

# Reduction of Hospital Utilization in Patients With Chronic Obstructive Pulmonary Disease

## A Disease-Specific Self-management Intervention

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**Background:** Self-management interventions improve various outcomes for many chronic diseases. The definite place of self-management in the care of chronic obstructive pulmonary disease (COPD) has not been established. We evaluated the effect of a continuum of self-management, specific to COPD, on the use of hospital services and health status among patients with moderate to severe disease.

**Methods:** A multicenter, randomized clinical trial was carried out in 7 hospitals from February 1998 to July 1999. All patients had advanced COPD with at least 1 hospitalization for exacerbation in the previous year. Patients were assigned to a self-management program or to usual care. The intervention consisted of a comprehensive patient education program administered through weekly visits by trained health professionals over a 2-month period with monthly telephone follow-up. Over 12 months, data were collected regarding the primary outcome and number of hospitalizations; secondary outcomes included emergency visits and patient health status.

**Results:** Hospital admissions for exacerbation of COPD were reduced by 39.8% in the intervention group compared with the usual care group ( $P = .01$ ), and admissions for other health problems were reduced by 57.1% ( $P = .01$ ). Emergency department visits were reduced by 41.0% ( $P = .02$ ) and unscheduled physician visits by 58.9% ( $P = .003$ ). Greater improvements in the impact subscale and total quality-of-life scores were observed in the intervention group at 4 months, although some of the benefits were maintained only for the impact score at 12 months.

**Conclusions:** A continuum of self-management for COPD patients provided by a trained health professional can significantly reduce the utilization of health care services and improve health status. This approach of care can be implemented within normal practice.

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**C**HRONIC OBSTRUCTIVE pulmonary disease (COPD) is a major public health problem. From 40% to 50% of patients with COPD discharged from hospitals are readmitted during the following year,<sup>1,2</sup> and 17% of patients discharged from emergency departments require hospitalization.<sup>3</sup> Although reasons for hospital admission are complex, acute exacerbation is the major cause of hospitalization in patients with COPD.<sup>4</sup> Despite optimal pharmacologic therapy, patients with COPD often have symptoms severe enough to limit normal physical activities of daily living and affect quality of life.<sup>5</sup>

In COPD, as in any chronic disease, day-to-day care responsibilities fall most heavily on patients and their families. Interventions to improve outcomes of chronic disease and/or reduce hospital readmissions have been developed on the basis of

self-management principles.<sup>6-8</sup> Self-management is a term applied to any formalized patient education program aimed at teaching skills needed to carry out medical regimens specific to the disease, guide health behavior change, and provide emotional support for patients to control their disease and live functional lives. This continuum of self-management training and support services can go from self-help approaches to more intensive case management. Case management promotes continuity, communication, and collaboration among the patient, the family, physicians, and various health care providers.

Findings from the published studies on the role of self-management in improving health service utilization or health status have been inconclusive.<sup>9-11</sup> The definite place of a continuum of self-management in the care of COPD has to be established by prospective controlled trials.<sup>11-13</sup>

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We hypothesized that a disease-specific self-management program and the ongoing attention and communication by a trained health professional could significantly reduce the number of hospital admissions for patients with advanced COPD. We conducted a multicenter, randomized clinical trial among patients with COPD to evaluate the impact of a self-management program on the use of hospital services and health status.

## METHODS

### HOSPITAL AND PATIENT SELECTION

Seven participating hospitals from 3 cities in the province of Quebec were selected based on their capacity to recruit patients with COPD and carry out a clinical trial. All patients in each participating hospital who were hospitalized at least once in the preceding year for an acute exacerbation of COPD were screened from February to July 1998. Patients were eligible if they met all of the following conditions: (1) stable COPD (respiratory symptoms and medication unchanged for at least 4 weeks before enrollment); (2) at least 50 years of age; (3) current or previous smoker (at least 10 pack-years); (4) forced expiratory volume in 1 second (FEV<sub>1</sub>) after the use of a bronchodilator between 25% and 70% of the predicted normal value<sup>14</sup> and FEV<sub>1</sub>-forced vital capacity ratio less than 70%; (5) no previous diagnosis of asthma, left congestive heart failure (definite radiographic evidence of pulmonary edema with improvement in response to diuresis), terminal disease, dementia, or uncontrolled psychiatric illness; (6) no participation in a respiratory rehabilitation program in the past year; and (7) no long-term-care facility stays. The study was approved by the research ethics committees at all participating centers, and all patients gave written informed consent.

