Quality-Based Procedures: Clinical Handbook for **Chronic Obstructive Pulmonary Disease**

Health Quality Ontario &
Ministry of Health and Long-Term Care

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List of Abbreviations

CACS	Comprehensive Ambulatory Care Classification System
CCI	Canadian Classification of Health Interventions
COPD	Chronic obstructive pulmonary disease
CIHI	Canadian Institute for Health Information
CMG	Case Mix Group
CMG+	Case Mix Groups Plus
COPD	Chronic obstructive pulmonary disease
CTS	Canadian Thoracic Society
DAD	Discharge Abstract Database
EBA	Evidence-based analysis
ECFAA	*Excellent Care for All Act*
ED	Emergency department
Expert Panel	Chronic Obstructive Pulmonary Disease Episode of Care Expert Advisory Panel
FEV_1 / FVC	Ratio of Forced Expiratory Volume in 1 second to Forced Vital Capacity
HBAM	Health-Based Allocation Model
HIG	HBAM Inpatient Grouper
HQO	Health Quality Ontario
ICD-10-CA	International Classification of Diseases, 10th Revision (Canadian Edition)
ICES	Institute for Clinical Evaluative Sciences
IMV	Invasive mechanical ventilation
LOS	Length of stay
Ministry	Ministry of Health and Long-Term Care
NACRS	National Ambulatory Care Referral System
NICE	National Institute for Health and Clinical Excellence
NPPV	Noninvasive positive pressure ventilation
OCCI	Ontario Case Costing Initiative
OHTAC	Ontario Health Technology Advisory Committee
PBF	Patient-Based Funding
QBP	Quality-Based Procedures
RIW	Resource Intensity Weight

Preface

The content in this document has been developed through collaborative efforts between the Ministry of Health and Long-Term Care ("Ministry"), Health Quality Ontario (HQO), and the HQO Episode of Care for Chronic Obstructive Pulmonary Disease Expert Advisory Panel ("Expert Panel").

The template for the Quality-Based Procedures Clinical Handbook and all content in Section 1 ("Purpose") and Section 2 ("Introduction") were provided in standard form by the Ministry. All other content was developed by HQO with input from the Expert Panel.

To consider the content of this document in the appropriate context, it is important to take note of the specific deliverables that the Ministry tasked HQO with developing for this Clinical Handbook. The following is an excerpt from the HQO–Ministry Accountability Agreement for fiscal year 2012/13:

> *To guide HQO's support to the funding reform, HQO will:*
>
> 1. *Conduct analyses/consultation in the following priority areas in support of funding strategy implementation for the 2013/14 fiscal year:*
>   a) *Chronic Obstructive Pulmonary Disease,*
>   b) *Congestive Heart Failure, and*
>   c) *Stroke.*
>
> 2. *Include in their analyses/consultation noted in clause 21, consultations with clinicians and scientists who have knowledge and expertise in the identified priority areas, either by convening a reference group or engaging an existing resource of clinicians/scientists.*
>
> 3. *Work with the reference group to:*
>   *a) Define the population/patient cohorts for analysis,*
>   *b) Define the appropriate episode of care for analysis in each cohort, and*
>   *c) Seek consensus on a set of evidence-based clinical pathways and standards of care for each episode of care.*
>
> 4. *Submit to the Ministry their draft report as a result of the consultations/analysis outlined in clause 22 above on October 31st and its final report on November 30th, and include in this a summary of its clinical engagement process.*

Following sign-off on the Accountability Agreement, the Ministry subsequently asked HQO to also develop the following additional content for each of the 3 assigned clinical areas:

a) Guidance on the development of performance indicators aligned with the recommended episodes of care to inform the Ministry's Quality-Based Procedure (QBP) Integrated Scorecard.

b) Guidance on the real-world implementation of the recommended practices contained in the Clinical Handbook, with a focus on implications for multi-disciplinary teams, service capacity planning considerations and new data collection requirements.

Key Principles

At the start of this project, discussions between HQO, the 3 Episode of Care Expert Advisory Panels and the Ministry established a set of key principles or 'ground rules' to guide this evolving work:

- **HQO's work will not involve costing or pricing.** All costing and pricing work related to the QBP funding methodology will be completed by the Ministry using a standardized approach, informed by the content produced by HQO. This principle also extended to the deliberations of the Expert Panels, where discussions were steered away from considering the dollar cost of particular interventions or models of care and instead focused on quality considerations and non-cost measures of utilization, such as length of stay.
- **The scope of this phase of work will focus on hospital care.** Given that the Ministry's QBP efforts for 2013/14 focus largely on hospital payment, HQO was asked to adopt a similar focus with its work on episodes of care. Notwithstanding, all 3 Expert Panels emphasized the importance of extending this analysis beyond hospital care alone to also examine post-acute and community care. COPD is a condition that spans all parts of the continuum of care, with hospitalization being only one piece of this continuum; future efforts will need to also address community-based care to have full impact on all parts of the health system.

  Recognizing the importance of this issue, the Ministry has communicated that, following the initial phase of deliverables, work will continue in all 3 clinical areas to extend the episodes of care to include community-based services.
- **Recommended practices, supporting evidence, and policy applications will be reviewed and updated at least every 2 years.** The limited 4-month timeframe provided for the completion of this work meant that many of the recommended practices in this document could not be assessed with the full rigour and depth of HQO's established evidence-based analysis process. Recognizing this limitation, HQO reserves the right to revisit the recommended practices and supporting evidence at a later date by conducting a full evidence-based analysis or to update this document with relevant new published research. In cases where the episode of care models are updated, any policy applications informed by the models should also be similarly updated.

  Consistent with this principle, the Ministry has stated that the QBP models will be reviewed at least every 2 years.
- **Recommended practices should reflect the best patient care possible, regardless of cost or barriers to access.** HQO and the Expert Panels were instructed to focus on defining best practice for an *ideal* episode of care, regardless of cost implications or potential barriers to access. Hence, the resulting cost implications of the recommended episodes of care are not known. However, all 3 Expert Panels have discussed a number of barriers that will challenge implementation of their recommendations across the province. These include gaps in measurement capabilities for tracking many of the recommended practices, shortages in health human resources and limitations in community-based care capacity across many parts of the province.

  Some of these barriers and challenges are briefly addressed in the section "Implementation of Best Practices." However, the Expert Panels noted that, with the limited time they were provided to address these issues, the considerations outlined here should only be viewed as an initial starting point towards a comprehensive analysis of these challenges.

Finally: HQO and the COPD Episode of Care Expert Panel recognize that given the limitations of their mandate, much of the ultimate impact of this content will depend on subsequent work by the Ministry to incorporate the analysis and advice contained in this document into the Quality-Based Procedures policy

framework and funding methodology. This will be complex work, and it will be imperative to ensure that any new funding mechanisms deployed are well-aligned with the recommendations of the Expert Panel.

Nevertheless, the Expert Panel believes that, regardless of the outcome of efforts to translate this content into hospital funding methodology, the recommended practices in this document can also provide the basis for setting broader provincial standards of care for COPD. These standards could be linked not only to funding mechanisms, but to other health system change levers such as guidelines and care pathways, performance measurement and reporting, program planning and quality improvement activities.

Purpose

Provided by the Ministry of Health and Long-Term Care

This Clinical Handbook has been created to serve as a compendium of the evidence-based rationale and clinical consensus driving the development of the policy framework and implementation approach for COPD patients seen in hospitals.

This handbook is intended for a clinical audience. It is not, however, intended to be used as a clinical reference guide by clinicians and will not be replacing existing guidelines and funding applied to clinicians. Evidence-informed pathways and resources have been included in this handbook for your convenience.

Introduction to Quality-Based Procedures

Provided by the Ministry of Health and Long-Term Care

Quality-Based Procedures (QBPs) are an integral part of Ontario's Health System Funding Reform (HSFR) and a key component of Patient-Based Funding (PBF). This reform plays a key role in advancing the government's quality agenda and its ***Action Plan for Health Care.*** HSFR has been identified as an important mechanism to strengthen the link between the delivery of high quality care and fiscal sustainability.

Ontario's health care system has been living under global economic uncertainty for a considerable time. Simultaneously, the pace of growth in health care spending has been on a collision course with the provincial government's deficit recovery plan.

In response to these fiscal challenges and to strengthen the commitment towards the delivery of high quality care, the ***Excellent Care for All Act*** (ECFAA) received royal assent in June 2010. ECFAA is a key component of a broad strategy that improves the quality and value of the patient experience by providing them with the right evidence-informed health care at the right time and in the right place. ECFAA positions Ontario to implement reforms and develop the levers needed to mobilize the delivery of high quality, patient-centred care.

Ontario's ***Action Plan for Health Care*** advances the principles of ECFAA, reflecting quality as the primary driver to system solutions, value, and sustainability.

What Are We Moving Towards?

Prior to the introduction of HSFR, a significant proportion of hospital funding was allocated through a global funding approach, with specific funding for some select provincial programs and wait times services. However, a global funding approach reduces incentives for health service providers to adopt best practices that result in better patient outcomes in a cost-effective manner.

To support the paradigm shift from a culture of cost containment to that of quality improvement, the Ontario government is committed to moving towards a patient-centred, evidence-informed funding model that reflects local population needs and contributes to optimal patient outcomes (Figure 1).

PBF models have been implemented internationally since 1983. Ontario is one of the last leading jurisdictions to move down this path. This puts the province in a unique position to learn from international best practices and the lessons others learned during implementation, thus creating a funding model that is best suited for Ontario.

PBF supports system capacity planning and quality improvement through directly linking funding to patient outcomes. PBF provides an incentive to health care providers to become more efficient and effective in their patient management by accepting and adopting best practices that ensure Ontarians get the right care at the right time and in the right place.

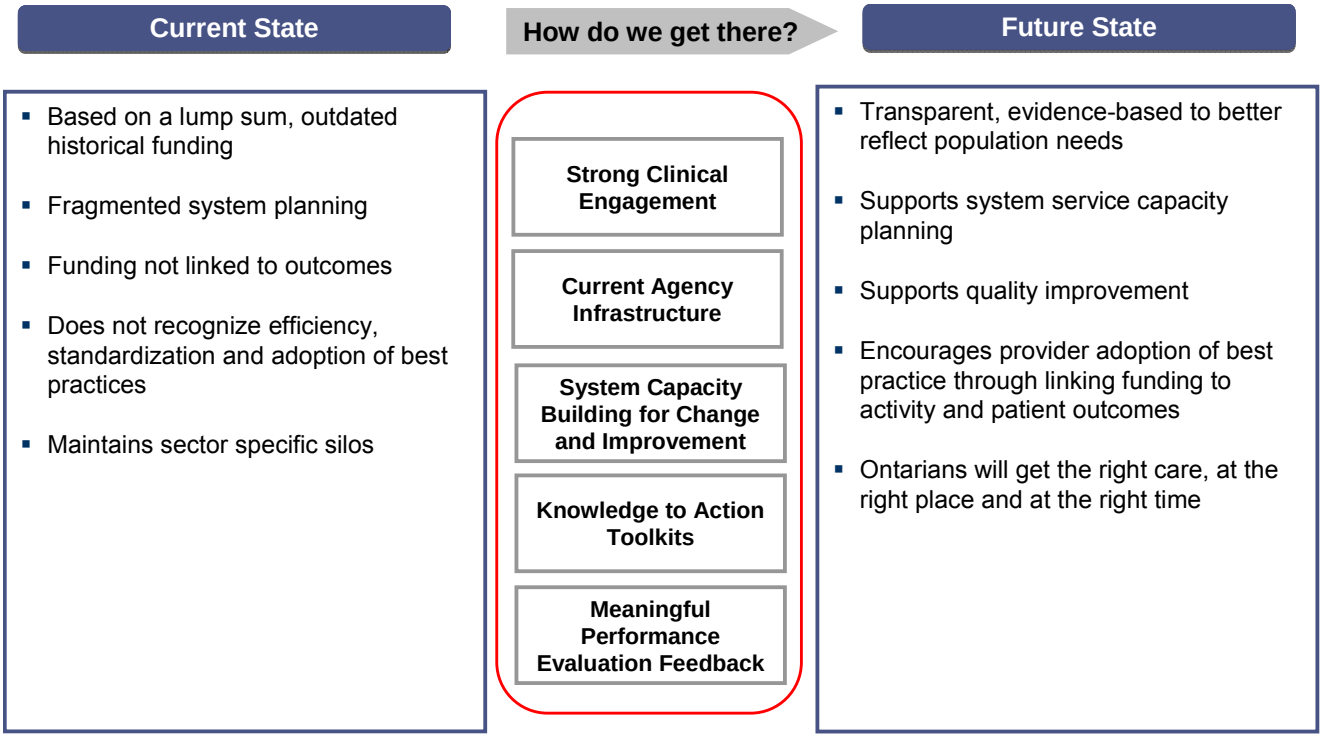

Figure 1: Current and Future States of Health System Funding

How Will We Get There?

The Ministry of Health and Long-Term Care has adopted a 3-year implementation strategy to phase in a PBF model and will make modest funding shifts starting in fiscal year 2012/13. A 3-year outlook has been provided to support planning for upcoming funding policy changes.

The Ministry has released a set of tools and guiding documents to further support the field in adopting the funding model changes. For example, a QBP interim list has been published for stakeholder consultation and to promote transparency and sector readiness. The list is intended to encourage providers across the continuum to analyze their service provision and infrastructure in order to improve clinical processes and, where necessary, build local capacity.

The successful transition from the current, provider-centred funding model towards a patient-centred model will be catalyzed by a number of key enablers and field supports. These enablers translate to actual principles that guide the development of the funding reform implementation strategy related to QBPs. These principles further translate into operational goals and tactical implementation (Figure 2).

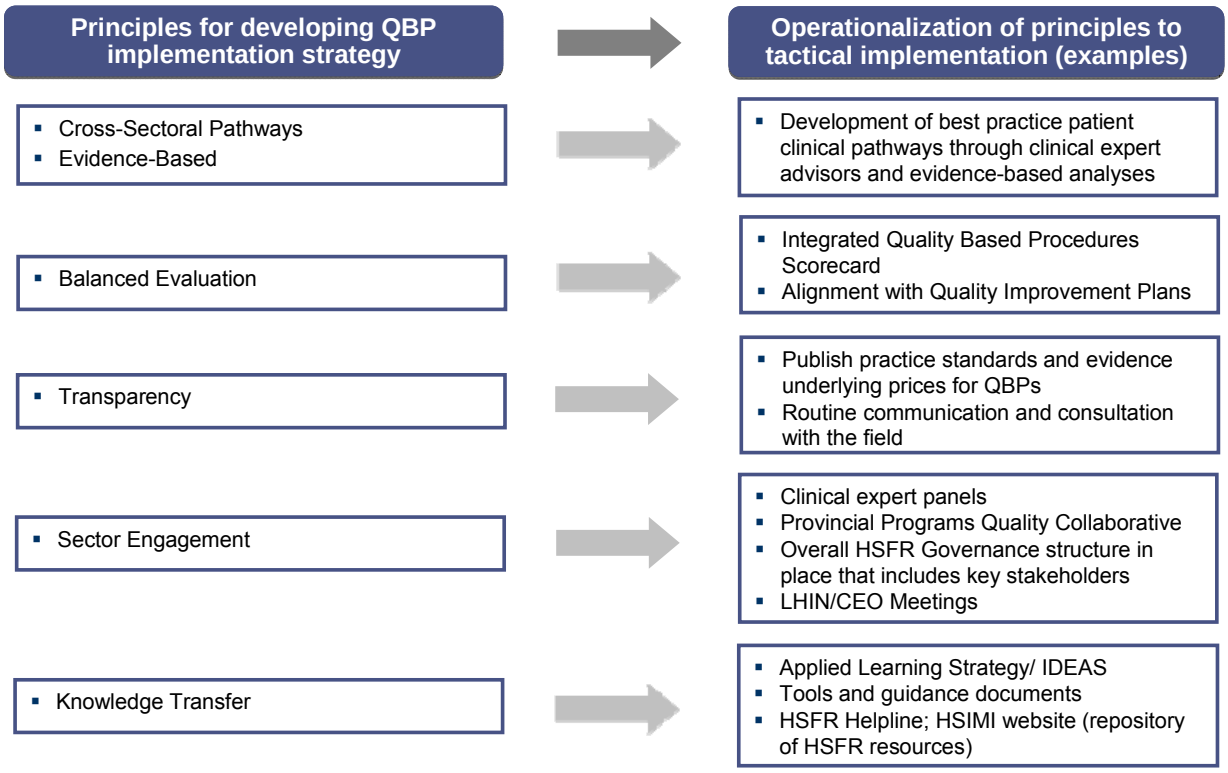

Figure 2: Principles Guiding Implementation of Quality-Based Procedures

Abbreviations: HSFR, Health System Funding Reform; HSIMI, Health System Information Management and Investment: IDEAS, Improving the Delivery of Excellence Across Sectors; LHIN, Local Health Integration Network; QBP. Quality-Based Procedures.

