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Assessing COPD care quality in a rural Ontario primary care clinic: A retrospective chart review

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Abstract

Background: Primary chronic obstructive pulmonary disease (COPD) care may be worse in rural versus more urban environments.

Purpose: To evaluate the quality of COPD care in a rural Ontario primary care clinic.

Methods: A 12-month retrospective chart review study was conducted between June 2022 and January 2023 at a Goderich, Ontario primary care clinic. Electronic medical records (EMRs) were randomly selected for inclusion. Baseline sociodemographic (e.g., occupation) and health (e.g., smoking status) characteristics were extracted as well as information regarding COPD care received (i.e., Health Quality Ontario [HQO] Quality Standard [QS] indicators; n=33. The primary study outcome was overall proportion of HQO QS indicators met.

Results: Eighty primary care EMRs were accessed (72.3±9.74 years; 39% female). Overall, HQO QS indicators were met 43.2% of the time.

Conclusion: Strengths and opportunities regarding the quality of COPD care delivered in a rural Ontario primary care setting were identified.

Keywords

Chronic Obstructive Pulmonary Disease, Primary Care, Rural, Electronic Medical Records, Health Quality Ontario, Quality Standards, Retrospective Chart Review.

Summary for Lay Audience

Chronic obstructive pulmonary disease (COPD) is one of the most prevalent chronic diseases in Canada with nearly 13% of Canadian adults living with the disease. COPD is a complex chronic disease with significant human (e.g., quality of life) and system-level (e.g., costly hospitalization) consequences. High quality COPD management in primary care settings is so important that Health Quality Ontario (HQO), an agency of the Government of Ontario, created a set of quality standards to assess care quality. This retrospective chart review study examined the quality of care provided for adults living with COPD in a rural Ontario area using the HQO standards. Eighty randomly selected patient electronic medical records (EMR) were examined at a primary care clinic in Goderich, Ontario. On average, patients' received care satisfying less than half (43.2%) of HQO standard indicators. Exploratory analyses revealed that participation in self-management programs, seeing a family physician, being a former or never smoker, and seeing a Respirologist most strongly influenced the QS indicators received. The results of this study may support future Quality Improvement (QI) initiatives in the area. The results also provide rationale for the implementation of a local pulmonary rehabilitation program.

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List of Abbreviations

COPD – Chronic Obstructive Pulmonary Disease

HQO – Health Quality Ontario

GOLD – Global Initiative for Chronic Obstructive Lung Disease

AACVPR - American Association of Cardiovascular and Pulmonary Rehabilitation

PR – Pulmonary Rehabilitation

QI – Quality Improvement

EMR(s) – Electronic Medical Record(s)

QS – Quality Standard(s)

FEV_1 – Forced Expiratory Volume in one Second

FVC – Forced Vital Capacity

AECOPD – Acute Exacerbation of Chronic Obstructive Pulmonary Disease

FSA – Forward Sortation Address

MVFHT – Maitland Valley Family Health Team

FHT – Family Health Team

PS – Personal Score

VIF - Variance Inflation Factors

Chapter 1 : Introduction

Chronic obstructive pulmonary disease (COPD) is a common chronic condition worldwide (Adeloye et al., 2015; Vos et al., 2020). In Ontario, the prevalence of COPD amongst adults is 9.6% (Public Health Agency of Canada, 2018). COPD is an inflammatory disease of the lungs that causes respiratory symptoms. Common symptoms include dyspnea, cough, and/or sputum production (Global Initative for Chronic Obstructive Lung Disease et al., 2021). COPD is now one of the top three causes of death internationally (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Halpin et al., 2019). Even in Canada, a country with developed economic, social, education, and health care systems, the risk of developing COPD over a lifetime is one in four (Gershon et al., 2011). The risk of developing COPD is even greater in rural areas (32.4% vs. 26.7% in urban settings) (Gershon et al., 2011). COPD places tremendous burden on the health care system, cited by the Canadian Institute of Health Information as the number two reason for hospitalization in Canada in 2019 (Canadian Institute for Health Information, 2021a).

The personal burden of COPD is also great. More than one in three individuals with COPD experience depression and anxiety (FitzGerald et al., 2007; Panagioti et al., 2014; Zhang et al., 2011) and COPD causes a reduction in quality of life (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Zamzam et al., 2012). Nearly 80% of individuals with COPD state that their respiratory symptoms limit them from being able to do anything they would like to do (Horner et al., 2020). This significant impact of COPD leaves 30% of moderate-to-severe COPD patients effectively housebound, and

half of COPD patients on long-term oxygen therapy, only leaving the house for medical appointments (Donaldson et al., 2005).

1.1 Primary Health Care: Access, Barriers, Impact

High-quality COPD health care is important. About 80% of COPD care is delivered by primary health care practitioners (i.e., physicians and nurse practitioners) (Perez et al., 2012). Primary health care, a cornerstone of Canadian health care systems, is defined by Health Quality Ontario (HQO) as:

> "…The foundation of people's health care: it supports people throughout their lifetime, from birth to death, providing comprehensive care that promotes health and well-being and prevents, detects, treats and manages illnesses…" (Health Quality Ontario, 2015).

Urban and rural dwelling individuals have different levels of access to primary care in Canada (Bosco & Oandasan, 2016; Shah et al., 2019). In Canada, nearly one in five individuals live in a rural area, accounting for more than six million people (Statistics Canada, 2011), yet only 3% of specialist physicians are considered rural health care professionals (Society of Rural Physicians of Canada, 2009). While an increasing number of specialist health professionals work to meet the needs of highly intensive and technical hospitals in large urban centers, rural communities often rely on primary care physicians to provide general and diverse care across different settings, populations, and physical locations (Bosco & Oandasan, 2016). Primary care physicians in rural communities often provide other medical care outside of the office setting. This includes emergency departments, inpatient clinics, surgery, obstetrical, anesthesia, and long-term care coverage. This means they may not be working full-time providing primary care in the

office setting (Shah et al., 2019). Individuals living in rural areas also face specific barriers to care for their COPD, including limited availability of pulmonary rehabilitation (PR) (Brooks et al., 2007), low awareness of available COPD support programs (Health Quality Ontario, 2018b), reduced access to smoking cessation programs (Baliunas et al., 2020), and rural culture (e.g., cultural marginalization of rural dwellers in the urban health context, low health literacy, and resistance to seek care) (Brundisini et al., 2013). Individuals must often travel long distances (Brundisini et al., 2013; Health Quality Ontario, 2018b) and have less access to primary and specialist physician care (Brundisini et al., 2013; Shah et al., 2019). Rural living status is associated with an increased risk of COPD exacerbation (Burkes et al., 2018), worse health status, and greater impairment as measured by the BODE Index (i.e., Body mass index, airflow Obstruction, Dyspnea, and Exercise), a key COPD indicator (Jackson et al., 2013).

1.2 Guidelines for COPD Care

To ensure higher quality COPD care for more people, organizations such as the Global Initiative for Chronic Obstructive Lung Disease (GOLD), the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR), and HQO have worked together to provide their respective clinical practice guidelines for COPD care. HQO is part of Ontario Health, an agency created by the Government of Ontario (Health Quality Ontario, 2022a). HQO focuses on making health care more effective, efficient, and affordable (Health Quality Ontario, 2022a). Their objective is to find the best evidence of what works, and translate that evidence into clinical standards and recommendations that can easily be put into practice to make improvements (Health Quality Ontario, 2018a).

HQO has released a set of 14 quality standards (QS), each with one or more unique indicators, for the care of COPD (Health Quality Ontario, 2018a). These QS address areas such as spirometry, comprehensive assessment, goals of care and individualized care planning, specialized respiratory care, and acute care (see Appendix 1 for a full list of QS and indicators) (Health Quality Ontario, 2018a). Since the release of the HQO QS in 2018, HQO has been integrated into Ontario Health. However, the programs and services that HQO offers remain unchanged (Ministry of Health, 2019). To ensure COPD patients in Ontario receive the highest level of care, critical evaluation of care and delivery is needed. Currently, there is a lack of evidence surrounding the quality of COPD care being delivered to rural Canadians (Bourbeau et al., 2008; Lee et al., 2021). Existing retrospective chart reviews in Ontario (Bourbeau et al., 2008; Lee et al., 2021) have not maintained a rural focus and have grouped rural and urban areas in analyses. This means that existing literature cannot provide detailed insight into the level of COPD care being delivered in rural Ontario settings.

1.3 Pulmonary Rehabilitation for COPD

Pulmonary rehabilitation (PR) has been established as a key element of COPD care. PR, a multi-component chronic disease management program, is part of all national and international guidelines for COPD care (Bourbeau et al., 2019; Global Initative for Chronic Obstructive Lung Disease et al., 2021) and has been defined as:

> "…a comprehensive intervention based on thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and self-management intervention aiming at behaviour change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviours." (Spruit et al., 2013)

The benefits of PR are numerous. Compared to usual care, PR has been shown to be one of the most effective therapeutic strategies to improve shortness of breath, health status, and exercise tolerance (McCarthy et al., 2015). Psychological conditions are also improved, with PR reducing symptoms of anxiety and depression (Global Initative for Chronic Obstructive Lung Disease et al., 2021). Without habitual physical activity (a core component of PR) in COPD, detrimental outcomes often ensue. Physical inactivity early during the course of disease is strongly linked to hospital admission (Garcia-Aymerich et al., 2006) and premature mortality (Garcia-Aymerich et al., 2006; Rabe & Watz, 2017; Waschki et al., 2011; Watz et al., 2009). It is important that PR for COPD is comprehensive in nature and includes exercise therapy as a cornerstone (Global Initative for Chronic Obstructive Lung Disease et al., 2021). As comprehensive PR is critical for the care of COPD, access should also be maximized for Ontarians in general, and Ontarians living rural areas in particular given their lower access to care (Brooks et al., 2007).

1.4 Quality Improvement in Health Care

In 2019, $265.5 billion CAD was spent on health care in Canada (Canadian Institute for Health Information, 2021b). Working towards the best possible outcomes for patients within finite health care budgets is paramount. Engaging in quality improvement (QI) activities is one way to achieve this goal (Health Quality Ontario, 2012). QI is defined as:

> "A broad range of activities of varying degrees of complexity and methodological and statistical rigor through which health care providers develop, implement and assess small-scale interventions, identify those that work well and implement them more broadly in order to improve clinical practice" (Health Quality Ontario, 2012).

The present study is a QI activity designed to begin the process of small-scale intervention development in a rural COPD context. The HQO QI model, "Model for Improvement", will guide this activity by providing a step-by-step framework to follow (Health Quality Ontario, 2012). The first step, according to the "Model for Improvement", involves establishing the "aim" of the QI activity (i.e., "What are we trying to accomplish?"). In this case, the "aim" is to evaluate the quality of COPD care in a rural Ontario primary care setting.

1.5 The COVID-19 Pandemic

The World Health Organization declared the COVID-19 pandemic (caused by the SARS-CoV-2 virus) on March 11th 2020 (World Health Organization, 2020). COVID-19 was first identified overseas as a highly transmissible respiratory virus that can cause serious illness and even death. As part of the global response to the outbreak of COVID-19 the Government of Ontario instituted various control measures including a variety of lockdown measures and stages. In the context of this thesis there were no major or prolonged "lockdowns" (e.g., closure of businesses, stay-at-home orders) that occurred during the study period (i.e., June 2021 to June 2022). In January 2022, Ontario was placed in a modified stage 2 of its reopening plan for three weeks (Canadian Institute for Health Information, 2022). This meant that even at the most severe level of restriction during the study period indoor gatherings of up to 25 people were permitted (Office of the Premier, 2021). See Figure 1 below for examples of what each stage of the roadmap to reopen entailed. This context is important to consider as the COVID-19 pandemic impacted various aspects of the health care system, and it is likely that treatment

priorities changed during this time frame to help deal with the burden generated by the pandemic (Fekadu, 2021).

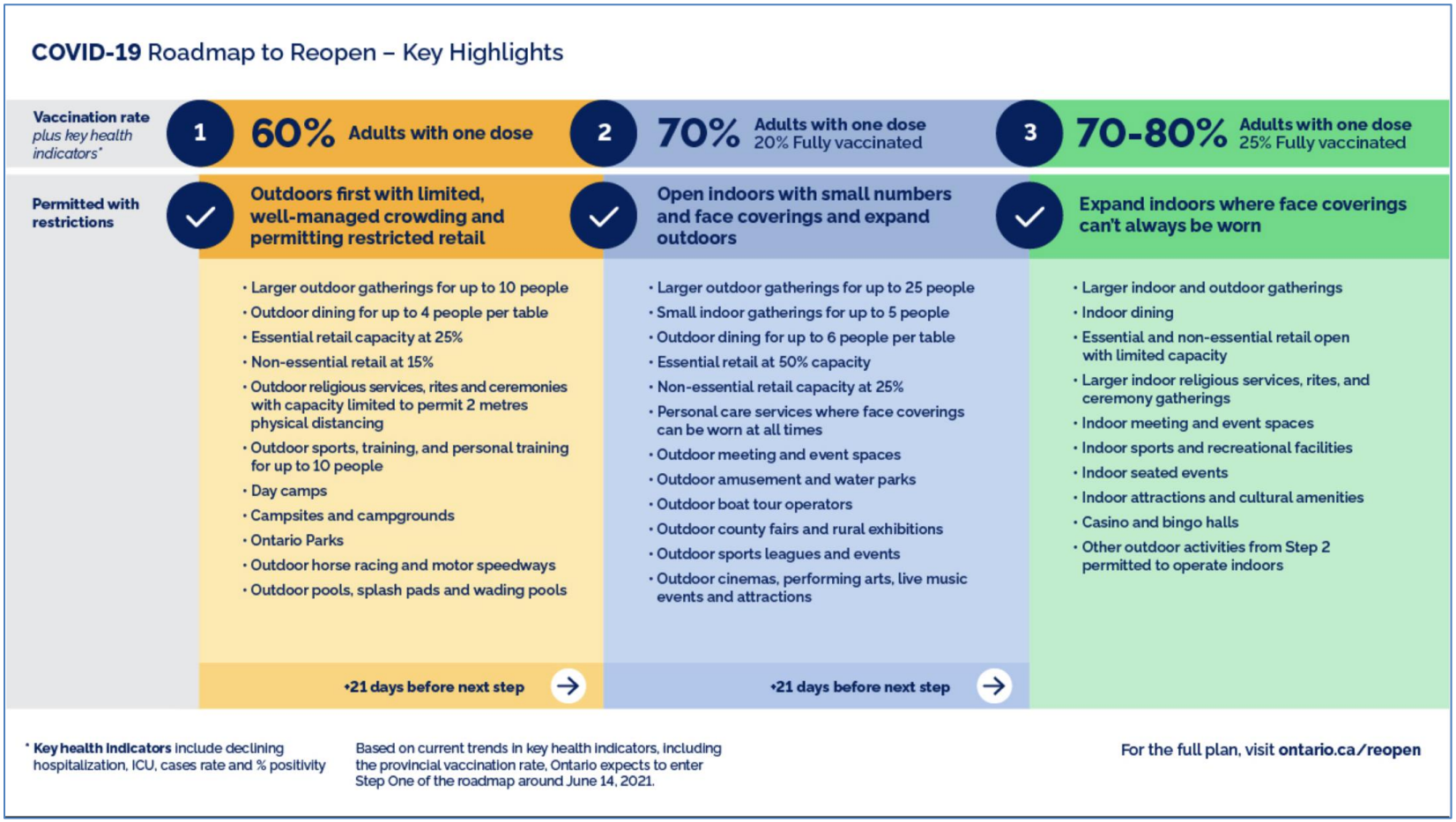

Figure 1. Ontario COVID-19 roadmap to reopen.

