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Community-Based Multidisciplinary Care for Patients With Stable Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis

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About the Medical Advisory Secretariat

Effective April 5, 2011, the Medical Advisory Secretariat (MAS) became a part of Health Quality Ontario (HQO), an independent body funded by the Ministry of Health and Long-Term Care. The mandate of MAS is to provide evidence-based recommendations on the coordinated uptake of health services and health technologies in Ontario to the Ministry of Health and Long-Term Care and to the health care system. This mandate helps to ensure that residents of Ontario have access to the best available and most appropriate health services and technologies to improve patient outcomes.

To fulfill its mandate, MAS conducts systematic reviews of evidence and consults with experts in the health care services community. The resulting evidence-based analyses are reviewed by the Ontario Health Technology Advisory Committee—to which MAS also provides a secretariat function—and published in the *Ontario Health Technology Assessment Series*.

About the *Ontario Health Technology Assessment Series*

To conduct its comprehensive analyses, MAS systematically reviews the available scientific literature, making every effort to consider all relevant national and international research; collaborates with partners across relevant government branches; consults with clinical and other external experts and developers of new health technologies; and solicits any necessary supplemental information.

In addition, the Secretariat collects and analyzes information about how a new technology fits within current practice and existing treatment alternatives. Details about the technology's diffusion into current health care practices add an important dimension to the review of the provision and delivery of the health technology in Ontario. Information concerning the health benefits; economic and human resources; and ethical, regulatory, social and legal issues relating to the technology assist decision-makers in making timely and relevant decisions to optimize patient outcomes.

The public consultation process is available to individuals wishing to comment on an analysis prior to publication. For more information, please visit: http://www.hqontario.ca/en/mas/ohtac_public_engage_overview.html.

Disclaimer

This evidence-based analysis was prepared by MAS for the Ontario Health Technology Advisory Committee and developed from analysis, interpretation, and comparison of scientific research and/or technology assessments conducted by other organizations. It also incorporates, when available, Ontario data and information provided by experts and applicants to MAS to inform the analysis. While every effort has been made to reflect all scientific research available, this document may not fully do so. Additionally, other relevant scientific findings may have been reported since completion of the review. This evidence-based analysis is current to the date of the literature review specified in the methods section. This analysis may be superseded by an updated publication on the same topic. Please check the MAS website for a list of all evidence-based analyses:
http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

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List of Abbreviations

CI	Confidence interval(s)
CINAHL	Cumulative Index to Nursing & Allied Health Literature
COPD	Chronic obstructive pulmonary disease
ED	Emergency department
FEV_1	Forced expiratory volume in 1 second
FVC	Forced vital capacity
MDC	Multidisciplinary care
GOLD	Global Initiative for Chronic Obstructive Lung Disease
I^2	Index of heterogeneity
n	Number
NR	Not reported
NS	Nonsignificant
OHTAC	Ontario Health Technology Advisory Committee
RCT	Randomized controlled trial
RR	Relative risk
SD	Standard deviation
SGRQ	St. George's Respiratory Questionnaire
UC	Usual care

Executive Summary

In July 2010, the Medical Advisory Secretariat (MAS) began work on a Chronic Obstructive Pulmonary Disease (COPD) evidentiary framework, an evidence-based review of the literature surrounding treatment strategies for patients with COPD. This project emerged from a request by the Health System Strategy Division of the Ministry of Health and Long-Term Care that MAS provide them with an evidentiary platform on the effectiveness and cost-effectiveness of COPD interventions.

After an initial review of health technology assessments and systematic reviews of COPD literature, and consultation with experts, MAS identified the following topics for analysis: vaccinations (influenza and pneumococcal), smoking cessation, multidisciplinary care, pulmonary rehabilitation, long-term oxygen therapy, noninvasive positive pressure ventilation for acute and chronic respiratory failure, hospital-at-home for acute exacerbations of COPD, and telehealth (including telemonitoring and telephone support). Evidence-based analyses were prepared for each of these topics. For each technology, an economic analysis was also completed where appropriate. In addition, a review of the qualitative literature on patient, caregiver, and provider perspectives on living and dying with COPD was conducted, as were reviews of the qualitative literature on each of the technologies included in these analyses.

The Chronic Obstructive Pulmonary Disease Mega-Analysis series is made up of the following reports, which can be publicly accessed at the MAS website at: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

- Chronic Obstructive Pulmonary Disease (COPD) Evidentiary Framework
- Influenza and Pneumococcal Vaccinations for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis
- Smoking Cessation for Patients With Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis
- Community-Based Multidisciplinary Care for Patients With Stable Chronic Obstructive Pulmonary Disease (COPD): An Evidence-Based Analysis
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- Cost-Effectiveness of Interventions for Chronic Obstructive Pulmonary Disease Using an Ontario Policy Model
- Experiences of Living and Dying With COPD: A Systematic Review and Synthesis of the Qualitative Empirical Literature

For more information on the qualitative review, please contact Mita Giacomini at: http://fhs.mcmaster.ca/ceb/faculty_member_giacomini.htm.

For more information on the economic analysis, please visit the PATH website: http://www.path-hta.ca/About-Us/Contact-Us.aspx.

The Toronto Health Economics and Technology Assessment (THETA) collaborative has produced an associated report on patient preference for mechanical ventilation. For more information, please visit the THETA website: http://theta.utoronto.ca/static/contact.

Objective

The objective of this evidence-based analysis was to determine the effectiveness and cost-effectiveness of multidisciplinary care (MDC) compared with usual care (UC, single health care provider) for the treatment of stable chronic obstructive pulmonary disease (COPD).

Clinical Need: Condition and Target Population

Chronic obstructive pulmonary disease is a progressive disorder with episodes of acute exacerbations associated with significant morbidity and mortality. Cigarette smoking is linked causally to COPD in more than 80% of cases. Chronic obstructive pulmonary disease is among the most common chronic diseases worldwide and has an enormous impact on individuals, families, and societies through reduced quality of life and increased health resource utilization and mortality.

The estimated prevalence of COPD in Ontario in 2007 was 708,743 persons.

Technology

Multidisciplinary care involves professionals from a range of disciplines, working together to deliver comprehensive care that addresses as many of the patient's health care and psychosocial needs as possible.

Two variables are inherent in the concept of a multidisciplinary team: i) the multidisciplinary components such as an enriched knowledge base and a range of clinical skills and experiences, and ii) the team components, which include but are not limited to, communication and support measures. However, the most effective number of team members and which disciplines should comprise the team for optimal effect is not yet known.

Research Question

What is the effectiveness and cost-effectiveness of MDC compared with UC (single health care provider) for the treatment of stable COPD?

Research Methods

Literature Search

Search Strategy

A literature search was performed on July 19, 2010 using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 1995 until July 2010. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

- health technology assessments, systematic reviews, or randomized controlled trials
- studies published between January 1995 and July 2010;
- COPD study population
- studies comparing MDC (2 or more health care disciplines participating in care) compared with UC (single health care provider)

Exclusion Criteria

- grey literature
- duplicate publications
- non-English language publications
- study population less than 18 years of age

Outcomes of Interest

- hospital admissions
- emergency department (ED) visits
- mortality
- health-related quality of life
- lung function

Quality of Evidence

The quality of each included study was assessed, taking into consideration allocation concealment, randomization, blinding, power/sample size, withdrawals/dropouts, and intention-to-treat analyses.

The quality of the body of evidence was assessed as high, moderate, low, or very low according to the GRADE Working Group criteria. The following definitions of quality were used in grading the quality of the evidence:

High	Further research is very unlikely to change confidence in the estimate of effect.
Moderate	Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate.
Low	Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.
Very Low	Any estimate of effect is very uncertain.

Summary of Findings

Six randomized controlled trials were obtained from the literature search. Four of the 6 studies were completed in the United States. The sample size of the 6 studies ranged from 40 to 743 participants, with a mean study sample between 66 and 71 years of age. Only 2 studies characterized the study sample in terms of the Global Initiative for Chronic Obstructive Lung Disease (GOLD) COPD stage criteria, and in general the description of the study population in the other 4 studies was limited. The mean percent predicted forced expiratory volume in 1 second (% predicted FEV_1) among study populations was

between 32% and 59%. Using this criterion, 3 studies included persons with severe COPD and 2 with moderate COPD. Information was not available to classify the population in the sixth study.

Four studies had MDC treatment groups which included a physician. All studies except 1 reported a respiratory specialist (i.e., respiratory therapist, specialist nurse, or physician) as part of the multidisciplinary team. The UC group was comprised of a single health care practitioner who may or may not have been a respiratory specialist.

A meta-analysis was completed for 5 of the 7 outcome measures of interest including:

- health-related quality of life,
- lung function,
- all-cause hospitalization,
- COPD-specific hospitalization, and
- mortality.

There was only 1 study contributing to the outcome of all-cause and COPD-specific ED visits which precluded pooling data for these outcomes. Subgroup analyses were not completed either because heterogeneity was not significant or there were a small number of studies that were meta-analysed for the outcome.

Quality of Life

Three studies reported results of quality of life assessment based on the St. George's Respiratory Questionnaire (SGRQ). A mean decrease in the SGRQ indicates an improvement in quality of life while a mean increase indicates deterioration in quality of life. In all studies the mean change score from baseline to the end time point in the MDC treatment group showed either an improvement compared with the control group or less deterioration compared with the control group. The mean difference in change scores between MDC and UC groups was statistically significant in all 3 studies. The pooled weighted mean difference in total SGRQ score was −4.05 (95% confidence interval [CI], −6.47 to 1.63; P = 0.001). The GRADE quality of evidence was assessed as low for this outcome.

Lung Function

Two studies reported results of the FEV_1 % predicted as a measure of lung function. A negative change from baseline infers deterioration in lung function and a positive change from baseline infers an improvement in lung function. The MDC group showed a statistically significant improvement in lung function up to 12 months compared with the UC group (P = 0.01). However this effect is not maintained at 2-year follow-up (P = 0.24). The pooled weighted mean difference in FEV_1 percent predicted was 2.78 (95% CI, −1.82 to −7.37). The GRADE quality of evidence was assessed as very low for this outcome indicating that an estimate of effect is uncertain.