### STUDY DESIGN

The study was a parallel-group, randomized, multicenter trial. After consenting to participate in the study, patients underwent randomization with the use of a central computer-generated list of random numbers. Randomization was stratified per center and in blocks of 6, and patients were assigned to the self-management program (intervention group) or to usual care. The blocking factor was not known by the investigators or their staff in each participating center. Since a double-blind design was impossible, an independent evaluator unaware of the patient assignment was responsible for the evaluation process in each center. The evaluator was cautioned not to ask about the workbook modules and types of contact.

Patients in the usual care and the intervention groups continued to be managed by their respective specialists or general practitioners and maintained their usual access to the provincial universal health programs, which includes free health care services as well as a drug benefit plan. The comparison group received every element of care that the intervention group received except the added-on management program.

Each patient randomized to the intervention group received a disease-specific self-management program ("Living Well with COPD"; Boehringer Ingelheim Canada, Burlington, Ontario) consisting of approximately 1 hour per week of teaching at home for 7 to 8 weeks. The program was supervised by experienced and trained health professionals (nurses in 4 centers, respiratory therapists in 2, and a physiotherapist in 1) who acted as case managers, with the supervision and collaboration of the treating physician. Follow-up was conducted with patients in the intervention group by weekly telephone calls for 8 weeks (educational period) and then monthly calls for

the remainder of the study. Case managers were available by telephone only to the intervention group for advice and treatment supervision throughout the study period.

### EDUCATION PROGRAM

The teaching material consisted of a flip chart designed for health educators; 7 skill-oriented, self-help, patient workbook modules detailing COPD management in all facets of the disease; inhalation technique sheets; and a plan of action. All patient materials were available in English and French, written in clear, simple language with friendly, upbeat graphics. The education program was developed based on a review of the evidence-based literature and the opinions of medical experts, patients, and family members. Recommended revisions following pilot testing with 16 patients and 5 health professionals were incorporated into the final version of the education program.

Teaching program patient workbooks included basic information about COPD, breathing and coughing techniques, energy conservation during day-to-day activities, and relaxation exercises (module 1); preventing and controlling symptoms through inhalation techniques (module 2); understanding and using a plan of action for acute exacerbation (module 3); adopting a healthy lifestyle (smoking cessation, nutrition, sexuality, sleep habits, managing emotions) (module 4); leisure activities and traveling (module 5); a simple home exercise program (module 6); and long-term home oxygen therapy when appropriate (module 7). The action plan for acute exacerbation was customized for each patient and included a contact list as well as a symptom-monitoring list for different situations (stress, environmental change, and respiratory tract infection) linked to appropriate therapeutic actions, including a prescription from the patient's treating physician to be used when the patient had an exacerbation. It emphasized the prompt initiation of an antibiotic and an oral corticosteroid for 10 to 14 days for exacerbation with infective symptoms (defined as at least 2 of the following 3 symptom changes: dyspnea, sputum, or sputum purulence).<sup>15</sup> It also included safeguards to call the case manager or the treating physician if symptoms became worse despite the use of the antibiotic and corticosteroid.

After an exercise evaluation (not mandatory), the exercise teaching began at about the seventh week, and the training program was initiated with a supervised session at home. The exercise program included warm-up and stretching exercises, muscle exercises, and cardiovascular exercises (stationary bicycle, walking, or climbing stairs). Patients were encouraged to follow the exercise program at least 3 times per week for 30 to 45 minutes per session. They were asked to use the modified Borg scale (3-4) during the aerobic training exercise as a guide to training intensity.<sup>16</sup>

### FOLLOW-UP AND ASSESSMENT OF OUTCOME

All study visits were conducted in the hospital. Baseline measurements included sociodemographic characteristics, smoking habits, respiratory conditions and symptoms, current medical conditions, medical history, and a general physical examination. Other information and measurements collected at baseline and at 4 and 12 months included medication profile, spirometry,<sup>17</sup> a 6-minute walk test,<sup>18,19</sup> dyspnea measurements after exercise,<sup>19</sup> and health-related quality of life measured by the St George Respiratory Questionnaire (SGRQ).<sup>20-22</sup> In addition, standardized telephone interviews were conducted for the intervention and comparison groups every 4 weeks by 1 research assistant per center, who was not involved in the patient care or the patient education program. Data obtained by telephone included patient-recorded items regarding acute

COPD exacerbations, other health problems, changes in medication, and health care utilization (scheduled and unscheduled physician visits, emergency department visits, and hospital admissions).