1.6 Study Objectives

Aligning with the HQO “Model for Improvement”, the overarching purpose of this study is to evaluate the quality of COPD care in a rural Ontario primary care setting. The primary study objective is to report the overall proportion of HQO QS indicators met in the sample. The proportion of indicators met for each QS will also be reported. A secondary study objective will be to explore whether individual-level factors predict quality of COPD care received.

Chapter 2 : Literature Review

2 Literature Review

2.1 What is Chronic Obstructive Pulmonary Disease?

Chronic obstructive pulmonary disease (COPD) is a common (Adeloye et al., 2015; Vos et al., 2020) and progressive inflammatory disease, and is one of the top three leading causes of death internationally (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Halpin et al., 2019). The most common respiratory symptoms include dyspnea, cough, and/or sputum production (Global Initative for Chronic Obstructive Lung Disease et al., 2021). COPD is defined as "A common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development" (Global Initative for Chronic Obstructive Lung Disease et al., 2021). COPD effects the airways, alveoli, and the microvasculature of the lungs. Key features of COPD include irreversible limitation of airflow, caused by remodeling of the small-airway compartments and loss of elastic recoil by emphysematous destruction of parenchyma. This leads to progressive declines in lung function with inadequate ability to empty on expiration and subsequent static and dynamic hyperinflation (Global Initative for Chronic Obstructive Lung Disease et al., 2021; O'Donnell, 2006; Rabe & Watz, 2017). Dyspnea (shortness of breath) is the most common primary symptom in advanced disease (O'Donnell, 2006). Dyspnea leads to an avoidance of exercise and activities of daily living which causes a loss of skeletal muscle mass and function (Maltais et al., 2014;

Roman-Rodriguez & Kocks, 2021). Avoidance of physical activity due to dyspnea also leads to poor patient outcomes such as reduced quality of life and premature mortality (Ramon et al., 2018). This is referred to as the downward spiral of COPD. Those with moderate severity COPD spend an average of six years in disability and individuals with severe COPD spend nine years in disability (Tachkov et al., 2017). COPD has been identified as the eighth leading cause of disability adjusted life years (DALYS) worldwide (Hay et al., 2017). This causes burden from an economic, social, health care, and humanistic perspective (Dang-Tan et al., 2015; Igarashi et al., 2018; Iheanacho et al., 2020).

2.2 Classifying COPD Severity and Phenotypes

According to the GOLD Report 2021 (Global Initative for Chronic Obstructive Lung Disease et al., 2021), COPD severity can be classified by post-bronchodilator forced expiratory volume in one second (FEV_1) scores. In patients with a FEV_1 to forced vital capacity (FVC) ratio of less than 0.70, the following categories can be applied. Mild COPD is equal to $FEV_1 \geq 80\%$ predicted, moderate COPD is equal to $50\% \leq FEV_1 < 80\%$ predicted, severe COPD is equal to $30\% \leq FEV_1 < 50\%$ predicted, very severe COPD is equal to $FEV_1 < 30\%$ predicted (Global Initative for Chronic Obstructive Lung Disease et al., 2021). However, this classification system does not capture the heterogenous nature of COPD (Global Initative for Chronic Obstructive Lung Disease et al., 2021; O'Donnell, 2006; Rabe & Watz, 2017). There are three typical phenotypes of COPD, including small airway obstruction, emphysema, and chronic bronchitis (O'Donnell, 2006). However, more phenotypes continue to be discussed and added to the conversation (Corlateanu et al., 2020). Widely accepted COPD phenotypes include

chronic bronchitis, emphysematous, Asthma - COPD Overlap (ACO), frequent exacerbator, and rare exacerbator (Corlateanu et al., 2020). The point and value of identifying phenotypes does continue to be discussed (Agusti et al., 2020; Sheikh et al., 2016). However, it does seem to still hold enough value in its ability to help identify treatable traits in COPD patients (Agusti et al., 2020; Global Initative for Chronic Obstructive Lung Disease et al., 2021). More recently a push to implement imaging techniques such as magnetic resonance imaging and computerized tomography (Sheikh et al., 2016) along with implementing blood eosinophil counts (Global Initative for Chronic Obstructive Lung Disease et al., 2021) continues to push the conversation around COPD phenotypes forward.

2.3 Prevalence, Trends, and Burden of COPD

There are roughly two-million Canadians aged 35 and older who are living with COPD (Public Health Agency of Canada, 2018). The number of new COPD cases has declined since 2000 while the number of Canadians living with the disease has increased (Public Health Agency of Canada, 2018). However, the prevalence of COPD may be underestimated in Canada. In a 2014 Statistics Canada study it was found that the prevalence of measured airflow obstruction compatible with COPD was two to six times greater than estimates based on self-reports of a diagnosis (Evans, 2014). This means that an estimated 16.6% of people aged 35 to 79 had pre-bronchodilator airflow obstruction as defined by GOLD Stage I and II (Evans, 2014). COPD prevalence is difficult to accurately ascertain but it is an important step to ensure adequate resources are directed to the prevention, care, and treatment of COPD in Canada. This important task is highlighted by the ongoing project “Helping the Missing Million” by the Lung Health

Foundation of Canada (Lung Health Foundation, 2022). The lifetime risk of developing COPD in Ontario, Canada has been found to be about one in four (27.6%) (Gershon et al., 2011). Risk was identified to be higher in men than in women, in those with lower socioeconomic status compared to those of higher socioeconomic status, and in individuals who lived in a rural setting compared to an urban setting (Gershon et al., 2011). COPD is a leading cause of hospitalization in Canada (Canadian Institute for Health Information, 2020, 2021a). Individuals diagnosed with COPD are likely to visit the emergency department twice per a year (Neil et al., 2010) and be hospitalized once every two years due to COPD (Iheanacho et al., 2020). In 2020 COPD took the lives of 11,722 Canadians (Statistics Canada, 2022) making it the third leading cause of death in Canada for those aged 65 to 84 (Statistics Canada, 2022). It is estimated that by 2030 the number of Canadians with COPD will rise to 2.5 million people (Lung Health Foundation, 2022). This will only increase the burden, cost, and impact of COPD in Canada.

2.3.1 Health Care and Human Burden of COPD

The burden of COPD in Canada is high. COPD was the leading cause of hospitalization (excluding child birth) in Canada in 2019-2020, resulting in 87,964 admissions to hospital (Canadian Institute for Health Information, 2020). The average length of stay in hospital was 7.1 days (Canadian Institute for Health Information, 2020). In Ontario, the care for one COPD patient costs between $693-$2655 per month (Karissa Johnston, 2021). This is up to nine times more health care expense than that of an average Canadian (Karissa Johnston, 2021). Provincially, from 2008 to 2011, people with COPD accounted for 24% of hospitalizations, 24% of emergency department visits, 21% of ambulatory

care visits, 30% of home care services, and 35% of long-term care residence places. In 2011, the total economic burden of COPD in Ontario, comprising direct and indirect costs, was estimated to be $3.9 billion (direct health care costs alone were estimated to be $3.3 billion) (Health Quality Ontario, 2022b).

In Alberta COPD patients who have a high health care need (over age 75 and multiple health conditions) average on a yearly basis; five specialist visits, 18 drug claims, 14 primary care physician visits, 8 emergency department visits, and 4 hospitalizations totaling 73 days of stay (Canadian Institute for Health Information, 2017a). In Canada between 2016 and 2017 the most expensive condition to treat in hospital was COPD, totaling $753 million (Canadian Institute for Health Information, 2017b) in yearly in-hospital costs. This is much higher than the second most expensive condition to treat in hospital, totaling nearly $200 million dollars more than the in-hospital treatment of heart failure ($575 million). It is estimated that the direct and indirect cost associated with COPD care will reach $9.45 billion by 2030 (Lung Health Foundation, 2022).

It is important to acknowledge that COPD does not just create a tremendous economic and health care system burden, it also creates a large humanistic burden. COPD symptoms such as breathlessness, cough, sputum production, wheeze, and chest tightness have a substantial detrimental impact on health status, quality of life, and daily activities. These symptoms also contribute to increased anxiety and depression in those who have COPD (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Miravitlles & Ribera, 2017). More than 1 in 3 individuals with COPD experience depression and

anxiety (FitzGerald et al., 2007; Panagioti et al., 2014; Zhang et al., 2011). Nearly 80% of individuals with COPD state that their respiratory symptoms limit them from being able to do anything they would like to do, and 17% being unable to go out for entertainment or recreation due to their condition (Horner et al., 2020). This significant impact of COPD leaves 30% of moderate to severe COPD patients effectively housebound, and half of COPD patients on long term oxygen therapy only leave the house for medical appointments (Donaldson et al., 2005). COPD causes a large reduction in quality of life (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Zamzam et al., 2012). In order to progress the care for COPD, it is important to acknowledge the burden faced by COPD patients in their day-to-day lives.

2.4 Exacerbations of COPD

2.4.1 What is an Exacerbation of COPD?

In patients with COPD an acute worsening of respiratory symptoms is often described as an exacerbation. Exacerbations are associated with a significant increase in mortality, hospitalization, and health-care utilization (Rodriguez-Roisin, 2000; Sapey & Stockley, 2006). A definition of an acute exacerbation of chronic obstructive pulmonary disease (AECOPD) was first developed in 2000 as: “a sustained worsening of the patient’s condition, from the stable state and beyond normal day-to-day variations, that is acute in onset and necessitates a change in regular medication in a patient with underlying COPD” (Rodriguez-Roisin, 2000). This definition has continued to evolve over the years along with progression in management practices (Ko et al., 2016). Triggering factors for AECOPD include infections and non-infectious precipitants, however 11% to 30% of AECOPD is of unknown etiology (Ko et al., 2016; Sapey & Stockley, 2006). AECOPD

can be caused by infections (viral or bacterial), outdoor air pollution, indoor air pollution, meteorological changes (drop in temperature or humidity), other comorbidities (pulmonary embolism, congestive heart failure), and discontinuation of COPD medications (Ko et al., 2016).

2.4.2 COPD Exacerbation Management

The time surrounding COPD exacerbations is one of the most important for the appropriate treatment and management of COPD as AECOPD is a cause of mortality and morbidity (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Sapey & Stockley, 2006). Repeated AECOPD has cumulative and negative effects on lung function over time, causing a higher rate of decline of FEV_1 scores (Celli et al., 2008). Treatment and management of exacerbations vary based on the severity of the exacerbation and setting in which it is treated (self-managed, outpatient care, or hospitalization) (Global Initative for Chronic Obstructive Lung Disease et al., 2021). Common treatments include bronchodilators, systemic corticosteroids, antibiotics, oxygen, and non-invasive ventilation (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Ko et al., 2016; Pavord et al., 2016). Unfortunately, both short and long-term prognosis following hospitalization for a COPD exacerbation is poor. In patients requiring an intensive care unit admission the in-hospital mortality rate was up to 25% (Ko et al., 2016). In the long term, post exacerbation requiring hospitalization the five-year mortality rate is about 50% (Hoogendoorn et al., 2011). Although strides continue to be made in the prevention and management of COPD more still needs to be learned and implemented in order to continue to improve care for COPD (Global Initative for Chronic Obstructive Lung Disease et al., 2021).

2.5 Rural Care and Urban-Rural Differences in Care for COPD

2.5.1 Access to Care

Access to care for COPD is important to patients, family members, caregivers, communities, physicians, and other care team members (Global Initative for Chronic Obstructive Lung Disease et al., 2021). Across the rural spectrum (Statistics Canada, 2018) access to care (primary care providers) is worse than in urban environments (Bosco & Oandasan, 2016; Bosco C, 2016; Shah et al., 2019). Several factors can affect the quality of COPD care including access and barriers to care, care models, and access to specialized care. Access to physicians in rural areas has worsened in the past two decades (Rourke, 2008). It is estimated that in order to equalize access to primary care to the level seen in urban environments in Canada, the number of rural based physicians would need to increase by more than 25% (Rourke, 2008). In Southwestern Ontario, only 9% of primary care physicians practice in a rural environment (Shah et al., 2019). Across Canada the same problem also exists in rural specialist care with 2.4% of specialist physicians serving more than 6 million people in rural areas (Rourke, 2008). Migration of health professionals from rural environments to urban environments also plays a role in this problem (Judith C. Kulig, 2012). In most rural communities, shortages of primary care physicians have been reported for many years and rural areas have felt this chronic shortage longer and more severely than have urban areas (Bosco C, 2016).