What Are Quality-Based Procedures?

QBPs involve clusters of patients with clinically related diagnoses or treatments. COPD was chosen as a QBP using an evidence- and quality-based selection framework that identifies opportunities for process improvements, clinical redesign, improved patient outcomes, enhanced patient experience, and potential cost savings.

The evidence-based framework used data from the Discharge Abstract Database (DAD) adapted by the Ministry of Health and Long-Term Care for its Health-Based Allocation Model (HBAM) repository. The HBAM Inpatient Grouper (HIG) groups inpatients based on their diagnosis or their treatment for the majority of their inpatient stay. Day surgery cases are grouped in the National Ambulatory Care Referral System (NACRS) by the principal procedure they received. Additional data were used from the Ontario Case Costing Initiative (OCCI). Evidence in publications from Canada and other jurisdictions and World Health Organization reports was also used to assist with the patient clusters and the assessment of potential opportunities.

The evidence-based framework assessed patients using 4 perspectives, as presented in Figure 3. This evidence-based framework has identified QBPs that have the potential to both improve quality outcomes and reduce costs.

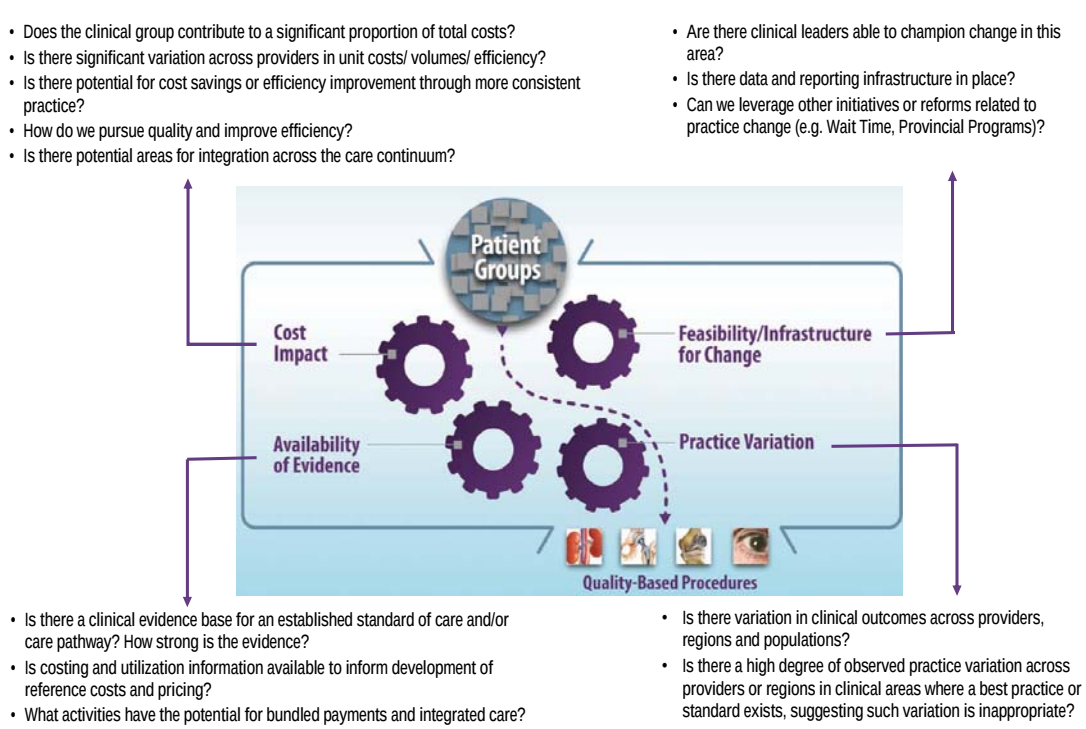

Figure 3: Evidence-Based Framework

Practice Variation

The DAD stores every Canadian patient discharge, coded and abstracted, for the past 50 years. This information is used to identify patient transition through the acute care sector, including discharge locations, expected lengths of stay and readmissions for each and every patient, based on their diagnosis and treatment, age, gender, comorbidities and complexities, and other condition-specific data. A demonstrated large practice or outcome variance may represent a significant opportunity to improve patient outcomes by reducing this practice variation and focusing on evidence-informed practice. A large number of "Beyond Expected Days" for length of stay and a large standard deviation for length of stay and costs are flags to such variation. Ontario has detailed case-costing data for all patients discharged from a case-costing hospital from as far back as 1991, as well as daily utilization and cost data by department, by day, and by admission.

Availability of Evidence

A significant amount of Canadian and international research has been undertaken to develop and guide clinical practice. Using these recommendations and working with the clinical experts, best practice guidelines and clinical pathways can be developed for these QBPs, and appropriate evidence-informed indicators can be established to measure performance.

Feasibility/Infrastructure for Change

Clinical leaders play an integral role in this process. Their knowledge of the patients and the care provided or required represents an invaluable component of assessing where improvements can and should be made. Many groups of clinicians have already provided evidence for rationale-for-care pathways and evidence-informed practice.

Cost Impact

The selected QBP should have no fewer than 1,000 cases per year in Ontario and represent at least 1% of the provincial direct cost budget. While cases that fall below these thresholds may, in fact, represent improvement opportunity, the resource requirements to implement a QBP may inhibit the effectiveness for such a small patient cluster, even if there are some cost efficiencies to be found. Clinicians may still work on implementing best practices for these patient subgroups, especially if they align with the change in similar groups. However, at this time, there will be no funding implications. The introduction of evidence into agreed-upon practice for a set of patient clusters that demonstrate opportunity as identified by the framework can directly link quality with funding.

Opportunities to Improve Care for COPD

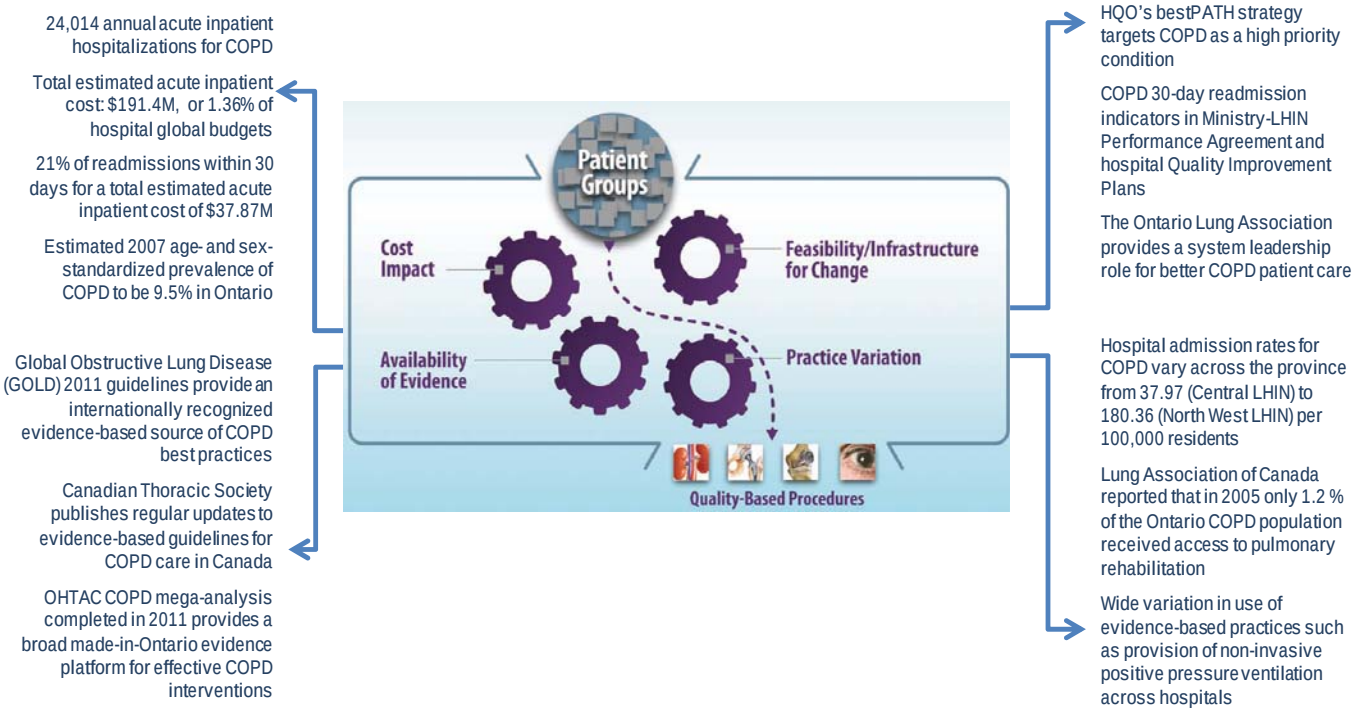

Figure 4: Evidence-Based Framework for COPD

Abbreviations: HQO, Health Quality Ontario; LHIN, Local Health Integration Network; OHTAC, Ontario Health Technology Advisory Committee;
Sources: Discharge Abstract Database 2010/11; Gershon (2010); CIHI Canadian Health Indicators 2011; Lung Association of Canada 2005

How Will Quality-Based Procedures Encourage Innovation in Health Care Delivery?

Implementing evidence-informed pricing for the targeted QBPs will encourage health care providers to adopt best practices in their care delivery models and maximize their efficiency and effectiveness. Moreover, best practices that are defined by clinical consensus will be used to understand required resource utilization for the QBPs and further assist in developing evidence-informed pricing. Implementation of a "price x volume" strategy for targeted clinical areas will motivate providers to:

- adopt best practice standards
- re-engineer their clinical processes to improve patient outcomes
- develop innovative care delivery models to enhance the experience of patients

Clinical process improvement may include better discharge planning, eliminating duplicate or unnecessary investigations, and paying greater attention to the prevention of adverse events, that is, postoperative complications. These practice changes, together with adoption of evidence-informed practices, will improve the overall patient experience and clinical outcomes and help create a sustainable model for health care delivery.

Methods

Overview of the HQO Episode of Care Analysis Approach

In order to produce this work, Health Quality Ontario (HQO) has developed a novel methodology known as an *episode of care analysis* that draws conceptually and methodologically from several of HQO's core areas of expertise:

- **Health technology assessment**: Recommended practices incorporate components of HQO's evidence-based analysis methodology and draw from the recommendations of the Ontario Health Technology Advisory Committee (OHTAC).
- **Case mix grouping and funding methodology:** Cohort and patient group definitions use clinical input to adapt and refine case mix methodologies from the Canadian Institute for Health Information (CIHI) and the Ontario Health-Based Allocation Model (HBAM).
- **Clinical practice guidelines and pathways:** Recommended practices synthesize guidance from credible national and international guideline bodies, with attention to the strength of evidence supporting each piece of guidance.
- **Analysis of empirical data:** Expert Advisory Panel recommendations were supposed by descriptive and multivariate analysis of Ontario administrative data (e.g., Discharge Abstract Database [DAD] and National Ambulatory Care Reporting System [NACRS]) and data from disease-based clinical data sets (e.g., the Ontario Stroke Audit [OSA] and Enhanced Feedback For Effective Cardiac Treatment [EFFECT] databases).
- **Clinical engagement**: All aspects of this work were guided and informed by leading clinicians, scientists and administrators with a wealth of knowledge and expertise in the clinical area of focus.

The development of the episode of care analysis involves the following key steps:

1. **Defining cohorts and patient groups**
2. **Defining the scope of the episode of care**
3. **Developing the episode of care model**
4. **Identifying recommended practices, including the Rapid Review process**

The following sections describe each of these steps in further detail.

Defining Cohorts, Patient Groups, and Complexity Factors

At the outset of this project, the Ministry of Health and Long-Term Care provided HQO with a broad description of each assigned clinical population (e.g., stroke), and asked HQO to work with the Expert Panels to define inclusion and exclusion criteria for the cohort they would examine using data elements from routinely reported provincial administrative datasets. It was also understood that each of these populations might encompass multiple distinct subpopulations (referred to here as "patient groups") with significantly different clinical characteristics. For example, the stroke population includes subpopulations with ischemic strokes, hemorrhagic strokes, and transient ischemic attacks (TIA). These patient groups each have very different levels of severity, different treatment pathways, and different distributions of expected resource utilization. Consequently, these groups may need to be reimbursed differently from a funding policy perspective.

Conceptually, the process employed here for defining cohorts and patient groups shares many similarities with methods used around the world for the development of case mix methodologies, such as Diagnosis-Related Groups (DRGs) or the Canadian Institute for Health Information's (CIHI) Case Mix Groups. Case mix methodologies have been used since the late 1970s to classify patients into groups that are similar in terms of both clinical characteristics and resource utilization for the purposes of payment, budgeting and performance measurement.[1] Typically, these groups are developed using statistical methods such as classification and regression tree analysis to cluster patients with similar costs based on common diagnoses, procedures, age, and other variables. After the initial patient groups have been established based on statistical criteria, clinicians are often engaged to ensure that the groups are clinically meaningful. Patient groups are merged, split, and otherwise reconfigured until the grouping algorithm reaches a satisfactory compromise between cost prediction, clinical relevance, and usability. Most modern case mix methodologies and payment systems also include a final layer of patient complexity factors that modify the resource weight (or price) assigned to each group upward or downward. These can include comorbidities, use of selected interventions, long- or short-stay status, and social factors.

In contrast with these established methods for developing case mix systems, the patient classification approach that the Ministry asked HQO and the Expert Panels to undertake is unusual in that it *begins* with the input of clinicians rather than with statistical analysis of resource utilization. The Expert Panels were explicitly instructed not to focus on cost considerations, but instead to rely on their clinical knowledge of those patient characteristics that are commonly associated with differences in indicated treatments and expected resource utilization. Expert Panel discussions were also informed by summaries of relevant literature and descriptive tables containing Ontario administrative data.

Based on this information, the Expert Panels recommended a set of inclusion and exclusion criteria to define each disease cohort. Starting with establishing the ICD-10-CA[2] diagnosis codes included for the population, the Expert Panels then excluded diagnoses with significantly different treatment protocols from the general population, including pediatric cases and patients with very rare disorders. Next, the Expert Panels recommended definitions for major patient groups within the cohort. Finally, the Expert Panels identified patient characteristics that they believe would contribute to additional resource utilization for patients within each group. This process generated a list of factors ranging from commonly occurring comorbidities to social characteristics such as housing status.

In completing the process described above, the Expert Panel encountered some noteworthy challenges:

1 Fetter RB, Shin Y, Freeman JL, Averill RF, Thompson JD. Case mix definition by diagnosis-related groups. Med Care. 1980 Feb;18(2):iii, 1-53.
[2] *International Classification of Diseases, 10th Revision (Canadian Edition).*

1. **Absence of clinical data elements capturing important patient complexity factors.** The Expert Panels quickly discovered that a number of important patient-based factors related to the severity of patients' conditions or their expected utilization are not routinely collected in Ontario hospital administrative data. These include both key clinical measures (such as FEV_1 / FVC for chronic obstructive pulmonary disease (COPD) patients and AlphaFIM®[3] scores for stroke patients) as well as important social characteristics (such as caregiver status).[4] For stroke and congestive heart failure (CHF), some of these key clinical variables have been collected in the past through the OSA and EFFECT datasets, respectively. However, these datasets were limited to a group of participating hospitals and at this time are not funded for future data collection.