Acute exacerbation of COPD was defined as a change from baseline reported by the patient in respiratory symptoms lasting a minimum of 24 hours, dyspnea deterioration, an increase in sputum volume, or yellowish or greenish sputum. Respiratory status had to return to baseline for at least 72 hours to consider changes in respiratory symptoms as a new exacerbation. Hospital admission was defined as (1) hospital stay of any duration in an acute care bed; (2) day hospital stay of at least 8 hours per day for 2 consecutive days; or (3) emergency department visit requiring at least 24 hours of care.

Disease-specific health-related quality of life was measured by the SGRQ<sup>20,22</sup> and was administered by a trained interviewer. The SGRQ consists of 76 items grouped in 3 domains: (1) respiratory symptoms; (2) activities (a measure of the activities that cause or are limited by breathlessness); and (3) impact (a measure of the overall disturbance of daily life, social function, and well-being). The scoring range was 0 to 100, with lower scores indicating a better quality of life.

### STATISTICAL ANALYSIS

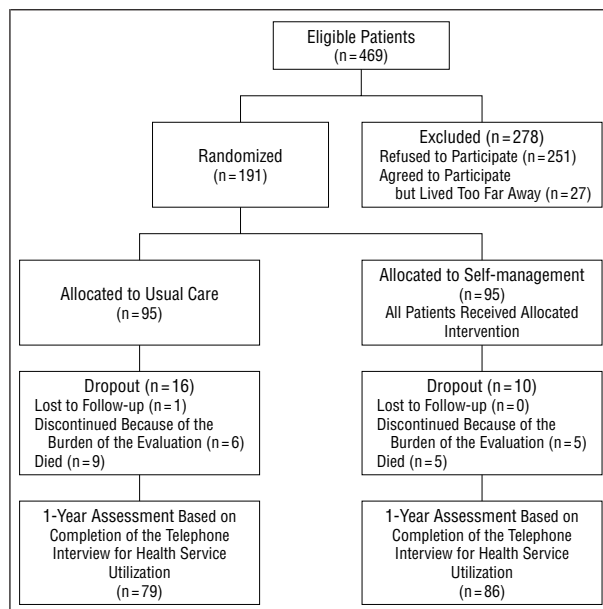
The primary prespecified outcome was hospital admission. Secondary outcomes included scheduled and unscheduled visits to the physician, emergency department visits, health-related quality of life, pulmonary function, and functional exercise capacity. We calculated that a sample size of 85 patients per group would be adequate for 80% power to detect an estimated cumulative incidence of hospital admissions of 0.20 in the intervention as compared with 0.40 in the comparison group at the  $\alpha$  of .05 significance level (2-sided test).

An intention-to-treat analysis included all available study patients. All tests of significance were 2-sided. A comparison of the proportion of hospital admissions or emergency department and medical visits was based on the  $\chi^2$  test. The Fisher exact test was used when the frequencies were small. Percent difference effects of the intervention were calculated by dividing the absolute difference between the intervention and usual care group values. For the SGRQ scores, differences from baseline, both within and between study groups, and 95% confidence intervals (CIs) were calculated. Kaplan-Meier curves with log-rank testing were used to assess the probability of not being admitted to the hospital over the 1-year follow-up period.

## RESULTS

### STUDY PATIENTS

**Figure 1** shows detailed information on enrollment, allocation to the study intervention, study dropout, and 1-year assessment based on completion of the telephone interview for evaluation of acute exacerbations and other health problems, and related health service utilization. The enrollment proceeded as follows: (1) From the hospital registry database, medical charts were selected for all patients admitted with a primary diagnosis of COPD (*International Classification of Diseases, Ninth Revision* codes 490-492 and 496) in the year preceding the beginning of the study. (2) Medical charts were reviewed, patients were contacted and informed of the study, and their eligibility was confirmed. (3) Eligible patients were invited to participate in the study. Patients' main reasons for refusal to participate were logistic or discre-



**Figure 1.** Trial profile based on completion of telephone interviews for evaluation of acute exacerbations and other health problems and related health service utilization.

tionary; the evaluation process was considered by many to be a serious inconvenience. Those who refused were similar to the study group with respect to sex, age, and level of airflow obstruction. Of the 469 eligible patients, 191 were randomized, of whom 96 were assigned to the intervention group and 95 to the usual care group. None of the disease severity characteristics were otherwise different between the 2 study groups.