An important consideration in this problem is that rural primary care providers serve in a more diverse role than their urban counterparts and they are less likely to work in one

type of practice environment. Rural practitioners practice in a combination of office/clinic environments, nursing homes, community hospitals and emergency departments (Bosco C, 2016). 53 Percent of rural primary providers provide services in community hospitals vs. 19% of urban providers, 49% of rural primary providers provide services in emergency departments vs. 13% of urban providers, and 34% of rural primary providers provide services in nursing homes vs. 13% of urban providers. Rural primary care providers have a more diverse role than their urban counterparts, with this comes the possible problem of delivering truly comprehensive care to their patients as they are stretched across multiple practice settings (Bosco C, 2016). Although rurality is a complex concept and involves many different factors, a definition of 'rural' was developed for this study's statistical analysis. This was done to maintain consistency with the Government of Canada definition of rurality using forward sortation area (FSA) codes. FSA codes containing a '0', as a second digit are designated 'rural' areas (Statistics Canada, 2015). This means that these rural communities have one and only one rural postal code, with the postal code very closely representing the official boundaries of rural communities.

2.5.2 Barriers to Care for COPD

Barriers to care exist in both rural and urban environments. However, rurality has been established as a type of vulnerability. Rurality increases patients' potential susceptibility to health risks. It may also contribute to a sense of defenselessness or marginalization when patients experience difficulties accessing either local or remote health care services (Brundisini et al., 2013). Three key factors in this vulnerability are Geography, Access to Care, and Rural Culture (Brundisini et al., 2013). Geography increases vulnerability as it

relates to isolation, distance from services, weather, and transportation (Brundisini et al., 2013; Goodridge et al., 2011). The access, availability, and responsiveness of health care providers can also create barriers to care in rural environments (Brundisini et al., 2013). Issues with access often relate to the rural-urban referral system, health care professional shortages in rural areas, lack of educational opportunities (self-management type programing) (Baliunas et al., 2020; Brooks et al., 2007) and peer support programs in the rural context (Brundisini et al., 2013; Cox et al., 2017). Rural culture (cultural marginalization of rural dwellers in the urban health context) also contributes to the barriers faced by rural individuals accessing health care in more urban environments. Rural culture may also introduce additional resistance to seek care as they may have a strong sense of self-reliance and community reliance (Brundisini et al., 2013). An additional barrier to care for COPD patients across the urban and rural context is low health literacy. Over 50% of individuals with COPD have low health literacy (Puente-Maestu et al., 2016). Individuals with COPD and low health literacy were more likely to have comorbidities, need assistance, have greater levels of anxiety and depression, and be admitted to hospital or visit an emergency department (Omachi et al., 2013; Puente-Maestu et al., 2016). In summary, individuals living in rural areas face barriers to care for their COPD, including limited availability of PR (Brooks et al., 2007), low awareness of available programs (Health Quality Ontario, 2018b), and reduced access to smoking cessation programs (Brundisini et al., 2013). Individuals must travel long distances (Brundisini et al., 2013; Health Quality Ontario, 2018b) and have less access to physician care (Brundisini et al., 2013; Shah et al., 2019).

2.5.3 Urban-Rural Difference in COPD Outcomes

There are disparities between COPD outcomes when rural and urban dwelling individuals are compared. In the United States rural residence for those with COPD was associated with poorer health status and higher health care utilization (Jackson et al., 2013). Rural living status is associated with increased risk of costly COPD exacerbations (Burkes et al., 2018), worse health status (Jackson et al., 2013), and greater impairment as measured by the Body mass index, airflow Obstruction, Dyspnea, and Exercise (BODE) Index (Jackson et al., 2013).

2.5.4 Factors Contributing to Urban-Rural Differences

There may be several factors that are influencing this phenomenon. Exposure to noxious particles and gases is a cause of COPD (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Murgia & Gambelunghe, 2022). Industry, agriculture, manufacturing, construction, forestry, and mining are prevalent in rural environments, accounting for more than 1 in 5 jobs (Statistics Canada, 2021). Exposures to these in inorganic vapors, gases, dusts, and fumes create the foundations for the initiation of airway damage and inflammation, the pathological beginnings of COPD. Occupational exposures account for 14% of COPD development (Murgia & Gambelunghe, 2022). In addition to these occupational exposures some rural homes still utilize home heating techniques that may introduce more lung irritants, such as wood burning fireplaces, stoves, and furnaces (Rural Ontario Institute, 2019).

2.6 Pulmonary Rehabilitation and Self-management

PR is important and has been established as a cornerstone therapy for the treatment and management of COPD (Global Initative for Chronic Obstructive Lung Disease et al.,

2021; Spruit et al., 2013). PR is an evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory diseases who are symptomatic and often have decreased activities of daily life. It should include patient-tailored therapies including, exercise training, education, and self-management intervention aiming at behaviour change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviours. The PR program should be integrated into the individualized treatment of the patient. PR is designed to reduce symptoms, optimize functional status, increase participation, and reduce health care costs through stabilizing or reversing systemic manifestations of the disease (Americian Association of Cardiovascular & Pulmonary Rehabilitation, 2020; Spruit et al., 2013). PR can be completed in inpatient, outpatient, or community settings (Americian Association of Cardiovascular & Pulmonary Rehabilitation, 2020).

Eligibility for PR is broad in nature and patients with a variety of conditions are eligible. Individuals with COPD, persistent asthma, cystic fibrosis, interstitial lung disease, interstitial fibrosis, occupational or environmental lung disease, lung cancer, pulmonary hypertension, and before and/or after a variety of lung surgeries (Spruit et al., 2013) are all eligible for PR. In the context of COPD, a variety of eligibility markers have been proposed and utilized in the past. The GOLD recommends that PR be used in the management of patients with a high risk of exacerbation or a high symptom burden (Global Initative for Chronic Obstructive Lung Disease et al., 2021). In the United States the Centers for Medicare and Medicaid services has approved PR based on moderate to

severe disease defined by pulmonary function test results (FEV1 < %80 predicted and FEV1/FVC ratio <0.70) (Americian Association of Cardiovascular & Pulmonary Rehabilitation, 2020). Patients that have a high disease burden continue to benefit from PR, dispelling the myth that you can be too disease burdened (i.e., “sick”) to receive the benefits of PR. Patients with a high degree of frailty and even respiratory failure show large benefits from PR (Americian Association of Cardiovascular & Pulmonary Rehabilitation, 2020).

The outcomes associated with PR are positive (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Maltais et al., 2014; McCarthy et al., 2015). In comparing usual care for COPD vs. PR important differences were found. PR reduced dyspnea, increased quality of life, and increased exercise capacity (McCarthy et al., 2015). Psychological conditions are also improved, with PR reducing symptoms of anxiety and depression (Global Initative for Chronic Obstructive Lung Disease et al., 2021). Without physical activity (a core component of PR) there are detrimental outcomes. Physical inactivity early during the course of disease (Watz et al., 2009) is strongly linked to hospital admission (Garcia-Aymerich et al., 2006) and mortality (Garcia-Aymerich et al., 2006; Rabe & Watz, 2017; Waschki et al., 2011). Therefore, it is important that PR for COPD is comprehensive in nature and includes exercise therapy as a cornerstone (Global Initative for Chronic Obstructive Lung Disease et al., 2021). These outcomes directly target the downward spiral of COPD and have been deemed important to treat at the primary care level (Roman-Rodriguez & Kocks, 2021). Access to PR in Canada is low, and there is a marked shortfall between the number of people who have COPD and the

capacity of PR programs. A 2005 survey of PR programs across Canada showed that only 1.2% of the Canadian COPD population had access to PR (Brooks et al., 2007). It is vital to improve access to PR to better treat and manage COPD across Canada.

Self-management for COPD is not only a component of PR, but can also be used on its own to help people with COPD to acquire and practice the skills that they need to carry out for disease management, guide changes in health behavior, and provide emotional support to enable them to control their COPD (Schrijver et al., 2022). Self-management interventions for people with COPD are associated with improvements in health-related quality of life (Schrijver et al., 2022). In the context of the present study, patients did have a self-management program available them. This program called, Best Care COPD, has been shown to substantially improve quality of life, COPD knowledge, reduce severe exacerbations, and health service utilization in a high-risk primary care COPD population (Ferrone et al., 2019).

2.7 Guidelines for COPD Management

2.7.1 Exercise and Physical Activity Guidelines

Beyond PR, exercise and physical activity levels are critically important for the care and maintenance of COPD (Global Initative for Chronic Obstructive Lung Disease et al., 2021). Summary guidelines have been developed by the American College of Sport Medicine (ACSM). These guidelines help to establish a scientific approach to exercise programing for individuals with COPD to insure optimal results. However, no evidence-based guidelines that describe the specific application of the Frequency, Intensity, Time, Type (FITT) principle for patients with COPD exist (American College of Sports

Medicine, 2018). Expert reviews, official statements, and clinical practice guidelines for the components of the FITT principle have been published (American College of Sports Medicine, 2018).

Aerobic, resistance, and flexibility training are recommended for individuals with COPD. It is recommended that individuals with COPD engage in aerobic activities at least three to five days a week, at a moderate to vigorous intensity (four to six on the BORG CR10 Scale), for twenty to sixty minutes (if twenty minutes is not achievable, bouts of less than twenty minutes may be interspersed with periods of rest). Physical activity and exercise make up a core component of PR and treatment for COPD patients. Exercise should be part of all treatment plans when exercise is tolerated well by the patient (American College of Sports Medicine, 2018; Global Initative for Chronic Obstructive Lung Disease et al., 2021).

Individuals with COPD should also engage in resistance type training two to three times a week. Intensity should be varied depending on training goal and experience level. To target strength for beginners sixty to seventy percent of One Rep Maximum (1-RM) should be used and for experienced trainees greater than or equal to eighty percent of 1-RM should be used. For both beginners and more experienced trainees looking to build strength with resistance training two to four sets of eight to twelve repetitions should be utilized. For endurance-based resistance training less than fifty percent of 1-RM should be used for greater than two sets of fifteen to twenty repetitions (American College of Sports Medicine, 2018).

Flexibility training should also be utilized for individuals with COPD. Flexibility training is important as it may help overcome the impacts of postural impairments that limit thoracic mobility and therefore lung function (Spruit et al., 2013). Flexibility training can be performed every day. The type of stretching performed can be static, dynamic, or proprioceptive neuromuscular facilitation based. Stretching should be performed until a light stretch is felt with slight discomfort for ten to thirty seconds. Stretches can be repeated two to four times a day (American College of Sports Medicine, 2018).

2.7.2 Clinical Care Guidelines

The care of COPD has been researched and evaluated in the past decades. A variety of National and International organizations contribute to the conversation surrounding QS for the treatment and management of COPD. Internationally the GOLD Report (Global Initative for Chronic Obstructive Lung Disease et al., 2021) guidelines provide the foundation for care in Canada and abroad. The GOLD Science Committee first established in 2002, last updated their report in 2021. The report's goal is to produce recommendations for management of COPD based on the best scientific information available. The GOLD report covers topics related to COPD's definition, burden, pathology, diagnosis, symptoms, assessment, prevention and maintenance therapies, medication, rehabilitation, end of life care, surgical treatments, monitoring, maintenance, and comorbidities.

Provincially, HQO has the role of being the province's advisor on health care quality. HQO monitors and reports on how the health care system is performing, provides

guidance of quality issues, assesses evidence to determine what high-quality care is, partners with patients to give them a voice in the health care system, and promotes QI to facilitate positive changes in health care (Health Quality Ontario, 2022c).

In 2018 HQO published their QS for care in the community of COPD (Health Quality Ontario, 2018a). The QS addresses care for people with COPD, including the assessment of people who may have COPD. It provides guidance on the diagnosis, management, and treatment of COPD in community-based settings. The QS can be applied in a variety of settings including primary care, specialist care, home care, and long-term care. The QS cover a wide breadth of topics related to the care of COPD including; (1) diagnosis confirmed with spirometry, (2) comprehensive assessment, (3) goals of care and individualized care planning, (4) education and self-management, (5) promoting smoking cessation, (6) pharmacological management of stable COPD, (7) vaccinations, (8) specialized respiratory care, (9) PR, (10) management of acute exacerbations of COPD, (11) follow-up after hospitalization for an acute exacerbation of COPD, (12) PR after hospitalization for an acute exacerbation of COPD, (13) long-term oxygen therapy and, (14) palliative and end of life care (Health Quality Ontario, 2018a). A detailed list of QS and indicators is available in Appendix 1.

2.8 Similar Literature

Lee *et al.* (2021) utilized a cross-sectional retrospective chart review study design with EMR data from 6995 Ontario patients to measure adherence to standard quality of care criteria for COPD management in primary care using primary care EMRs. The authors performed an assessment of COPD quality standards related to vaccination (influenza and pneumococcal), spirometry, inhaled medication prescriptions, long term oxygen assessment, referral to PR, and smoking cessation. Lee *et al.* (2021) reported levels of vaccine usage, Influenza vaccine usage (60.5%) and pneumococcal vaccine usage (66.0%). Spirometry use for the diagnosis of COPD was 54.7% in Lee *et al.* (2021). Prescription of short-acting bronchodilator prescription as 73.4% in Lee *et al.* (2021) and long-acting bronchodilator prescription as 76.9%. Lee *et al.* (2021) levels of smoking cessation interventions as 64.3%. Lee *et al.* (2021) found a rate of referral to PR of 4.0%.

The prospective cross-sectional study by Bourbeau *et al.* (2008) evaluated self-reported physician data from 1090 patients in Ontario and Quebec using the 2003 Canadian Thoracic Society COPD guidelines – Recommendation for Management of COPD. They evaluated pharmacological treatment, spirometric confirmation of diagnosis and non-pharmacological management (i.e., smoking cessation counselling, influenza immunization and, referral to PR). Bourbeau *et al.* (2008) found that short-acting bronchodilators were well used (76.0%). However, long-acting bronchodilators were less often used by comparison (41.9%). Bourbeau *et al.* (2008) found that spirometry was used in over half of patients (58.9%). Smoking cessation interventions were found to be exceedingly well utilized by Bourbeau *et al.* (2008). They report that 94.8% of patients

who smoke received smoking cessation interventions Bourbeau also reported a level of referral to PR programing of 7.8%.