2. **Focus on a single disease grouping within a broader case mix system.** While the Expert Panels were asked to recommend inclusion/exclusion criteria only for the populations tasked to them, the 3 patient populations assigned to HQO are a small subset of the many patient groups under consideration for Quality-Based Procedures. This introduced some additional complications when defining population cohorts; after the Expert Panels had recommended their initial patient cohort definitions (based largely on diagnosis), the Ministry informed the Expert Panels that there were a number of other patient groups planned for future Quality-Based Procedure (QBP) funding efforts that overlapped with the cohort definitions.

   For example, while the vast majority of patients discharged from hospital with a most responsible diagnosis of COPD receive largely ward-based medical care, a small group of COPD-diagnosed patients receive much more cost-intensive interventions such as lung transplants or resections. Based on their significantly different resource utilization, the Ministry's HBAM grouping algorithm assigns these patients to a different HBAM Inpatient Grouper (HIG) group from the general COPD population. Given this methodological challenge, the Ministry requested that the initial cohorts defined by the Expert Panels be modified to exclude patients that receive selected major interventions. It is expected that these patients may be assigned to other QBP patient groups in the future. This document presents both the initial cohort definition defined by the Expert Panel and the modified definition recommended by the Ministry.

In short, the final cohorts and patient groups described here should be viewed as a compromise solution based on currently available data sources and the parameters of the Ministry's HBAM grouping methodology.

3 The Functional Independence Measure (FIM) is a composite measure consisting of 18 items assessing 6 areas of function. These fall into 2 basic domains; physical (13 items) and cognitive (5 items). Each item is scored on a 7-point Likert scale indicative of the amount of assistance required to perform each item (1 = total assistance, 7 = total independence). A simple summed score of 18–126 is obtained where 18 represents complete dependence / total assistance and 126 represents complete independence.

4 For a comprehensive discussion of important data elements for capturing various patient risk factors, see Iezzoni LI, editor. Range of risk factors. In Iezzoni LI (Ed.) Risk adjustment for measuring health care outcomes, 4th ed. Chicago: Health Administration Press; 2012. p. 29-76.

Defining the Scope of the Episode of Care

HQO's episode of care analysis draws on conceptual theory from the emerging worldwide use of episode-based approaches for performance measurement and payment. Averill et al,[5] Hussey et al,[6] and Rosen and Borzecki[7] describe the key parameters required for defining an appropriate episode of care:

- **Index event:** The event or time point triggering the start of the episode. Examples of index events include admission for a particular intervention, presentation at the emergency department (ED) or the diagnosis of a particular condition.
- **Endpoint:** The event or time point triggering the end of the episode. Examples of endpoints include death, 30 days following hospital discharge, or a "clean period" with no relevant health care service utilization for a defined window of time.
- **Scope of services included:** While an "ideal" episode of care might capture all health and social care interventions received by the patient from index event to endpoint, in reality not all these services may be relevant to the objectives of the analysis. Hence, the episode may exclude some types of services such as prescription drugs or services tied to other unrelated conditions.

Ideally, the parameters of an episode of care are defined based on the nature of the disease or health problem studied and the intended applications of the episode (e.g., performance measurement, planning, or payment). For HQO's initial work here, many of these key parameters were set in advance by the Ministry based on the government's QBP policy parameters. For example, in 2013/14 the QBPs will focus on reimbursing acute care, and do not include payments for physicians or other non-hospital providers. These policy parameters resulted in there being limited flexibility to examine non-hospital elements such as community-based care or readmissions.

Largely restricted to a focus on hospital care, the Chairs of the Expert Panels recommended that the episodes of care for all 3 conditions begin with a patient's presentation to the ED (rather than limit the analysis to the inpatient episode) in order to provide scope to examine criteria for admission. Similarly, each of the Expert Panels ultimately also included some elements of postdischarge care in the scope of the episode in relation to discharge planning in the hospital and the transition to community services.

5 Averill RF, Goldfield NI, Hughes JS, Eisenhandler J, Vertrees JC (2009). Developing a prospective payment system based on episodes of care. J Ambul Care Manage. 32(3):241-51.
6 Hussey PS, Sorbero ME, Mehrotra A, Liu H, Damberg CL (2009). Episode-based performance measurement and payment: making it a reality. Health Affairs. 28(5):1406-17.
7 Rosen AK, Borzecki AM Windows of observation. In Iezzoni LI, ed. Risk adjustment for measuring health care outcomes, 4th ed. Chicago: Health Administration Press; 2012. p. 71-94.

Developing the Episode of Care Model

HQO has developed a model that brings together the key components of the episode of care analysis through an integrated schematic. The model is structured around the parameters defined for the episode of care, including boundaries set by the index event and endpoints, segmentation (or stratification) of patients into the defined patient groups, and relevant services included in the episode. The model describes the pathway of each patient case included in the defined cohort, from initial presentation through segmentation into one of the defined patient groups based on their characteristics, and finally through the subsequent components of care that they receive before reaching discharge or death.

While the model bears some resemblance to a clinical pathway, it is not intended to be used as a traditional operational pathway for implementation in a particular care setting. Rather, the model presents the critical decision points and phases of treatment within the episode of care, respectively referred to here as *clinical assessment nodes* and *care modules*. Clinical assessment nodes (CANs) provide patient-specific criteria for whether a particular case proceeds down one branch of the pathway or another. Once patients move down a particular branch, they then receive a set of recommended practices that are clustered together as a care module. Care modules represent the major phases of care that patients receive within a hospital episode, such as treatment in the ED, care on the ward, and discharge planning. The process for identifying the recommended practices within each CAN and care module is described in the next section.

Drawing from the concept of decision analytic modelling, the episode of care model includes crude counts (N) and proportions (Pr) of patients proceeding down each branch of the pathway model. For the 3 conditions studied in this exercise, these counts were determined based on annual utilization data from the DAD, NACRS, and (for CHF and stroke) clinical registry data.

Figure 4 provides an illustrative example of a care module and CAN:

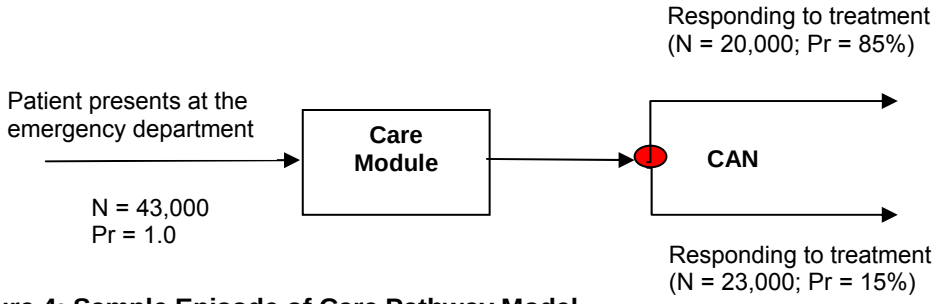

Figure 4: Sample Episode of Care Pathway Model
Abbreviations: CAN, clinical assessment node; N, crude counts; Pr, proportions.

Identifying Recommended Practices

Each CAN and care module in the episode of care model contains a set of recommended practices reviewed and agreed upon through the Expert Panel. The end goal communicated by the Ministry for the QBP methodology is to develop cost estimates for the recommended practices and aggregate these to determine a total "best practice cost" for an ideal episode of care to inform the pricing of the QBP.

In keeping with HQO's mandate to support evidence-based care, considerable attention has been paid to ensure that the recommended practices here are supported by the best available evidence. For this process, HQO considers the gold standard of evidence to be official OHTAC recommendations. While there are many other organizations that release high quality clinical guidance based on rigorous standards of evidence, OHTAC recommendations are considered the highest grade of evidence in this process for several reasons:

- **Consistency:** While many guidance bodies issue disease-specific recommendations, OHTAC produces guidance in all disease areas, providing a common evidence framework across all the clinical areas analyzed.
- **Economic modelling:** OHTAC recommendations are generally supported by economic modelling to determine the cost-effectiveness of an intervention, whereas many guidance bodies assess only effectiveness.
- **Contextualization:** In contrast with recommendations and analyses from international bodies, OHTAC recommendations are developed through the contextualization of evidence for Ontario. This ensures that the evidence is relevant for the Ontario health system context.

Notwithstanding these strengths, it is also crucial to mention several important limitations in the mandate and capacity of OHTAC to provide a comprehensive range of evidence to support HQO's episode of care analyses:

- **Focus on non-drug technologies:** While evidence shows that various in-hospital drugs are effective in treating all 3 of the patient populations analyzed, OHTAC traditionally does not consider pharmaceuticals under its mandate. Recently, OHTAC has reviewed some drug technologies in comparison with non-drug technologies for a given population as part of mega-analyses.
- **Capacity constraints:** There are a considerable number of candidate practices and interventions that require consideration for each episode of care. As OHTAC makes recommendations largely based on evidence-based analyses supplied by HQO, it may be limited in its capacity to undertake new reviews in all required areas.
- **Focus on high quality evidence:** OHTAC uses the GRADE criteria[8] to assess the strength of evidence for an intervention, with randomized controlled trials (RCTs) considered the gold standard of evidence here. Not every practice within an episode of care may be appropriate or feasible to study through an RCT. For example, some interventions may be regarded as accepted clinical practice, while others may be unethical to evaluate as part of a clinical trial.

Thus, in situations where OHTAC recommendations do not exist, HQO's episode of care analysis makes use of other sources of evidence:

8 Guyatt GH, Oxman AD, Schunemann HJ, Tugwell P, Knottnerus A. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. J Clin Epidemiol. 2011;64(4):380-2.

- **Guidance from other evidence-based organizations:** Each of the Expert Panels recommended credible existing sources of evidence-based guidance, such as the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines for COPD. Recommendations from these bodies were included along with their assessment of the evidence supporting the recommendation.
- **Analysis of empirical data:** The Expert Panels reviewed the results of descriptive and multivariate analysis using empirical data, including administrative data sources and clinical data sources such as the EFFECT database.
- **Expert consensus:** In areas that the Expert Panels saw as important but where evidence was limited or nonexistent, the Expert Panels relied on consensus agreement while noting the need for further research in these areas.

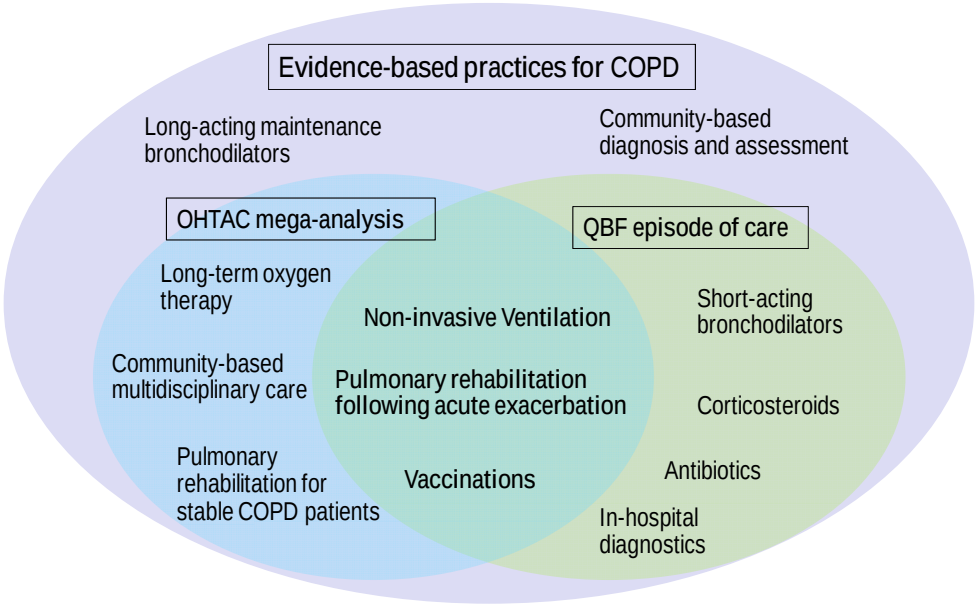

Figure 5: Example Illustrating the Alignment of OHTAC COPD Practice Recommendations with the Scope of Practices Reviewed Through the COPD Episode of Care

Abbreviations: COPD, chronic obstructive pulmonary disease; OHTAC. Ontario Health Technology Advisory Committee; QBF, Quality-Based Funding.

The process for identifying recommended practices for the episode of care involves the following steps:

1. Reviewing existing guidance from OHTAC and other selected evidence-based bodies and extracting all candidate practices for each care module and CAN;
2. Consulting with members of the Expert Panel for additional candidate interventions not included in the guidance reviewed;
3. Reviewing and summarizing the strength of evidence cited for each candidate intervention in the guidance literature, where it exists and is clearly stated;
4. Summarizing the results of steps 1 to 3 above for each phase of the episode of care model and presenting the summary to the Expert Panel for review;
5. Facilitating discussion by the Expert Panel members on contextualizing the candidate practices for the Ontario health system and arriving at a consensus recommendation; and
6. Identifying gaps in the evidence that the Expert Panel agreed are high value candidates for research questions for rapid reviews (see below) and future evidence-based analyses.

Rapid Reviews

In order to address cases where a gap in the evidence is identified and prioritized for further analysis in step 6 (above), HQO has developed a rapid evidence review process that is able to operate within the compressed timeframe of this exercise, recognizing that a full evidence-based analysis would be impractical given the short timelines.

For each question, the rapid review analysis began with a literature review 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, 2000, to October 2012. Abstracts were reviewed by a single reviewer and full-text articles were obtained for those studies meeting the eligibility criteria. Reference lists were also examined for any additional relevant studies not identified through the search.

Articles were reviewed if they were:

- English language full-text reports
- published between January 1, 2008, and October 2012
- health technology assessments, systematic reviews, and meta-analyses

If systematic reviews were not available, RCTs, observational studies, case reports, and editorials were selected.

The methodological quality of systematic reviews was assessed using the Assessment of Multiple Systematic Reviews (AMSTAR) measurement tool.[9] The quality of the body of evidence for each outcome was examined according to the GRADE Working Group criteria.[8] The overall quality was determined to be very low, low, moderate, or high using a step-wise, structural methodology.

Study design was the first consideration; the starting assumption was that RCTs are high quality, whereas observational studies are low quality. Five additional factors—risk of bias, inconsistency, indirectness, imprecision, and publication bias—were then taken into account. Limitations or serious limitations in these areas resulted in downgrading the quality of evidence. Finally, 3 factors that could raise the quality of evidence were considered: large magnitude of effect, dose response gradient, and accounting for all residual confounding.[8]

For more detailed information, please refer to the latest series of GRADE articles.[8]

As stated by the GRADE Working Group,[7] the final quality score can be interpreted using the following definitions:

9 Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of sytematic reviews. BMC Med Res Methodol. 2007;7(10).

High	Very confident that the true effect lies close to the estimate of the effect
Moderate	Moderately confident in the effect estimate—the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low	Confidence in the effect estimate is limited—the true effect may be substantially different from the estimate of the effect
Very Low	Very little confidence in the effect estimate—the true effect is likely to be substantially different from the estimate of effect

Description of COPD

The following is an excerpt from the Ontario Health Technology Assessment Series COPD Evidentiary Framework.[10]

Background

COPD is a disease state characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response by the lungs to noxious particles or gases. The airflow limitation is caused by small airway disease (obstructive bronchiolitis) and parenchymal destruction (emphysema), both of which contribute to the disease to varying degrees, depending on the person. Chronic inflammation causes structural changes in the lungs and narrowing of the small airways. Inflammatory processes also cause destruction of the lung parenchyma, which leads to the loss of alveolar attachments to the small airways and decreases lung elastic recoil. These changes diminish the ability of the airways to remain open during expiration.