Hospital Admissions

All-Cause

Four studies reported results of all-cause hospital admissions in terms of number of persons with at least 1 admission during the follow-up period. Estimates from these 4 studies were pooled to determine a summary estimate. There is a statistically significant 25% relative risk (RR) reduction in all-cause hospitalizations in the MDC group compared with the UC group (P < 0.001). The index of heterogeneity

(I^2) value is 0%, indicating no statistical heterogeneity between studies. The GRADE quality of evidence was assessed as moderate for this outcome, indicating that further research may change the estimate of effect.

COPD-Specific Hospitalization

Three studies reported results of COPD-specific hospital admissions in terms of number of persons with at least 1 admission during the follow-up period. Estimates from these 3 studies were pooled to determine a summary estimate. There is a statistically significant 33% RR reduction in all-cause hospitalizations in the MDC group compared with the UC group ($P = 0.002$). The I^2 value is 0%, indicating no statistical heterogeneity between studies. The GRADE quality of evidence was assessed as moderate for this outcome, indicating that further research may change the estimate of effect.

Emergency Department Visits

All-Cause

Two studies reported results of all-cause ED visits in terms of number of persons with at least 1 visit during the follow-up period. There is a statistically nonsignificant reduction in all-cause ED visits when data from these 2 studies are pooled (RR, 0.64; 95% CI, 0.31 to −1.33; $P = 0.24$). The GRADE quality of evidence was assessed as very low for this outcome indicating that an estimate of effect is uncertain.

COPD-Specific

One study reported results of COPD-specific ED visits in terms of number of persons with at least 1 visit during the follow-up period. There is a statistically significant 41% reduction in COPD-specific ED visits when the data from these 2 studies are pooled (RR, 0.59; 95% CI, 0.43–0.81; $P < 0.001$). The GRADE quality of evidence was assessed as moderate for this outcome.

Mortality

Three studies reported the mortality during the study follow-up period. Estimates from these 3 studies were pooled to determine a summary estimate. There is a statistically nonsignificant reduction in mortality between treatment groups (RR, 0.81; 95% CI, 0.52–1.27; $P = 0.36$). The I^2 value is 19%, indicating low statistical heterogeneity between studies. All studies had a 12-month follow-up period. The GRADE quality of evidence was assessed as low for this outcome.

Conclusions

Significant effect estimates with moderate quality of evidence were found for all-cause hospitalization, COPD-specific hospitalization, and COPD-specific ED visits (Table ES1). A significant estimate with low quality evidence was found for the outcome of quality of life (Table ES2). All other outcome measures were nonsignificant and supported by low or very low quality of evidence.

Table ES1: Summary of Dichotomous Data

Outcome	Number of Studies (n)	Relative Risk (95% CI)	GRADE
Hospitalizations			
All-cause (number of persons)	4 (1121)	0.75 (0.64–0.87)	Moderate
COPD-specific (number of persons)	3 (916)	0.67 (0.52–0.87)	Moderate
Emergency Department Visits			
All-cause (number of persons)	2 (223)	0.64 (0.31–1.33)	Very Low
COPD-specific (number of persons)	2 (783)	0.59 (0.43–0.81)	Moderate
Mortality			
	3 (1033)	0.81 (0.52–1.27)	Low

*Abbreviations: CI, confidence intervals; COPD, chronic obstructive pulmonary disease; n, number.

Table ES2: Summary of Continuous Data

Outcome	Number of Studies (n)	Weighted Mean Difference (95% CI)	GRADE
Quality of Life (SGRQ)	2 (942)	-4.05 (-6.47 to -1.63)	Low
Lung Function (FEV_1% predicted)	2 (316)	2.78 (-1.82–7.37)	Very Low

*Abbreviations: CI, confidence intervals; FEV_1, forced expiratory volume in 1 second; n, number; SGRQ, St. George's Respiratory Questionnaire.

Background

In July 2010, the Medical Advisory Secretariat (MAS) began work on a Chronic Obstructive Pulmonary Disease (COPD) evidentiary framework, an evidence-based review of the literature surrounding treatment strategies for patients with COPD. This project emerged from a request by the Health System Strategy Division of the Ministry of Health and Long-Term Care that MAS provide them with an evidentiary platform on the effectiveness and cost-effectiveness of COPD interventions.

After an initial review of health technology assessments and systematic reviews of COPD literature, and consultation with experts, MAS identified the following topics for analysis: vaccinations (influenza and pneumococcal), smoking cessation, multidisciplinary care, pulmonary rehabilitation, long-term oxygen therapy, noninvasive positive pressure ventilation for acute and chronic respiratory failure, hospital-at-home for acute exacerbations of COPD, and telehealth (including telemonitoring and telephone support). Evidence-based analyses were prepared for each of these topics. For each technology, an economic analysis was also completed where appropriate. In addition, a review of the qualitative literature on patient, caregiver, and provider perspectives on living and dying with COPD was conducted, as were reviews of the qualitative literature on each of the technologies included in these analyses.

The Chronic Obstructive Pulmonary Disease Mega-Analysis series is made up of the following reports, which can be publicly accessed at the MAS website at: http://www.hqontario.ca/en/mas/mas_ohtas_mn.html.

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Objective of Analysis

The objective of this evidence-based analysis was to determine the effectiveness and cost-effectiveness of multidisciplinary care (MDC) compared with usual care (UC, single health care provider) for the treatment of stable chronic obstructive pulmonary disease (COPD).

Clinical Need and Target Population

Description of Problem

Chronic obstructive pulmonary disease is a progressive disorder with episodes of acute exacerbations associated with significant morbidity and mortality. (1) Cigarette smoking is linked causally to COPD in more than 80% of cases. (1;2) Chronic obstructive pulmonary disease is among the most common chronic diseases worldwide and has an enormous impact on individuals, families, and societies through reduced quality of life and increased health resource utilization and mortality. (3)

Ontario Prevalence

The estimated prevalence of COPD in Ontario in 2007 was 708,743 persons. (4)

Technology

Multidisciplinary care involves professionals from a range of disciplines, working together to deliver comprehensive care that addresses as many of the patient's health care and psychosocial needs as possible.

Mitchell et al (5) hypothesized that MDC can be delivered by a range of professionals functioning as a team under one organizational umbrella, or from a range of organizations brought together as a unique team.

The concept of MDC for COPD is not a new one. In 1985, The American Thoracic Society Position Paper stated that "the individual with chronic obstructive pulmonary disease (COPD) requires long-term multidisciplinary care because of the physiologic and psychological problems associated with this disease" and that "because of the chronic, progressive nature of COPD, provision of care must be comprehensive and continuous, with particular attention given to outpatient and home care services." (6) The health care of persons with COPD was seen as the responsibility of the health care team, which included at the very least a physician and a pulmonary clinical nurse specialist or respiratory therapist.

Nie et al (7) found that persons in Ontario with COPD who were cared for by both a family physician or general practitioner and a specialist had significantly lower mortality rates than persons cared for by only one physician, suggesting that coordinated care can result in better survival.

Two variables are inherent in the concept of a multidisciplinary team: i) the multidisciplinary components such as an enriched knowledge base and a range of clinical skills and experiences, and ii) the team components, which include but are not limited to, communication and support measures. (5) However, the most effective number of team members and which disciplines should comprise the team for optimal effect is not yet known. (5)

Evidence-Based Analysis

Research Question

What is the effectiveness and cost-effectiveness of MDC compared with UC (single health care provider) for the treatment of stable chronic COPD?

Literature Search

Search Strategy

A literature search was performed on July 19, 2010 using OVID MEDLINE, OVID MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), the Wiley Cochrane Library, and the Centre for Reviews and Dissemination database, for studies published from January 1, 1995 until July 2010. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

Inclusion Criteria

- health technology assessments, systematic reviews, or randomized controlled trials (RCTs)
- studies published between January 1995 and July 2010
- COPD study population
- studies comparing MDC (2 or more health care disciplines participating in care) with UC (single health care provider)

Exclusion Criteria

- grey literature
- duplicate publications
- non-English language publications
- study population less than 18 years of age

Outcomes of Interest

- hospital admissions
- emergency department (ED) visits
- mortality
- health-related quality of life (HRQOL)
- lung function

Statistical Analysis

Where appropriate, a meta-analysis was undertaken to determine the pooled estimate of effect of multidisciplinary care for explicit outcomes using Review Manager 5 version 5.0.25.

Quality of Evidence

The quality of each included study was assessed taking into consideration the following 7 study design characteristics:

- adequate allocation concealment,
- randomization (study must include a description of the randomization procedure used and this must be a proper method),
- power/sample size (adequate sample size based on a priori calculations; underpowered studies were identified, when possible, using post hoc sample size power calculations),
- blinding (if double blinding is not possible, a single blind study with unbiased assessment of outcome was considered adequate for this criterion),
- < 20% withdrawals/dropouts,
- intention-to-treat analysis conducted and done properly (withdrawals/dropouts considered in analysis), and
- other criteria as appropriate for the particular research question and study design.

The quality of the body of evidence was assessed as high, moderate, low, or very low according to the GRADE Working Group criteria (8) as presented below.

- Quality refers to the criteria such as the adequacy of allocation concealment, blinding and follow-up.
- Consistency refers to the similarity of estimates of effect across studies. If there are important and unexplained inconsistencies in the results, our confidence in the estimate of effect for that outcome decreases. Differences in the direction of effect, the magnitude of the difference in effect, and the significance of the differences guide the decision about whether important inconsistency exists.
- Directness refers to the extent to which the interventions and outcome measures are similar to those of interest.

As stated by the GRADE Working Group, the following definitions of quality were used in grading the quality of the evidence:

High	Further research is very unlikely to change confidence in the estimate of effect.
Moderate	Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate.
Low	Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.
Very Low	Any estimate of effect is very uncertain.

Results of Evidence-Based Analysis

The database search yielded 2,919 citations published between January 1, 1995, and July 2010 (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment. Figure 1 shows the breakdown of when and for what reason citations were excluded in the analysis.

Four randomized controlled trials met the inclusion criteria. (9-14) The references lists of the included studies and health technology assessment websites were hand searched to identify any additional potentially relevant studies, and 2 additional citations were included for a total of 6 included citations.

