent study with patients with COPD revealed that patients who used more problem-oriented coping strategies were less depressed by mediating the relationship between the personal resources and depressive symptoms. Also, higher self-efficacy was directly associated with fewer depressive symptoms [9]. Given the significant roles of constructive coping strategies and self-efficacy in managing depressive symptoms, this intervention study was designed to examine the effectiveness of PST to decrease depressive symptoms for patients with COPD. The three hypotheses were as follows: PST may have effects on (i) increasing problem-oriented coping skills, (ii) increasing self-efficacy and (iii) decreasing depressive symptoms for patients with COPD. Coping and self-efficacy were the intermediate outcomes influencing depressive symptoms, and the main outcome of this study was depressive symptoms.

**Methods**

**Participants**

This study was conducted with patients from three outpatient clinics at a university-affiliated medical centre and two respiratory clinics in South Korea from 2010 to 2011. A total of 791 patients were assessed for eligibility. Inclusion criteria were patients who were (i) 40–80 years of age, (ii) diagnosed with COPD by a physician based on a pulmonary function test and (iii) in stable condition and expected to live ≥6 months as determined by a physician who specialised in respiratory medicine. Pulmonary function was tested based on the guidelines by the American Thoracic Society [10] using the Vmax 22 system (SensorMedics, Yorba Linda, CA, USA) and the Ultima PFX system (Medical Graphics Corporation, St Paul, MN, USA). The forced expiratory volume (FEV)1% predicted was used to assess the severity of COPD. Exclusion criteria were patients who had (i) severe co-morbid conditions that interfered with walking and (ii) communication difficulties due to hearing loss or illiteracy.

A previous meta-analysis study indicated that the mean effect size of PST for depression was 0.40 [11], so a target sample of ~100 patients per group was sufficient power (1–β = 0.80) at a two-tail α = 0.05. However, we over-recruited patients by 25% considering the potential dropouts, so we set the target sample size at 250. Screening yielded 254 recruited patients who were randomly assigned to two groups, with 151 patients completing the study (Figure 1).

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**Figure 1.** CONSORT flow diagram of this study. *Stated reasons for discontinuing intervention (n = 48) in the intervention group included busy schedules or no need for the intervention. †Stated reason for refusing the post-test (n = 51) in the comparison group included exacerbated health condition (n = 34), out of contact (n = 14) and moved to another region (n = 3).
All participants were informed of the study protocols, and written informed consent was obtained. Approval was obtained from the Institutional Review Boards (IRBs) of the three university hospitals. In the two respiratory clinics without an IRB, we received permission to conduct the study from the directors of the hospitals.

**Intervention**

In this study, the PST programme was developed to improve the patients’ appraisal of problems as challenges or opportunities for benefit and to help patients believe that problems are solvable within their ability. However, the modality of PST in this study differed from other PST studies. In the current study design included (i) telephone-based counselling considering the physical condition of the COPD patients and the cost-effectiveness of such intervention [12], and (ii) PST led by a trained nurse as the primary interventionist. A registered nurse who had ≥3 years of clinical experience in internal medicine was chosen as the primary interventionist. The nurse attended a 16-h course on the problem-solving counselling, which was approved by the Problem-Solving Counseling Research Center in Korea. She also completed 40 h of training to obtain full knowledge of COPD symptom management and the intervention protocols.

The nurse provided the individualised intervention through 12 telephone sessions per patient with an interval of every 2 weeks over ~6 months. The initial session was a maximum of 60 min, and each of the following sessions was a maximum of 30 min [13]. All telephone counselling sessions were recorded, and the research team including another research nurse and the principal investigator reviewed the interviews every 10th case monitoring competency of the nurse as the interventionist and to ensure adequate and consistent delivery of the PST with the protocol. The nurse also kept a case management diary log to maintain consistency of the intervention. The detailed protocol of the nurse-led PST is provided in the Supplementary data, Appendix available in Age and Aging online.