### PATIENT CHARACTERISTICS

Baseline characteristics were similar across sociodemographic, clinical, and functional variables (**Table 1**). Most patients were elderly, not highly educated, and had advanced COPD reflected by a mean FEV<sub>1</sub> of 1 L, and 46% reported a dyspnea score of 5/5 on the ATS-DLD-78 scale (American Thoracic Society and National Heart and Lung Institute—Division of Lung Disease Questionnaire of 1978). The use of respiratory medications was similar between study groups, except that oral steroids were used less commonly in the intervention group (7%) than in the usual care group (13%). None of the disease severity characteristics were otherwise different between the study groups.

### LUNG FUNCTION AND EXERCISE CAPACITY

Lung function did not change significantly from baseline to the end of the study. In the usual care group, the mean  $\pm$  SD FEV<sub>1</sub> was 0.98  $\pm$  0.31 L at baseline and 1.01  $\pm$  0.36 L at 12 months, and the forced vital capacity was 2.24  $\pm$  0.69 L at baseline and 2.30  $\pm$  0.68 L at 12 months. In the intervention group, the FEV<sub>1</sub> was 1.0  $\pm$  0.33 L at baseline and 0.96  $\pm$  0.32 L at 12 months, and the forced vital capacity was 2.27  $\pm$  0.74 L at baseline and 2.31  $\pm$  0.77 L at 12 months. Walking distance on the 6-minute walk-

**Table 1. Baseline Characteristics of the Study Patients\***

| Characteristic                              | Usual Care Group (n = 95) | Intervention Group (n = 96) |
|---|---------------------------|-----------------------------|
| Age, y                                      | 69.6 ± 7.4                | 69.4 ± 6.5                  |
| Male sex                                    | 56 (59)                   | 50 (52)                     |
| Living alone                                | 40 (42)                   | 46 (48)                     |
| Education <12th grade                       | 73 (77)                   | 79 (82)                     |
| Currently smoking                           | 25 (26)                   | 24 (25)                     |
| Pack-years of smoking                       | 56.1 ± 31.3               | 57.8 ± 40.6                 |
| Postbronchodilator FEV <sub>1</sub> , L     | 0.98 ± 0.31               | 1.00 ± 0.33                 |
| FEV <sub>1</sub> /FVC, %                    | 45                        | 46                          |
| Dyspnea, ATS-DLD-78, grade 5                | 47 (49)                   | 44 (46)                     |
| 6-min walking distance, m                   | 280 ± 90                  | 282 ± 91                    |
| Respiratory drugs at time of enrollment     |                           |                             |
| Short-acting β <sub>2</sub> agonist         | 75 (80)                   | 80 (84)                     |
| Long-acting β <sub>2</sub> agonist          | 15 (16)                   | 13 (14)                     |
| Anticholinergic                             | 58 (62)                   | 63 (66)                     |
| Combined B <sub>2</sub> and anticholinergic | 23 (24)                   | 22 (23)                     |
| Methylxanthine                              | 27 (29)                   | 29 (31)                     |
| Inhaled steroids                            | 69 (73)                   | 74 (78)                     |
| Oral steroids                               | 12 (13)                   | 7 (7)                       |
| Comorbid conditions                         |                           |                             |
| Cardiovascular                              | 45 (48)                   | 41 (43)                     |
| Renal                                       | 4 (4)                     | 16 (17)                     |
| Endocrine                                   | 23 (24)                   | 18 (19)                     |
| Gastrointestinal                            | 30 (32)                   | 25 (26)                     |

Abbreviations: ATS-DLD-78, American Thoracic Society and National Heart and Lung Institute—Division of Lung Disease Questionnaire of 1978; FEV<sub>1</sub>, forced expiratory volume in 1 second; FVC, forced vital capacity.

\*Unless otherwise indicated, data are mean ± SD or number (percentage) of patients.

ing test did not change significantly within or between groups at 4 and 12 months.