2.9 Quality Improvement and Evaluation

Quality in health care is important. According to HQO, QI has nine key attributes. A high-performing health care system should be accessible, effective, safe, patient-centered, equitable, efficient, appropriately resourced, integrated, and focused on population health (Health Quality Ontario, 2012). Evaluation of these characteristics forms the foundation of health care QI initiatives. To create a high-performing health care system frequent evaluation is needed and so this thesis (i.e., QI activity) will evaluate the effectiveness of primary COPD care delivery in a rural context. A QI model, “Model for Improvement”, has been proposed by HQO as a guide for QI activities (see Figure 2 below). The first step in the model involves establishing the QI activity “aim”. To address “aim”, QI teams must answer, “What are we trying to accomplish?”. In the present study, assessing the quality of COPD care is a necessary first step in the development of small-scale interventions designed to improve care. Once a QI activity “aim” is established, the next step, according to the model, is to "measure” care quality by answering the question, “How will we know if a change is an improvement?”. To do this, the proportion of HQO QS indicators being met among patients of a rural Ontario primary care clinic will be reported. Following the “aim” and “measure” steps, QI teams may initiate change(s) to improve health care delivery by entering a “Plan-Do-Study-Act” (PDSA) cycle designed to test and refine change ideas, and then implement them more broadly. This cyclical process can be adjusted to fit the needs of different QI activities.

According to the “Model for Improvement”, QI activities can be broad in nature (e.g., initiatives across a system level) or can focus on specific issues at the institution or facility level (e.g., disease-specific care quality assessment at a single clinic). Whether a system-based or more local approach is used, putting QI activities into action is one important way to ensure that Ontario’s health care system performs optimally (Hamilton et al., 2020; Health Quality Ontario, 2012). Each QI model, however, has benefits and drawbacks (Hamilton et al., 2020). Potential “Model for Improvement” drawbacks include a lack of research to formally evaluate the efficacy of the QI model (e.g., outside of the outcomes it produces) and inconsistent use of the model (e.g., as it is applied in many different settings within health care) (Hamilton et al., 2020). Despite some of these limitations, the “Model for Improvement” has been widely used in Canadian health care and is endorsed by HQO (Health Quality Ontario, 2012).

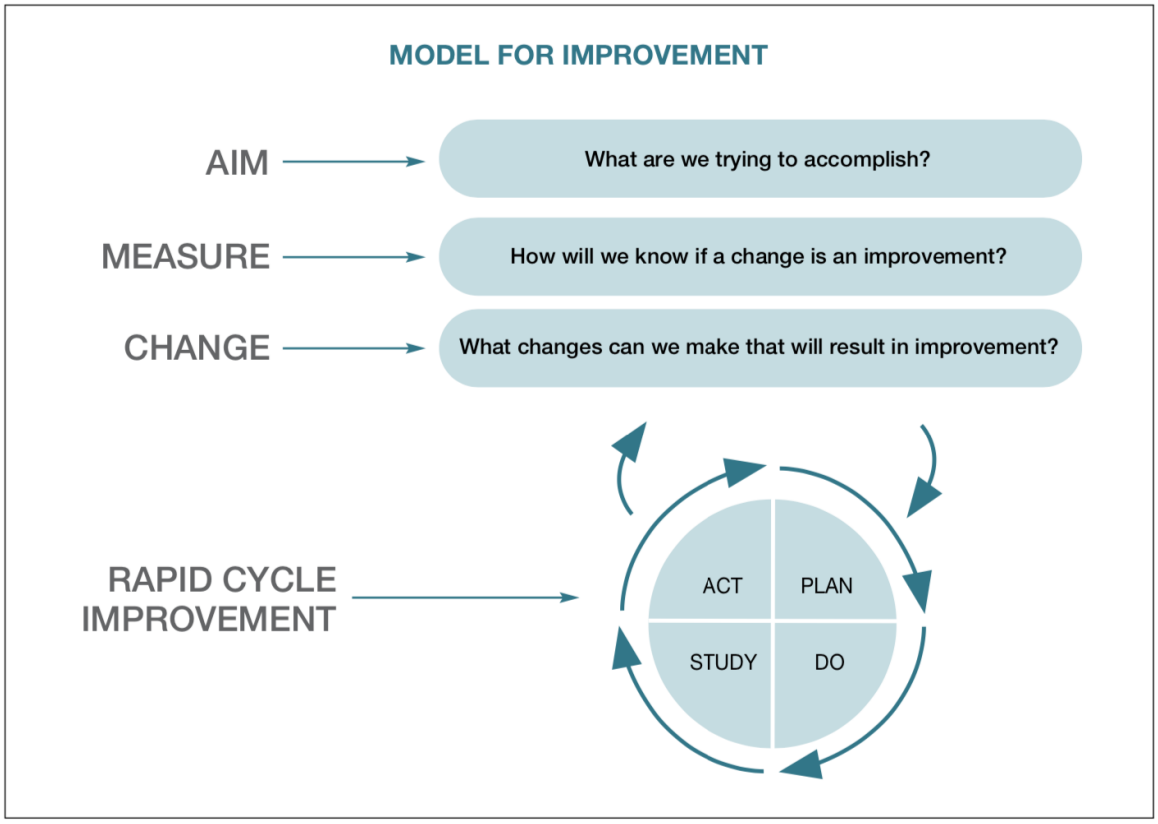

Figure 2. Health Quality Ontario quality improvement model.

Chapter 3 Methodology

3 Methodology

3.1 Study Setting

This QI study was conducted at a Goderich, Ontario Family Health Team (FHT) (i.e., Maitland Valley Family Health Team [MVFHT]). MVFHT is an affiliated teaching center for the Schulich School of Medicine at Western University (Maitland Valley Family Health Team, 2021). MVFHT offers a smoking cessation program, in-office spirometry, and has access to the *Best Care COPD Integrated Disease Management* program, a program designed for managing high-risk, exacerbation-prone patients with COPD in a primary care setting. The town of Goderich is a small population area with approximately 7800 residents (Statistics Canada, 2023), approximately 900 of which have COPD (Gershon AS, 2017). The surrounding area is made up of low-density rural communities with the nearest medium-sized population area (i.e., 30,000 plus residents) located over an hour's car drive away (i.e., 78 km) (Statistics Canada, 2017) (Stratford, Ontario). MVFHT serves a wide geographical area and patients come from across the "rural spectrum" (Statistics Canada, 2018). The "rural spectrum" is a term used to describe the fact that rural areas vary widely in population density and living conditions. Rural areas can include small towns, villages, areas surrounding consensus metropolitan areas, agricultural land, undeveloped land, and non-developable land (Statistics Canada, 2018). In this study, a 2015 Statistics Canada definition of rural postal codes was used (Statistics Canada, 2015). This was done to maintain consistency with the Government of Canada definition of rurality using forward sortation area (FSA) codes. FSA codes

containing a ‘0’, as a second digit are designated ‘rural’ areas (Statistics Canada, 2015). Alternative FHT’s are located to the north 53 km away, to the east 20 km away, and to the south 44 km away (Ministry of Health and Long Term Care, 2021). The MVFHT was chosen as it is the only large clinic in the area, has many COPD patients, and is set up in a similar fashion to other rural FHTs in the “Huron Perth and Area Ontario Health Team” (Huron Perth & Area Ontario Health Team, 2023). MVFHT is associated with a Family Health Organization. Family Health Organizations have more than three physicians and operate on a blended capitalization model. This type of organization is compensated primarily through capitation payments (i.e., pays a physician a set amount for each enrolled person assigned to them, per period of time, whether or not that person visits their doctor) but also receives fee for service payments. This is important to consider as patients with multiple visits are less likely to see the same physician (or a physician within the same group) on a regular basis, suggesting little within-group coverage in this type of model. This may influence the care that is delivered to the patient (McLeod et al., 2016).

3.2 Study Design

To assess the quality of care provided for adults living with COPD at a FHT in rural Ontario, a 12-month retrospective chart review of 80 patients’ EMRs was conducted between June 2022 and January 2023. Care provided between June 2021 and June 2022 was examined. To be included in the study, patients must have received a COPD diagnosis at least 12 months prior and be 18 years of age or older. COPD history of at least 12 months was chosen to allow time for QS to be delivered to the patient. This is in

line with select HQO standards that should be delivery annually (e.g., QS #2 and QS #5; see Appendix 1) (Health Quality Ontario, 2018a). A sample size of 80 was chosen as it aligns with similar work in this field (Belletti et al., 2013; Martinez et al., 2021; Surani et al., 2019). Previous and similar studies have included six or more patient charts *per physician* enrolled (e.g., at least 60 patient charts if ten physicians enrolled in study) (Belletti et al., 2013; Igarashi et al., 2018). The sample of 80 EMRs was randomly chosen from a pool of 260 eligible. To do this, each eligible EMR was assigned a unique study identification number. To select which EMRs to review the "RANDBETWEEN" function in Excel was used (Microsoft Support, 2023). For this study, a local data collection approach was utilized (Health Quality Ontario, 2018a). All information was extracted from patients' own clinical records, and not provincial or research databases (e.g., Institute for Clinical Evaluative Sciences). This allowed questions to be answered that could not be addressed from a provincial perspective. This also provided additional richness to the data for the local community, practice, and patients from where the data was drawn.

3.3 Modifications to Health Quality Ontario Methodology

Data will be presented for 13 of the 14 HQO QSs (including 33 indicators). Upon consultation with MVFHT members, QS #13: "Palliative Care", was not included in the study. This decision was made because of a lack of available data as well as sampling restrictions. A second deviation from HQO methodology was the exclusion of patient-centered, survey-based data collection. As participants were unaware of their involvement in this study, and express written consent from participants was not required

to access their charts, it was not practical to contact all involved participants to discern if they would be willing to complete a study survey.

3.4 Approval Process and Physician Recruitment

This study was approved by Western University's Health Science Research Ethics Board (REB # 118760). To gain approval for the project from MVFHT, a search authorization form was circulated to the MVFHT QI committee along with research ethics board approval for this study (Appendix 2). This form included all the information that would be extracted from patients' EMRs to inform physicians of the scope of the project as well as the rationale for collecting this information. Next, a presentation was delivered by the study team to MVFHT physicians and administrators describing study rationale, proposed methodology, and how previous work in the area generated benefits (Appendix 3). The presentation also sought to answer any questions the physicians and administrators had about the study. Once the project was approved by the MVFHT Board of Directors, the physician recruitment process began. Physicians were asked to give consent to access their patients' EMRs by signing a search authorization form and returning the form to the MVFHT QI committee (Appendix 4). At this point, all interested physicians signed and returned the consent form to the QI committee and data collection could begin.

3.5 Data Collection

A data extraction template, including EMR search terms (Appendix 1), was developed and refined over the course of 20 trial extractions. A full list of extracted data is available in Appendix 5. Briefly, baseline sociodemographic and health characteristics were

extracted, as well as information regarding QS indicator (n=33) delivery. Data were stored electronically in a Western University Research Drive. During the data extraction process, QS indicators were only assessed if the patient was eligible to receive the indicator. For example, if an individual did not smoke, they were not expected to receive smoking cessation counselling. To ensure accuracy in the data extraction process, as recommended by Vassar & Holzmann (2013) (Vassar & Holzmann, 2013), one study team member (DH) extracted all data with another study team member (RH) extracting data from eight EMRs only (i.e., 10% of the overall sample) as a test of interrater reliability. The two-time extracted EMRs were checked for consistency to confirm the methodological approach was sound and that data extraction was consistent between data extractors. Number and type of interrater discrepancy were collected.

3.6 Data Analysis

Baseline sociodemographic and health characteristics are presented descriptively (i.e., means ± SD and proportions). The overall proportion of HQO QS indicators met was calculated by assigning a denominator and numerator for each. In the case of QS #1, for example, the denominator represented the total number of people clinically suspected of having COPD. The numerator represented the number of people in the denominator who have undergone spirometry testing to confirm a diagnosis of COPD within three months of developing respiratory symptoms (see Appendix 1). This process of calculating proportions was repeated for each QS indicator. In addition, QS indicator scores were calculated for each patient to produce an individual-level, or personal, score (PS). Following HQO methodology, a PS ranging from -3 to 27 was generated (i.e., scoring

unfavourable QS indicators [re-admission to hospital post discharge] as -1 and favourable QS indicators [appropriate medication prescription] as +1). A score of -3 indicated that the patient received COPD care consistent with none of the HQO QS indicators and had each of the three negative indicators as defined by HQO. A perfect score of 27 indicated that the patient received COPD care consistent with every favourable indicator and had no negative indicators. Scores (i.e., -3 to 27) were then converted to a percentage for easier interpretation and exploratory analysis (e.g., 18 out of 27 = 66%). To examine whether the PS was normally distributed a Shapiro-Wilk test of normality was conducted. Stepwise linear regressions were used to explore relationships between the PS and potential predictor variables (e.g., baseline sociodemographic and health characteristics, or QS indicator data). Multicollinearity will be examined using a Variance Inflation Factor (VIF) (Daoud, 2017). A VIF of one or less will be considered "not correlated", a VIF >1 and five or less will be considered "moderately correlated", and a VIF greater than five will be considered "highly correlated" (Daoud, 2017). Interrater agreement was also calculated using Cohen's Kappa of interrater reliability. Agreement can range from 0 to 1, with a score of 0 meaning the agreement was "less than by chance", 0.01 to 0.20 being "slight agreement", 0.21 to 0.40 being "fair agreement", 0.40 to 0.60 being "moderate agreement", 0.61 to 0.80 being "substantial agreement", and 0.81 to 0.99 being "almost perfect agreement" (Viera & Garrett, 2005).

Chapter 4 Results

4 Results

4.1 Physician and Sample Characteristics

Nine physicians provided access to their patients' EMRs (9/12; 75%). Physicians providing care had on average 15.2 (±12.5) years of experience. All physicians were specialists in family medicine, and all held hospital-based practice privileges. Select physicians also held additional specialties in anesthesiology and emergency medicine. Characteristics describing the three physicians who did not participate in this study were unavailable. In the end, 80 primary care EMRs were accessed for this study (72.3 $\pm$ 9.74 years; 39% female). Sample and population characteristics are presented in Table 1. Mean patient COPD history was 6.2 years ($\pm$ 3.55). While nearly half of patients had mild COPD (38/80), 52.5% of patients had moderate or severe COPD (42/80; by % FEV1 predicted). Much of the sample were current or former smokers, 40.0% (32/80) and 52.5% (42/80) respectively, with 7.5% (6/80) being never smokers. In all cases smoking status was recorded in the patients' EMR. Almost all patients in the sample (76/80; 95.0%) had comorbid COPD conditions. Nearly half (37/80; 46.2%) of the sample was seen in primary care for COPD at least once in the past 12 months. The level of specialist COPD care involvement in the current sample was 17.5% (14/80 patients seen by a respirologist at any point in time). Occupational exposure to COPD precipitants was high with 60.0% (48/80) exposed to noxious gases and chemicals through industry, agriculture, manufacturing, construction, or mining jobs (Silver et al., 2021). Almost one fifth of the sample lived in a rural designated postal code (15/80; 18.7%), with the

remaining patients living in and around the Goderich, Ontario area. Notably, the current study sample may have included a higher proportion of males, mild severity COPD, and current smoker participants than the broader Ontario COPD population. Patients included in this study may have also visited primary care more often.