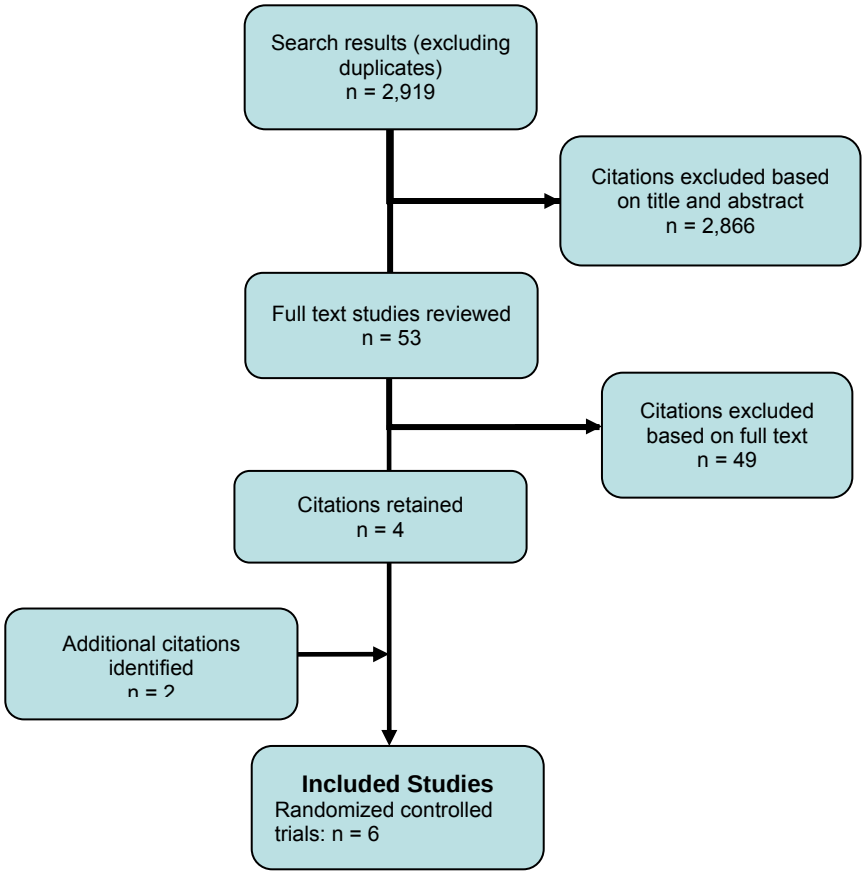

Figure 1: Citation Flow Chart

For each included study, the study design was identified and is summarized below in Table 1, which is a modified version of a hierarchy of study design by Goodman. (15)

Table 1: Body of Evidence Examined According to Study Design*

Study Design	Number of Eligible Studies
RCT Studies	
Systematic review of RCTs	
Large RCT	3
Small RCT	3
Observational Studies	
Systematic review of non-RCTs with contemporaneous controls	
Non-RCT with non-contemporaneous controls	
Systematic review of non-RCTs with historical controls	
Non-RCT with historical controls	
Database, registry, or cross-sectional study	
Case series	
Retrospective review, modelling	
Studies presented at an international conference	
Expert opinion	
Total	6

*Abbreviation: RCT, randomized controlled trial.

Characteristics of Included Studies

Table 2 presents an overview of the characteristics of the studies included in this evidence-based analysis and Table 3 reports the methodological characteristics of each study. Complete study details are reported in Appendix 2. Four of the 6 studies were completed in the United States. (10-13) The sample size of the 6 studies ranged from 40 to 743 people, with a mean study sample age between 66 and 71 years. Only the studies by van Wetering et al (14) and Koff et al (10) characterized the study sample in terms of the Global Initiative for Chronic Obstructive Lung Disease (GOLD) COPD stage criteria, and in general the description of the study population in the other 4 studies was limited. The mean percent predicted forced expiratory volume in 1 second (% predicted FEV_1) among study populations was between 32% and 59%.

The GOLD COPD (16) stage criteria are as follows:

Stage I: Mild COPD - Mild airflow limitation (Forced Expiratory Volume in 1 minute/Forced Vital Capacity, $FEV_1/FVC < 70\%$; $FEV_1 \geq 80\%$ predicted) and sometimes, but not always chronic cough and sputum production. At this stage, the individual may not be aware that his or her lung function is abnormal.

Stage II: Moderate COPD - Worsening airflow limitation ($FEV_1/FVC < 70\%$; $50\% > FEV_1 < 80\%$ predicted), with shortness of breath typically developing on exertion. This is the stage at which patients typically seek medical attention for chronic respiratory symptoms or an exacerbation of their disease.

Stage III: Severe COPD - Further worsening of airflow limitation ($FEV_1/FVC < 70\%$; $30\% > FEV_1 < 50\%$ predicted), greater shortness of breath, reduced exercise capacity, and repeated exacerbations, which have an impact on a patient's quality of life.

Stage IV: Very Severe COPD - Severe airflow limitation ($FEV_1/FVC < 70\%$; $FEV_1 < 30\%$ predicted) or ($FEV_1 < 50\%$ predicted plus chronic respiratory failure). Patients may have very severe (Stage IV) COPD (even if the FEV_1 is > 30% predicted) whenever this complication is present. At this stage, quality of life is very appreciably impaired and exacerbations may be life-threatening.

Using the GOLD stage FEV_1 percent predicted criterion, there are 2 studies that have populations with moderate COPD and 3 with populations with severe COPD (Table 2).

Four studies had MDC treatment groups, which included a physician (9-11;13), and 2 did not. (12;14) All studies other than the one by Solomon et al (13) reported a respiratory specialist (i.e., respiratory therapist, specialist nurse, or physician) as part of the multidisciplinary team.

The UC group was comprised of a single health care practitioner that may or may not have been a respiratory specialist. The UC group in the study by Rice et al (12) had access to a 24-hour nursing telephone helpline, which was standard practice for the health care facility where the study was carried out.

Study methodological characteristics are reported in Table 3. Adequate allocation concealment was unclear in 2 studies, those by Rea et al (11) and Solomon et al. (13) The study by Rea et al (11) randomized general practitioner practices and thus randomization was not done at the patient level. However, the data was reported at the patient level. This study has been pooled with the results of the other studies where applicable, with sensitivity analyses undertaken to determine its effect on the overall summary statistic. The studies by van Wetering et al (14) and Casas et al (9) had a loss to follow-up rate of greater than 20%. All methodological assessments have been taken into consideration when determining the GRADE quality of evidence.

Table 2: Characteristics of Studies Included for Analysis*

Study	Country	n	Age (Mean, Yr)	Population	FEV_1% Predicted (Mean) (GOLD Stage)	MDC Group	Usual Care Group	Follow-up (Months)
van Wetering et al, 2010 (14)	Netherlands	199	66	GOLD stage 2 or 3	59 (moderate)	Physiotherapist, dieticians, and respiratory nurses	Respiratory physician	12
Rice et al, 2010 (12)	United States	743	70	Severe, FEV_1 < 70% predicted post bronchodilator 55% used home oxygen	37 (severe)	Respiratory therapist and pharmacist	Usual care which included access to 24 hour nursing helpline	12
Koff et al, 2009 (10)	United States	40	66	GOLD stage 3 or 4	32 (severe)	Respiratory therapist, General practitioner	Healthcare provider	3
Casas 2006 (9)	Spain	155	71	Moderate to severe, persons hospitalized for >48 hours for exacerbation	42 (severe)	Specialized nurse, physician, nurse, social worker	Physician	12
Rea et al, 2004 (11)	New Zealand	135	68	Moderate to severe	51 (moderate)	General practitioner, nurse, respiratory physician, respiratory nurse specialist	General practitioner	12
Solomon et al, 1998 (13)	United States	98	69	Diagnosed with COPD as per the American Thoracic Society Criteria	Not reported (unknown)	Pharmacist and physician	Physician	6

*Abbreviations: COPD, chronic obstructive pulmonary disease; FEV_1, forced expiratory volume in 1 second; GOLD, Global Initiative for Chronic Obstructive Lung Disease; MDC, multidisciplinary care; n, number; yr, years.

Table 3: Methodological Characteristics of Included Studies*

Study	n	Adequate Randomization Methods	Baseline Comparable	Adequate Allocation Concealment	Blinding of Outcome Assessors for Primary Outcome	Sample Size Calculation	Losses to Follow-up	ITT Analysis with Primary Outcome
van Wetering et al, 2010 (14)	199	✓	✓	✓	✓	✓	21% MDC:25% UC:16.5%	✓
Rice et al, 2010 (12)	743	✓	✓	✓	✓	✓	3%	✓
Koff et al, 2009 (10)	40	✓	✓	✓	x	✓	5%	Not reported
Casas et al, 2006 (9)	155	✓	†✓	✓	✓	✓	23% 17% deaths ‡6% other	✓
Rea et al, 2004 (11)	135	✓	✓	unclear	unclear	✓	10% GP practices 13% patients	✓
Solomon et al, 1998 (13)	98	✓	✓	unclear	x	x	11%	Not reported

*Abbreviations: MDC, multidisciplinary care group; n, number; UC, usual care group; GP, general practice; ITT, intention-to-treat.
†Statistically significantly more persons in the control group had influenza vaccinations.
‡ Reasons include palliative care, change of address, neoplasm.

In all studies the MDC group were provided with several COPD interventions, which were often collectively described as a program of care. Table 4 reports the interventions with general descriptions obtained from the 6 studies included in this review.

Table 4: Chronic Obstructive Pulmonary Disease Interventions*

Interventions	Description
Disease specific education	The program provided education about causes, symptoms, and treatment of exacerbations and general knowledge of COPD, including the importance of vaccinations
Medication review	Review and adjustment of COPD medication
Physical activity counselling	Provided exercise training
Smoking cessation counselling	Provided counselling on smoking cessation and smoking cessation interventions
Self-care counselling	Taught awareness for changes in health, worsening symptoms, symptom control, and nutritional management
Evidence-based guidelines	MDC team followed evidence-based guidelines for the management of COPD
Regular follow-up	Regular follow-up visits and/or phone calls were scheduled

*Abbreviations: COPD, chronic obstructive pulmonary disease; MDC, multidisciplinary care.

These interventions were further categorized using Wagner's model of chronic care (Table 5). All studies included a decision support component and a self-management component in their program. Five of the 6 studies used an intervention under the delivery system component. At least 50% of the studies used 2 interventions under each domain (Table 5).