### ACUTE EXACERBATIONS

A total of 362 acute exacerbations of COPD were reported in the usual care group and 299 in the intervention group ( $P = .06$ ). Dyspnea deterioration was reported in 88% of the acute exacerbations in the usual care group and in 90% in the intervention group ( $P = .54$ ); increases in sputum volume were 54% and 57%, respectively, in the intervention and usual care groups ( $P = .53$ ); and presence of purulent sputum was 48% and 53% ( $P = .29$ ) in each respective group.

### HOSPITAL ADMISSIONS

In the usual care group, 118 (32.5%) of the 362 acute exacerbations resulted in a hospital admission compared with 71 (23.7%) of the 299 in the intervention group. Patient admissions for acute exacerbations in the year preceding study entry were similar between both groups (**Table 2**). At 12-month follow-up, Table 2 shows a 39.8% reduction in hospital admissions for acute exacerbations and a 57.1% reduction in hospital admissions for other health problems in the intervention group compared with the usual care group. Significantly more patients in the usual care group had at least 1 hospital admission and 2 or more admissions during the 12-month study (Table 2 and **Figure 2**).

## EMERGENCY DEPARTMENT AND PHYSICIAN VISITS

In the usual care group, 161 (44.4%) of the 362 acute exacerbations resulted in an emergency department visit compared with 95 (31.7%) of 299 in the intervention group. Emergency department visits in the year preceding study entry were comparable and decreased during the 12-month follow-up in the usual care and intervention groups (**Table 3**). At 12 months, Table 3 shows a 41% reduction in emergency department visits for acute exacerbation in the intervention group compared with the usual care group. Significantly fewer unscheduled family physician visits were observed in the intervention group ( $n = 46$ ) than in the usual care group ( $n = 112$ ). However, scheduled family physician visits as well as scheduled and unscheduled specialist visits were comparable between groups.

### HEALTH-RELATED QUALITY OF LIFE

Baseline health-related quality-of-life scores on the SGRQ were comparable between usual care and intervention groups on each of the subscales and the total score (**Table 4**). Activity and impact subscale and total scores significantly improved at 4 months compared with baseline only in the intervention group. There were significant treatment differences for impact subscale and total scores. At 12 months, impact subscale and total scores were still significantly improved compared with baseline in the intervention group, but the only remaining treatment difference was on the impact subscale ( $P = .05$ ).

## CONCLUSIONS

Recommendations for the use of self-management programs for patients with COPD are based on experience with other chronic diseases.<sup>6-8</sup> Our study showed that patients with COPD who received an education intervention with supervision and support based on disease-specific self-management principles had a better outcome than the usual care group with respect to hospital admissions, emergency department and unscheduled family physician visits, and health-related quality of life. These differences, especially those on health care utilization, are important and worth considering. These benefits to the health system could potentially add to the patients' quality of life by avoiding institutionalization. Although we cannot identify which component of the intervention had an effect, the results nevertheless remain important, considering (1) the limitations of current COPD treatment; (2) the heavy burden of the disease on patients and society; and (3) the need for effective care plans to optimize the use of limited resources.

The reduction in hospital admissions and emergency department and acute care physician visits in the present study was of greater magnitude than that reported in randomized controlled trials of pulmonary rehabilitation programs.<sup>23-25</sup> The number of hospital admissions was also reduced for other health problems, which suggests that disease-specific self-management and the ongoing attention and communication by trained car-

**Table 2. Hospital Admissions During 12-Month Follow-up\***

| Variable  | Usual Care Group<br>(n = 95) | Intervention Group<br>(n = 96) | Treatment<br>Difference, † % | P Value |
|---|------------------------------|--------------------------------|------------------------------|---------|
| Admissions for acute exacerbation in the year preceding study entry | 152                          | 158                            | +3.9                         | .45     |
| No. of admissions during 1-y follow-up                              |                              |                                |                              |         |
| For acute exacerbations   | 118                          | 71                             | -39.8                        | .01     |
| For other health problems   | 49                           | 21                             | -57.1                        | .01     |
| Patients admitted for acute exacerbations during 1 y                |                              |                                |                              |         |
| Once or more  | 48 (50.5)                    | 31 (32.3)                      | -35.4                        | .01     |
| Twice or more   | 29 (30.5)                    | 15 (15.6)                      | -48.3                        | .01     |
| Three times or more   | 18 (18.9)                    | 9 (9.4)                        | -50.0                        | .06     |
| Hospital days   |                              |                                |                              |         |
| Total   | 1190                         | 688                            |                              |         |
| Per patient in study  | 12.5 ± 21.2                  | 7.2 ± 19.5                     | -42.4                        | .01     |

\*Unless otherwise indicated, data are mean ± SD or number (percentage) of patients.