Table 1. Sample and population characteristics.

	Sample	**Population**
Mean age (± SD), years	72.3 (±9.74)	70.4 (±11.9)[I]
Female (%)	38.7%	50.8%[II]
Patient COPD history, years (± SD)	6.2 (±3.55)	4.8[III]
Occupationally exposed to COPD precipitants (%)	60.3%	n/a
Disease severity [a] (%)		
• Mild	48.7%	30.6%[IV]
• Moderate to Severe	51.2%	66.7%[IV]
Smoking status (%)		
• Current	40.0%	30.4%[I] to 31.1%[V]
• Former	52.5%	46.1%[I]
• Never	7.5%	8.7%[I]
• Not Recorded	0%	14.9%[I]
Respirology involved in care (%)	17.5%	20.0%[VI]
Seen in primary care for COPD in past year (%)	46.2%	35.5%[II]
Presence of comorbid COPD conditions (%) [b]	95.0%	90.0%[VII]
Rural designated postal codes (%)	18.7%	17.8%[VIII]

Notes. SD = Standard Deviation, COPD = Chronic Obstructive Pulmonary Disease, [a]Disease severity assessed using FEV_1 = Forced Expiratory Volume in One Second. [b]Heart Failure, Cardiovascular disease, etc. (Lee et al., 2021)[I] (Gershon AS, 2017)[II], (Belletti et al., 2013)[III] (Bednarek et al., 2008)[IV], (Guanzhang, 2019)[V], (Canadian Institute for Health Information, 2017a)[VI], (Yin et al., 2017)[VII], (Statistics Canada, 2015)[VIII]

4.2 Main Findings

The overall proportion of HQO QS indicators met was 43.2%. Proportion of indicators met for each QS is in Table 2. Indicators were most frequently met for: (a) QS #1: Diagnosis Confirmed with Spirometry at 72.1% (44 out of 61 eligible opportunities), (b) QS #6: Pharmacological Management of Stable COPD at 73.0% (219 out of 300), and (c) QS #7: Vaccinations, at 63.1% (101 out of 160). Indicators were never met for: (a) QS #9: PR (0 out of 150 eligible opportunities), (b) QS #10: Management of Acute Exacerbations of COPD (0 out of 35), and (c) QS #12: PR After Hospitalization for an Acute Exacerbation of COPD (0 of 26). Indicators for all other QS indicators were met 24.3% to 50.2% of the time. Importantly, indicators related to smoking cessation were met 39.6% (69 out of 174) of the time.

Table 2. Proportion of indicators met for each Health Quality Ontario COPD quality standard.

Quality Standard	Indicator(s)	Proportion
QS #1: Diagnosis Confirmed with Spirometry	• Spirometry is performed with 90 days of clinical suspicion of COPD	72.1% (44/61)
QS #2: Comprehensive Assessment	Assessment of: • Disability, • Exacerbation risk, • Co-morbidities	50.2% (119/237)
QS #3: Goals of Care and Individualized Care Planning	• Goals of care discussed with interprofessional care team • At least one visit to primary care in the past year	24.3% (39/160)
QS #4: Education and Self-Management	• Participation in intervention to support self-management • Utilization of a written self-management plan	42.1% (67/159)
QS #5: Promoting Smoking Cessation	For those who smoke: • A plan is made to quit within 12 months • Reception of counselling in the past 12 months • Receive pharmacological intervention to help stop smoking in the past 12 months • Not daily smokers	39.6% (69/174)
QS #6: Pharmacological Management of Stable COPD	• Reception of short acting bronchodilator therapy • Reception of long-acting bronchodilator therapy for those with moderate-severe COPD • Reception of inhaled corticosteroid monotherapy (lower is better)	73.0% (219/300)
QS #7: Vaccinations	• Reception of influenza vaccination in the past 12 months • Reception of pneumonia vaccine	63.1% (101/160)
QS #8: Specialized Respiratory Care	• Referral to specialized respiratory care when clinically indicated • Wait time for specialized respiratory care is less than 90 days	25.0% (23/92)

	• If individuals have been seen by a respirologist (for all COPD patients)	
QS #9: Pulmonary Rehabilitation	• Those with moderate to severe COPD who experience exercise limitation and breathlessness despite appropriate pharmacological management are referred to a PR program • Those who are eligible for PR begin the program • Those who begin PR complete more than 70% of the program	0% (0/150)
QS #10: Management of Acute Exacerbations of COPD	• Access to their primary care provider or health care professional in their care team within 24 hours of the onset of an exacerbation	0.0% (0/35)
QS #11: Follow-Up After Hospitalization for an Acute Exacerbation of COPD	For those hospitalized for COPD; • They are seen within 7 days for follow up in primary care • Are seen in specialist care within 30 days of discharge • Do not visit an emergency department for COPD within 30 days of discharge (lower is better) • Not readmitted to hospital for COPD within 3 months of discharge (lower is better)	50.0% (26/52)
QS #12: Pulmonary Rehabilitation After Hospitalization for an Acute Exacerbation of COPD	• Those hospitalized for COPD are referred to a PR program • Those referred to a PR program begin the program within 30 days of hospital discharge	0.0% (0/26)
QS #14: Long-Term Oxygen Therapy	Those receiving long term oxygen therapy: • Have their oxygen saturation measured via oximetry in the past 12 months • Have their arterial blood gases measured in the past 12 months • For those with a least one indication for long-term oxygen therapy receive long-term oxygen therapy	47.0% (8/17)

Notes. QS = Quality Standard, Proportion = number participants receiving care vs. number eligible to receive care, COPD = chronic obstructive pulmonary disease, PR = pulmonary rehabilitation

4.3 Secondary Findings

The mean PS was 42.2% (±18.7%). A stepwise linear regression analysis was conducted to identify potential PS predictors. Overall, the regression model explained 75% of the variation in PS ($R^2 = 0.754$, $F(4, 72) = 55.28$, $p < 0.001$; Table 3). The predictor variables ultimately included in the final model were: (a) primary care visit for COPD in the past year (QS #3), (b) having a non-smoking status (QS #8), (c) being seen by specialist respirologist for COPD (QS #5), and most notably, (d) participation in a self-management program (QS #4). Model 1 from Table 3 below included self-management program participation only and accounted for 56% of the variation in PS. Within the model there was a small level of multicollinearity between the predictors. Model 1 and 2 had a VIF value of 1.68, this falls close to 1.00 and thus indicates a small amount of inter predictor correlation (1.00 = no correlation, 1 to 5 indicates moderate correlation).

Table 3. Stepwise regression models exploring the relationship between Personal Score and potential predictor variables.

Model	R^2	Std. Error of the Estimate	R^2 Change	Degrees of Freedom	F Significance	Durbin-Watson	VIF
1	0.566	12.55	0.566	75	<0.001		1.00
2	0.691	10.65	0.125	74	<0.001		1.68
3	0.741	9.83	0.049	73	<0.001		1.075
4	0.754	9.63	0.014	72	0.049	2.302	1.120

Notes. Dependent variable: Personal Score = quality standard indicator summary scores were calculated for each patient to produce an individual-level, or personal, score, Variance Inflation Factor = VIF; Model 1 Predictors - Participation in self-management program; Model 2: Predictors - Participation in Participation in self-management program, Annual Primary Care Visit; Model 3: Predictors – Participation in self-management program , Annual Primary Care Visit, Non-Smoking Status; Model 4: Predictors – Participation in self-management program, Annual Primary Care Visit, Non-Smoking Status, Seen by Respirologist

In addition, a scatterplot illustrating participant PS by *Best Care COPD Integrated*

Disease Management program participation status is provided in Figure 3.

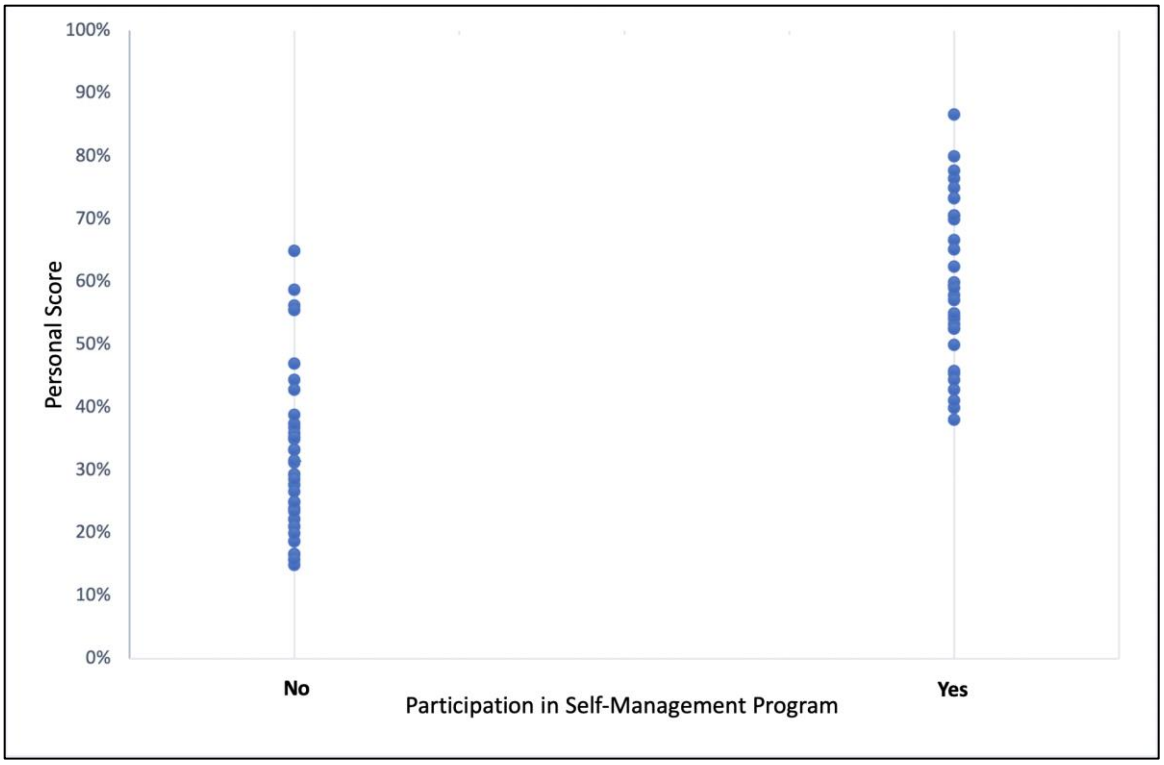

Figure 3. Scatterplot illustrating participant Personal Scores by self-management program participation status.

4.4 Interrater Reliability

"Substantial" interrater agreement was achieved (k=0.714). A summary of interrater discrepancies is in Appendix 6. Notably, interrater disagreements were more common for QS #2 and QS #8.

Chapter 5

5 Discussion

5.1 Main Findings

A retrospective chart review of EMRs from a primary care clinic in rural Ontario was conducted to begin to assess the quality of COPD care in rural Ontario. Overall, HQO QS indicators were met less than half the time. Indicators were most often met for QS #1, QS #6, and QS #7. Never met indicators were identified within QS #9, QS #10, and QS #12. No patient received standard-level care in all instances. The care gaps identified here may be partly explained by COVID-19 physical distancing measures during the evaluation period. These measures have been previously shown to negatively impact chronic disease management (e.g., by reducing access to services and delaying timely access) (Fekadu, 2021; Hacker et al., 2021). As well, exploratory analyses suggest four QS indicators may predict individual-level care (i.e., PS), including: (a) primary care team visit in the past year (QS #3), (b) being seen by a specialist respirologist (QS #8), (d) having a non-smoking status (QS #5), and (d) participation in a self-management program (QS #4). Taken together, the assessment of COPD care in this setting represents the first critical step (“aim”) in HQO’s “Model for Improvement”. Identifying care delivery strengths as well as opportunities for improvement in this setting may initiate small-scale intervention development in the future.

5.2 Similar Literature

The results of this study should be considered in light of similar literature. Lee *et al.* (2021), Martinez *et al.* (2021), Belletti *et al.* (2013), and Bourbeau *et al.* (2008) have all examined COPD care using retrospective chart review methodologies. Each study, however, employed slightly different approaches. For example, these studies assessed different arrays of COPD care metrics. As well, in addition to conducting retrospective chart reviews these studies also included patient and physician survey data. The study that most closely resembles the present study in terms of methodology was conducted by Lee *et al.* (2021). Lee *et al.* (2021) utilized a cross-sectional retrospective chart review study design with EMR data from 6995 Ontario patients. They measured adherence to COPD care standards using primary care EMRs. The authors performed an assessment of COPD QS related to vaccination (i.e., influenza and pneumococcal), spirometry, inhaled medication prescriptions, long term oxygen assessment, referral to PR, and smoking cessation. Lee *et al.* (2021) reported levels of vaccine usage similar to that reported here (i.e., influenza [60.5% vs. 58.7% in this study] and pneumococcal vaccine usage [66.0.% vs. 67.5% in this study]). Spirometry use for the diagnosis of COPD was less frequent in Lee *et al.* (2021) than reported here (54.7% vs 72.1%, respectively). Prescription of both short- and long-acting bronchodilator inhalers occurred at a higher rate in the present study than found by Lee *et al.* (2021) (i.e., short-acting bronchodilator prescription (73.4% vs. 80.0% in this study) and long-acting bronchodilator prescription (76.9% vs. 85.3% in this study). Unfortunately, Lee *et al.* (2021) reported higher levels of smoking cessation intervention (64.3 vs. 21.2% in this study) despite there being more current smokers in the present sample. Lee *et al.* (2021) also found a higher rate of referral to PR

than what was observed here (4.0% vs. 0.0%). Further comparison to other similar studies is provided in Appendix 7.