The most common symptoms of COPD include chronic and progressive breathlessness, cough, sputum production, wheezing, and chest congestion. In addition to the airflow restriction and changes to the lung, COPD is associated with systemic effects and comorbidities. Systemic effects include weight loss, nutritional abnormalities and malnutrition, and skeletal muscle dysfunction. Common comorbidities are ischemic heart disease, osteoporosis, respiratory infection, bone fractures, depression and anxiety, diabetes, sleep disorders, anemia, glaucoma and cataracts, and cancer.

Natural History of COPD

COPD is a progressive disease. The rate of progression varies and may occur over several years or several decades, depending on factors such as continued exposure to noxious particles (e.g., tobacco smoke). There are several systems for classifying the severity of COPD; one of the most widely used is the Global Initiative for Chronic Obstructive Lung Disease (GOLD) staging criteria, which are based on postbronchodilator spirometry (forced expiratory volume in 1 second [FEV1]). In the GOLD system there are 4 stages, which range from mild to very severe (See Table 1, below).

[10] *For more information, see: OHTAC COPD Collaborative. Chronic obstructive pulmonary disease (COPD) evidentiary framework. Ont Health Technol Assess Ser [Internet]. 2012 March;12(2):1-97. Available from: www.hqontario.ca/en/mas/tech/pdfs/2012/rev_COPD_Framework_March.pdf*

Table 1: GOLD Staging Criteria for COPD*

Stage	Severity	FEV_1/FVC	FEV_1	Symptoms
I	Mild	< 0.70	$FEV_1 \geq 80\%$ predicted	Symptoms may or may not be present Possible symptoms include chronic cough and sputum production
II	Moderate	< 0.70	$50\% \leq FEV_1 < 80\%$ predicted	Shortness of breath on exertion Cough and sputum production are sometimes present
III	Severe	< 0.70	$30\% \leq FEV_1 < 50\%$ predicted	Greater shortness of breath, reduced exercise capacity, fatigue, and repeated exacerbations
IV	Very severe	< 0.70	$FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted plus chronic respiratory failure	Respiratory failure, which may also lead to cor pulmonale

*Abbreviations: COPD, chronic obstructive pulmonary disease; FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease.
Source: Global Initiative for Chronic Obstructive Lung Disease, 2010. (1)

The disease course varies, but typically patients fluctuate between stable disease and acute exacerbations, which become more common as the disease progresses. Acute exacerbations are periods when symptoms worsen. There is debate about the best definition for exacerbations; a consensus definition developed by GOLD defines an acute exacerbation as "an event in the natural course of the disease characterized by a change in the patient's baseline dyspnea, cough, and/or sputum that is beyond normal day-to-day variations, is acute in onset, and may warrant a change in regular medication." (GOLD 2011)[11] Patients may also experience a variety of other symptoms, such as worsening exercise tolerance, fatigue, malaise, and decreased oxygen saturation. After an acute exacerbation, the individual may not recover to his/her previous level of airflow limitation, and this permanent loss of lung function contributes to the progressive nature of the disease.

Two-thirds of exacerbations are caused by either an infection of the tracheobronchial tree or air pollution, but the cause is unknown in the remaining cases. Risk factors for exacerbations include disease severity, winter months, and a previous exacerbation in the past 8 weeks. The frequency of exacerbations varies by disease severity. Using data from the ISOLDE Study, the European Respiratory Society Study on COPD, and the Copenhagen City Lung Study, Donaldson et al found that patients with severe disease (GOLD stage III) experienced an average of 3.43 exacerbations per year, while patients with moderate disease (GOLD stage II) experienced an average of 2.68 exacerbations per year.[12]

Epidemiology of COPD

Prevalence

Estimates of COPD prevalence vary depending on the methods and diagnostic criteria used to identify cases. Many of the prevalence estimates are also believed to be underestimates due to underdiagnosis and underrecognition of COPD and to limited diagnoses of mild cases, as individuals often do not require health care services until they reach the moderate to severe stages of the disease.

[11] Global Initiative for Chronic Obstructive Lung Disease (2010). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease [cited 2012 Nov 6]. Available: http://www.goldcopd.org/uploads/users/files/GOLDReport_April112011.pdf
[12] Donaldson GC, Wedzicha JA. COPD exacerbations.1: Epidemiology. Thorax. 2006 Feb;61(2):164-8.

Based on the Canadian Community Health Survey, in 2007 about 4.4% of Canadians self-reported that they had been diagnosed with COPD by physicians.[13] Based on Ontario administrative data sets, Gershon et al (2010) estimated the 2007 age- and sex-standardized prevalence of COPD in Ontario to be 9.5%.[14] The prevalence of COPD has increased over time; Gershon et al. (2010) found a 23% increase in the prevalence rate between 1996 and 2007 (1996, 7.8%; 2007, 9.5%),[14] and this corresponds to an increase of 64.8% in the number of adults with COPD. The aging population alone does not entirely account for this increase.[14]

Incidence

Based on Ontario administrative data sets, the 2007 age- and sex-standardized incidence of COPD in Ontario was 8.5 cases per 1,000 adults. Gershon et al. (2010) showed that the incidence rate has been declining since 1996, when it was 11.8 cases per 1,000 adults.[14] The age-standardized incidence rate is higher in males than in females (9.4 cases per 1,000 adults vs. 7.8 cases per 1,000 adults, respectively); however, the incidence rate has been declining faster in males than females (% decline since 1996, 32.3% vs. 24.7%, respectively).[14]

Risk Factors for COPD

The most common risk factor for COPD—and the primary cause of COPD in 80% to 90% of cases—is exposure to tobacco smoke.[13] There are numerous other risk factors, however, including exposure to occupational dusts and chemicals (including vapours, irritants, and fumes), indoor air pollution (e.g., from burning biomass fuels for heating and cooking in confined spaces in developing countries), outdoor air pollution, genetics, lung growth and development, oxidative stress, respiratory infections and previous tuberculosis, and asthma. The quality and strength of evidence supporting these risk factors vary, with the strongest evidence being for tobacco smoke, occupational exposures, indoor air pollution, and alpha1-antitrypsin deficiencies.

Diagnosis of COPD

The GOLD guidelines recommend that any individual with breathlessness, chronic cough, or sputum production—especially those with risk factors (such as cigarette smokers)—be evaluated for COPD. Spirometry, the best standardized, objective measurement for airflow limitation, should be used to confirm all COPD diagnoses. Spirometry (or pulmonary function tests) include the forced vital capacity (FVC, volume of air forcibly exhaled from the point of maximal inspiration) and the FEV1 (volume of air exhaled during the first second of the FVC measurement). During a test, patients reference values based on age, height, sex, and race; and with results presented as a percentage of the predicted value.

Apart from spirometry, other tests may be conducted to help assess severity of disease and provide additional information necessary for treatment. These tests include bronchodilator reversibility testing, chest x-ray, and arterial blood gas measurements.

Both over- and underdiagnosis of COPD are possible issues. Overdiagnosis can occur when the diagnosis is based solely upon an individual's medical history and physical examination and is not confirmed by spirometry. Underdiagnosis can occur due to underrecognition of COPD by both clinicians and patients.

[13] Public Health Agency of Canada. COPD [Internet]. [Ottawa (ON)]: Public Health Agency of Canada; [updated 2007 Nov 22; cited 2011 Jun 21]. Available from: http://www.phacaspc.gc.ca/publicat/2007/lbrdc-vsmrc/copd-mpoc-eng.php

[14] 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.

Management of COPD

COPD management and treatment is a staged process depending on the severity of the disease, with new treatments/management strategies introduced as needed. It begins with avoiding risk factors (e.g., vaccinations, smoking cessation, etc.), and as the disease progresses, introducing additional treatments and medications (e.g., drug therapy, pulmonary rehabilitation, oxygen therapy, etc.).

Impact of COPD

First and foremost, COPD has a considerable impact on the person with the disease. This impact varies and is influenced not just by the degree of airflow limitation, but also by the severity of symptoms, including breathlessness, decreased exercise capacity, systemic effects, and comorbidities. These symptoms can have a substantial impact on people living with the disease: based on the 1998/1999 National Population Health Survey, 51% of Canadians with COPD reported that their disease restricted their activity at home, at work, or in other activities.[15]

In addition, people with moderate to severe COPD typically experience 1 or more acute exacerbations per year. These exacerbations impact health related quality of life HRQOL) and lung function; may require hospitalization and invasive treatment such as invasive mechanical ventilation (IMV); and increase the risk of mortality. COPD is the fourth leading cause of death in Canada and is expected to be the third leading cause of
death by 2020. The 2007 age- and sex-standardized mortality rate in Ontario was 4.3%, which translates to 32,156 deaths.[14]

Apart from its impact on individual patients, COPD has a substantial effect on the health system. COPD is a leading cause of health care utilization, both globally and in Canada. In 1997, COPD was the fourth most common cause of hospitalization among Canadian men and the sixth most common among Canadian women. The age- and sex-standardized average hospitalization rate from 1996 to 1999 was 632 hospitalizations per 100,000 adults in Ontario.[15]

Furthermore, acute exacerbations of COPD are a leading cause of emergency department (ED) visits and hospitalizations, particularly in the winter.
The economic burden of COPD is high. The Canadian component of a large-scale international survey, Confronting COPD in North America and Europe, showed an annual direct cost of almost $2,000 (Cdn) per patient for COPD-related primary and secondary care visits, treatment, and laboratory tests.[16]

[15] Editorial Board for Respiratory Disease in Canada. Respiratory disease in Canada [2001]. Health Canada. [cited: 2011 Jun 12]. Available: http://www.phac-aspc.gc.ca/publicat/rdc-mrc01/pdf/rdc0901e.pdf
[16] Chapman KR, Bourbeau J, Rance L. The burden of COPD in Canada: results from the Confronting COPD survey. Respir Med. 2003 Mar;97 Suppl C:S23-S31.

COPD Episode of Care Model

Initial COPD Cohort Inclusion/Exclusion Criteria

The following age ranges, ICD-10-CA diagnosis codes, and diagnosis types were recommended for defining the COPD population for this episode of care analysis:

a) Age: Persons aged 35 years and older.

*Rationale***:** The 35-year age threshold is used in the ICES cohort and a wide range of COPD-related studies. COPD is a progressive disease that generally manifests itself after a person is exposed to risk factors for a number of years. Few people under 35 years old are diagnosed with COPD (only 67 cases admitted to acute inpatient care in 2010/2011). For those who are, their disease probably results from congenital factors. As a result, their care pathways and treatment protocols are likely to be substantially different from the vast majority of COPD patients, and not practical to consider within the Expert Panel's initial set of deliverables.

b) Diagnosis codes: ICD-10-CA codes J41-J44, with the exception of *Panlobular emphysema* (J43.1), *Centrilobular emphysema* (J43.2), and *Macleod's syndrome* (J43.0) (see Table 2).

Table 2: ICD-10-CA Diagnoses Included in COPD Episode of Care Cohort (Volumes and Length of Stay Data From 2010/11 Ontario Acute Inpatient Discharges):

Description of Most Responsible Diagnosis	ICD-10 Code	Inclusion in HBAM HIG Grouper	Inclusion in CIHI CMG+ Grouper	Inclusion in ICES COPD Cohort	# of Discharges	Average Length of Stay	Included in HQO COPD Episode of Care Cohort?
Chronic obstructive pulmonary disease with acute exacerbation, unspecified	J441	HIG 139a: Chronic Bronchitis	All included in CMG 139: COPD	Included	12,115	6.98	YES
Other specified chronic obstructive pulmonary disease	J448				392	8.68	YES
Mixed simple and mucopurulent chronic bronchitis	J418				0	0.00	YES
Unspecified chronic bronchitis	J42				23	4.74	YES
Mucopurulent chronic bronchitis	J411				0	0.00	YES
Panlobular emphysema	J431	HIG 139b: COPD			1	19.00	NO
Centrilobular emphysema	J432				1	43.00	NO
Other emphysema	J438				12	6.33	YES
MacLeod's syndrome	J430				1	13.00	NO
Emphysema, unspecified	J439				115	10.65	YES
Chronic obstructive pulmonary disease with acute lower respiratory infection	J440				10,578	9.51	YES
Chronic obstructive pulmonary disease, unspecified	J449				709	8.95	YES
Simple chronic bronchitis	J410				1	19.00	YES
Bronchitis, not specified as acute or chronic	J40			Not Included	392	4.42	NO
Chronic respiratory conditions due to chemicals, gases, fumes and vapours	J684				7	11.86	NO

Rationale: The diagnoses included in the ICES COPD cohort (ICD-10-CA codes J41-J44) have been adopted, with the exception of 3 very rare, low volume (1 inpatient acute admission with most responsible diagnosis for each in 2010/2011) diagnoses that have significantly different care pathways than the general COPD population and were not seen by the Expert Panel as practical to consider within HQO's deliverables due November 30.

It should also be noted that two diagnosis codes included in the HIG and CMG+ methodologies are not included in this cohort definition: *bronchitis, not specified as acute or chronic* (J40) and *chronic respiratory conditions due to chemicals, gases, fumes, and vapours* (J68.4). These diagnoses are

seldom found in COPD cohorts in the literature and the Expert Panel did not regard these cases as part of the general COPD population.

c) Diagnosis types identified: The following diagnosis types are included in the COPD patient cohort for analysis:

Acute inpatient cases: Included diagnosis codes from **1b)** present as one of the following diagnosis types:

- **Most responsible diagnosis** (MRDx): The diagnosis determined by the coder as having the greatest contribution to the patient's utilization and/or length of stay. This is most often—but not always—the same as the admitting diagnosis.

- **Admitting diagnosis**: An optional diagnosis type coded in cases where the most responsible diagnosis differs from the original diagnosis the patient was admitted for.

- **Preadmit comorbidity**: Coded in a case where a patient has multiple recorded diagnoses, where the preadmit comorbidity is seen to have contributed to at least an additional 24 hours of the patient's stay, but not seen to have been the primary contributing diagnosis to a patient's utilization or length of stay.

Emergency department cases: Included diagnosis codes from 1b) present as one of the following diagnosis types:

- **Main problem:** Similar to MRDx for inpatient, the diagnosis determined by the coder to have had the greatest contribution to patient utilization and/or length of stay.

- **Other problem(s):** Similar to preadmit comorbidity, a diagnosis existing in combination with the main problem that is seen to have contributed to utilization and/or length of stay.

Rationale: The Expert Panel felt that cases where a COPD-related diagnosis was not recorded as MRDx (inpatient acute) or main problem (ED visit) but recorded as admitting diagnosis or preadmit comorbidity (inpatient care), or other problem (ED visit) would still be likely to benefit from at least a subset of the recommended interventions in the COPD pathway. Additionally, due to the uncertainty around COPD diagnosis and coding, it was thought there are likely to be a number of cases where COPD might be considered the true 'most responsible' condition or the etiological disease behind a presenting condition such as chronic obstructive pulmonary disease, but was not attributed as MRDx.

Modified COPD Cohort Inclusion/Exclusion Criteria for Funding Purposes

The following ICD-10-CA diagnosis codes, diagnosis types, and ICD-10-CCI intervention exclusion criteria are recommended for the purposes of funding COPD through the QBP funding mechanism:

Inclusion/exclusion criteria:

1) **Diagnoses:** Most responsible diagnosis in the range of J41-J44, excluding "J43.1" "J43.2" "J43.0"

2) **Age:** Age greater than or equal to 35 at time of admission

3) **Intervention:** Is not assigned to an intervention based HIG cell based on the current methodology (i.e., MCC_partition variable is not "I")

Rationale: At their second (September 11) meeting, the Expert Panel heard from MOHLTC representatives about the challenges of incorporating the recommended inclusion of COPD preadmit comorbidity diagnosis types into the QBP funding methodology.

Case mix grouping algorithms of the sort used by the Ministry for funding the quality-based procedures (QBPs) typically assign cases to groups based on either principal intervention (typically a major 'qualifying procedure' such as a surgery) or in cases where there is no major qualifying procedure, by most responsible diagnosis. There is a need for case mix groups to be mutually exclusive—that is, the logic of the grouping algorithm should assign a case to one group or another, not both.