Table 5: Interventions Used in Multidisciplinary Care Treatment Categorized Using Wagner's Chronic Care Model

	Wagner's Chronic Care Model						
	Decision Support		***Self Management (Behaviour Modification)**			**Delivery System**	
Study	**Disease Specific Education**	**Medication Review**	**Physical Activity Counselling**	**Smoking Cessation Counselling**	**Self-Care Counselling**	**Evidence-Based Guidelines**	**Regular Follow-Up**
van Wetering et al, 2010 (14)	✓	x	✓	✓	✓	x	✓
Rice et al, 2010 (12)	✓	✓	✓	✓	✓	✓	✓
Koff et al, 2009 (10)	✓	✓	x	x	✓	✓	✓
Casas et al, 2006 (9)	✓	✓	x	x	✓	✓	✓
Rea et al, 2004 (11)	✓	✓	✓	✓	✓	✓	✓
Solomon et al,1998 (13)	✓	✓	x	x	✓	x	x
Total	**6**	**5**	**3**	**3**	**6**	**4**	**5**

* Domains of Wagner's Chronic Care Model.

Summary of Existing Evidence

A meta-analysis was completed for 5 of the 7 outcome measures of interest including:

- quality of life,
- lung function,
- all-cause hospitalization,
- COPD-specific hospitalization, and
- mortality.

There was only 1 study contributing to the outcome of all-cause and COPD-specific ED visits, which precluded pooling data for these outcomes. Subgroup analyses were also not completed because heterogeneity was not significant or there were a small number of studies that were meta-analysed for the outcome.

Quality of Life

Three studies reported results of the quality of life assessment based on the St. George's Respiratory Questionnaire (SGRQ). (10;12;14) All studies compared the difference in the mean change scores from baseline to the end time point between the MDC and UC groups. The study by van Wetering et al (14) reported the mean difference in change scores between groups at 4 months and at 24 months, while Koff et al (10) reported this change at 3 months, and Rice et al (12) at 12 months. The results from each study are reported in Table 6. A decrease in the SGRQ score indicates an improvement in quality of life, while an increase indicates deterioration of quality of life. In all studies the mean change score from baseline to the end time point in the MDC treatment group showed either an improvement compared with the control group, or in the Rice et al (12) study, less deterioration compared with the control group. The mean difference in change scores between the MDC and UC groups was statistically significant in all 3 studies.

Table 6: Mean Change Scores on the St. George's Respiratory Questionnaire*

Study	n	Follow-Up (Months)	MDC Group Mean Change From Baseline (SD) (95% CI)	UC Group Mean Change From Baseline (SD) (95% CI)	Mean Difference in Mean Change From Baseline (SD)	*P* Value
van Wetering et al (14)	199	4	−3.9 (10.3)	0.3 (9.4)	4.2 (*NR)	0.004
van Wetering et al (14)	199	24	−1.4 (8.6)	1.2 (8.4)	2.6 (NR)	0.045
Koff et al (10)	38	3	−10.3 [−17.4; −2.1]	−0.6 [06.5–5.3]	9.7 (NR)	0.018
Rice et al (12)	743	12	1.3 (13.2)	6.4 (13.6)	5.1 (13.6)	< 0.001

Abbreviations: CI, confidence intervals; MDC, multidisciplinary care; ; NR, not reported; n, number; SD, standard deviation; UC, usual care.

Figure 2 reports the meta-analysis of 2 of the 3 studies. The study by Koff et al (10) could not be included, as it did not report standard deviations for each treatment group. An attempt to contact the authors for this information was unsuccessful. Figure 2 includes the data from van Wetering et al (14) at 24 months and Rice et al (12) at 12 months. There is moderate heterogeneity in the analysis (index of heterogeneity [I^2] = 66%). The overall mean difference in the change from baseline scores is −4.09, which is statistically significant ($P = 0.001$) as well as clinically significant. Limitations in this analysis include the study by van Wetering et al (14) that had a 21% loss to follow-up (25% in the MDC group,

and 16.5% in the control group), which may bias the results of the study. As well, the response rate in the Rice et al (12) study for the SRGQ at 1 year was 55% for the MDC group and 60% for the UC group.

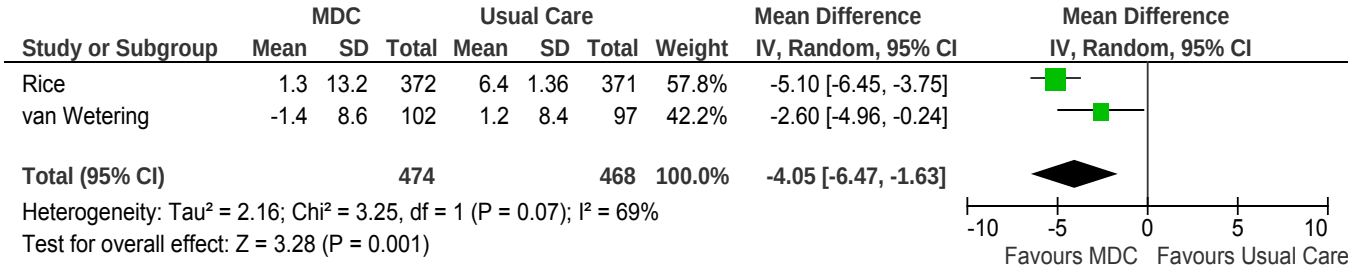

Figure 2: Meta-Analysis of the St. George's Respiratory Questionnaire Mean Change Scores From Baseline*

*Abbreviations: CI, confidence interval; I^2, index of heterogeneity; IV, instrumental variables; MDC, multidisciplinary care; SD, standard deviation.

The GRADE quality of evidence was assessed as low for this outcome, indicating that further research is likely to change the estimate of effect. Details of this assessment, including reasons for downgrading the quality of evidence, are reported in Appendix 3.

Lung Function

Two studies (11;14) reported results of the percent predicted FEV_1 as a measure of lung function (Table 7). van Wetering et al (14) reported this outcome at the 4 and 12-month follow-up, while Rea et al (11) reported it at the 12-month follow-up. A negative change from baseline infers deterioration in lung function and a positive change from baseline infers an improvement in lung function. The MDC group showed a statistically significant improvement in lung function in the van Wetering et al (14) study at 4 months ($P = 0.03$) and in the Rea et al study at 12 months ($P = 0.001$) compared with the UC group. van Wetering et al (14) reported a statistically nonsignificant decrease in lung function in the MDC group compared with the usual care group at the 2-year follow-up.

Table 7: Mean Change From Baseline in FEV_1 (% Predicted)*

Study	n	Follow-up (Months)	MDC Group Mean Change From Baseline (SD)	UC Group Mean Change From Baseline (SD)	Mean Difference in Mean change From Baseline (SD)	*P* Value
van Wetering et al (14)	199	4	0.87 (6.5)	-1.74(7.4)	2.7 (NR)	0.03
van Wetering et al (14)	199	24	-1.6 (7.5)	-2.9 (6.6)	1.3 (NR)	NS
Rea et al (11)	117	12	2.1 (18.7)	-4.40 (18.9)	6.5 (NR)	0.001

*Abbreviations: FEV_1, forced expiratory volume in 1 second; MDC, multidisciplinary care; n, number; NR, not reported; NS, nonsignificant; SD, standard deviation UC, usual care.

These data were pooled and the results are reported in Figures 3 and 4. There is a significant improvement in lung function when the data from Rea et al (11) at 12 months and van Wetering et al (14) at 4 months is pooled ($P = 0.01$) (Figure 3), however this is lost when the data of Rea et al (11) is pooled with the data of van Wetering et al (14) at 2 years ($P = 0.24$) (Figure 4). The study by van Wetering et al (14) indicates that the effect of MDC on lung function is not maintained at the 2-year follow-up.

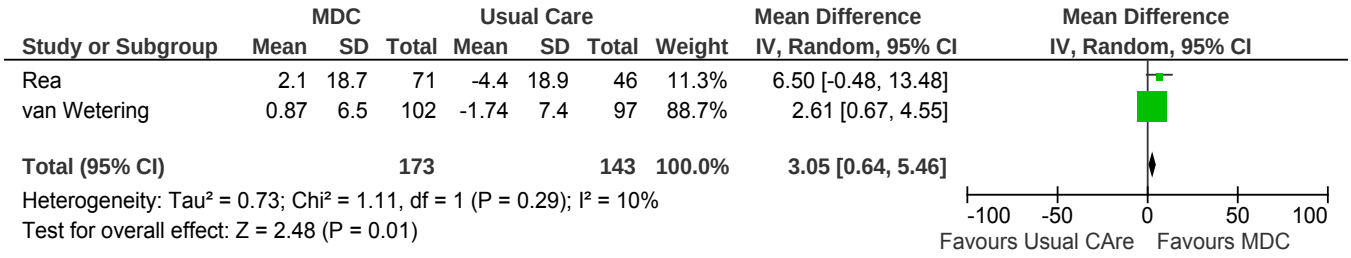

Figure 3: Pooled Results of FEV_1 (% Predicted) Mean Change From Baseline*,†

*Abbreviations: CI, confidence interval; FEV_1, forced expiratory volume in 1 second; I^2, index of heterogeneity; IV, instrumental variables; MDC, multidisciplinary care; SD, standard deviation.
†Data from Rea et al (11) at 12 months pooled with data from van Wetering et al (14) at 4 months.

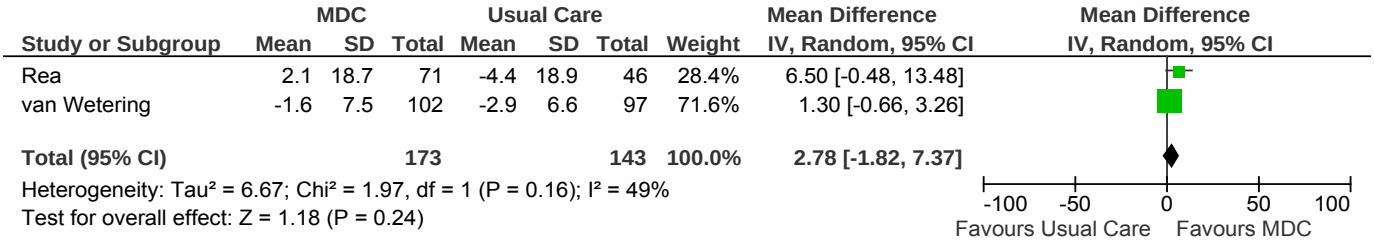

Figure 4: Pooled Results of FEV_1 (% Predicted) Mean Change From Baseline*,†

*Abbreviations: CI, confidence interval; FEV_1, forced expiratory volume in 1 second; I^2, index of heterogeneity; IV, instrumental variables; MDC, multidisciplinary care; SD, standard deviation.
†Data from Rea et al (11) at 12 months pooled with data from van Wetering et al (14) at 2 years.