5.3 Notable Quality Standards

Five QSs and indicators (i.e., QS #1, QS #4, QS #5, QS #6, and QS #9) will be further discussed given their central role in COPD management. First, spirometry (QS #1) was well utilized in this study for the diagnosis of COPD (72.1%). Despite this relatively high proportion, 24% of the current sample had not received spirometry testing. This can lead to disease severity mis-classification for affected patients, as well as sub-optimal treatment (e.g., pharmacotherapy) (Global Initative for Chronic Obstructive Lung Disease *et al.*, 2021). Second, self-management and education indicators (QS #4) were met in half of patients (48.1%); twice the rate reported by Martinez *et al*. (2021) (23.0%). Continued emphasis on maintaining and increasing self-management program participation would be prudent since participation may be a key contributor to quality of care (i.e., PS) in this sample. Third, regarding smoking cessation indicators (QS #5), 23.8% of the study sample received smoking cessation counselling and pharmacological support. This is lower than rates reported by Belletti *et al.* (2013) (34.0%), Lee *et al.* (2021) (64.3%) and Bourbeau *et al.* (2008) (94.9%). Moving forward, prioritizing smoking cessation intervention will be critical since it is the most important management objective for those who smoke *(Global Initative for Chronic Obstructive Lung Disease et al.*, 2021; Tonnesen, 2013). Fourth, indicators regarding pharmacological management (QS #6) of stable COPD were often met. Sustained and appropriate bronchodilation with inhaled medication has important clinical benefits including long-term symptom control and

enhanced quality of life (Global Initative for Chronic Obstructive Lung Disease et al., 2021; Yawn et al., 2012). Lastly, indicators regarding PR (QS #9) represent an important area for COPD care improvement in this rural Ontario context. There is a structural lack of PR programming in this region to support COPD patients as part of routine care, for exacerbation prevention and management, or post-hospitalization. Virtual program offerings could help offset this lack of access (Buyting et al., 2022).

5.4 Strengths and Limitations

This study is one of the first to assess the quality of COPD care in rural Ontario. In general, while other similar studies have focused on narrower sets of quality indicators (e.g., 3-5 indicators) using central health administrative databases and billing codes, a broader array of indicators was examined here using a local data collection approach and guided by the HQO COPD QS. As a result, several opportunities for improvement were identified.

The results of this study should also be interpreted in light of some limitations as well, most notably: (a) that data was extracted from the EMR at only one primary care clinic, (b) the possibility of a treatment versus documentation gap, (c) incomplete physician recruitment, (d) that a human-based extraction process was used (possibly introducing confirmation bias or observer-expectancy bias), (e) that physician/clinician familiarity with HQO QS was not assessed, (f) that care quality could be overestimated, (g) that equal weight was given to each of the components of the PS, and (h) that physicians may be incentivized to complete some aspects of care over others . These are discussed, in order, below.

First, data was drawn from EMRs at a single primary care clinic only. The MVFHT possesses significant resources compared to what other single physician rural practitioners might have at their disposal. The clinic has an in-house smoking cessation program, spirometry, and access to the *Best Care COPD Integrated Disease Management* program. MVHFT is responsible for the care of about 30,000 patients (approximately 850 of which have COPD), making it the largest FHT in Huron County (Gilliland et al., 2016). The clinic also houses 30% of all primary care providers in Huron County (Gilliland et al., 2016). Conducting the same study using EMRs from other rural Ontario clinics may therefore yield different results. Replication of this work is recommended. Second, this study examined EMR data between June 2021 and June 2022. COVID-19 related physical distancing policies during this time may have impacted the way care was delivered as well as clinician priorities (Fekadu, 2021). It is possible that human health resources were used differently during this pandemic phase. Third, a treatment versus documentation gap may limit the strength of study conclusions. At the core of medical documentation, a human is responsible for imputing medical information. As part of this process the physician or clinician may intentionally omit information (e.g., deem the information not important enough to go through the time and effort to chart it). This may be because EMR usage is perceived as contributing to physician burnout by physicians (Tajirian et al., 2020). Clinicians may also underuse important EMR features such as the "problem list". In a recent study by Poulos *et al.* (2021) in London, England Hospitals, 40% of diagnoses were only mentioned in the free text of EMRs and not on patients' "problem list" (Poulos et al., 2021). In the present context, this may mean that physicians are in fact delivering care consistent with HQO QS indicators but are not recording them

in patients' charts. This could be due to lack of time as EMR documentation quality is directly impacted by patient load (Aasems Jacob, 2021). Fourth, physician recruitment from the clinic was incomplete (75%). All physicians at the clinic did not give authorization for the study team to access and evaluate their COPD patient charts. This may have introduced selection bias as every patient who was receiving care was not eligible to be randomly selected for EMR review. However, among participating physicians a range of practice experience was observed (i.e., 3.5 to 39 years). Fourth, only one researcher conducted all 80 EMR extractions. A second researcher extracted data from eight randomly selected EMRs to check for discrepancies and substantial interrater agreement was observed. This might suggest that data extracted only once (i.e., for the remaining 70 EMRs) are generally trustworthy. A lower level of agreement was found for QS #2 and QS #8, however. These can be explained, in part, by differing levels of extractor COPD knowledge in general in the first instance, and second extractor oversight regarding specialist respirology care referrals in the second instance. Fifth, physician/clinician familiarity with the HQO QS for COPD care was not assessed. A lack of familiarity could be one reason for sub-optimal QS adherence. Sixth, that care quality could be overestimated. This is possible as the sample of physicians that the study was made up of, volunteered to participate. This may mean that the physicians felt comfortable and confident in the care that they were delivering, and physicians that did not volunteer to participate may have not been delivering care at the same high standard as those who volunteered. Seventh, that equal weight was given to each of the components of the PS. This could mean that the components of the HQO QS that potentially carry more "clinical weight" (such a participation in PR, appropriate

medication prescription, and avoiding repeat admission to hospital for exacerbations of COPD) were not "weighted" highly enough to show their true impact on clinical care reflected in the PS. Lastly, physicians may be incentivized to complete some aspects of care over others. This could be possible because of the payment structure of Ontario's health care system. It is possible that physicians and clinics may prioritize completion of certain indicatiors within the HQO QS as there are financial incentives to completing certain aspects of care (as part of the blended and fee for service model). Other indicators which may not have a direct billing code or billable action may not be prioritized as there is not a financial incentive to complete that component of care for "free".

5.5 Implications

Three practical study implications are worth noting. First, the *Best Care COPD Integrated Disease Management* program was an important predictor of higher quality COPD care in this sample and should remain a management focus moving forward. It appears that ensuring self-management program participation, along with at least annual primary care visits, may provide a strong foundation of COPD care in this setting. Second, given that there is a paucity of exercise inclusive PR programing in the geographical area in question, incorporating an exercise component to the *Best Care COPD Integrated Disease Management* program may yield additional benefit. A third practical recommendation stemming from this work might be incorporating established COPD charting tools, such as a "COPD flowsheet" (Terasaki et al., 2015). These flowsheets can be used to prevent missing important care components by reminding team members to complete and report on important metrics (e.g., disability status, exacerbation

risk). Flowsheets promoting clinical survey completion, such as St. George's Respiratory Questionnaire or the mMRC dyspnea scale, may help in this regard as well. Improvements in QS indicator delivery, such as for vaccination, comorbidity screening, and inhaler technique screening, have been noted previously with flowsheet incorporation (Terasaki et al., 2015). Flowsheets are already being used for diabetes care at MVFHT suggesting it may be possible for COPD as well.

5.6 Future Directions

Through this work several suggestions for future research have been identified, including: (a) executing the current study protocol at different rural clinics across Ontario, (b) assessing physician familiarity with the HQO QS, and (c) strengthening study methodology by including administrative billing and health data as well as qualitative components. First, executing the current study protocol at different rural clinics would allow for comparisons between rural parts of the province. MVFHT is a rural clinic but is not at the most remote end of the rural spectrum. Completing the study at a more remote rural location would allow care across the rural spectrum to be assessed. This may help better establish areas for improvement in the rural environment. A second area for future research may include assessing physicians' familiarity with the HQO Chronic Obstructive Pulmonary Disease: Care in the Community for Adults. This document was published by HQO to explain the QS. Physician familiarity with the QS at MVFHT could be assessed by survey-based data or focus group interviews. Assessing primary care team members knowledge of COPD guidelines and QS may help tailor small-scale interventions to help increase the quality of care delivered by the primary care team.

Lastly, the methodology employed here could be combined with billing and administrative data as well as with survey or focus group-based data. This would provide a more complete picture of COPD care, including information more qualitative in nature (i.e., documenting rich patient and provider experiences). Examining health care billing data may help better illustrate certain QS, such as flu vaccination. Flu vaccines, for example, may have been given in a community setting and not appropriately charted in the patients EMR as the primary care provider did not administer the vaccination. A similar problem may exist with smoking cessation product usage. A patient may have been directed to try an over-the-counter smoking cessation aid without it being prescribed by the physician. This could be captured with surveys or focus groups. These suggestions may help address the treatment versus documentation gap noted above.

5.7 Conclusion

Primary care physicians represent an invaluable resource for rural Ontarians and they are uniquely positioned to help with better COPD management. This study provides insight into the quality of care being delivered for COPD patients at a rural Ontario primary care clinic. COPD care strengths, as well as opportunities for improvement, were identified. As COPD places a heavy burden on individuals' quality of life, it is important to continue to look for new opportunities to enhance patient care. Aligning with the HQO endorsed QI model, "Model for Improvement", this study sets the stage for further evaluation work as well as small-scale intervention development.

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6 Appendices

6.1 Appendix 1. Health Quality Ontario's Chronic Obstructive Pulmonary Disease Quality Standards and Indicators.

Quality Standard	Quality Standard Definition	Indicators	Indicator Definition(s)	Search Terms for Each Indicator (if applicable)
Quality Standard #1 – Diagnosis Confirmed with Spirometry	Those clinically suspected of having COPD (have at least one respiratory symptom and one risk factor for COPD) should have spirometry completed within 3 months to definitively confirm a diagnosis of COPD (Health Quality Ontario, 2018a).	*1.1 Diagnosis Confirmed with Spirometry* Meets standard 1.1 if upon discovering both ONE respiratory symptom and ONE risk factor spirometry is performed within 3 months.	*Respiratory Symptoms Include:* (1) Persistent shortness of breath that worsens with activity and/or exercise, (2) Chronic cough, (3) Regular sputum production, (4) Recurrent respiratory infections, (5) Chronic wheezing, (6) Chest tightness, (7) Activity and/or exercise limitation owing to breathlessness. *Risk Factors Include:* (1) Exposure to second-hand smoke, (2) Exposure to occupational lung irritants, such as dust, vapors, fumes, gases, and other chemicals. (3) Childhood factors, such as low birthweight, recurrent respiratory infections, and other lung development issues, (4) Exposure to significant air pollution, (5) Family history of COPD, (6) Genetic predisposition (alpha-1 antitrypsin deficiency), (6) History of asthma, (7) Use of biomass fuels for indoor heating or cooking without proper ventilation.	*1.1* *Spirometry* *Pulmonary Function Test* *PFT* *SOB* *Shortness of Breath* *Cough* *Sputum* *Wheezing*

Quality Standard #2 – Comprehensive Assessment	People with COPD have a comprehensive assessment to determine the degree of disability, risk of acute exacerbation, and presence of comorbidities near the time of diagnosis and on an annual basis. The severity of airflow limitation, as initially determined by spirometry testing to confirm diagnosis, is reassessed when people's health status changes (Health Quality Ontario, 2018a).	*2.1 Degree of Disability Assessed:* Standard 2.1 Can considered to be met when COPD-related disability is assessed in the past 12 months. The definition is not strict in what assessments or questionaries should be performed. However, they should be related to COPD and not disability caused by a comorbidity or external factor (such as a fall). *2.2 Risk of Acute Exacerbation* Standard 2.2 can considered to be met when there has been an assessment of dyspnea, airflow obstruction (spirometry), BMI assessment or changes charted, medication changes aimed at preventing an exacerbation or improving patient symptoms in the past 12 months. *2.3 Comorbidities* Standard 2.3 can considered to be met when there has been an assessment of the patients' comorbidities. These assessments are not limited to the list in the	*Comprehensive Assessment* A comprehensive assessment includes a medical history, physical exam, medication reconciliation, nutrition assessment, and the evaluation and documentation of the severity of airflow limitation, degree of disability, risk of acute exacerbation, and presence of comorbidities. *2.1 Degree of Disability* The degree of COPD-related disability depends on symptom severity and can be measured using a number of instruments, including, but not limited to, the following: - Clinical Frailty Scale (CFS) - COPD Assessment Test (CAT) - COPD Control Questionnaire (CCQ) - Medical Research Council (MRC) Dyspnea Scale - Tests of exercise capacity (e.g., 6-minute walking test, shuttle walk test, gait speed) *2.2 Risk of Acute Exacerbation* The risk of acute exacerbation can be assessed by obtaining a history of past acute exacerbations of COPD, including their timing, frequency, and severity, and any associated hospitalizations. Severe and worsening airflow obstruction, based on spirometry results, and the presence of chronic bronchitis are associated with a higher risk of acute exacerbation of COPD. *2.3 Comorbidities* The following conditions are common in people with COPD and should be considered in assessment and care planning: Asthma, Cardiovascular disease (e.g., arrhythmia, heart failure, hypertension, ischemic heart	*2.1* *Frailty,* *CAT,* *6MWT,* *Six Minute Walk Test,* *CCQ,* *MRC,* *Dyspnea Scale,* *Dyspnea,* *Exercise Capacity,* *COPD Flowsheet* *2.2* *COPD Flowsheet,* *Best Care COPD,* *dyspnea,* *AECOPD,* *ACOPD,* *ECOPD,* *COPD Exacerbation,* *PFT,* *Pulmonary Function Test,* *Spirometry*

		definitions however they should be related to COPD. I.e., regular colorectal screening would not constitute an assessment of COPD comorbidities. Should be completed in the past 12 months	disease, peripheral vascular disease, stroke), Cognitive impairment (e.g., dementia), Gastroesophageal reflux, Lung cancer, Metabolic disease (e.g., diabetes, metabolic syndrome, obesity), Mental illness (e.g., anxiety, depression), Musculoskeletal disorders (e.g., osteoarthritis), Osteoporosis, Pulmonary embolism, Sleep apnea, Substance use disorders (e.g., tobacco).	