The original inclusion criteria identified by the Expert Panel led to a substantial amount of overlap with cases in other QBP groups (see Table 3), where the case shares a COPD preadmit comorbidity diagnosis with an MRDx for a different condition. Most notably, 19% (1659 cases) of all COPD preadmit comorbidity discharges in 2010/2011 were assigned MRDx of chronic obstructive pulmonary disease, which overlaps with the separate QBP grouping for COPD.

Table 3: Cases with COPD Comorbidity, by MRDx (Top 10 MRDx by Volume)

MRDx	COUNT	PERCENT	Overlap with other QBP
I500	1659	18.84	CHF
J960	314	3.57	
I214	298	3.38	
J969	219	2.49	
A419	214	2.43	
I480	203	2.31	
N390	165	1.87	
J690	129	1.46	
J189	128	1.45	
I269	119	1.35	
Z515	117	1.33	
…	…	…	…
Total	8806	100.00	

Expert Panel members agreed that for the short-term purposes of the Ministry's QBP funding methodology, the preadmit comorbidity cases may be excluded. However, these cases should still be subject to the recommended practices defined for the COPD population, as they are still likely to benefit from receiving these. It should also be remembered that current diagnosis coding for these cases may be inaccurate.

Following the second meeting of the Expert Panel, the Ministry arranged a call with the COPD Expert Panel co-chair and HQO staff to present data on the distribution of cases in the identified COPD cohort across HIG cells (Table 4).

Nearly 99% of acute inpatient COPD cases (23,561 of 23,878) fall into two HIG cells: *chronic bronchitis* (139a) and *chronic obstructive pulmonary disease* (139b). The remaining 1.3% (317) of cases are dispersed in low volumes across 16 other HIG cells. Ten of these HIGs are assigned to cases based on a "major qualifying procedure"–typically a surgery–such as pleurectomy (113) or lung transplant (110). These cases tend to expend considerably greater resources than the majority of primarily medical COPD cases and, as a result, are grouped to a different HIG.

The Ministry requested that, for funding purposes, cases that include major qualifying procedures (n = 276 for 2010/2011) be excluded from the COPD QBP group. It was agreed that the smaller proportion of cases (n = 31) that do not have a major qualifying procedure but do not fall into the 2 major COPD groups (e.g., bacterial pneumonia (n = 21), anemia (n = 1)) should be included in the COPD cohort, as many of these appeared to be grouped based on comorbidities occurring in combination with COPD.

Table 4: Distribution of COPD Diagnosis Cohort Across HBAM Inpatient Grouper (HIG) Cells

HIG	Description	# Patients with COPD MRDx in This Group	# All Patients in These HIGs	Included in QBP Funded Group?
	Missing HIG	2	788	YES
034	Other disorder of nerve	1	630	YES
110	Lung transplant	20	71	NO
112	Open thoracic lung resection	10	1457	NO
113	Pleurectomy	11	523	NO
114	Endoscopic lung resection	15	1220	NO
115	Respiratory biopsy/inspection	8	440	NO
116	Pleurodesis	1	23	NO
117	Other respiratory intervention	26	779	NO
119	Lymph node excision/biopsy with respiratory diagnosis	2	87	NO
120	Other intervention with respiratory diagnosis	30	246	NO
136	Bacterial pneumonia	21	2060	YES
138	Viral/unspecified pneumonia	5	19574	YES
139a	Chronic bronchitis	12379	12414	YES
139b	Chronic obstructive pulmonary disease	11182	11598	YES
480	Kidney disease	1	1128	YES
635	Other anemia	1	3947	YES
904	MCC 04 unrelated intervention	163	692	NO

Table 5: Distribution of COPD Diagnosis Cohort Across ED Visit Comprehensive Ambulatory Care Classification System (CACS) Groups

CACS	Description	# Patients with COPD Diagnosis	Total # of Patients in CACS
A001	Dead on arrival	4	696
A002	Left without being seen or triaged and not seen	9	193799
B002	Respiratory condition with acute admission/transfer	17023	73928
B051	Emergency visit interventions	395	73648
B053	Interventions generally performed by non-emergency department service: Other	2	1559
B116	Disease or disorder respiratory system	25721	289828
E151	Respirology	61	473

Recommended COPD Patient Groups

As described in the **Methods** section, the Expert Panel was asked to recommend an approach to stratifying patients hospitalized with exacerbations of COPD based on their clinical characteristics and expected resource utilization. The Expert Panel reviewed the Ministry's default HIG grouping logic for COPD (see Table 2) and agreed that the two HIG groups for the cohort were not clinically meaningful; they appeared to be largely determined based on the coding of a concurrent lower respiratory tract infection in a patient (which would assign the case to HIG 139b 'Chronic Obstructive Pulmonary Disease' as opposed to HIG 139a 'Chronic Bronchitis', which does not include the cases with respiratory infection). Given that a high proportion of COPD admissions have lower respiratory tract infections in combination with COPD, with inconsistent diagnosis and coding, the Expert Panel agreed that it would be necessary to explore alternative grouping approaches.

Determining an appropriate approach for stratifying COPD patients for this task was challenging given the outcome of interest: resource utilization during the hospitalization episode. While a number of approaches have been developed to classify COPD patients by severity over the course of their disease—such as the GOLD Staging Criteria (see Table 1) using FEV1 / FVC and the BODE Index (recommended by NICE, GOLD and CTS)—these are not intended to be applied to the stratification of particular COPD acute exacerbations. With that said, studies have found that COPD patients with lower FEV_1 / FVC scores[17] and more severe dsypnea[18] tend to both have more frequent exacerbations and more severe exacerbations, contributing to higher costs. Routine collection of these types of clinical measures may assist the Ministry in developing more accurate risk adjustment models for COPD patient groups.

In a review of studies examining the costs of COPD exacerbations, Toy et al. [19]found that the majority of articles surveyed used retrospective utilization as a proxy for grouping exacerbations by severity—e.g. seen in primary care (typically a 'mild' exacerbation) versus admitted to hospital (typically a 'moderate' or 'severe' exacerbation). Oostenbrink et al.[20] prospectively stratified COPD exacerbations by severity using a questionnaire based on patients' reported symptoms; this approach avoids being determined based on hospital utilization patterns, but is unlikely to be feasible for funding purposes.

Consistent with much of the literature, the Expert Panel recommended that, given the limitations of current administrative data sources, COPD exacerbation hospitalizations be classified into the following 3 groups for the purpose of QBP funding:

1. **Mild exacerbation:** Patient treated in the ED or in outpatient settings and discharged home without requiring an inpatient admission.

2. **Moderate exacerbation:** Patient requires admission to inpatient care.

3. **Severe exacerbation:** Patient requires ventilation (either noninvasive or invasive ventilation) and/or admission to an intensive care unit.

It is recognized that these 3 patient groups are largely based on disposition (or level of care received) rather than prospective clinical symptoms. While 'Severe' exacerbations may be defined by markers of acute respiratory failure or acidosis, the Expert Panel noted that there are few definitive measures to

[17] Cao Z, Ong KC, Eng P, Tan WC, Ng TP (2006). Frequent hospital readmissions for acute exacerbation of COPD and their associated factors. Respirology. Mar;11(2):188-95
[18] Oostenbrink JB, Rutten-van Mölken MP (2004). Resource use and risk factors in high-cost exacerbations of COPD. Respir Med. Sep;98(9):883-91
19 Economic Impact of Exacerbations of Chronic Obstructive Pulmonary Disease and Exacerbation Definition: A Review
[20] Oostenbrink JB, Rutten-van Mölken MP (2004). Resource use and risk factors in high-cost exacerbations of COPD. Respir Med. Sep;98(9):883-91

distinguish between ‘Mild’ and ‘Moderate’ exacerbations—these largely rely on clinical judgment and the availability of hospital resources. For example, it may be possible for the same patient to be treated in and discharged from a well-equipped ED in one hospital—and thus classified as ‘Mild’—while they might be admitted in another hospital and be classified as ‘Moderate’. The Ministry should exercise extreme caution in designing funding methodologies based on these groups, paying particularly close attention to the possibility of creating perverse incentives for hospitals to admit borderline ‘Mild / Moderate’ patients in order to claim a higher payment for the ‘Moderate’ group.

While the COPD care pathway (see Section 7) includes a list of criteria for consideration in determining whether to admit patients or to treat them in ED/outpatient settings, there are no objective markers or thresholds defined on this list for a mild versus a moderate exacerbation; this may be a potential future area for research and/or evidence-based analysis. While

Using the Expert Panel’s definitions, the Ministry subsequently conducted analysis of the costs for the two COPD patient groups that require admission, ‘Moderate’ exacerbations and ‘Severe’ exacerbations. Table 6 presents this analysis, and demonstrates that the group definitions are highly predictive of cost: the Severe group has a mean total cost of nearly three times that of the Moderate group ($17,791.46 compared with $6,101.81).

Table 6: Ministry analysis of costs per case for Moderate and Severe Exacerbation groups

COPD_group	NumCases	tc_mean	CPWC_mean	tc_median	CPWC_median
All (single price)	17,916	7,568.56	5,741.30	4,925.35	5,025.27
Moderate	15,668	6,101.81	5,723.15	4,490.10	4,989.01
Severe	2,248	17,791.46	5,867.80	13,385.11	5,261.95
Note: tc - total cost; CPWC - cost per weighted case					

Factors Contributing to COPD Patient Complexity

Evidence shows that within the 3 major exacerbation severity groups defined above, there is considerable heterogeneity in patient clinical characteristics, utilization, and cost. The Expert Panel identified a number of markers that should be considered as potential complexity adjustment factors within the QBP funding model, in terms of their impact on the indicated interventions for a patient and their expected utilization of health care resources.

The Expert Panel grouped these complexity factors for consideration into 3 broad categories:

a) Severity of disease

- O_2 dependence
- Respiratory failure
- Recent (e.g., within 30 days) discharge from ED/hospital
- Frequency of acute exacerbations over previous 6 to 12 months
- Oral steroid use/dependence
- Functional ability (activity) on the MMRC dyspnea scale
- Lung function (FEV_1/FVC)
- Failed response to outpatient therapy

b) Significant comorbidities

- Bronchiectasis
- Pneumonia
- Coinfections (pseudomonas, mycobacterium, urosepsis)
- Mental health (anxiety, depression, dementia, delirium)
- Chronic obstructive pulmonary disease
- Arrythmia (including atrial fibrillation)
- Diabetes
- Tobacco dependence
- Benzodiazepine dependence/chronic benzodiazepine use
- Immunosuppressant disease
- Lung cancer
- Renal failure
- Osteoporosis
- BMI (overweight or underweight)
- Chronic pain
- Sleep apnea
- Myocardial infarction
- Neuromuscular disorder
- Gastroesophageal reflux disease
- Muscoskeletal disorders
- Asthma
- Interstitial lung disease

c) Housing/supports/frailty

- Homeless
- Lack of support (isolation, lack of transportation)
- Continuing care/nursing home

- Access to primary care
- Functional status (e.g., walking aids)
- Drug plan
- Access to pulmonary rehab

Many of the factors identified here have also been substantiated in the scientific literature as being associated with higher costs for COPD exacerbations, including: lower FEV_1/FVC;[21] [22]more severe dyspnea;[23] underweight BMI;[24] and comorbidity score.[25]

The Expert Panel requests that the Ministry conduct multivariate analysis on the impact of the identified factors above on COPD case cost, recognizing that not all of the factors above will be measurable through current provincial administrative data sets.

Further consideration of comorbidities: There has been some discussion that upon completion of the pathway for the "typical" COPD case, the Expert Panel may consider the implications of commonly occurring comorbidities such as pneumonia, diabetes, arrhythmia (see Table 7) on the COPD pathway. While it is expected that the foundational pathway will remain the same, the inclusion of comorbidities may result in recommending additional interventions in each care module.

[21] Cao Z, Ong KC, Eng P, Tan WC, Ng TP (2006). Frequent hospital readmissions for acute exacerbation of COPD and their associated factors. Respirology. Mar;11(2):188-95

[22] Schermer TRJ, Saris CGJ, Van Den Bosch WJHM, Chavannes NH, van Schayck CP, Dekhuijzen PNR, van Weel C. Exacerbations and associated healthcare cost in patients with COPD in general practice. Monaldi Arch Chest Dis 2006;65:133–140

[23] Oostenbrink JB, Rutten-van Mölken MP (2004). Resource use and risk factors in high-cost exacerbations of COPD. Respir Med. Sep;98(9):883-91

[24] Oostenbrink JB, Rutten-van Mölken MP (2004). Resource use and risk factors in high-cost exacerbations of COPD. Respir Med. Sep;98(9):883-91

[25] Mapel DW, Schum M, Lydick E, Marton JP. A new method for examining the cost savings of reducing COPD exacerbations. Pharmacoeconomics. 2010;28(9):733-49

Table 7: Most Common Comorbidities Recorded With COPD Admissions
2010/11 Discharge Abstract Database Acute Inpatient Admissions with COPD MRDx

Comorbidity Diagnosis	Diagnosis Type	# Discharges	Avg LOS
(J960) ACUTE RESPIRATORY FAILURE	POST-ADMIT COMORBIDITY/COMPLICATION	180	21.41
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	743	14.93
	SECONDARY DIAGNOSIS	18	11.72
(J969) RESPIRATORY FAILURE UNSPECIFIED	POST-ADMIT COMORBIDITY/COMPLICATION	106	25.75
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	604	11.91
	SECONDARY DIAGNOSIS	31	10.35
(I500) CONGESTIVE HEART FAILURE	POST-ADMIT COMORBIDITY/COMPLICATION	140	23.70
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	2,735	11.48
	SECONDARY DIAGNOSIS	802	7.44
(E1152) TYPE 2 DM W CERTAIN CIRC COMP	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	244	12.47
	SECONDARY DIAGNOSIS	1,724	10.00
(E119) TYPE 2 DM NO COMP	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	225	7.93
	SECONDARY DIAGNOSIS	1,552	7.41
(J189) PNEUMONIA UNSPECIFIED	POST-ADMIT COMORBIDITY/COMPLICATION	88	36.30
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	8,003	9.05
	SECONDARY DIAGNOSIS	230	8.87
(J180) BRONCHOPNEUMONIA UNSPECIFIED	POST-ADMIT COMORBIDITY/COMPLICATION	11	32.82
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	577	8.51
	SECONDARY DIAGNOSIS	11	14.64
(J181) LOBAR PNEUMONIA UNSPECIFIED	POST-ADMIT COMORBIDITY/COMPLICATION	8	38.38
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	350	9.83
	SECONDARY DIAGNOSIS	7	8.71
(Z515) PALLIATIVE CARE	DIAGNOSIS ASSOCIATED WITH FIRST TRANSFER SERVICE	171	17.10
	DIAGNOSIS ASSOCIATED WITH SECOND TRANSFER SERVICE	12	71.92
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	917	14.92
	SECONDARY DIAGNOSIS	15	9.40
(N390) URINARY TRACT INFECTION SITE NOT SPECIFIED	POST-ADMIT COMORBIDITY/COMPLICATION	218	38.88
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	699	13.67
	SECONDARY DIAGNOSIS	86	14.07
(N189) CHRONIC KIDNEY DISEASE UNSPECIFIED	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	130	14.16
	SECONDARY DIAGNOSIS	653	9.92
(N179) ACUTE RENAL FAILURE UNSPECIFIED	POST-ADMIT COMORBIDITY/COMPLICATION	157	21.83
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	841	12.70
	SECONDARY DIAGNOSIS	73	11.99
(I480) ATRIAL FIBRILLATION	POST-ADMIT COMORBIDITY/COMPLICATION	134	22.21
	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	1,262	12.50
	SECONDARY DIAGNOSIS	1,256	9.27
(I100) BENIGN HYPERTENSION	PRE-ADMIT COMORBIDITY/PRIMARY DIAGNOSIS	819	11.73
	SECONDARY DIAGNOSIS	4,906	8.57

Additional Considerations Related to the COPD Cohort and Patient Grouping Approach