The GRADE quality of evidence was assessed as very low for this outcome, indicating that an estimate of effect is very uncertain. Details of this assessment, including reasons for downgrading the quality of evidence, are reported in Appendix 3.

Hospital Admissions

All-Cause

Four studies (9;11-13) reported results of all-cause hospital admissions in terms of the number of persons with at least 1 admission during the follow-up period. Estimates from these 4 studies were pooled to determine a summary estimate (Table 8, Figure 5). There is a statistically significant 25% relative risk (RR) reduction ($P < 0.001$) in all-cause hospitalizations in the MDC group compared with the UC group. The I^2 value is 0%, indicating no statistical heterogeneity between the studies.

Table 8: All-Cause Hospital Admissions*

Study	n	Follow-Up (months)	MDC Group	UC Group	RR (95% CI)
Casas et al (9)	155	12	29/65	60/90	0.67 (0.49–0.91)
Rea et al (11)	135	12	29/83	26/52	0.70 (0.47–1.04)
Solomon et al (13)	88	6	4/41	6/47	0.76 (0.23–2.52)
Rice et al (12)	743	12	115/372	144/371	0.80(0.65–0.97)

*Abbreviations: CI, confidence intervals; MDC, multidisciplinary care; n, number; RR, relative risk; UC, usual care.

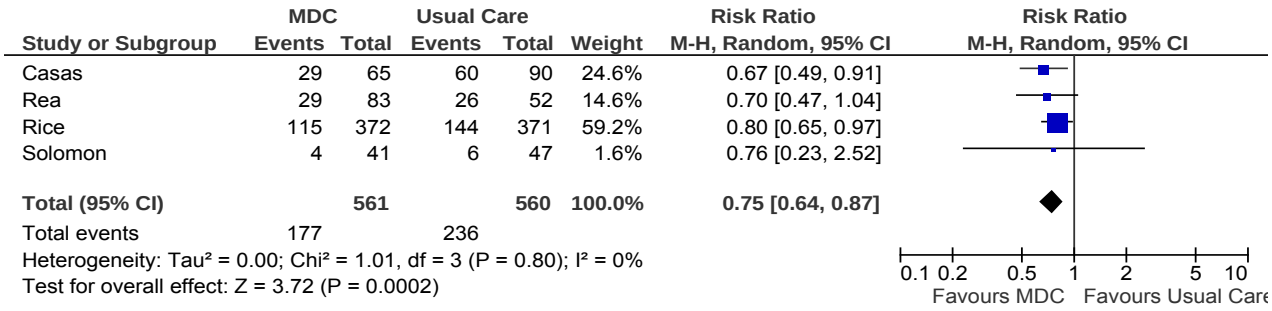

Figure 5: Pooled Results of All-Cause Hospitalizations*

*Abbreviations: CI, confidence interval; I^2, index of heterogeneity; MDC, multidisciplinary care; M–H, Mantel–Haenszel.

Rea et al (11) accounts for 14.6% of the weight in the pooled analysis. As mentioned, this study carried out cluster randomization. If it was removed from the analysis, the RR would be 0.76 (0.64–0.89) and the I^2 value would remain at 0%, with the Rice et al (12) study still contributing the greatest weight in the pooled analysis.

The GRADE quality of evidence was assessed as moderate for this outcome, indicating that further research may change the estimate of effect. Details of this assessment, including reasons for downgrading the quality of evidence, are reported in Appendix 3.

COPD-Specific

Three studies (10-12) reported results of COPD-specific hospital admissions in terms of the number of persons with at least 1 admission during the follow-up period. Estimates from these 3 studies were pooled to determine a summary estimate (Table 9, Figure 6). There is a statistically significant 33% RR reduction ($P = 0.002$) in COPD-specific hospitalizations in the MDC group compared with the UC group. The I^2 value is 0%, indicating no statistical heterogeneity between studies. Removing the Rea et al (11) study from the analysis due to the cluster randomization resulted in a pooled RR of 0.71 (95% CI, 0.53–0.95). However, the summary estimate remains statistically significant and the I^2 value is 0%. The bulk of the weight (98%) when the Rea et al (11) study is removed is contributed from the Rice et al (12) study.

Table 9: COPD-Specific Hospital Admissions*

Study	n	Follow-Up (Months)	MDC Group	UC Group	RR (95% CI)
Koff et al (10)	38	3	1/19	3/19	0.33 (0.04–2.93)
Rea et al (11)	135	12	18/83	20/52	0.56 (0.33–0.96)
Rice et al (12)	743	12	62/372	86/371	0.72(0.54–0.96)

*Abbreviations: CI, confidence intervals; COPD, chronic obstructive pulmonary disease; MDC, multidisciplinary care; n, number; RR, relative risk; n, number; UC, usual care.

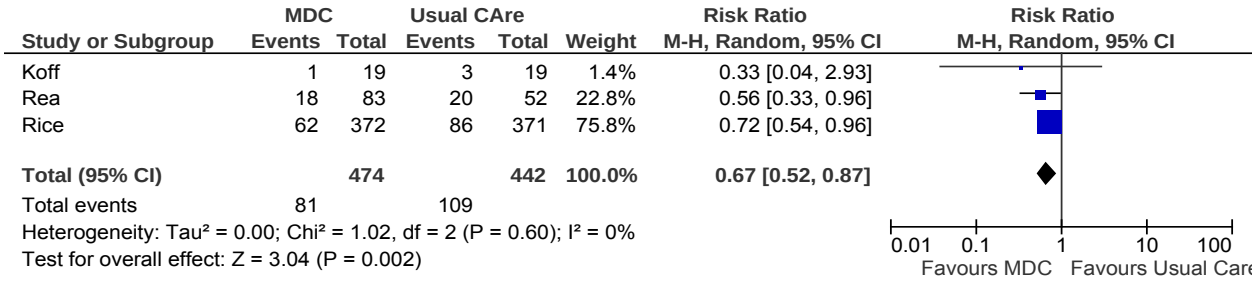

Figure 6: Pooled Results of COPD-Specific Hospital Admissions*

*Abbreviations: CI, confidence interval; I^2, index of heterogeneity; MDC, multidisciplinary care; M–H, Mantel–Haenszel.

The GRADE quality of evidence was assessed as moderate for this outcome, indicating that further research may change the estimate of effect. Details of this assessment, including reasons for downgrading the quality of evidence, are reported in Appendix 3.

Emergency Department Visits

All-Cause

Two studies (11;13) reported results of all-cause ED visits in terms of the number of persons with at least 1 visit during the follow-up period (Table 10). The pooled RR estimate is reported in Figure 7. There is a statistically nonsignificant reduction ($P = 0.24$) in all-cause ED visits when the data from these 2 studies are pooled. There is inconsistency in the RR estimates between the studies and wide confidence estimates denoting imprecision. The relatively low event rates could be contributing to type II error and imprecision. Of note, the study by Rice et al (12) reported a statistically significant reduction in all-cause ED visits ($P < 0.05$). However, data was not provided in the report such that the results could be included in this meta-analysis.

Table 10: All-Cause Emergency Department Visits*

Study	n	End Time Point	MDC Group	UC Group	RR (95% CI)
Solomon et al (13)	88	6 months	6/41	8/47	0.86 (0.33–2.27)
Rea et al (11)	135	12 months	5/83	7/52	0.45(0.15–1.34)

*Abbreviations: CI, confidence intervals; MDC, multidisciplinary care; n, number; RR, relative risk; UC, usual care

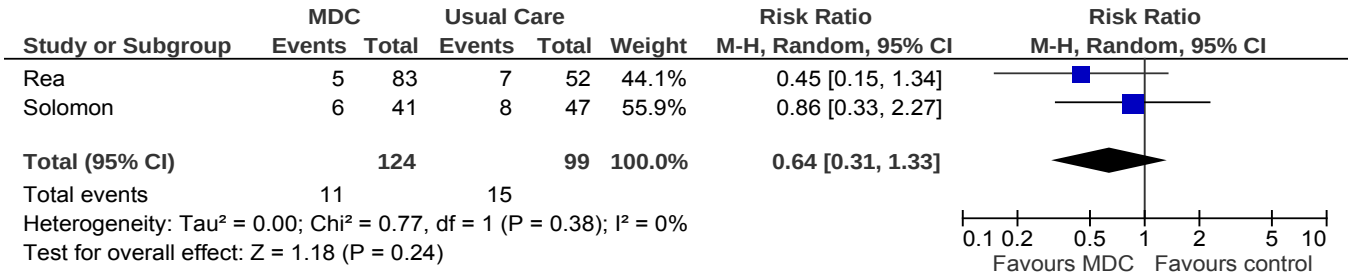

Figure 7: Pooled Results of All-Cause Emergency Department Visits*

*Abbreviations: CI, confidence interval; I^2, index of heterogeneity; MDC, multidisciplinary care; M–H, Mantel–Haenszel.

The GRADE quality of evidence was assessed as very low for this outcome, indicating that an estimate of effect is very uncertain. Details of this assessment, including reasons for downgrading the quality of evidence, are reported in Appendix 3.

COPD-Specific

Two studies (10; 12) reported results of COPD-specific ED visits in terms of the number of persons with at least 1 visit during the follow-up period (Table 11). The pooled RR estimate is reported in Figure 8. There is a statistically significant reduction ($P < 0.001$) in COPD-specific ED visits when data from the 2 studies are pooled. There is some inconsistency in the RR point estimate from each study, which may be in part due to the low event rates in the study by Koff et al. (10)

Table 11: COPD-Specific Emergency Department Visits*

Study	n	Follow-up (Months)	MDC Group	UC Group	RR (95% CI)
Koff et al (10)	38	3	1/19	3/19	0.33 (0.04–2.93)
Rice et al (12)	743	12	51/372	85/371	0.60(0.44–0.82)

*Abbreviations: CI, confidence intervals; MDC, multidisciplinary care; n, number; RR, relative risk; UC, usual care.