The patients in the comparison group received usual care from their physicians. To ensure that usual care was delivered, the physicians taking care of these study participants were not informed of which patients were in the intervention group or comparison group.

**Measurements**

Coping was measured using the Jalowiec Coping Scale (JCS) [14]. The JCS included two subscales: problem-oriented and emotion-oriented coping, but we only used the subscale of problem-oriented coping (15 items) in this study. The items assessed tendencies that constructively deal with stressors using a 5-point scale ranging from 1 to 5. Higher scores indicated more frequent use of a particular coping strategy. The Cronbach’s α of the JCS was 0.88.

Self-efficacy was measured using the COPD Self-Efficacy Scale (CSES), which assesses one’s confidence in managing breathing difficulties in a variety of situations [15]. The CSES consists of 34 items with a 5-point scale. We used the mean score of these 34 items ranging from 0 to 5. Higher scores indicated higher self-efficacy in dealing with dyspnoea. The Cronbach’s α of the CSES was 0.96.

Depressive symptoms were measured with the CES-D developed by Radloff [16]. The previously developed Korean version of the CES-D consists of 20 items with a 4-point scale ranging from 0 to 3. The total scores for depressive symptoms ranged from 0 to 60, with higher scores indicating higher levels of depressive symptoms [17]. A cut-off score of 16 has been used to indicate depressive symptoms [16], but we used a cut-off scores of 24 for Koreans as suggested by Shin considering the cultural differences [17]. The reliability of CES-D was 0.86.

**Data analysis**

PASW 18.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis. Levene’s test was used to assess the homogeneity of three outcome variables at baseline between the groups. A paired t-test was conducted to examine the difference of the means between pre- and post-test scores in each group. To examine the intervention effect by group, regression analysis was utilised using post-test scores as the dependent variable and the group as the independent variable controlling for pre-test scores.

**Results**

**Baseline characteristics**

The mean age was 66.1 years (SD = 8.2). Most participants were male (91.4%) and married (84.8%). The mean number of years since being diagnosed with COPD was 7.3 years (SD = 8.6), and the mean FEV1% predicted was 61.2%. The demographic characteristics, self-efficacy and depressive symptoms of participants between the two groups were comparable at baseline. However, problem-oriented coping had group differences with higher levels of coping in the control group (P = 0.025) (Table 1).

**Effects of the intervention**

Table 2 shows the means of the pre- and post-tests of the two groups. There were no group differences between the pre- and post-tests on problem-oriented coping (P = 0.212), self-efficacy (P = 0.230) and depressive symptoms (P = 0.283). Participants in both groups tended to show decreased problem-oriented coping, decreased self-efficacy and increased depressive symptoms at the post-test compared with the pre-test, but they were not statistically significant by group.

We did further analysis with subjects who were clinically depressed (CES-D ≥ 24, n = 25). There were no significant group differences in the general characteristics and main outcomes at baseline (not shown in the table). However, the participants in the intervention group reported increased self-efficacy (mean difference = −0.6, P = 0.041) and decreased...
Discussion

PST is intended to encourage patients to adopt a positive problem orientation and apply a rational problem-solving approach, which plays a significant moderating or mediating role on the relationship between stressful events and depression [11]. Although PST has been found to be effective for diabetic patients’ self-efficacy and depression [8], the nurse-led PST intervention in this study was not efficacious on coping, self-efficacy and depressive symptoms for patients with COPD.

One of the reasons we could not detect an intervention effect may be that the participants had fewer depressed symptoms at baseline than participants in other studies. PST has been primarily used for patients with depression and has been as effective as medications or psychosocial therapy and more effective than support/attention groups [11]. However, the participants in this study were relatively less depressed indicating that the mean of the baseline depressed symptoms was only 14.2 out of 60; and only 25 out of the 151 participants were clinically depressed (CES-D ≥ 24). Although caution should be taken when interpreting a finding from a subgroup analysis, PST in this study was partially effective for the patients who were clinically depressed. Considering that depressive symptoms are often underestimated and undertreated in patients with COPD [18] and they are reluctant to use anti-depressants [19], this study might provide information about more specific target population of patients with COPD who experience the most effectiveness from the PST. Further studies are needed to examine this hypothesis.