Quality Standard #3 – Goals of Care and Individualized Care Planning	People with COPD discuss their goals of care with their future substitute decision-maker, their primary care provider, and other members of their interprofessional care team. These discussions inform individualized care planning, which is reviewed and updated regularly (Health Quality Ontario, 2018a).	*3.1 Goals of Care* Standard 3.1 can consider to be satisfied when the patient has discussed their goals of care with their interprofessional care team. Charted discussion surrounding life expectancy, relieving symptoms, optimizing quality of life, maintaining control, achieving a good death, and getting support for caregivers, family, and loved ones. *3.2 Seen In Primary Care for COPD in the past 12 Months* Standard 3.2 can consider to be satisfied when the patient has been seen in the primary care setting by their primary care provider or their interprofessional care team in the past 12 months for their COPD.	*3.1 Goals of Care* A person's goals of care are their overall priorities and health expectations for care; these are based on their personal values, wishes, beliefs, and perception of quality of life, and what they characterize as meaningful and important. Examples of goals of care include prolonging life, relieving suffering, optimizing quality of life, maintaining control, achieving a good death, and getting support for caregivers, family, and loved ones. Goals of care are not the same as health care decisions or consents for treatments. Typically, discussions of goals of care should precede health care decision-making and giving consent for treatment. *3.2 Seen in Primary Care for COPD in the past 12 Months* Patient has been seen by their primary care provider or a member of their interprofessional care team in relation to their COPD within the past 12 months. Interprofessional Care Team: An interprofessional care team includes a primary care provider, multiple health care professionals with different training and skills, the person with COPD, and their caregivers. Interprofessional care occurs when multiple health care professionals with different areas of expertise provide comprehensive health services by working with patients, their caregivers, and communities to deliver the highest quality of care across settings. Professionals include: Respiratory therapy and respiratory education, Respirology or other specialist care, Care coordination or case management, Caregiver	*3.1 Goals of Care, Quality of Life, QOL, Control, Death, Family, Care Plan* *3.2 COPD*

			support, Home care, Kinesiology, Nutrition support, Occupational therapy, Palliative care, Pharmacy, Physiotherapy, Rehabilitation and/or clinical psychology, Social work, psychology, psychiatry, or other psychosocial support, Spiritual or religious support	

Quality Standard #4 – Education and Self-Management	People with COPD and their caregivers receive verbal and written information about COPD from their health care professional and participate in interventions to support self-management, including the development of a written self-management plan (Health Quality Ontario, 2018a).	*4.1 Participation in Self-Management Program* Standard 4.1 can consider to be satisfied if people who have COPD participate one or more interventions to support self-management.	*4.1 Self-Management* According to a consensus definition, a self-management intervention for COPD is a structured but individualized plan to motivate, engage, and support people with COPD to positively adapt their health behaviours and develop skills to better manage their disease. The goals of self-management are to optimize physical health; reduce symptoms and functional impairments; increase quality of life, including emotional and social well-being; and establish effective relationships with health care professionals, family, friends, and community. The process requires iterative interactions between people with COPD and health care professionals trained in behaviour change techniques and health literacy–sensitive approaches to providing self-management interventions. The focus is on identifying needs and goals, formulating a plan to reach goals, and re-evaluating the plan as necessary.	*4.1* *Self-Management* *Best Care COPD* *Best Care* *Self-Management Intervention* *Behaviour Change*
		4.2 Written Self-Management Plan Standard 4.2 can consider to be satisfied if people who have COPD a written self-management plan (action plan) that may include standing orders for medications or prescriptions, daily strategies, and instructions for exacerbation management.	*4.2 Written Self-Management Plan* Also referred to as a COPD action plan, a written self-management plan is a written document developed together by people with COPD, their health care professionals, and their caregivers. It outlines a person's treatments and the strategies they should use daily and in the case of an acute exacerbation. It may include prescriptions or standing orders for medications. This plan should be used in conjunction with interventions to support self-management provided by a health care professional.	*4.2* *Action Plan* *COPD Action Plan* *COPD Flowsheet* *Best Care COPD* *Best Care*

Quality Standard #5 – Promoting Smoking Cessation	People with COPD are asked about their tobacco-smoking status at every opportunity. Those who continue to smoke are offered pharmacological and nonpharmacological smoking cessation interventions (Health Quality Ontario, 2018a).	*5.1 People with COPD who smoke tobacco and who made plan with a health care professional to stop smoking tobacco in the past 12 months* Quality standard 5.1 can consider to be satisfied if people who have COPD and also smoke tobacco have made a plan to quit with their health care professional within the past 12 months. *5.2 Tobacco Smokers received Counselling regarding smoking cessation in the past 12 months* Quality standard 5.2 can consider to be satisfied if people who smoke tobacco received counselling intervention to stop tobacco smoking in the past 12 months *5.3 Tobacco smokers received pharmacological intervention to promote smoking cessation in the past 12 months* Quality standard 5.3 can consider to be satisfied if people who smoke tobacco received pharmacological intervention to promote smoking cessation in the past 12 months.	Smoking Cessation Interventions A range of pharmacological and nonpharmacological interventions are available to help people stop smoking tobacco. Options include, but are not limited to, the following: Behavioural support, Intensive counselling (≥ 90 minutes per session), Motivational interviewing, Nicotine replacement therapy products, Pharmacotherapy (e.g., bupropion, varenicline)	*5.1, 5.2, 5.3* *Smoking* *Smoking Cessation* *Tobacco Use* *Smoking Risk Factor* *Stop Smoking* *COPD Flowsheet* *Best Care COPD* *Best Care* *Behavioural Support* *Behaviour Change* *Counselling* *Patch* *Nicotine Replacement* *Nicotine Replacement Therapy* *Bupropion* *Varenicline* *Champix*

Quality Standard #6 – Pharmacological Management of Stable COPD	People with a confirmed diagnosis of COPD are offered individualized pharmacotherapy to improve symptoms and prevent acute exacerbations. Their medications are reviewed at least annually (Health Quality Ontario, 2018a).	*6.1 Short Acting Bronchodilator Therapy* Quality Standard 6.1 can be satisfied if individuals diagnosed with COPD received a short-acting bronchodilator therapy. *6.2 Long Acting Bronchodilator Therapy* Quality standard 6.2 can be satisfied if individuals with moderate to severe COPD receive a long-acting bronchodilator therapy (either LAMA or LABA). If the individual has asthma initial maintenance therapy with an inhaler that combines a LABA and ICS. *6.3 Inhaled Corticosteroid Monotherapy* Quality Standard 6.3 is considered a negative indicator, ICS monotherapy not indicated for the treatment of COPD. If ICS monotherapy is present the standard is not met. *6.4 Inhaled Medication Delivery System Use* Quality standard 6.4 is met if the person with COPD is taught proper inhaler use and delivery technique.	Individualized pharmacotherapy A short-acting, fast-onset inhaled bronchodilator for immediate symptom relief should be offered to all people diagnosed with COPD. People with moderate to severe COPD, who do not have features of asthma, should be offered an inhaled long-acting bronchodilator—either a long-acting anti-muscarinic (LAMA) or long-acting beta-2-agonist (LABA). However, for people who also have asthma, initial pharmacological management should include maintenance therapy with an inhaler that combines a LABA and an inhaled corticosteroid (LABA/ICS) of low to moderate dose. Further pharmacotherapy should be individualized based on symptom severity and the frequency and severity of acute exacerbations according to current treatment recommendations and algorithms. The person with COPD should be taught proper inhaler use and delivery device technique. When appropriate, the use of a spacer should be considered. If breathlessness persists or worsens, or if acute exacerbations occur frequently and/or are severe, additional inhaled pharmacologic treatment should be considered to help prevent acute exacerbations. Combination inhaled corticosteroid therapy with two long-acting bronchodilators in one inhaler (LAMA/LABA) should be tried first, followed by triple therapy with a LAMA and a LABA/ICS. ICS monotherapy is not indicated for the treatment of COPD, nor is LABA/ICS indicated as a first-line medication. In some cases, oral pharmacologic treatment may also be considered (e.g., mucolytics, macrolides, roflumilast, and theophylline).	*6.1* *Short Acting Bronchodilators* *Atrovent* *Airomir* *Bricanyl* *Ventolin* *Albuterol* *Salbutamol* *Ipratropium bromide* *Terbutaline* *6.2* *Long-Acting Bronchodilators* *LAMAs* *(1) Incruse Ellipta (umeclidinium bromide)* *(2) Seebri Breezhaler (glycopyrronium bromide)* *(3) Spiriva Handihaler (tiotropium bromide monohydrate)* *(4) Spiriva Respimat* *(5) Tudorza Genuair (aclidinium bromide)* *LABAs* *(1) Foradil Aerolizer (Formoterol Fumarate)* *(2) Onbrez Breezhaler (indacaterol maleate)* *(3) Serevent Diskus (salmeterol xinafoate)* *(4) Striverdi Respimat (olodaterol hydrochloride)*

		Technique must be assessed and charted for the standard be met. *6.5 Yearly or Clinically Indicated Medication Review* If breathlessness persists or worsens, or if an acute exacerbation occurs medication reconciliation should be a priority during follow up. Medications should be reviewed at least yearly.		

Quality Standard #7 – Vaccinations	People with COPD are offered appropriate influenza and pneumococcal vaccinations (Health Quality Ontario, 2018a).	*7.1 Influenza Vaccination* Quality Standard 7.1 can consider to be satisfied if individuals with COPD have received their influenza vaccination in fall of 2021 (or past 12 months) . *7.2 Pneumococcal Vaccination* Quality standard 7.2 can consider to be satisfied if individuals with COPD have received their pneumococcal vaccination at some point in the past in accordance with clinician judgement and NACI statements.	*7.1 Influenza Vaccination* Quality Standard 7.1 can consider to be satisfied if individuals with COPD have received their influenza vaccination in fall of 2021 (or past 12 months) . *7.2 Pneumococcal Vaccination* Quality standard 7.2 can consider to be satisfied if individuals with COPD have received their pneumococcal vaccination at some point in the past in accordance with clinician judgement and NACI statements.	*7.1 Influenza vaccination* Influenza vaccination should be offered annually to all people with COPD unless contraindications are present. People with immunosuppression (e.g., those receiving immunocompromising therapy such as long-term corticosteroids) and those who are 65 years of age or older should be offered a high-dose influenza vaccine. *7.2 Pneumococcal vaccinations* Pneumococcal vaccinations should be offered to all people with COPD, unless contraindications are present. Both available vaccines should be considered according to National Advisory Committee on Immunization (NACI) statements and individual clinical indications, such as age and the presence of factors contributing to an increased risk of developing invasive pneumococcal disease (e.g., the use of immunocompromising therapy such as long-term corticosteroids).

Quality Standard #8 – Specialized Respiratory Care	People with a confirmed diagnosis of COPD are referred to specialized respiratory care when clinically indicated, after receiving a comprehensive assessment and being offered treatment in primary care. This consultation occurs in accordance with the urgency of their health status (Health Quality Ontario, 2018a).	*8.1 Referred to Specialized Respiratory Care when Clinically Indicated* Standard 8.1 Can consider to be satisfied when people with COPD are referred to specialized respiratory care when clinically indicated *8.2 Wait time for specialized respiratory care* If patient is referred for specialized respiratory care record the number of days between referral and first consultation with specialized respiratory care. There is no listed number of days that meets the quality standard in the HQONT standards. Patient should be seen within a reasonable time frame (1-3 months) *8.3 Seen by a Respirologist* Report the percentage of individuals who have COPD who have been seen by a Respirologist. This is reported across the total number of people with COPD not just those referred for specialized care.	*Specialized Respiratory Care* Depending on the clinical indication, specialized respiratory care may be provided by a respirologist, a general internist with expertise in respiratory medicine, or a family physician or nurse practitioner with expertise in respiratory medicine or working within a specialized respiratory health clinic. *Clinically Indicated* Clinical indications for referral to specialized respiratory care include, but are not limited to, the following: - Accelerated decline in lung function - Assessment required for any of the following: Oral pharmacologic treatment (e.g., mucolytics, macrolides, roflumilast, and theophylline), Long-term oxygen therapy, Pulmonary rehabilitation, Suitability for air travel in a person with hypoxemia, Surgery, Complex comorbidities (see Statement 2), Frequent infections, Hemoptysis, Hypercapnia, Onset of pulmonary hypertension, Onset of symptoms at a young age or a family history of alpha-1 antitrypsin deficiency, Patient request for second opinion, Severe or very severe COPD, Severe or recurrent acute exacerbations, Severe symptoms disproportionate to airflow limitation, Uncertain diagnosis	*8.1, 8.3* Referral Referrals Sort by Referral Tab in EMR Respirologist Respirology *Comorbidities:* Asthma, Cardiovascular disease (e.g., arrhythmia, heart failure, hypertension, ischemic heart disease, peripheral vascular disease, stroke), Cognitive impairment (e.g., dementia), Gastroesophageal reflux, Lung cancer, Metabolic disease (e.g., diabetes, metabolic syndrome, obesity), Mental illness (e.g., anxiety, depression), Musculoskeletal disorders (e.g., osteoarthritis), Osteoporosis, Pulmonary embolism, Sleep apnea, Substance use disorders (e.g., tobacco).

Quality Standard #9 – Pulmonary Rehabilitation	People with moderate to severe, stable COPD are referred to a pulmonary rehabilitation program if they have activity or exercise limitations and breathlessness despite appropriate pharmacological management (Health Quality Ontario, 2018a).	*9.1 Referral to PR when indicated* Standard 9.1 can consider to be met when individuals who are eligible for referral to PR and referred. *9.2 Beginning PR Post Referral* Standard 9.2 can consider to be met when individuals who are eligible and referred to PR begin the program. *9.3 PR Completion* Standard 9.3 can consider to be met when individuals who are eligible, complete a PR program with at least 70% attendance.	*Moderate to severe, stable COPD* The severity of stable COPD can be classified based on severity of airflow limitation and degree of disability. Severity of airflow limitation (as percentage predicted) Mild: FEV1 ≥ 80% Moderate: 50% ≤ FEV1 < 80% Severe: 30% ≤ FEV1 < 50% Very severe: FEV1 < 30% Degree of disability (e.g., based on MRC Dyspnea Scale rating) Mild: Breathlessness from COPD when walking at a quick pace on level ground or walking up a slight hill (MRC grade 2) Moderate: Shortness of breath from COPD causing the person to stop after walking about 100 metres (or after a few minutes) on level ground (MRC grades 3–4) Severe: Shortness of breath from COPD resulting in the person being too breathless to leave the house or breathless when dressing or undressing (MRC grade 5), or the presence of chronic respiratory failure or clinical signs of right heart failure *Pulmonary rehabilitation* Pulmonary rehabilitation consists of supervised aerobic (endurance) and resistance (strength) training to increase exercise capacity and functional status. Other components include education and self-management, including behavioural interventions and nutrition and psychological support.	*9.1, 9.2, 9.3* *Referral* *Pulmonary Rehabilitation* *PR*

			Programs are multicomponent, interdisciplinary, and individualized, and run for at least 6 to 8 weeks. A person's eligibility for enrolment includes clinically stable, symptomatic COPD with increased breathlessness and reduced activity levels despite appropriate pharmacological treatment; no evidence of poorly controlled cardiovascular, neurological, or musculoskeletal conditions that might limit participation; ability to understand instructions; and a willingness to participate.	