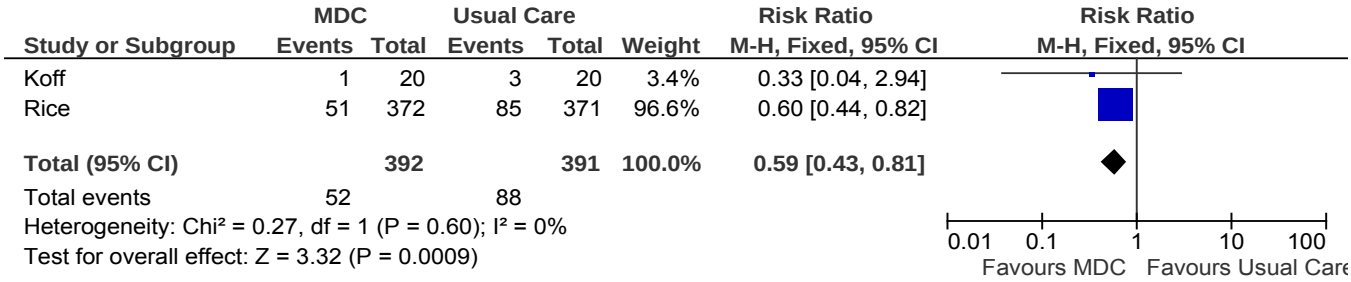

Figure 8: Pooled Results for COPD-Specific Emergency Department Visits*

*Abbreviations: CI, confidence interval; I^2, index of heterogeneity; MDC, multidisciplinary care; M–H, Mantel–Haenszel.

The GRADE quality of evidence was assessed as moderate for this outcome, indicating that further research may change the estimate of effect. Details of this assessment, including reasons for downgrading the quality of evidence, are reported in Appendix 3.

Mortality

Three studies reported mortality during the study follow-up period. (9;11;12) Estimates from these 3 studies were pooled to determine a summary estimate (Table 12, Figure 9). There is a statistically nonsignificant reduction ($P = 0.36$) in mortality between the treatment groups. The I^2 value is 21%, indicating low statistical heterogeneity between studies. All studies had a 12-month follow-up period.

Table 12: All-Cause Mortality*

Study	n	Follow-up (Months)	MDC Group	UC Group	RR (95% CI)
Casas et al (9)	155	12	12/65	14/90	1.19 (0.59–2.39)
Rea et al (11)	135	12	2/71	4/46	0.32 (0.06–1.70)
Rice et al (12)	88	6	36/372	48/371	0.75 (0.50–1.12)

*Abbreviations: CI, confidence intervals; MDC, multidisciplinary care; n, number; RR, relative risk; UC, usual care.

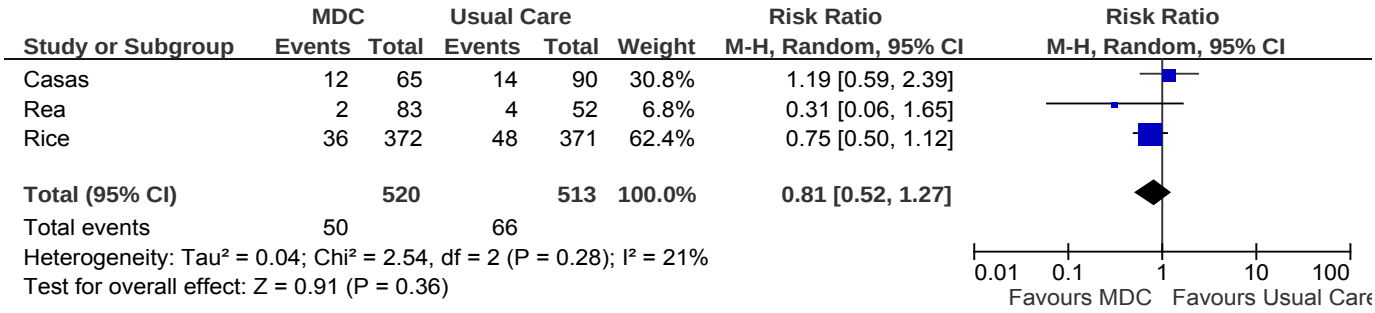

Figure 9: Pooled Results for All-Cause Mortality*

*Abbreviations: CI, confidence interval; I^2, index of heterogeneity; MDC, multidisciplinary care; M–H, Mantel–Haenszel.

The GRADE quality of evidence was assessed as low for this outcome, indicating that further research is likely to change the estimate of effect. Details of this assessment, including reasons for downgrading the quality of evidence, are reported in Appendix 3.

Economic Analysis

The results of the economic analysis are summarized in issue 12 of the COPD series entitled *Cost-Effectiveness of Interventions for Chronic Obstructive Pulmonary Disease Using an Ontario Policy Model*. This report can be accessed at: www.hqontario.ca/en/mas/tech/pdfs/2012/rev_COPD_Economic_March.pdf.

Conclusions

The summary effect of estimates for the outcome measures assessed in this evidence-based analysis are reported in Tables 13 and 14 with the associated GRADE quality of evidence evaluation for each outcome measure. Significant effect estimates with moderate quality of evidence were found for all-cause hospitalization, COPD-specific hospitalization, and COPD-specific ED visits. A significant effect supported by low quality of evidence was found for the quality of life outcome. Effect estimates for all other outcome measures were not significant, and these estimates were supported by either low or very low quality of evidence.

Table 13: Summary of Continuous Data*

Outcome	Number of Studies (n)	Weighted Mean Difference (95% CI)	GRADE
Quality of Life (SGRQ)	2 (942)	-4.05 (-6.47 to -1.63)	Low
Lung Function (FEV_1% predicted)	2 (316)	2.78 (-1.82–7.37)	Very Low

*Abbreviations: CI, Confidence intervals; COPD, chronic obstructive pulmonary disease; FEV_1 , forced expiratory volume in 1 second; n, number; SGRQ, St. George's Respiratory Questionnaire.

Table 14: Summary of Dichotomous Data*

Outcome	Number of Studies (n)	Relative Risk (95% CI)	GRADE
Hospitalizations			
All-cause (no. persons)	4 (1121)	0.75 (0.64–0.87)	Moderate
COPD-specific (no. persons)	3 (916)	0.67 (0.52–0.87)	Moderate
Emergency Department Visits			
All-cause (no. persons)	2 (223)	0.64 (0.31–1.33)	Very Low
COPD-specific (no. persons)	2 (783)	0.59 (0.43–0.81)	Moderate
Mortality			
	3 (1033)	0.81 (0.52–1.27)	Low

*Abbreviations: CI, confidence intervals; COPD; chronic obstructive pulmonary disease; n, number.

Glossary

6 Minute Walking Test (6MWT)	A measure of exercise capacity which measures the distance that a patient can quickly walk on a flat, hard surface in a period of 6 minutes. A widely used outcome measure in respiratory rehabilitation of patients with COPD.
Acute exacerbations of chronic obstructive pulmonary disease (AECOPD)	A change in baseline symptoms that is beyond day-to-day variation, particularly increased breathlessness, cough, and/or sputum, which has an abrupt onset.
Admission avoidance hospital-at-home program	Treatment program for patients experiencing acute exacerbations of COPD which allows patients to receive treatment in their home and avoid admission to hospital. After patients are assessed in the emergency department for an acute exacerbation, they are prescribed the necessary medications and additional care needed (e.g., oxygen therapy) and then sent home where they receive regular visits from a medical professional until the exacerbation has resolved.
Ambulatory oxygen therapy	Provision of oxygen therapy during exercise and activities of daily living for individuals who demonstrate exertional desaturation.
Bilevel positive airway pressure (BiPAP)	A continuous positive airway pressure mode used during noninvasive positive pressure ventilation (see definition below) that delivers preset levels of inspiratory and expiratory positive airway pressure. The pressure is higher when inhaling and falls when exhaling, making it easier to breathe.
Cost-effectiveness acceptability curve (CEAC)	A method for summarizing uncertainty in estimates of cost-effectiveness.
Cor pulmonale	Right heart failure, as a result of the effects of respiratory failure on the heart.
Dyspnea	Difficulty breathing or breathlessness.
Early discharge hospital-at-home program	Treatment program for patients experiencing acute exacerbations of COPD which allows patients to receive treatment in their home and decrease their length of stay in hospital. After being assessed in the emergency department for acute exacerbations, patients are admitted to the hospital where they receive the initial phase of their treatment. These patients are discharged early into a hospital-at-home program where they receive regular visits from a medical professional until the exacerbation has resolved.
Forced expiratory volume in 1 second (FEV_1)	A measure of lung function used for COPD severity staging; the amount of air that can be forcibly exhaled from the lungs in the first second of a forced exhalation.
Forced vital capacity (FVC)	The amount of air that can be forcibly exhaled from the lungs after taking the deepest breath possible.

Fraction of inspired oxygen (FiO_2)	The percentage of oxygen participating in gas exchange.
Hypercapnia	Occurs when there is too much carbon dioxide in the blood (arterial blood carbon dioxide > 45 to 60 mm Hg).
Hypopnea	Slow or shallow breathing.
Hypoxemia	Low arterial blood oxygen levels while breathing air at rest. May be severe ($PaO_2 \leq 55$ mm Hg), moderate (56 mm Hg $\leq PaO_2 <$ 65 mm Hg), or mild-to-moderate (66 mm Hg $< PaO_2 \leq$ 74 mm Hg).[1]
Incremental cost-effectiveness ratio (ICER)	Ratio of the change in costs of a therapeutic intervention to the change in effects of the intervention compared to the alternative (often usual care).
Intention-to-treat analysis (ITT)	An analysis based on the initial treatment the participant was assigned to, not on the treatment eventually administered.
Invasive mechanical ventilation (IMV)	Mechanical ventilation via an artificial airway (endotracheal tube or tracheostomy tube).
Long-term oxygen therapy (LTOT)	Continuous oxygen use for about 15 hours per day. Use is typically restricted to patients fulfilling specific criteria.
Multidisciplinary care	Defined as care provided by a team (compared to a single provider). Typically involves professionals from a range of disciplines working together to deliver comprehensive care that addresses as many of the patient's health care and psychosocial needs as possible.
Nicotine replacement therapy (NRT)	The administration of nicotine to the body by means other than tobacco, usually as part of smoking cessation.
Noninvasive positive pressure ventilation (NPPV)	Noninvasive method of delivering ventilator support (without the use of an endotracheal tube) using positive pressure. Provides ventilatory support through a facial or nasal mask and reduces inspiratory work.
Partial pressure of carbon dioxide ($PaCO_2$)	The pressure of carbon dioxide dissolved in arterial blood. This measures how well carbon dioxide is able to move out of the body.
Partial pressure of oxygen (PaO_2)	The pressure of oxygen dissolved in arterial blood. This measures how well oxygen is able to move from the airspace of the lungs into the blood.
Palliative oxygen therapy	Use of oxygen for mildly hypoxemic or nonhypoxemic individuals to relieve symptoms of breathlessness. Used short term. This therapy is "palliative" in that treatment is not curative of the underlying disease.
Pulmonary rehabilitation	Multidisciplinary program of care for patients with chronic respiratory impairment that is individually tailored and designed to optimize physical and social performance and autonomy. Exercise training is the cornerstone of pulmonary rehabilitation programs.