Another consideration for the non-significant findings is that the subjects had relatively high levels of self-efficacy at baseline. While the scores of self-efficacy for patients with COPD ranged from 1.6 out of 5 at baseline in one study [20], this study shows that the mean baseline COPD self-efficacy score was relatively high indicating 3.3 for all participants and 2.7 for the clinically depressed group. Considering that depressive symptoms are often underestimated and undertreated in patients with COPD and they are reluctant to use anti-depressants, this study might provide information about more specific target population of patients with COPD who experience the most effectiveness from the PST. Further studies are needed to examine this hypothesis.

Discussion

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Table 1. Baseline characteristics of the study subjects (n = 151)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total (n = 151)</th>
<th>Intervention (n = 78)</th>
<th>Comparison (n = 73)</th>
<th>χ²/t/F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%) or mean (SD)</td>
<td>n (%) or mean (SD)</td>
<td>n (%) or mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age &lt;70 years</td>
<td>96 (63.6%)</td>
<td>47 (60.3%)</td>
<td>49 (67.1%)</td>
<td>−1.02</td>
<td>0.311</td>
</tr>
<tr>
<td>Age ≥70 years</td>
<td>55 (36.4%)</td>
<td>31 (39.7%)</td>
<td>24 (32.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender Male</td>
<td>138 (91.4%)</td>
<td>73 (93.6%)</td>
<td>65 (89.0%)</td>
<td>0.99</td>
<td>0.391</td>
</tr>
<tr>
<td>Gender Female</td>
<td>13 (8.6%)</td>
<td>5 (6.4%)</td>
<td>8 (11.0%)</td>
<td>0.99</td>
<td>0.391</td>
</tr>
<tr>
<td>Marital status Married</td>
<td>128 (84.8%)</td>
<td>63 (80.8%)</td>
<td>65 (89.0%)</td>
<td>2.00</td>
<td>0.180</td>
</tr>
<tr>
<td>Marital status Single, divorced or bereaved</td>
<td>23 (15.2%)</td>
<td>15 (19.2%)</td>
<td>8 (11.0%)</td>
<td>0.99</td>
<td>0.391</td>
</tr>
<tr>
<td>Level of education &lt;High school</td>
<td>82 (54.3%)</td>
<td>41 (52.6%)</td>
<td>41 (56.2%)</td>
<td>0.20</td>
<td>0.744</td>
</tr>
<tr>
<td>Level of education ≥High school</td>
<td>69 (45.7%)</td>
<td>37 (47.4%)</td>
<td>32 (43.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total monthly family income &lt;1,000 (US$)</td>
<td>89 (58.9%)</td>
<td>45 (57.7%)</td>
<td>44 (60.3%)</td>
<td>0.10</td>
<td>0.869</td>
</tr>
<tr>
<td>Total monthly family income ≥1,000 (US$)</td>
<td>62 (41.1%)</td>
<td>33 (42.3%)</td>
<td>29 (39.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration since diagnosed as COPD &lt;10 years</td>
<td>124 (82.1%)</td>
<td>63 (80.8%)</td>
<td>61 (83.6%)</td>
<td>1.18</td>
<td>0.279</td>
</tr>
<tr>
<td>Duration since diagnosed as COPD ≥10 years</td>
<td>27 (17.9%)</td>
<td>15 (19.2%)</td>
<td>12 (16.4%)</td>
<td>2.00</td>
<td>0.180</td>
</tr>
<tr>
<td>Smoking status None or ex-smoker</td>
<td>125 (82.8%)</td>
<td>64 (82.1%)</td>
<td>61 (83.6%)</td>
<td>0.06</td>
<td>0.833</td>
</tr>
<tr>
<td>Smoking status Current smoker</td>
<td>26 (17.2%)</td>
<td>14 (17.9%)</td>
<td>12 (16.4%)</td>
<td>0.71</td>
<td>0.250</td>
</tr>
<tr>
<td>Other chronic disease Yes</td>
<td>88 (58.3%)</td>
<td>48 (61.5%)</td>
<td>40 (54.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other chronic disease No</td>
<td>63 (41.7%)</td>
<td>30 (38.5%)</td>
<td>33 (45.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV% predicted &lt;50 (severe to very severe)</td>
<td>48 (31.8%)</td>
<td>24 (30.8%)</td>
<td>24 (32.9%)</td>
<td>1.18</td>
<td>0.279</td>
</tr>
<tr>
<td>FEV% predicted ≥50 (mild to moderate)</td>
<td>102 (67.5%)</td>
<td>54 (69.2%)</td>
<td>48 (65.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem-oriented copinga (5–75)</td>
<td>45.8 (10.4)</td>
<td>44.0 (10.8)</td>
<td>47.8 (9.7)</td>
<td>1.18</td>
<td>0.279</td>
</tr>
<tr>
<td>COPD self-efficacya (0–5)</td>
<td>3.3 (0.8)</td>
<td>3.4 (0.9)</td>
<td>3.3 (0.8)</td>
<td>0.88</td>
<td>0.350</td>
</tr>
<tr>
<td>Depressive symptomsa (0–60)</td>
<td>14.2 (9.2)</td>
<td>14.0 (9.2)</td>
<td>14.4 (9.4)</td>
<td>0.06</td>
<td>0.812</td>
</tr>
</tbody>
</table>