The Expert Panel highlighted the following considerations related to the COPD cohort and patient groups:

a) **Accuracy and consistency of current COPD diagnosis, charting, and coding practices:** There was agreement amongst Expert Panel members that current diagnosis, charting, and coding of COPD in Ontario is likely to be inconsistent and unreliable. In many cases, COPD diagnoses are assigned based on symptoms or clinical intuition without objective confirmation through spirometry. The Expert Panel recommended that in the future, any diagnosis of COPD on a patient chart should be accompanied by confirmation through spirometry (either during the stay or reported in the patient's previous history). In the absence of spirometry, coders should not assign a COPD diagnosis.

b) **Meaningfulness of ICD-10-CA COPD-related diagnosis codes:** The Expert Panel felt that a number of the current ICD-10-CA diagnosis codes for COPD-related conditions were not clinically meaningful. For example, some of the different specificities of bronchitis (e.g., mucopurulent vs. simple and mucopurulent) appeared to be nonexclusive, while, on the other hand, the two COPD diagnosis codes (J44.0 and J44.1) that capture the vast majority of COPD-related cases are not specific enough to be meaningful.

c) **Important unmeasured clinical variables:** There are a number of patient characteristics and clinical measures, such as FEV_1/FVC and MMRC, that studies have shown are associated with the severity and cost of COPD exacerbations but that are not captured in routine administrative data in Ontario. These variables may be important for adequately adjusting for variation in patient complexity. It has been suggested that the collection of these measures might be facilitated through creation of a COPD registry, or piloted in a small number of hospitals through chart review.

d) **Completeness of coding for COPD-related procedure codes:** Some interventions that play an important role within the COPD pathway are not routinely recorded in hospital data. For example, only 33 instances of spirometry testing were recorded in acute inpatient records in 2010/2011, while use of bronchodilators is not captured at all. The coding of other interventions, such as different modalities of ventilation, may also be inconsistent. Given that such missing data elements would invalidate attempts to estimate the costs of all interventions for these cases, the Ministry should consider chart reviews of a COPD case sample to assess current hospital coding practices.

e) **Consistency of diagnosis coding across ED and inpatient settings:** Given the importance of capturing both COPD ED visits and inpatient admissions, the Expert Panel drew the scope of the COPD "bundle" to include both the ED visit and inpatient acute stay for admitted cases. From a payment perspective, COPD patients admitted to hospital under this model would be funded at a rate including both the ED visit and the inpatient hospitalization. The Expert Panel saw a challenge related to administrative data in this area: in 2010/2011, about 23% of inpatients with a COPD-related MRDx assigned for their inpatient stay were previously assigned a non-COPD related MRDx for their ED visit. It can be assumed that the MRDx assigned based on the inpatient stay is likely the more accurate of the 2 diagnoses, given the greater amount of time and resources available to record this.

   This data raises two considerations: 1) The "bundled" rate for the inpatient stay and ED visit would likely need to be grouped based on the inpatient MRDx and then linked backwards to the preceding ED visit, and; 2) if a similar proportion of "misdiagnosis" can be assumed for COPD cases discharged from the ED, then a substantial portion of COPD cases would not receive COPD QBP funding.

COPD Acute Exacerbation Episode of Care Model

The diagram presented in Figure 6 has been adopted by the Expert Panel as a high level functional model of the COPD acute exacerbation episode of care. The model framework has been developed by HQO to structure its episode of care analyses in selected clinical areas, and includes two key components: care modules cluster together recommended practices and interventions at each stage of the patient pathway, while assessment nodes provide patient-based criteria for a particular case proceeding down one branch of the pathway or another. The crude counts and proportion of patients proceeding down each major branch of the pathway—based on 2010/2911 DAD and NACRS data, where available—are presented below next to the *N* and *Pr* symbols.

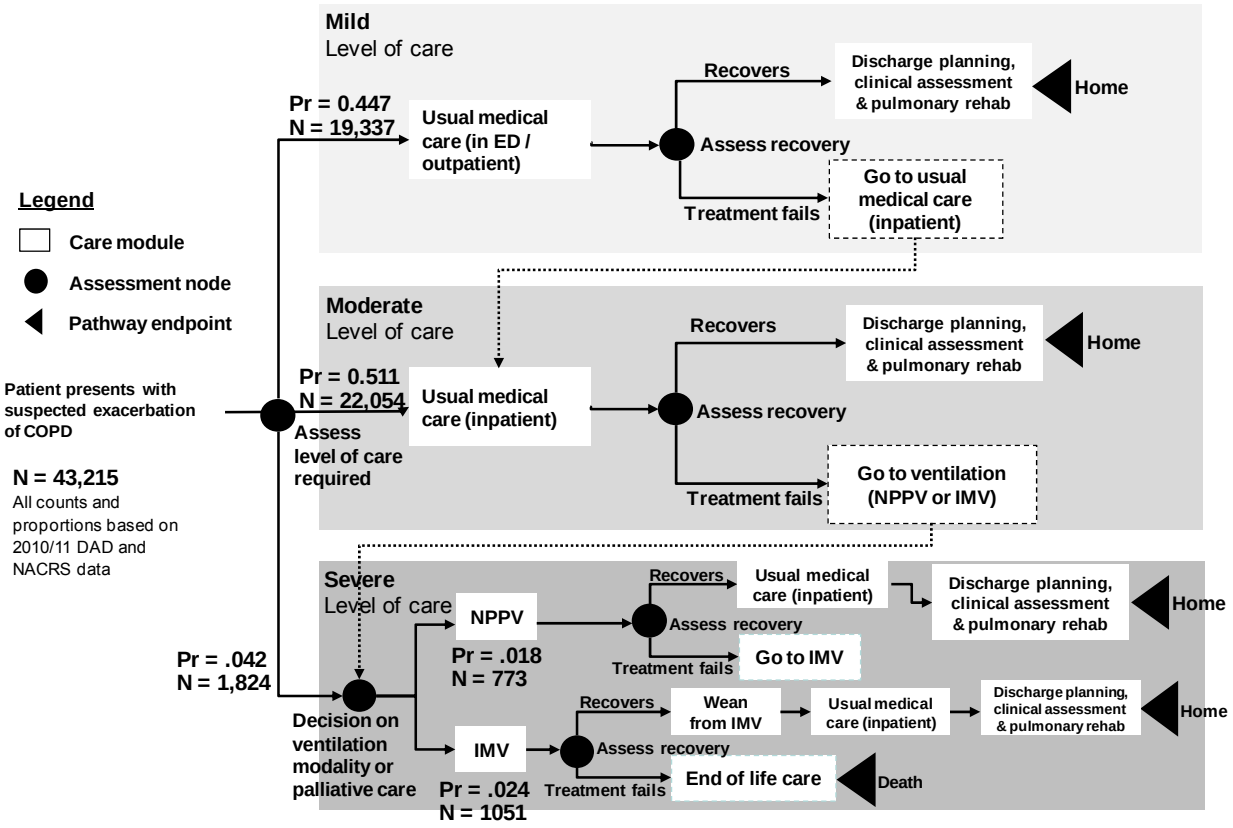

Figure 6: COPD Acute Exacerbation Episode of Care Model

It should be noted that while the episode of care model resembles a care pathway from a visual and conceptual standpoint, it is not intended to function as an operational pathway that would be implemented at an organizational level. Rather, it functions as a model pathway on a provincial level, as articulated by Vanhaecht et al (2010)[26]: an aggregated pathway based on the best available evidence that is not specific to any organization. This aggregate nature enables it to provide an abstract structure for the relevant types of information required to inform the design of an evidence-based funding methodology, including identifying the major patient groups, defining the boundaries and key components of the episode of care, and mapping the proportion of patients proceeding through each component of the episode.

[26] Vanhaecht K, Panella M, van Zelm R, Sermeus W. 2010. An overview on the history and concept of care pathways as complex interventions. International Journal of Care Pathways 14:3 117-123

The COPD episode of care model was developed by HQO staff with the input of members of the Expert Panel. The design of the pathway was informed by a review of COPD care pathways in the literature (e.g., the NICE COPD Pathway), as well as the key components of care and decision points identified in the guidance materials reviewed. An initial "straw model" structure was developed to represent the major branches of a patient's journey through a COPD acute exacerbation, and then later refined with the input of clinicians from the Expert Panel.

There are some data limitations to the model that should be noted. Our ability to quantify the exact number or proportion of patients proceeding down individual branches is limited by our available administrative data. Thus, while we are able to retrospectively assign counts to the number of admitted or ventilated patients, we do not have sufficiently granular data to tell us which patients were first treated in the ED or in the usual medical care and then subsequently ventilated after these treatments failed. This lack of granular data also applies to the percentage of patients that receive the recommended practices within each component of the episode of care.

Finally, the actual volume of COPD patients presenting at the ED may be different than what is noted on the model, due to the frequency of incorrect or inconclusive diagnosis (e.g., shortness of breath) of COPD in the ED. While some of these patients can be identified through linkage with a subsequent admission, those patients that were treated and discharged from the ED are more difficult to identify in this way.

Recommended Practices

Evidence Sources for Recommended Practices

The process for developing recommended practices is described in detail in the **Methods** section. HQO staff used the COPD Acute Exacerbation Episode of Care model (Figure 6) as a framework and scoping guide for identifying and organizing candidate clinical practices for the Expert Panel's consideration. The following evidence sources were reviewed to synthesize practices for review:

- Health Quality Ontario Chronic Obstructive Pulmonary Disease Evidentiary Framework and corresponding Ontario Health Technology Advisory Committee recommendations (2012) [27]
- Health Quality Ontario Rapid Reviews developed for Inhospital Physiotherapy for Acute Exacerbations of Chronic Obstructive Pulmonary Disease and Action Plans for Individuals with Chronic Obstructive Pulmonary Disease
- Global Initiative for Chronic Obstructive Lung Disease Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease report (2011)[28]
- National Institute for Health and Clinical Excellence Chronic Obstructive Pulmonary Disease Guideline (2011 Update)[29]
- Canadian Thoracic Society recommendations for management of chronic obstructive pulmonary disease (2007 update)[30]
- Empirical data analysis from the Discharge Abstract Database, National Ambulatory Care Reporting, and Ontario Health Insurance Plan Medical Services Table through Canadian Institute for Health Information Portal and Ministry of Health and Long-Term Care IntelliHealth

Although this work has considered the HQO COPD Evidentiary Framework (mega-analysis) and corresponding OHTAC recommendations as the highest standard of evidence, the scope of OHTAC's review did not include some key interventions such as inhospital pharmacotherapy. Accordingly, the Expert Panel Chairs identified several other credible sources of evidence-based guidance for the management of acute exacerbations of COPD: the Canadian Thoracic Society (CTS) guidelines (2007), the Global Initiative for Chronic Obstructive Lung Disease (GOLD) report (2011), and the National Institute for Health and Clinical Excellence (NICE) COPD guideline.

In addition to being developed by well-respected organizations in the COPD community, these three sets of guidelines all included assessments of the strength of the evidence supporting each of their recommendations. While employing different evidence-assessment methodologies, they are based on a similar evidence hierarchy that places systematic reviews and meta-analyses of randomized controlled trials at the highest level of evidence, followed by randomized controlled trials, observational studies, and, finally, expert consensus.

[27] See full review: http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/ohtas-reports-and-ohtac-recommendations/chronic-obstructive-pulmonary-disease-copd-evidentiary-framework
[28] See full report: http://www.goldcopd.org/guidelines-global-strategy-for-diagnosis-management.html
[29] See full guideline: http://www.nice.org.uk/cg101
[30] See full guideline: http://www.respiratoryguidelines.ca/COPD-2007-update

The **Recommended Practices** section organizes the Expert Panel's recommended practices according to their corresponding component within the COPD Acute Exacerbation Episode of Care model (e.g., definition of the COPD diagnosis, ED assessment, discharge planning). Where relevant, the evidence sources supporting each recommended practice are identified along with their assessment of the strength of the evidence.

HQO and the Expert Panel's review of the evidence confirmed there is a high degree of agreement across the four sets of guidelines, particularly in relation to practices where there is a strong evidence base in the literature, such as smoking cessation, noninvasive ventilation, and pulmonary rehabilitation. This is to be expected given that the four organizations relied on many of the same studies to support their recommendations in a particular area. Greater divergence tended to be observed across the organizations in cases of practices that are supported by limited evidence or expert consensus, such as a number of recommendations around diagnostic tests, discharge planning, and specific patient criteria for particular interventions. In these cases, the Expert Panel relied mainly on their own judgment and experience of the Ontario clinical context to issue a final recommendation (See Appendix for the summary of guidance materials reviewed by the Expert Panel).

The scope of the Recommended Practices are defined by the agreed upon scope of the COPD exacerbation episode of care for this project, with the endpoints ('Discharge home' and 'death') being largely drawn from the hospital's perspective. Hence, the Recommended Practices identified by the Expert Panel dealt with elements of discharge planning within the hospital, but very little in the way of prescription of maintenance medication at discharge or ongoing management of the patient in the community.

Recommended Practices

Please note that the following recommended practices and interventions are intended for the purposes of defining an ideal COPD exacerbation episode of care for funding and analysis purposes. They should not substitute for published clinical guidelines, or substitute for clinicians' own clinical judgment.

Definition: **Diagnosis of COPD**

Recommended practice	**Relevant guidance and evidence**
• Consider clinical diagnosis of COPD in any patient who has dyspnea, chronic cough or sputum production, and/or a history of exposure to risk factors for the disease	• CTS, GOLD (Expert opinion)
• Spirometry is required to make clinical diagnosis: post-bronchodilator $FEV_1/FVC < 0.70$ confirms COPD	• CTS, GOLD (Expert opinion)
• Spirometry need not be performed during the initial phase of an exacerbation when the patient is unstable, but should be performed once the patient has stabilized	• GOLD (Expert opinion)
• Spirometry should only be performed if the patient has no recent, reliable, objective documentation of COPD by spirometry	• Expert Panel consensus

Definition: **Exacerbation of COPD**

Recommended practice	**Relevant guidance and evidence**
• An exacerbation of COPD is an acute event characterized by a worsening of the patient's respiratory symptoms (baseline dyspnea, cough, and/or sputum production) that is beyond normal day-to-day variations and leads to a change in medication.	• GOLD, NICE (Expert opinion)

Care Module 1: **Patient presents with suspected COPD exacerbation**
(Index event commencing episode of care)

The following interventions should be performed regardless of whether the patient presents at the ED, outpatient clinic and/or is admitted directly

Recommended practice	**Relevant guidance and evidence**
• Check vital signs, including: – Assess for hypoventiliation – Check level of consciousness / cognition – Pulse oximetry – check blood saturation level – Assess whether patient has purulent sputum	• CTS, GOLD, NICE (Expert opinion)
• Physical examination	• CTS, GOLD, NICE (Expert opinion)
• Check patient history	• CTS, GOLD, NICE (Expert opinion)
• Document and reconcile medications currently used by patient	• GOLD, NICE (Expert opinion)
• Chest X-ray – Posteroanterior and lateral – Portable x-ray for patients that are too unwell to leave emergency department – Expiratory view when concerned with pneumothorax	(For chest x-ray; no specific approach specified) • GOLD, NICE (Expert opinion) • CTS (One or more well-designed cohort or case control studies; moderate evidence)
• Baseline bloodwork – Complete blood count – Electrolytes – Creatinine – Blood urea nitrogen (if available)	• GOLD, NICE (Expert opinion)
• Electrocardiogram (check for arrhythmias, myocardial ischemia, right ventricular strain etc.)	• GOLD, NICE (Expert opinion)
• If low oxygen saturation on oximetry and/or acute respiratory failure suspected, check arterial blood gases where appropriate	• CTS, GOLD, NICE (Expert opinion)
• If suspected pneumonia or sepsis – draw blood cultures	• GOLD, NICE (Expert opinion)
• Cardiac markers, if appropriate (suspected cardiac disorders)	• GOLD
• Identify patient wishes with respect to goals of care and/or limitations of treatment – i.e. code status	• Expert Panel consensus
• Spirometry need not be performed during the initial assessment of an exacerbation, but should be performed once	• GOLD (Expert opinion)

the patient has stabilized, if patient has no prior objective documentation of COPD through spirometry	
• Other diagnostic interventions as appropriate to identify / rule out other suspected diagnoses or co-morbidities	• Expert Panel consensus

It is noted that many patients with COPD exacerbations do not present to the ED as well-characterized COPD patients, but as undifferentiated patients that could potentially be suffering from a variety of conditions (e.g. chronic obstructive pulmonary disease, acute myocardial infarction and other cardiac conditions, pulmonary embolus, pneumonia, asthma, acute bronchitis pneumonia, asthma). As the recommendations presented here focus on defining a COPD-specific care pathway, it is expected that additional diagnostic interventions not included here may be required and based on clinical assessment. The type of tests performed may depend more on individual hospitals' standard ED processes rather than COPD-specific guidelines.