[1] The mild-to-moderate classification was created for the purposes of the report.

Pulse oximetry	A noninvasive sensor, which is attached to the finger, toe, or ear to detect oxygen saturation of arterial blood.
Quality-adjusted life-years (QALYs)	A measure of disease burden that includes both the quantity and the quality of the life lived that is used to help assess the value for money of a medical intervention.
Respiratory failure	Respiratory failure occurs when the respiratory system cannot oxygenate the blood and/or remove carbon dioxide from the blood. It can be either acute (acute respiratory failure, ARF) or chronic, and is classified as either hypoxemic (type I) or hypercapnic (type II) respiratory failure. Acute hypercapnic respiratory failure frequently occurs in COPD patients experiencing acute exacerbations of COPD.
Short-burst oxygen therapy	Short-duration, intermittent, supplemental oxygen administered either before or after exercise to relieve breathlessness with exercise.
Sleep apnea	Interruption of breathing during sleep due to obstruction of the airway or alterations in the brain. Associated with excessive daytime sleepiness.
Smoking cessation	The process of discontinuing the practice of inhaling a smoked substance.
Spirometry	The gold standard test for diagnosing COPD. Patients breathe into a mouthpiece attached to a spirometer which measures airflow limitation.
SpO_2	Oxygen saturation of arterial blood as measured by a pulse oximeter.
Stable COPD	The profile of COPD patients which predominates when patients are not experiencing an acute exacerbation.
Supplemental oxygen therapy	Oxygen use during periods of exercise or exertion to relieve hypoxemia.
Telemedicine (or telehealth)	Refers to using advanced information and communication technologies and electronic medical devices to support the delivery of clinical care, professional education, and health-related administrative services.
Telemonitoring (or remote monitoring)	Refers to the use of medical devices to remotely collect a patient's vital signs and/or other biologic health data and the transmission of those data to a monitoring station for interpretation by a health care provider.
Telephone only support	Refers to disease/disorder management support provided by a health care provider to a patient who is at home via telephone or videoconferencing technology in the absence of transmission of patient biologic data.
Ventilator-associated pneumonia (VAP)	Pneumonia that occurs in patients undergoing mechanical ventilation while in a hospital.

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The role of the expert panel was to provide direction on the scope of the project and the relevant outcomes measures of effectiveness, to review the evidence-based analyses and to identify any societal or systemic issues that are relevant to intervention effectiveness. However, the statements, conclusions and views expressed in this report do not necessarily represent the views of the expert panel members.

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Appendices

Appendix 1: Literature Search Strategies

July 19, 2010
Databases searched: OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, Wiley Cochrane, CINAHL, Centre for Reviews and Dissemination/International Agency for Health Technology Assessment

Database: Ovid MEDLINE(R) <1950 to July Week 1 2010>
Search Strategy:
---
1 exp Pulmonary Disease, Chronic Obstructive/ (13894)
2 (chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab. (20844)
3 (copd or coad).ti,ab. (15846)
4 chronic airflow obstruction.ti,ab. (484)
5 exp Emphysema/ (6903)
6 ((chronic adj2 bronchitis) or emphysema).ti,ab. (22517)
7 or/1-6 (52749)
8 exp Patient Care Team/ (45549)
9 exp "Delivery of Health Care, Integrated"/ (6274)
10 exp Interdisciplinary Communication/ (5170)
11 exp Cooperative Behavior/ (17768)
12 exp Interprofessional Relations/ (43788)
13 exp Program Evaluation/ or disease management program*.mp. or exp Program Development/ (55786)
14 exp "Continuity of Patient Care"/ (11224)
15 (team* or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin$ or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat*).mp. [mp=title, original title, abstract, name of substance word, subject heading word, unique identifier] (575645)
16 or/8-15 (653664)
17 7 and 16 (1615)
18 limit 17 to (english language and humans and yr="1995 -Current") (1120)
19 limit 18 to (case reports or comment or editorial or letter) (73)
20 18 not 19 (1047)

Database: EMBASE <1980 to 2010 Week 28>
Search Strategy:
---
1 exp chronic obstructive lung disease/ (36092)
2 (chronic obstructive adj2 (lung* or pulmonary or airway* or airflow or respiratory) adj (disease* or disorder*)).ti,ab. (19507)
3 (copd or coad).ti,ab. (15889)
4 chronic airflow obstruction.ti,ab. (453)
5 exp emphysema/ (14600)

6 exp chronic bronchitis/ (6204)
7 ((chronic adj2 bronchitis) or emphysema).ti,ab. (14594)
8 or/1-7 (58780)
9 exp cooperation/ (15758)
10 exp integrative medicine/ (591)
11 exp integrated health care system/ (609)
12 exp health program/ (63761)
13 exp program development/ (1986)
14 (multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin$ or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name] (390734)
15 disease management program*.mp. (1036)
16 team*.mp. (49014)
17 or/9-16 (480399)
18 8 and 17 (2206)
19 limit 18 to (human and english language and yr="1995 -Current") (1519)
20 limit 19 to (editorial or letter or note) (112)
21 case report/ (1113858)
22 19 not (20 or 21) (1366)

#	Query	Results
S17	((S1 or S2 or S3 or S4 or S5)) and (S15 and S16)	506
S16	(S1 or S2 or S3 or S4 or S5)	7235
S15	(S6 or S7 or S8 or S9 or S10 or S11 or S12 or S13 or S14)	141659
S14	AB (team* or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin$ or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat*)	74133
S13	TI (team* or multidisciplin* or multifacet* or multi-disciplin* or multi-facet* or cooperat* or co-operat* or interdisciplin*or inter-disciplin$ or collaborat* or multispecial* or multi-special* or share or sharing or shared or integrat*)	29056
S12	(MH "Program Development+")	29008
S11	(MH "Interprofessional Relations+")	12134
S10	(MH "Teamwork")	4830
S9	(MH "Health Care Delivery, Integrated")	2670
S8	(MH "Cooperative Behavior")	1928
S7	(MH "Continuity of Patient Care+")	6907
S6	(MH "Multidisciplinary Care Team+")	15506
S5	chronic bronchitis or emphysema	1553
S4	(MH "Emphysema+")	945
S3	copd or coad	3996

S2	(chronic obstructive and (lung* or pulmonary or airway* or airflow or respiratory) and (disease* or disorder*))	5471
S1	(MH "Pulmonary Disease, Chronic Obstructive+")	4226

Appendix 2: Description of Studies

Table A1: Description of Included Studies*

Author, Year	Design	N	Country, Sites	Population	Intervention	Control	Outcomes
van Wetering et al, 2010 (14)	RCT computerized randomization with concealed patient allocation.	199	Netherlands, 2 hospitals	GOLD stage 2 or 3 COPD Patients recruited were under the supervision of the department of respiratory medicine of 2 general hospitals in the Netherlands. They were judged to be clinically stable at inclusion by their respiratory physician.	Managed by physiotherapists, dieticians, and respiratory nurses. Phase 1: first 4 months after discharge from hospital the patient visited physiotherapist twice/week, individualized education program was provided, smokers worked with respiratory nurse for standardized smoking cessation counselling, nutritionally depleted patients received 4 visits by a dietician and nutritional supplements. Phase 2: subsequent 20 months following discharge patients visited physiotherapist once a month, nutritionally depleted patients visited dietician at 6, 9, 12, 24 months. Visits to respiratory nurse were scheduled upon request.	Managed by respiratory physician Pharmaco-therapy according to accepted guidelines, smoking cessation advice, and recommendation to eat more if nutritionally depleted.	Primary: Disease specific quality of life by SGRQ, total number of exacerbations Secondary: change in subscores of the SGRQ, dyspnea scale, exercise performance, cycle endurance test, and 6MWT, muscle strength, isometric quadriceps peak torque, maximum inspiratory mouth pressure, body composition, lung function, and global assessment of perceived effectiveness on a 5-point Likert scale Assessed at baseline, 4, 12, and 24 months

Author, Year	Design	N	Country, Sites	Population	Intervention	Control	Outcomes
Koff et al, 2009 (10)	RCT, blinded envelope used for randomization.	40	United States, single centre	GOLD Stage 3 or 4 COPD	Proactive integrated care Patients received disease-specific education, teaching of self-management techniques, enhanced communication with study co-ordinators and remote home monitoring.	Continued usual care with treatment prescribed by their health care provider.	Primary: quality of Life measured by the SGEQ. Secondary: health care costs, identification of unreported exacerbations. Assessed at baseline and 3 months
Rea et al, 2004 (11)	Randomized 51 GP with 116 GPs using computer generated random numbers	51 GPs 135 patients	New Zealand	Persons with moderate to severe COPD	Chronic disease management program. Patients were seen by a respiratory physician and a respiratory nurse specialist. During assessment a patient specific care plan was negotiated with each patient by their GP and practice nurse. Education about smoking cessation, medication and use of inhalers, annual influenza vaccination, and attendance at a pulmonary rehabilitation program were recommended. Visits to practice nurses monthly and to the GP every 3 months unless otherwise needed.	Conventional care Same assessment procedure as intervention group but did not have a care plan, were not seen by a respiratory physician during the assessment and did not have access to the respiratory nurse specialist. GPs had access to the COPD management guidelines and pulmonary rehabilitation program.	Primary: change in hospital bed days. Number of admissions. ITT for primary outcome and number of admissions. Changes in respiratory function, walking distance, and quality of life.