Homogeneity of two groups at baseline was tested using Levene’s test.

Depressive symptoms (mean difference = 6.8, P = 0.009) despite no group difference.

4 Homogeneity of two groups at baseline was tested using Levene’s test.
## Variables

### Table 2. Effects of nurse-led problem-solving counselling on coping strategies, self-efficacy and depressive symptoms

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention (n=78)</th>
<th>Comparison (n=73)</th>
<th>Group difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
<td>Mean difference (CI)</td>
</tr>
<tr>
<td>All subjects (n=151)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem-oriented coping</td>
<td>44.0 ± 10.8</td>
<td>42.2 ± 9.6</td>
<td>1.7 (-0.8, 4.3)</td>
</tr>
<tr>
<td>COPD self-efficacy</td>
<td>3.4 ± 0.9</td>
<td>3.2 ± 0.7</td>
<td>0.2 (-0.0, 0.4)</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>14.0 ± 9.2</td>
<td>15.9 ± 8.0</td>
<td>-1.8 (-3.7, 0.0)</td>
</tr>
<tr>
<td>COPD in men and women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) Subject with CES-D ≥ 24 (n=25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem-oriented coping</td>
<td>41.3 ± 11.6</td>
<td>39.1 ± 13.2</td>
<td>2.3 (-3.1, 8.8)</td>
</tr>
<tr>
<td>COPD self-efficacy</td>
<td>2.7 ± 0.7</td>
<td>3.3 ± 0.8</td>
<td>-0.6 (-1.0, -0.2)</td>
</tr>
<tr>
<td>Depressive symptoms</td>
<td>30.7 ± 6.3</td>
<td>239 ± 9.6</td>
<td>6.8 (0.3, 13.2)</td>
</tr>
</tbody>
</table>

*Post-test scores were tested by the group difference (intervention versus comparison) controlling for pre-test scores using regression analysis; higher scores of problem-oriented coping indicate more use of each coping strategy, higher scores of self-efficacy indicate more confidence in managing COPD symptoms and higher scores of depressive symptoms indicate more depressed status; CI = confidence interval at 95%.

### Limitations

A possible limitation of this study is that the majority of the participants were male (91%) and were from tertiary hospitals where patients were likely to receive an optimal level of care with well-managed COPD. This gender distribution is very different from the near-equal prevalence of COPD in men and women [2]. Future studies targeting COPD in men and women [2] are needed.