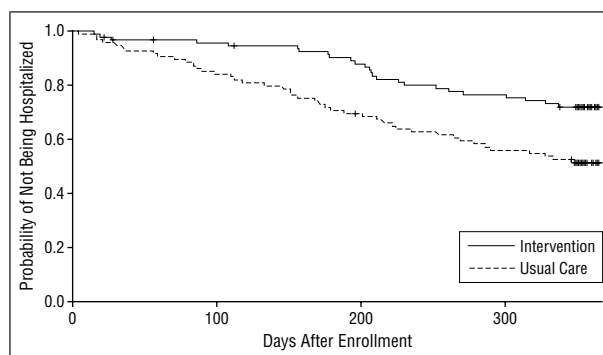
†Percent differences were calculated by dividing the absolute difference between groups by the usual care group value.

ing personnel may provide additional benefits to patients beyond those related to lung disease. The length of stay for those patients admitted to the hospital did not differ significantly between study groups, which contrasts with recent data in a randomized clinical trial of pulmonary rehabilitation.<sup>23</sup> However, it is not known if a structured pulmonary rehabilitation program, recognized to improve patients' functional capacity, could provide, as part of a continuum of self-management, an additional benefit by reducing patients' length of stay in the hospital.

The SGRQ impact subscale and total score treatment differences from baseline were statistically significant at 4 months, and the impact score difference almost reached statistical significance at 12 months. Importantly, these differences at 4 and 12 months reached the minimal clinically important difference of -4.<sup>20,26</sup> The impact score covers social, emotional, and psychological impact of the disease. However, there was no treatment effect on the SGRQ symptoms and activity scores. This fits well in the study with the absence of a treatment effect on exercise capacity as measured by the 6-minute walking distance. It contrasts with the recognized benefit of pulmonary rehabilitation with supervised exercise training on patients' dyspnea and functional capacity.<sup>27</sup> Only limited data are available on the use of the SGRQ in rehabilitation trials. In a recent study, the SGRQ appeared to be more sensitive than the Chronic Respiratory Questionnaire to long-term change; this is because at 1 year, the mean difference between the groups still exceeded the minimum clinically important difference.<sup>23</sup> In the present study, a decrease in the effects of intervention on quality of life at 12 months could have resulted from the progressive nature of the disease, the less intensive personal attention after the first 4 months of the education program, and the inability of patients to continue regular exercise.

Patient characteristics were similar except there were fewer patients taking oral steroids in the intervention group than in the usual care group. However, none of the other characteristics of disease severity such as FEV<sub>1</sub>, dyspnea, and the 6-minute walking test were different between the study groups.

In the present study, blinding was not possible. People may question the validity of the results because



**Figure 2.** Kaplan-Meier curves for the probability of not being admitted to the hospital during the 12-month follow-up period. Data on patients who dropped out or died without being admitted were censored at the time of dropout or death.

physicians and patients knew which treatment was allocated. It is possible, for instance, that physicians hospitalized fewer patients who received the intervention or that patients did better just because they were in the intervention group. We do not believe that there is a physician effect on the outcome of hospital utilization because (1) data were collected by an independent person unaware of the patient allocation and not involved in the care of the patient and (2) criteria for hospitalization were not changed for the sake of the study. We cannot rule out the effect of participation on outcome because being visited, contacted by telephone, and/or observed may have changed patient behavior and reporting. The support offered by the education sessions, the self-management plans, and the active participation of a case manager are the main factors likely responsible for the results.