Author, Year	Design	N	Country, Sites	Population	Intervention	Control	Outcomes
Casas et al, 2006 (9)	RCT, computer-generated random numbers	155	Spain, multicentered (2 hospitals)	Persons enrolled after hospital discharge for which they were admitted because of a previous episode or exacerbation requiring hospitalization for > 48 hours.	Integrated care was standardized between the 2 sites and included 4 key features: 1. a comprehensive assessment of the patient at discharge, 2. an educational program on self-management of the disease administered at discharge, 3. agreement on an individually tailored care plan following international guidelines shared via interaction between a specialized nurse case manager and the primary care team, 4. accessibility of the specialized nurse to patients/carers and primary care professionals during follow-up period with an information and communication platform including a web-based call centre.	Usual Care: Patients in this group were visited by their own physician without additional support. Visits were usually scheduled every 6 months. The controls did not receive help from the specialized nurse nor were they included in the educational program or had access to the call centre. They were visited by their own physician without additional support. The attending physician decided on the outpatient control regimen.	1-year follow-up SGRQ and the EuroQll Pulmonary function tests. Use of health care resources by phone or personal interview was carried out at 1,3,6,9 and 12 months in both arms of the study. Hospital admissions and mortality were obtained from hospital records and direct family interviews.

Author, Year	Design	N	Country, Sites	Population	Intervention	Control	Outcomes
Rice et al, 2010 (12)	RCT	743	United States, 5 VA medical centers	COPD patients at high risk for exacerbation of FEV_1 < 70% post bronchodilator spirometry predicted and FEV_1/FVC < 0.70.	Disease management: attended a single 1–1.5 hour group education session conducted by a respiratory therapist case manager. Education session included general information about COPD, including cause, symptoms and treatment of exacerbations, direct observation of inhaler techniques, review and adjustment of medications, smoking cessation counselling if needed, recommendations on influenza and pneumococcal vaccinations, encouragement of regular exercise, instruction on hand hygiene. Each subject received an individualized written action plan. Pharmacist monitored the use of action plan medications Monthly telephone calls to patients by case manager	Usual Care: received a 1-page handout with a summary of the principles of COPD care according to published guidelines, and the telephone number for the 24-hour VA nursing helpline, a service available to all VA patients.	Primary Outcome: combined number of hospitalizations and ED visits for COPD made by each patient during the 12-month follow-up.

Author, Year	Design	N	Country, Sites	Population	Intervention	Control	Outcomes
Solomon et al, 1998 (13)	RCT	98	United States, 11 hospitals	Diagnosed by pulmonary function tests, 40 years of age or older, treated for diagnosis of COPD per American Thoracic Society criteria.	Treatment group received pharmaceutical care in collaboration with physicians 6-month treatment period, scheduled visits at enrolment and then 1-month intervals for a total of 5 visits. Data collection at baseline and at 6-month follow-up (visit 5) Pharmacist involvement with health care team in the management of patient drug therapy, collaboration with physicians to implement a patient specific, optimized, approach to COPD, education of COPD patients about their disease and therapy, counselling for specific concerns, patient assessment and care through clinic visits and telephone follow-up.	Usual care group had no access to the primary pharmacy caregivers and received no supplemental education or assessment of needs beyond what was usually done.	Dyspnea using the Borg Scale Symptom severity scale Compliance by tablet count and self-reported measure Patients questioned on ED visits, office visits, hospital admission, length of stay, and new medication

*Abbreviations: COPD, chronic obstructive pulmonary disease; ED, emergency department; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; GP, general practice; GOLD, Global Initiative for Chronic Obstructive Lung Disease ; ITT, intention-to-treat; RCT, randomized controlled trial; SGRQ, St. George's respiratory questionnaire; VA, Veteran's Administration.

Appendix 3: GRADE Profile

Table A2: GRADE Quality of Evidence*

Quality Assessment							Summary of Findings			
							Number of Patients		Effect	Quality
Number of Studies	Design	Limitations	Inconsistency	Indirectness	Imprecision	Other Considerations	MDC	Usual Care	(95% CI)	
Quality of Life (St. George's Respiratory Questionnaire)										
2	RCT	Very serious†	none	none	none	none	474	468	WMD -4.05 (-6.47-1.63)	LOW
FEV_1 (% Predicted)										
2	RCT	Serious‡	Serious§	none	Serious‖	none	173	143	WMD 2.78 (-1.82-7.37)	VERY LOW
All-Cause Hospitalization										
4	RCT	Serious¶	none	none	none	none	561	560	RR 0.75 (0.64-0.87)	MODERATE
COPD-Specific Hospitalization										
3	RCT	Serious#	none	none	none	none	474	442	RR 0.67 (0.52-0.87)	MODERATE
Mortality										
3	RCT	Serious	Serious**	none	Serious‖	none	508	507	RR 0.81 (0.52-1.27)	LOW
All-Cause Emergency Department Visits										
2	RCT	Serious††	none	Serious‡‡	Very serious§§	none	124	99	RR 0.64 (0.31-1.33)	VERY LOW
COPD-Specific Emergency Department Visits										
2	RCT	Serious‖‖	none	none	none	none	392	391	RR 0.59 (0.43- 0.81)	MODERATE

*Abbreviations: CI, confidence interval; COPD, chronic obstructive pulmonary disease; FEV_1, forced expiratory volume in 1 second; MDC, multidisciplinary care; RCT, randomized controlled trial; RR, relative risk; SGRQ, St. George's Respiratory Questionnaire; WMD, weighted mean difference.

†High loss to follow-up or low response rate in both studies.

‡21% loss to follow-up in study by van Wetering et al (14) which may bias the results of the SGRQ mean scores in each group. If the scores of the losses to follow-up were above the group mean for MDC this may reduce the summary effect estimate below clinical significance, which is a score of 4.

§Inconsistency in point estimate.

‖Confidence intervals are sufficiently wide such that the estimate can show an important benefit or no benefit (or important harm).

¶ Two of the 4 studies including Rea et al (11) and Solomon et al (13) (50% of the body of evidence) in the body of evidence did not report if adequate allocation concealment was undertaken. Adequate allocation concealment remains unclear.

#One of the 3 studies, Rea et al, (11) did not report if adequate allocation concealment was carried out. Adequate allocation concealment remains unclear.

**There is inconsistency in the magnitude of the effect estimates across the studies.

††Unclear adequate allocation concealment.

‡‡Population not well described other than having COPD

§§Small event rates; imprecision in estimate.

‖‖ Three-month follow-up.

References

(1) Peytremann-Bridevaux I, Staeger P, Bridevaux PO, Ghali WA, Burnand B. Effectiveness of chronic obstructive pulmonary disease-management programs: systematic review and meta-analysis. Am J Med. 2008 May;121(5):433-43.

(2) Sin DD, McAlister FA, Man SF, Anthonisen NR. Contemporary management of chronic obstructive pulmonary disease: scientific review. JAMA. 2003 Nov 5;290(17):2301-12.

(3) Lemmens KM, Nieboer AP, Huijsman R. A systematic review of integrated use of disease-management interventions in asthma and COPD. Respir Med. 2009;103(5):670-91.

(4) Gershon AS, Wang C, Wilton AS, Raut R, To T. Trends in chronic obstructive pulmonary disease prevalence, incidence, and mortality in Ontario, Canada, 1996 to 2007: a population-based study. Arch Intern Med. 2010 Mar 22;170(6):560-5.

(5) Mitchell GK, Tieman JJ, Shelby-James TM. Multidisciplinary care planning and teamwork in primary care. Med J Aust. 2008;188(8):S61-S64.

(6) Kirilloff LH, Carpenter V, Kerby GR, Kigin C, Weimer MP. American Thoracic Society. Medical Section of the American Lung Association. Skills of the health team involved in out-of-hospital care for patients with COPD. Am Rev Respir Dis. 1986;133(5):948-9.

(7) Nie JX, Wang L, Upshur RE. Mortality of elderly patients in Ontario after hospital admission for chronic obstructive pulmonary disease. Can Respir J. 2007 Nov;14(8):485-9.

(8) Atkins D, Best D, Briss PA, Eccles M, Falck-Ytter Y, Flottorp S, et al. Grading quality of evidence and strength of recommendations. BMJ. 2004;328(7454):1490-8.

(9) Casas A, Troosters T, Garcia-Aymerich J, Roca J, Hernandez C, Alonso A, et al. Integrated care prevents hospitalisations for exacerbations in COPD patients. Eur Respir J. 2006 Jul;28(1):123-30.

(10) Koff PB, Jones RH, Cashman JM, Voelkel NF, Vandivier RW. Proactive integrated care improves quality of life in patients with COPD. Eur Respir J. 2009 May;33(5):1031-8.

(11) Rea H, McAuley S, Stewart A, Lamont C, Roseman P, Didsbury P. A chronic disease management programme can reduce days in hospital for patients with chronic obstructive pulmonary disease. Intern Med J. 2004 Nov;34(11):608-14.

(12) Rice KL, Dewan N, Bloomfield HE, Grill J, Schult TM, Nelson DB, et al. Disease management program for chronic obstructive pulmonary disease: a randomized controlled trial. Am J Respir Crit Care Med. 2010;182(7):890-6.

(13) Solomon DK, Portner TS, Bass GE, Gourley DR, Gourley GA, Holt JM, et al. Clinical and economic outcomes in the hypertension and COPD arms of a multicenter outcomes study. J Am Pharm Assoc (Wash). 1998;38(5):574-85.

(14) van Wetering CR, Hoogendoorn M, Mol SJ, Rutten-van Molken MP, Schols AM. Short- and long-term efficacy of a community-based COPD management programme in less advanced COPD: a randomised controlled trial. Thorax. 2010 Jan;65(1):7-13.

(15) Goodman, C. Literature searching and evidence interpretation for assessing health care practices. Stockholm, Sweden: Swedish Council on Technology Assessment in Health Care; 1996. 81 p. SBU Report No. 119E.

(16) Global Initiative for Chronic Obstructive Lung Disease. Pocket guide to COPD diagnosis, management, and pervention [Internet]. [updated 2010; cited 2011 Jul 10]. Available from: http://www.goldcopd.org/guidelines-pocket-guide-to-copd-diagnosis.html

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