Clinical Assessment Node 1: **Assess level of care required**

(Follows Care Module 1)

Recommended practice	Relevant guidance and evidence
• The decision to admit relies largely on clinical judgment and availability of local resources – use the NICE and/or GOLD criteria as a guide (see below)	• NICE / GOLD (Expert opinion)
• Trial immediate resuscitation on initial presentation at the ED, with re-evaluation for admission following this	• Expert Panel consensus

GOLD Decision Guidelines for Hospital Admission:

Table 5.3. Potential Indications for Hospital Assessment or Admission*

- Marked increase in intensity of symptoms, such as sudden development of resting dyspnea
- Severe underlying COPD
- Onset of new physical signs (e.g., cyanosis, peripheral edema)
- Failure of an exacerbation to respond to initial medical management
- Presence of serious comorbidities (e.g., heart failure or newly occurring arrhythmias)
- Frequent exacerbations
- Older age
- Insufficient home support

**Local resources need to be considered.*

Source: Global Initiative for Chronic Obstructive Lung Disease (2011)

NICE Decision Guidelines for Hospital Admission:

Factors to consider when deciding where to manage exacerbations (Take into account the person's preference)		
	Treat at home?	**Treat in hospital?**
Able to cope at home	Yes	No
Breathlessness	Mild	Severe
General condition	Good	Poor/deteriorating
Level of activity	Good	Poor/confined to bed
Cyanosis	No	Yes
Worsening peripheral oedema	No	Yes
Level of consciousness	Normal	Impaired
Already receiving LTOT	No	Yes
Social circumstances	Good	Living alone/not coping
Acute confusion	No	Yes
Rapid rate of onset	No	Yes
Significant comorbidity (particularly cardiac disease and insulin-dependent diabetes)	No	Yes
SaO_2 < 90%	No	Yes
Changes on chest X-ray	No	Present
Arterial pH level	≥ 7.35	< 7.35

Source: National Institute for Health and Clinical Excellence (2011)

Care Module 2: **Usual medical care**

(Follows Clinical Assessment Node 1 for Mild and Moderate levels of care; follows Care Modules 3 and 4 for Severe level of care)

Recommended practice	**Relevant guidance and evidence**
• **Short-acting bronchodilators are effective for treating an exacerbation**	• CTS (One or more well-designed cohort or case-control studies; good evidence) • GOLD (Nonrandomized trials / observational studies) • NICE (Systematic reviews and / or meta-analyses of RCTs)
– Beta-2 agonists are recommended	• CTS – in combination with sort-acting anticholinergics (Expert opinion) • GOLD (Nonrandomized trials / observational

	studies)
– If patient is already on long-acting anticholinergics, continue to administer in combination with Beta-2 agonists	• CTS (Expert opinion) • GOLD (Nonrandomized trials / observational studies)
– There is little evidence to support the benefits of adding short-acting anticholinergics to long-acting anticholinergics	• Expert Panel consensus
– Metered dose inhalers with spacers are the preferred delivery vehicle; nebulizers should be considered second line treatment due to infection risk	• Expert Panel consensus
– Ensure continuous supervision of the patient during delivery	• Expert Panel consensus
• **Corticosteroids are effective except for only very mild exacerbations, or if contraindicated**	• CTS – most patients with moderate to severe AECOPD (One or more RCTs or meta-analyses; good evidence) • GOLD (RCTs; rich body of data) • NICE – use in all patients in absence of significant contraindications (Systematic reviews and/or meta-analyses of RCTs)
– 30 – 50 mg / day Prednisone or equivalent (IV methylprednisolone 40mg if oral route unavailable)	• CTS – 30-40 mg day (One or more RCTs or meta-analyses; good evidence) • GOLD – 30–40 mg (Expert opinion) • NICE – 30 mg (Expert opinion)
– Manage corticosteroid-induced side effects	• Expert Panel consensus
– 10 – 14 day course of therapy	• CTS (One or more RCTs or meta-analyses; good evidence) • GOLD (Expert opinion) • NICE – 7-14 days (Expert opinion) • NICE – No advantage in prolonging steroid treatment beyond 14 days (Systematic review and/or meta-analyses of RCTs)
– Specific cautions and/or contraindications include: – Frequency of use (dependence or chronic use) – Chronic obstructive pulmonary disease – Diabetes – Osteoporosis – Avascular necrosis	• CTS – avoid hyperglycemia (Expert opinion)
• **Antibiotics should be used for indications of infection (e.g. purulent or high volume sputum)**	• CTS – in more severe purulent infections (One or more RCTs or meta-analyses; good evidence)

	• GOLD – patients who have purulent sputum, increase in sputum volume and dyspnea (RCTs; limited body of data) • NICE – in patients with purulent sputum (Systematic review and/or meta-analyses of RCTs) • NICE – patients without purulent sputum do not need unless there is consolidation on x-ray or signs of pneumonia (Controlled / quasi-experimental study)
– Refer to Canadian Thoracic Society antibiotic treatment recommendations (see table below)	• CTS (expert opinion)
– Refer to institution-specific antimicrobial stewardship policies	• GOLD – choice should be based on local bacterial resistance pattern (Expert opinion)
– Oral antibiotics are preferred	• GOLD (expert opinion)
– Intravenous antibiotics should be considered a 2nd line therapy used only when oral antibiotics are contraindicated (e.g. GI issues)	• GOLD (expert opinion)
• Theophylline is not recommended, unless the patient is already receiving theophylline – if so, check levels	• GOLD – consider as second line therapy, used when there is insufficient response to bronchodilators (RCTs, limited body of data) • NICE – should only be used if there is inadequate response to nebulised bronchodilators (Expert opinion)
• If necessary, deliver oxygen to maintain target oxygen saturation of 90%	• GOLD (Expert opinion) • NICE (Non-experimental descriptive study)
• Where appropriate, initiate bronchopulmonary (lung) hygiene physical therapy to clear mucus and secretion from the airway	• HQO Rapid Review: low quality evidence that some airflow clearing techniques may reduce need for ventilation, may reduce length of stay and may increase sputum expectoration
• If patient is admitted, use early ambulation therapy	• HQO Rapid Review: poor quality, non-generalizable evidence for improved lung function and exercise capacity through walking programs
• Begin discharge planning, including referral to pulmonary rehabilitation	• Expert Panel consensus

Canadian Thoracic Society Antibiotic Treatment Recommendations (2007):

Antibiotic treatment recommendations for purulent acute exacerbations of chronic obstructive pulmonary disease (COPD)

Group	Basic clinical state	Symptoms and risk factors	Probable pathogens	First choice
Simple	COPD without risk factors	Increased cough and sputum, sputum purulence, and increased dyspnea	*Haemophilus influenzae*, *Haemophilus* species, *Moraxella catarrhalis*, *Streptococcus pneumoniae*	Amoxicillin, doxycycline, trimethoprim/ sulfamethoxazole, second- or third-generation cephalosporins, extended-spectrum macrolides
Complicated	COPD with risk factors	As in simple plus at least one of: • FEV_1 <50% predicted • ≥4 exacerbations per year • Ischemic heart disease • Use of home oxygen • Chronic oral corticosteroid use • Antibiotic use in the past three months	As in simple plus: *Klebsiella* species and other Gram-negatives Increased probability of beta-lactam resistance	Beta-lactam/beta-lactamase inhibitor; fluoroquinolone (antibiotics for uncomplicated patients when combined with oral steroids may suffice)

FEV_1 Forced expiratory volume in 1 s

Source: Canadian Thoracic Society (2007)

Clinical Assessment Node 2: **Decision on ventilation or palliative care**

(Follows Clinical Assessment Node 1 for Severe level of care)

Recommended practice	Relevant guidance and evidence
• If possible, seek patient preferences for ventilation therapy before proceeding to ventilation interventions	• NICE and OHTAC both include recommendations to consider patient preferences for ventilation (Expert opinion)
• If ventilation is not desired, proceed to palliative care management of the patient	• Expert Panel consensus
• Noninvasive positive pressure ventilation (NPPV) should be considered as part of first line treatment for patients with acute respiratory failure and pH < 7.35	• NICE and OHTAC both include recommendations to consider patient preferences for ventilation (Expert opinion)
• NPPV should be trialed before proceeding to invasive ventilation (IV) for all patients with indications for ventilation, including severe patients (pH < 7.20), unless contraindications are present (including respiratory or cardiac arrest, loss of consciousness, craniofacial trauma, hemodynamic instability, impaired mental status)	• OHTAC (moderate quality evidence) • CTS – NPPV with ph < 7.30 (One or more RCTs or meta-analyses; good evidence) • GOLD – NPPV effective in acute respiratory failure (RCTs, rich body of data); trial NPPV before IMV in almost all cases (expert opinion) • NICE – NPPV as treatment of choice for persistent hypercapnic respiratory failure (Systematic review and/or meta-analysis of RCTs)
• Where patients have expressed preferences against intubation, NPPV can still be considered but ensure that therapy does not progress to IV in the case of failure to respond to NPPV	• NICE – clear plan covering what to do in event of deterioration (Expert opinion)

Care Module 3: **Noninvasive ventilation**
(Follows Clinical Assessment Node 2)

Recommended practice	Relevant guidance and evidence
• Ensure continuous monitoring of patients receiving NPPV	• CTS – should be administered in a setting that allows close cardiopulmonary monitoring (One or more RCTs or meta-analyses; good evidence)
• Specialized respiratory teams and/or units are likely to be more effective in delivering NPPV	• OHTAC – appropriate support systems and human resources • CTS – Access to personnel skilled at endotracheal intubation and IV (One or more RCTs or meta-analyses; good evidence) • NICE – Delivered in a dedicated setting with staff who have been trained in its application, who are experienced in its use and who are aware of its limitations (Expert opinion)

Care Module 4: **Invasive ventilation / weaning from invasive ventilation**
(Follows Care Module 3)

Recommended practice	Relevant guidance and evidence
• Use NPPV to help wean patients from IV when they fail spontaneous breathing tests	• OHTAC (Moderate quality evidence) • GOLD • NICE (Systematic review and/or meta-analyses of RCTs)
• There may be a volume-outcome relationship at the hospital level associated with effectiveness of IV	• Expert Panel consensus

Care Module 5: **Clinical assessment of stabilized patient**
(Follows Care Module 2)

Recommended practice	Relevant guidance and evidence
• Where a patient has no prior objective documentation of spirometry assessment, spirometry should be performed on the stabilized patient before discharge (as time and patient's condition allows) or arranged for following discharge	• NICE (Expert opinion) • CTS (Expert opinion) • GOLD (Expert opinion)
• In addition to classification of airflow limitation, patients should also be assessed for their severity of symptoms and other risk factors (e.g. co-morbidities), considering tools such as the MRC dyspnea scale, CAT / BODE / LACE indices	• NICE (Expert opinion) • CTS (Expert opinion) • GOLD (Expert opinion)

Care Module 6: **Discharge planning**
(Follows Care Module 5)

Recommended practice	Relevant guidance and evidence
• Perform a full clinical assessment on suspected COPD patients once their condition stabilizes, before they are discharged	• NICE (Expert opinion) • CTS (Expert opinion) • GOLD (Expert opinion)
• Patients should leave the hospital with an individualized discharge plan	• OHTAC (Moderate quality evidence for individualized discharge planning) • NICE (Expert opinion) • GOLD (Expert opinion)
• (Re-)establish patients on their long-term COPD maintenance bronchodilator therapy before discharge, including continuing or resuming use of handheld inhalers	• NICE (Expert opinion) • GOLD (Expert opinion)
• Review and reconcile patients' full range of medications before discharge. Ensure that patients understand their medication therapy, including when to stop corticosteroids if prescribed	• NICE (Expert opinion) • GOLD (Expert opinion)
• Assess the patient's inhaler technique before discharge	• Expert Panel consensus
• Consider developing an action plan with patients, including identified patient responsibilities for their ongoing care and instructions for seeking help for future acute exacerbations	• HQO Rapid Review: No evidence for effectiveness of patient action plans in themselves without being part of a multi-dimensional self-management program • NICE and GOLD: Patients provided with appropriate information to understand their ongoing maintenance care
• Patients that do not have up-to-date influenza (annual) or pneumococcal vaccinations should either be vaccinated before discharge, or referred for vaccination following discharge, unless there are contraindications present	• OHTAC: recommendation for maximizing use of influenza (high quality evidence) and pneumococcal vaccines (moderate quality evidence), including patients admitted to hospital • CTS: Annual influenza vaccination (One or more well-designed cohort or case control studies; good evidence), pneumococcal vaccination (expert opinion) • GOLD: All COPD patients should be offered influenza (RCTs, rich body of data) and pneumococcal vaccinations (RCTs, limited body of data); they appear to be more effective in older and/or more severe patients • NICE: Pneumococcal and annual influenza vaccination should be offered to all COPD patients

• All patients that qualify for home oxygen should be discharged on home oxygen	• Expert Panel consensus
• COPD patients with functional disabilities (e.g. shortness of breath when walking) should begin therapy in an evidence-based pulmonary rehabilitation program within 1 month following hospital discharge for an acute exacerbation of COPD	• OHTAC (Moderate quality evidence) • CTS (Meta-analysis) • GOLD (RCTs, limited body of data) • NICE (At least one RCT)
• COPD patients who smoke should receive smoking cessation counseling while in hospital, with the goal of referral to longer-term, intensive smoking cessation counseling (including appropriate pharmacotherapy) in the outpatient setting. May include providing information to patients with contact information / instructions for resources or other guidance	• OHTAC: Intensive counseling is the most effective and cost-effective counseling and should be encouraged (Moderate quality evidence) • CTS, GOLD: Minimal interventions should be offered to all smokers with more intensive counseling used whenever possible (one or more RCTs or meta-analyses; good evidence) • NICE: All COPD patients still smoking should be encouraged to stop, and offered help to do so, at every opportunity (Evidence from at least one RCT)
• Ensure that patient is supported by CCAC with appropriate home care services in the community after discharge	• Expert Panel consensus
• Where appropriate, arrange for an assessment of the patient's home or living situation by an occupational therapist following discharge	• Expert Panel consensus
• Ensure patients have a follow-up appointment with a primary care provider (PCP), respirologist or internist within 1-2 weeks of discharge	• NICE – 2 weeks following discharge (Expert opinion) • GOLD – 4-6 weeks following discharge (Expert opinion)
• If the patient does not have a regular PCP, have them connected with one before discharge. If there is no PCP available in the community, the patient may need support from hospitalists, specialists or the CCAC	• Expert Panel consensus
• Ensure the patient's primary care provider (PCP) and CCAC receives a discharge summary from the hospital, including full clinical assessment of the patient, within 48 hours of discharge	• Expert Panel consensus
• In some cases, direct communication between hospital staff and the PCP and/or CCAC case manager may be necessary	• Expert Panel consensus

Measuring Performance

COPD Performance Measurement in Ontario: Current State

As part of their work, the Expert Panel was requested by the Ministry to provide recommendations around COPD performance indicators. The intent is for these recommendations to inform the development of a Quality-Based Procedure Integrated Scorecard for COPD, which would track a number of indicators related to the episode of care and recommended practices for COPD. Similar Integrated Scorecards are to be developed for other clinical areas that are subject to Quality-Based Procedure funding.