One limitation of our study is the impossibility to separate the effect of education from the effect of direct support and counseling by the case manager. However, we have reasons to believe that when the patients got sick because of an acute exacerbation, they did not always call the contact health professional. It turned out that patients in the self-management group made a total of 143 calls because of changes in their respiratory conditions. This number contrasts with the 299 acute exacerbations reported by the same patients. This is an issue worthy of further investigation. In the meantime, the inter-

**Table 3. Emergency Department (ED) Visits and Physician Visits\***

| Variable   | Usual Care Group (n = 95) | Intervention Group (n = 96) | Treatment Difference, † % | P Value |
|--|---------------------------|-----------------------------|---------------------------|---------|
| Emergency department visits for acute exacerbation in the year preceding study entry | 212                       | 214                         | +0.94                     | .61     |
| No. of ED visits during 1-y follow-up  |                           |                             |                           |         |
| For acute exacerbation   | 161                       | 95                          | -41.0                     | .02     |
| For other health problems  | 74                        | 57                          | -23.0                     | .34     |
| No. of patients with   |                           |                             |                           |         |
| ≥1 ED visits   | 60 (63.2)                 | 39 (40.6)                   | -35.0                     | .002    |
| ≥2 ED visits   | 33 (34.7)                 | 20 (20.8)                   | -39.4                     | .03     |
| ≥3 ED visits   | 21 (22.1)                 | 13 (13.5)                   | -38.1                     | .12     |
| No. of unscheduled visits  |                           |                             |                           |         |
| Family physician   | 112                       | 46                          | -58.9                     | .003    |
| Specialist   | 26                        | 24                          | -7.7                      | .32     |
| No. of scheduled visits  |                           |                             |                           |         |
| Family physician   | 309                       | 354                         | +14.6                     | .34     |
| Specialist   | 316                       | 347                         | +9.8                      | .91     |

\*Unless otherwise indicated, data are number or number (percentage) of patients.

†Percent differences were calculated by dividing the absolute percent difference between groups by the comparison group value.

**Table 4. Changes in Health-Related Quality-of-Life Scores as Determined by the St George Respiratory Questionnaire\***

| Variable               | Symptoms            | Activity                  | Impact               | All (Total Score)   |
|------------------------|---------------------|---------------------------|----------------------|---------------------|
|                        |                     | <b>Usual Care Group</b>   |                      |                     |
| Baseline (n = 95)†     | 61.8 ± 16.2         | 72.4 ± 17.0               | 44.2 ± 19.3          | 55.7 ± 15.7         |
| 4-mo change (n = 84)‡  | -1.1 (-4.5 to 2.2)  | -1.8 (-5.0 to 1.4)        | -2.9 (-6.3 to 0.5)   | -2.3 (-4.8 to 0.3)  |
| 12-mo change (n = 76)‡ | -4.9 (-8.9 to -0.9) | 0.2 (-3.1 to 3.5)         | -1.4 (-4.5 to 1.8)   | -1.5 (-3.9 to 1.0)  |
|                        |                     | <b>Intervention Group</b> |                      |                     |
| Baseline (n = 96)†     | 60.3 ± 18.4         | 71.1 ± 18.1               | 42.4 ± 20.4          | 54.1 ± 16.6         |
| 4-mo change (n = 88)‡  | -1.5 (-5.6 to 2.7)  | -4.5 (-7.7 to -1.2)       | -9.1 (-12.0 to -6.2) | -6.4 (-8.9 to -4.0) |
| 12-mo change (n = 81)‡ | -3.1 (-7.6 to 1.5)  | 0.8 (-2.7 to 4.2)         | -6.1 (-9.6 to -2.5)  | -3.5 (-6.5 to -0.5) |
| Treatment difference§  |                     |                           |                      |                     |
| 4 mo                   | -0.3 (-5.7 to 5.0)  | -2.7 (-7.2 to 1.9)        | -6.2 (-10.7 to -1.8) | -4.2 (-7.7 to -0.7) |
| 12 mo                  | 1.8 (-4.2 to 7.8)   | 0.6 (-4.2 to 5.3)         | -4.7 (-9.5 to 0.01)  | -2.0 (-5.9 to 1.8)  |

\*Lower score or negative score changes on the questionnaire indicate better health status.

†Mean ± SD.

‡Values are change from the baseline (95% confidence interval).

§Treatment difference was calculated from the absolute changes at 4 and 12 months between the intervention and usual care groups (95% confidence interval).

vention, which combines multiple treatment components with the ongoing attention of and communication with a trained health professional, seems to provide favorable results in real life.

This approach of care through a continuum of self-management is interesting because it does not require specialized resources and it could easily be implemented within normal practice by health professionals. The present study supports its use as an integral part of the long-term care of patients with moderate to advanced COPD.

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