### Discussion

The short period of time between pre- and post-tests might be another source of the use of PST for inconsistent findings. A meta-analysis of the use of PST for depression revealed long-term effects indicating that a medium effect size was found at follow-up time points after post-treatment, while only small-to-medium effect size was found at post-treatment at 6 months without additional follow-ups or boosters, it was not possible to compare follow-up results to the pre- and post-tests. A seasonal period of measurement might be related to the non-significant findings on the effects of PST. The effect of seasonality of exacerbations of COPD was recently verified in clinical research. The effect of PST on the frequency of exacerbations was reported to be greater in the winter season because in winter COPD patients may experience more frequent exacerbations [22] or other physiological effects of weather [23]. The frequency of exacerbations of COPD may be influenced by weather conditions, with exacerbations more likely to occur in winter than in summer when the baseline characteristics [24] may be affected by susceptibility to infections [22] or physiological effects of weather [23]. The potential long-term effects were not possible to compare following follow-up results to the pre- and post-tests. Considering that the different experiences might be influenced by the environment and situation, the cost-effectiveness of PST compared with conducting sessions in-person [24] was described as being effective for patients with depression in Western countries.

Nurse-led PST for patients with COPD
appropriate gender distribution, patients who are receiving less favourable healthcare services and patients from a broader geographical area may reveal more distinct impacts of PST. Second, this study had a high-dropout rate (41%). Patients with more severe COPD symptoms, older age and more limited mobility tended to dropout throughout this study [27]. (More detailed information on dropouts in this study can be found in Ref. [27].) The percentage of dropouts of this study (41%) was relatively higher than randomised controlled trial (RCT) studies examining a comparable intervention, pulmonary rehabilitation programmes, in two studies with dropout rates of 31% [28] and 23% [29]. The longer period of intervention in this study inherently might result in a higher dropout rate: 6 months in this study versus 7 weeks and 10 weeks, respectively, in previous studies [28, 29]. Developing strategies to retain patients should be pursued in future studies.

Conclusion

This study demonstrated that the nurse-led PST intervention did not have a significant effect on Korean patients with COPD on coping, self-efficacy and depressive symptoms. However, a subgroup analysis revealed that the PST decreased depressive symptoms and increased self-efficacy for the clinically depressed patients with COPD. This finding should be interpreted cautiously due to the small sample size with post hoc analysis. Further RCT studies with diverse study participants in terms of gender and region and an extended follow-up period are recommended to obtain clear evidence of the effects of nurse-led PST for patients with COPD.

Key points

- PST is known to be an effective intervention for managing depressive symptoms in a variety of populations.
- The nurse-led PST for COPD patients did not demonstrate effectiveness compared with usual care over 6 months.
- A subgroup analysis with clinically depressed subjects with COPD showed improved self-efficacy and decreased depressive symptoms.

Conflicts of interest

None declared.

Funding

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Supplementary data

Supplementary data mentioned in the text are available to subscribers in Age and Ageing online.

References

Weather warnings predict fall-related injuries among older adults

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Abstract

Background: weather predictions are a useful tool for informing public health planning and prevention strategies for non-injury health outcomes, but the association between winter weather warnings and fall-related injuries has not been assessed previously.

Objective: to examine the association between fall-related injuries among older adults and government-issued winter weather warnings.

Methods: using a dynamic cohort of individuals ≥65 years of age who lived in Montreal between 1998 and 2006, we identified all fall-related injuries from administrative data using a validated set of diagnostic and procedure codes. We compared rates of injuries on days with freezing rain or snowstorm warnings to rates observed on days without warnings. We also compared the incidence of injuries on winter days to non-winter days. All analyses were performed overall and stratified by age and sex.

Results: freezing rain alerts were associated with an increase in fall-related injuries (incidence rate ratio [IRR] = 1.20, 95% confidence interval [CI]: 1.08–1.32), particularly among males (IRR = 1.31, 95% CI: 1.10–1.56), and lower rates of injuries