The Expert Panel agreed that given their mandate and the current state of COPD performance measurement in Ontario, it would not be appropriate for the Expert Panel to recommend a definitive set of COPD indicators. Unlike other conditions, such as stroke, where the Ontario Stroke Network has developed the Ontario Stroke Evaluation Program to measure a range of indicators at the provincial, LHIN, and hospital levels, COPD has very little existing performance measurement infrastructure in Ontario or Canada. In fact, Heffner et al (2010)[31] write that there is a remarkable dearth of performance indicators for COPD worldwide, especially given the tremendous burden of the disease.

To this end, the Expert Panel came to several conclusions with respect to measuring performance in COPD in Ontario:

1. There is an absence of measures in Ontario related to the quality of care provided to COPD patients. This is particularly true regarding the acute exacerbation episode. Very few of the Expert Panel's recommended practices—notably inhospital pharmacotherapy—can be measured in current Ontario hospital administrative datasets, and beyond routine administrative data there have been no attempts to date at creating provincial clinical registries for COPD (equivalent to the Ontario Stroke Audit for stroke or the EFFECT database for chronic obstructive pulmonary disease).

2. Measures that are currently collected around COPD hospitalization are largely generic measures that focus on either downstream outcomes of care—readmission and mortality rates—or overall utilization and cost, such as acute inpatient length of stay. While useful measures that can currently be collected and reported across all hospitals, these tell us very little about the clinical processes and quality of care provided during the acute exacerbation.

3. There is promising work in Ontario currently in the concept stage related to COPD indicators. Dr. Andrea Gershon, a member of the Expert Panel and a respirologist and ICES scientist with a distinguished history of publications on COPD, has developed a proposal for development of a suite of COPD performance indicators. This set of indicators would most likely include some of the key practices recommended by the Expert Panel for the acute exacerbation episode of care. If funded by the Ministry or other sources, this work would make an important contribution to measuring many of the identified quality practices.

[31] Heffner JA, Mularski RA, Calverley PMA. 2010. COPD Performance Measures: Missing Opportunities for Improving Care. *Chest* 137(5); 1181-1189

Recommendations for COPD Performance Indicators

The Expert Panel recommends that a dedicated initiative be established and funded by the Ministry to develop a comprehensive set of COPD indicators. This initiative should build on the initial proposal developed by Dr. Andrea Gershon. The process for selecting indicators should use a scientifically-validated methodology—such as a Delphi approach—for identifying and prioritizing current measures and new measures for development. The scope of this process should be comprehensive and include both inhospital measures covering each stage of the COPD episode of care model and community- and primary care-based measures, anticipating the needs of the next phase of quality-based funding work to be focused on community care.

Given the wide range of potential COPD measures that have either not been validated with current Ontario data sources or would require the collection of new data elements, it is recommended that a key piece of this COPD performance measurement initiative include piloting the collection of new data elements at several sites across the province, using either chart abstraction or a COPD clinical registry. New measures that are validated through this process should be rolled out across the province. In addition to performance indicators, these new data elements should include patient characteristics such as FEV_1/FVC and dyspnea that are important for describing patients and for use as potential risk adjustors for funding.

The following describes some currently reported and potential COPD performance measures that were discussed by members of the Expert Panel. These should not be taken to represent any sort of recommended set of potential indicators.

Measures that are currently available

Several measures related to COPD acute exacerbation are currently available and measured by hospitals:

- **Acute inpatient length of stay for COPD admissions:** Monitored by hospitals. Collected through the DAD.
- **Inhospital mortality for COPD admissions:** Monitored by hospitals. Collected through the DAD.
- **Unplanned readmissions within 30 days:** Currently reported through the Ministry-LHIN Performance Agreements and Hospital Service Accountability Agreements (as part of '30-day readmissions for selected CMGs' indicatory Disease, Age >= 45). Collected through the DAD.
- **COPD admission rate:** Reported on a population basis as part of CIHI Ambulatory Care Sensitive Conditions indicator (J41 – J44, J47, age < 75). Collected through the DAD and census population estimates.

While these are important measures of patient outcomes and hospital utilization, they do not measure the quality of care provided.

Measures that could potentially be developed using currently available administrative data elements

The following measures were proposed as indicators that could potentially be developed using currently reported data, but require validation:

- **Use of noninvasive ventilation for COPD patients:** The rate of use of noninvasive ventilation per patient admitted and/or the ratio of use of noninvasive ventilation to use of mechanical ventilation could potentially be measured through the ventilation procedure codes currently collected in the DAD. However, using this data for this purpose would require validation. The Expert Panel reviewed data on the use of noninvasive and invasive ventilation across Ontario hospitals with high volumes of COPD admissions (see Table 8) and found significant variation across hospitals. It has yet to be determined whether this is real variation in practice or a product of differences in coding.

- **Postdischarge follow-up visit for hospitalized COPD patients:** The Expert Panel recommended that COPD patients receive a follow-up visit with either a primary care doctor or respirologist within 2 weeks of hospital discharge. This can be tracked through linking the DAD with the OHIP Medical Services table. However, this data would require validation before being used for this purpose.

Table 8: Utilization of Ventilation (% All Ventilation, % IMV vs. NPPV) for COPD MRDx Patients
(DAD 2010/11 – Top 20 Ontario hospitals by volume of COPD discharges)

Hospital	Total COPD discharges (2010/11)	COPD cases w / ventilation	% total COPD cases w/ ventilation	% total COPD cases w/ IMV	% total COPD cases w/ NPPV	% NPPV of all ventilated cases
HOSPITAL 1	722	59	8.17%	7.62%	0.55%	6.8%
HOSPITAL 2	696	76	10.92%	6.18%	4.74%	43.4%
HOSPITAL 3	648	40	6.17%	4.78%	1.39%	22.5%
HOSPITAL 4	613	60	9.79%	4.40%	5.38%	55.0%
HOSPITAL 5	574	18	3.14%	3.14%	0.00%	0.0%
HOSPITAL 6	539	31	5.75%	2.97%	2.78%	48.4%
HOSPITAL 7	510	19	3.73%	3.73%	0.00%	0.0%
HOSPITAL 8	482	30	6.22%	4.98%	1.24%	20.0%
HOSPITAL 9	466	22	4.72%	2.58%	2.15%	45.5%
HOSPITAL 10	461	27	5.86%	5.86%	0.00%	0.0%
HOSPITAL 11	452	84	18.58%	3.32%	15.27%	82.1%
HOSPITAL 12	430	32	7.44%	5.12%	2.33%	31.3%
HOSPITAL 13	402	51	12.69%	3.73%	8.96%	70.6%
HOSPITAL 14	401	28	6.98%	6.73%	0.25%	3.6%
HOSPITAL 15	400	94	23.50%	5.25%	18.25%	77.7%
HOSPITAL 16	399	49	12.28%	5.51%	6.77%	55.1%
HOSPITAL 17	396	46	11.62%	7.83%	3.79%	32.6%
HOSPITAL 18	380	22	5.79%	3.16%	2.63%	45.5%
HOSPITAL 19	366	35	9.56%	3.01%	6.56%	68.6%
HOSPITAL 20	362	14	3.87%	3.87%	0.00%	0.0%

Measures requiring new data collection

The following are examples of several important COPD indicators that are measured elsewhere (e.g., NICE, American Medical Association) and are relevant to the Expert Panel's recommended episode of care. They would require new data collection in Ontario, potentially through the creation of a COPD registry or other clinically focused data set:

- **Access to pulmonary rehabilitation:** Patient referral to and receipt of pulmonary rehabilitation.
- **Use of in-hospital pharmacotherapy:** Use of recommended drug therapies (e.g., bronchodilators, corticosteroids, and/or antibiotics) for treating hospitalized COPD patients.
- **Spirometry testing:** Confirmation of hospitalized COPD patients' diagnosis through spirometry, where appropriate.

Implementation Considerations

After formulating the majority of their recommendations, the Expert Panel was asked by the Ministry to provide high-level advice around implementation, including specific recommendations focused on the following areas:

- Aligning the Expert Panel's recommendations with the QBP funding methodology
- Implementation of recommended practices
- Impact on multidisciplinary teams
- System program and capacity planning required
- Change management and support for change required

Aligning Recommendations to Funding

Importance of a well-designed funding policy framework and methodology: HQO and the Expert Panel recognize that their mandate in developing this work was to provide evidence, analysis, and recommendations that would inform a separate process of costing, pricing, and payment methodology design to be led by the Ministry. However, the Expert Panel continually emphasized that these recommendations will be inconsequential if they are not supported by a well-designed quality-based procedure funding system that takes into consideration issues such as the complexity and heterogeneity of the COPD patient population, avoids creating inappropriate incentives, and enables the extension of the funded episode into postacute and community care.

Consideration of patient heterogeneity and complexity: COPD patients are a very heterogeneous population characterized by varying levels of severity in their underlying COPD, high prevalence of comorbidities, and frequent presence of social issues and other factors that contribute to complexity. As discussed in Section 5, Ontario currently only captures a subset of the relevant variables necessary to account for COPD patient complexity in routine administrative data. Moving forward, effectively risk adjusting QBP prices for justifiable cost variation across COPD patients will require collecting some of these variables and incorporating these into a costing analysis.

Variation in costs for COPD patients: While the recommended practices in this clinical handbook provide a core set of interventions that should be performed in the treatment of COPD patients, a large proportion of utilization and costs for these patients will also be attributable to other factors, such as the severity of their disease and the number of recent exacerbations, comorbidities, and tests performed to confirm their diagnosis. These factors contribute to variations in both cost and length of stay. As a result, it should be recognized that the recommended practices in this handbook capture only a fraction of the total costs of COPD patients. Design of the funding methodology should take this into consideration and incorporate suitable adjustments for cost variation and long-stay outliers.

Implications of COPD diagnosis issues on the Ministry "carve-out" approach: The Expert Panel reinforced that the issues observed in current diagnosis and coding of COPD would have profound implications on the Ministry funding methodology if the same "carve-out" approach used for funding the 2012/2013 QBPs was applied for 2013/2014. While the "carve-out" is based on historical activity (2011/2012 activity for 2013/2014 carve-out), the Expert Panel will be making recommendations around

standards for future COPD diagnosis and coding. Thus, the activity coded as COPD-related care in 2011/2012 may not align with what will be coded as COPD-related activity in 2013/2014 moving forward. This may also create considerable variability in an individual hospital's recorded COPD case mix from year to year.

Incentives for inappropriate utilization: The Expert Panel recognized that in defining COPD patient groups largely based on utilization and disposition (see Section 5), there is the potential for perverse incentives to be created when these groups are assigned "prices" in a funding methodology. The cost of an average admitted COPD patient is often more than 10 times the cost of treating and discharging a COPD patient in the ED, while the cost of treating a COPD patient with ventilation is similarly much higher than treating them with usual medical care. If prices for the QBP funding system reflect these costs, care must be taken to ensure hospitals are not incentivized to admit greater proportions of patients for a higher payment or to make inappropriate use of ventilation. The QBP funding system can potentially mitigate these risks through bundling payment across the ED and inpatient settings, and setting policies around appropriateness. In the longer term, the collection of new data elements capturing important patient complexity factors may allow for these groups to be redefined based on patient characteristics rather than utilization.

Opportunity areas for funding: Notwithstanding these challenges, the Expert Panel also discussed some of the key areas of opportunity for funding mechanisms to drive high-quality COPD care:

- Supporting increased access to, and use of, pulmonary rehabilitation following an acute exacerbation through "bundling" rehabilitation into the hospital payment

- Supporting improvements in objective diagnosis of COPD through spirometry by including conditions on funding requiring confirmation of diagnosis

- Supporting more effective and efficient use of noninvasive ventilation, both in relation to its increased use where it is shown to be effective (i.e., in addition to usual medical care and as a first line treatment before progressing to invasive ventilation) and its provision in more cost-effective settings (i.e., inside respiratory wards instead of only ICUs)

Implementation of Recommended Practices

Provincial versus local care pathways: It should be recognized that the practices recommended in this clinical handbook have been defined at an aspirational provincial level to guide all hospitals across the province. This is not intended to be an operational care pathway—individual providers will have to implement these best practices based on their own local circumstances and available capacities. In many cases, the implementation of these recommendations will be challenged by local arrangements or the availability of services. For example, the Expert Panel discussed variation across the province in the provision of ventilation—while some hospitals provide noninvasive ventilation in a dedicated respiratory or general medical ward, others only provide it in Intensive Care Units—as well as access to pulmonary rehabilitation, which is not available in many communities.

Adapting recommended practices to the local level: Implementing recommended services will require customization at the local level. For example, it was discussed that many communities should look at the possibility of delivering pulmonary rehabilitation out of local community centre gyms or YMCAs, given the lack of hospital outpatient capacity in many areas. Similarly, follow-up care for a COPD patient after

discharge may take place with a variety of different primary care providers or a respirologist, depending on local availability of services.

Implement as a program of care: Many of these considerations speak to the need to approach the implementation of the recommended practices not simply at the level of individual patients and clinicians, but within a program of care that requires organization-level planning, resourcing, and the involvement of administrators. Program design should also involve a measurement system for tracking performance, supporting quality improvement, and it should include the consideration of other non-COPD respiratory patient groups, such as asthma and other lung disorders, which may be managed with the same types of resources. The program should also span the improvement of COPD care across care settings, including the community, recognizing that hospitalization is only one part of the COPD continuum of care.

Track current practice against recommended practices: As discussed in Section 8, many of the practices recommended by the Expert Panel are not currently tracked in any consistent way at either the local or provincial level. Thus, it is difficult to know what the "gap" is between current and ideal COPD practice, and how much this gap varies across different organizations and parts of the province. A key objective of developing a COPD performance measurement strategy should be to enable organizations to track, audit, and evaluate the implementation of care pathways and recommended practices at the organization level. Through such monitoring, variances can be identified, progress monitored, and the pathway can be refined over time.

Roles of Multidisciplinary Teams

One of the important issues in COPD care discussed by the Expert Panel is the lack of dedicated teams and resources in Ontario for COPD. In stroke care, for example, the Ontario Stroke Strategy has led to the widespread use of dedicated stroke units and interdisciplinary stroke teams. Such dedicated units and teams are much less common for COPD and respiratory diseases. The Expert Panel discussed a promising area for further research in evaluating the difference in outcomes between COPD patients cared for in non-specialized teams and/or units with those cared for by specialized respiratory teams and/or units. Further work is required to define what constitutes a specialized respiratory team and to assess the feasibility of establishing these teams in hospitals of different sizes across the province.

Service Capacity Planning

The Ministry was interested in advice from the Expert Panel around capacity planning and shifts across care settings for COPD. The most important issue in this respect identified by the Expert Panel is the inconsistent capacity in, and access to, pulmonary rehabilitation across the province. This is a major opportunity area for the Ministry, LHINs, hospitals, CCACs, and other providers to work together to improve outcomes for COPD patients and to also impact rates of unplanned readmissions. Current OHTAC-commissioned field evaluation work in this area, as well as the work of the OHTAC Implementation Sub-Committee and HQO staff focusing on implementation of the OHTAC COPD recommendations, can support this area of focus.

Expert Panel Membership

Name	Organization
Dr. Chaim Bell (Chair)	Mount Sinai Hospital
Dr. Charlie Chan (Chair)	University Health Network
Ms. Carole Madeley	Ontario Lung Association
Dr. Alan Kaplan	Family Physicians Airway Group
Dr. Chris Allen	St. Joseph's Healthcare Hamilton
Dr. Dina Brooks	University of Toronto
Dr. Eddy Fan	Mount Sinai Hospital
Dr. Eric Hentschel	St. Mary's General Hospital
Dr. Lori Whitehead	St. Joseph's Healthcare Hamilton
Dr. Rob McFadden	St. Joseph's Healthcare London
Dr. Roger Goldstein	West Park Healthcare Centre
Mr. Lawrence Jackson	Sunnybrook Health Sciences Centre
Ms. Lorraine Leblanc	Patient Advocate / Ontario Lung Association
Mr. Mark McIntyre	Mount Sinai Hospital
Ms. Ann Bartlett	St. Joseph's Healthcare Hamilton
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