Quality Standard #10 – Management of Acute Exacerbations of COPD	People with COPD have access to their primary care provider or a health care professional in their care team within 24 hours of the onset of an acute exacerbation (Health Quality Ontario, 2018a).	*10.1 Timely Access to Primary Care for treatment of an Acute Exacerbation of COPD* Quality Standard 10.1 can consider to be satisfied when an individual who has an acute exacerbation of COPD is able to access their primary care provider or member of their interprofessional care team within 24 hours of the onset of the exacerbation.	*Access* Access to a person's primary care provider or member of their interprofessional care team may be in person or via telephone, telemedicine, or secured electronic communication. *Acute exacerbation of COPD:* An acute exacerbation of COPD is characterized by a worsening of respiratory symptoms, such as breathlessness, cough, and sputum production (purulent or nonpurulent), that is more severe than the day-to-day variation in symptoms that a person with COPD is accustomed to and that lasts at least 48 hours. The severity of an acute exacerbation is categorized according to the treatment required: Mild: requires treatment with inhaled bronchodilators only, outside the hospital Moderate: requires treatment with inhaled bronchodilators, antibiotics, and/or corticosteroids, usually outside the hospital Severe: may be associated with acute respiratory failure; requires treatment in hospital (emergency department visit with possible admission to hospital)	*10.1* *Exacerbation,* *Acute COPD,* *AECOPD, COPD Exacerbation,* *Cough,* *Sputum,* *Short of Breath,* *SOB*

Quality Standard #11 – Follow-Up Post Hospitalization for an Acute Exacerbation of COPD	People with COPD who have been hospitalized for an acute exacerbation have an in-person follow-up assessment within 7 days after discharge (Health Quality Ontario, 2018a).	*11.1 Timely Follow-Up Post Hospitalization for AECOPD* Quality Standard 11.1 can consider to be met when an individual hospitalised for AECOPD is seen for an in-person follow-up assessment within 7 days of their hospital discharge. *11.2 Timely Specialist Follow-Up Post Hospitalization for AECOPD* Standard 11.2 can consider to be satisfied if when an individual hospitalized for AECOPD is seen for an in-person specialist follow-up assessment within 30 days of discharge from the hospital *11.3 Emergency Room Visit Post Hospitalization for AECOPD* Standard 11.3 is considered a negative quality indicator. Standard 11.3 is met if an individual who was hospitalized in the previous 30 days visits the emergency room for COPD care. *11.4 Hospital Readmission for COPD within 3 Months of Discharge*	*In-person follow-up assessment* The initial in-person follow-up assessment may be with one of a number of different health care professionals with expertise in assessing someone with COPD after discharge from hospital. Such health care professionals include, but are not limited to, the following: family physicians; nurse practitioners; respiratory therapists; and other health care professionals who are certified respiratory educators, have respiratory health expertise, or have the role of care coordinator or case manager for people with COPD, such as occupational therapists, physiotherapists, pharmacists, and nurses (including rapid-response nurses who provide home care). The follow-up assessment after hospitalization for an acute exacerbation of COPD should be individualized and related to the details of the hospitalization. Components of the follow-up assessment include, but are not limited to, the following: - Reviewing relevant comorbidities identified during the hospitalization - Updating and reconciling medications, including dose and frequency, and providing inhaler technique instruction (see Statement 6) - Assessing barriers to coping at home or in long-term care, and assessing the need for or access to home and community care (see Statement 3) - Ensuring spirometry testing has been done to confirm diagnosis and determine airflow limitation (see Statements 1 and 2) - Offering education about COPD and self-management interventions (see Statement 4)	*11.1* *Discharge* *Emergency* *Emerg* *Hospital* *11.2* *Respirology* *Resp* *Exacerbation,* *Acute COPD,* *AECOPD,* *COPD Exacerbation,* *Cough,* *Sputum,* *Short of Breath,* *SOB* *11.3* *Emergency* *Emerg* *Readmission* *Hospital* *Exacerbation,* *Acute COPD,* *AECOPD,* *COPD Exacerbation,* *Cough,* *Sputum,* *Short of Breath,* *SOB*

		Standard 11.4 is considered a negative quality indicator. Standard 11.4 is met if an individual is readmitted to hospital for COPD within 3 months of discharge for COPD.	- Promoting smoking cessation (see Statement 5) - Reviewing the need for vaccinations (see Statement 7) - Ensuring a referral to pulmonary rehabilitation has been made (see Statement 12) - Discussing goals of care and advance care planning as appropriate (see Statement 3) - Assessing the need for referral to additional palliative care supports as appropriate (see Statement 13) - If the person is discharged with oxygen, assessing the need for long-term oxygen therapy 30 to 90 days after discharge (see Statement 14)	*11.4* *Emergency* *Emerg* *Readmission* *Hospital* *Exacerbation,* *Acute COPD,* *AECOPD,* *COPD Exacerbation,* *Cough,* *Sputum,* *Short of Breath,* *SOB*

Quality Standard # 12 – PR Post Hospitalization for AECOPE	People who have been admitted to hospital for an acute exacerbation of COPD are considered for pulmonary rehabilitation at the time of discharge. Those who are referred to a pulmonary rehabilitation program start the program within 1 month of hospital discharge (Health Quality Ontario, 2018a).	*12.1 PR Post Hospitalization for COPD* Standard 12.1 can consider to be satisfied if after discharge from hospital related to COPD the patient in referred to a pulmonary rehabilitation program *12.2 Starting PR within 1 month of hospital discharge for COPD* Standard 12.2 can consider to be satisfied if after an admission for COPD the patient starts PR within 1 month of discharge from the hospital.	Pulmonary Rehabilitation Pulmonary rehabilitation consists of supervised aerobic (endurance) and resistance (strength) training to increase exercise capacity and functional status. Other components include education and self-management, including behavioural interventions, and nutrition and psychological support. Programs are multicomponent, interdisciplinary, and individualized, and run for at least 6 to 8 weeks. A person's eligibility for enrolment includes clinically stable, symptomatic COPD with increased breathlessness and reduced activity levels despite appropriate pharmacological treatment no evidence of poorly controlled cardiovascular, neurological, or musculoskeletal conditions that might limit participation; ability to understand instructions and a willingness to participate.	*12.1, 12.1* *Pulmonary Rehabilitation* *PR* *Discharge* *Referral* *Resp* *Respirology*
Quality Standard #14 – Long-Term Oxygen Therapy	People with stable COPD who have clinical indications of hypoxemia receive an assessment for and, if	*14.1 Utilizing Oximetry in those receiving long-term oxygen therapy*	Clinical Indications of Hypoxemia: Clinical indications of hypoxemia include one or more of the following:	*14.1, 14.2, 14.3* *SPO2*

	needed, treatment with long-term oxygen therapy (Health Quality Ontario, 2018a).	Standard 14.1 can consider to be met if individuals who are receiving long-term oxygen therapy have their oxygen saturation measured with oximetry in the past 12 months. *14.2 Utilizing ABG's in those receiving long-term oxygen therapy* Standard 14.2 can consider to be met if individuals who are receiving long-term oxygen therapy have had their arterial blood gases measured. *14.3 Long-term oxygen therapy for those who need it.* Standard 14.3 can consider to be met if individuals who have at least one indication for long-term oxygen therapy receive long-term oxygen therapy.	Very severe airflow obstruction (FEV1 < 30%), Bluish discolouration of skin or mucous membranes (cyanosis), Hematocrit > 55% (polycythemia or erythrocytosis), Physical exam findings suggestive of heart failure (cor pulmonale), including peripheral edema and raised jugular venous pressure, Resting oxygen saturation ≤ 92% (screened with oximetry), People with severe airflow obstruction (30% ≤ FEV1 < 50%) may also be considered for assessment, especially if oxygen saturation is less than 92% on oximetry. Treatment with Long-Term oxygen Therapy: Arterial blood gases should be used to assess the need for long-term oxygen therapy. Long-term oxygen therapy should be offered to people with stable COPD who have severe resting hypoxemia (arterial partial pressure of oxygen [PaO2] ≤ 55 mmHg and/or arterial oxygen saturation [SaO2] ≤ 88%). People with moderate resting hypoxemia (PaO2 56–60 mmHg and/or SaO2 89–90%) may also benefit from long-term oxygen therapy, especially if they have one of the following: Pulmonary hypertension Hematocrit > 55% (polycythemia or erythrocytosis) Physical exam findings suggestive of heart failure (cor pulmonale), including peripheral edema and raised jugular venous pressure Exercise limited by hypoxemia (SaO2 ≤ 88%) that improves with supplemental oxygen46 Nocturnal hypoxemia (SaO2 ≤ 88%) ≥ 30% of the night.	*LTO2* *ABG* *Arterial Blood Gas* *Oxygen* *PFT* *Pulmonary Function Test* *Spirometry* *Pulmonary Hypertension* *Hypoxemia* *Heart Failure* *HF* *CHF*

			People with exertional hypoxemia, as assessed by a standardized exercise test (SaO2 ≤ 88%), may be eligible for long-term oxygen therapy if their exercise tolerance is restricted owing to severe breathlessness (≥ MRC grade 4) and improves with supplemental oxygen, and if they are motivated to use oxygen therapy to increase their activity level. Once long-term therapy has been initiated, oxygen should be used at least 15 to 20 hours a day. The continued need for long-term oxygen therapy should be assessed with oximetry after 60 to 90 days and then at least once a year.	

6.2 Appendix 2. Maitland Valley Family Health Team Data Search Participation Form

(A-17e) DATA SEARCH PARTICIPATION FORM

NAME OF DATA SEARCH: COPD UWO

DATA SEARCHER: Daniel Henke – Western University

DATA TO BE COLLECTED:

Identifiers + Demographic Information:
- Patient ID Number (Master Identifier), Age, Sex, Forward Servicing Address (first 3 digits of postal code), COPD Diagnosis Date, Occupation/former occupation

Spirometry Testing Results:
- Spirometry test results (FEV1/FVC)
- Date of most recent spirometry test
- Date of first spirometry test after first clinical suspicion of COPD

Comprehensive Assessment:
- Date of most recent assessment of disability
- Date of most recent assessment of risk of exacerbation of COPD
- Date of most recent assessment of comorbidities
- Date of most recent discussion of goals of care between physician/primary care team and patient (charted discussion)

Education and Self-Management History
- Prescence of written self-management plan
- Participation in an intervention to support self-management (Best Care COPD Program, Living Well with COPD, ect.)

Smoking Cessation and History
- Smoking Status and History
- Individuals who smoke actively have received:
    - A plan to promote smoking cessation from a health care professional
    - Counsel to promote smoking cessation
    - Pharmacological intervention to promote smoking cessation

Pharmacological Management of Stable COPD
- Presence of short-acting bronchodilator therapy
- Reception of long-acting bronchodilator therapy in moderate to severe COPD

- Reception of inhaled corticosteroid monotherapy
- Reception of assessment of medications in the past 12 months
- Assessment of inhaler technique yields correct use of inhaler device

Vaccination History

- Reception of influenza vaccination in past 12 months (seasonally adjusted)
- Received a pneumococcal vaccination

Specialized Respiratory Care

- Referral to specialized respiratory care when clinically indicated
- Number of days between referral for specialized respiratory care and first specialized respiratory care consultation
- If the patient has been seen by a Respirologist

Pulmonary Rehabilitation:

- Referred to a pulmonary rehabilitation program (if eligibility criteria are met)
- Eligible and begin pulmonary rehabilitation
- Begin and complete a pulmonary rehabilitation program (over 70% attendance).

Management of Acute Exacerbations of COPD

- Access to primary care provider or a health care professional in their care team within 24 hours of the onset of exacerbation

Follow up After Hospitalization for an Acute Exacerbation of COPD

- People hospitalized for COPD who had an in-person follow-up assessment within 7 days of discharge
- People hospitalized for COPD who had an in-person follow-up assessment in specialist care within 30 days of discharge
- People with COPD who visited an emergency department for COPD within 30 days of discharge for a previous hospitalization for COPD
- People readmitted to hospital for COPD within 3 months of discharge

Pulmonary Rehabilitation after Hospitalization for an Acute Exacerbation of COPD

- Individuals discharged from hospital after an admission for COPD who are referred to a pulmonary rehabilitation program
- Individuals discharged from hospital after an admission for COPD who started a pulmonary rehabilitation program within 1 month of discharge

Long Term Oxygen Therapy

- Individuals with stable COPD receiving long-term oxygen therapy whose oxygen saturation was measured with oximetry in the past 12 months
- Individuals with stable COPD receiving long-term oxygen therapy whose arterial blood gases were measured

- Individuals with stable COPD and at least one indication for long-term oxygen therapy who receive long-term oxygen therapy

DATA TO BE USED FOR THE FOLLOWING PURPOSE:

All collected data is to be used for an academic study. The study seeks to perform an evaluation of the care for Chronic Obstructive Pulmonary Disease (COPD) in a rural setting. The study will apply its use of all data according to the Health Quality Ontario: Quality Standards for Chronic Obstructive Pulmonary Disease document. The collected data falls directly in line with the quality statements defined within Health Quality Ontario documentation surrounding quality standards for COPD.

Data collected in the identifiers and demographic information section will be used by the study team to determine if any correlations can be drawn between age, disease severity, time since diagnosis and the number of quality standards received by the individual. Patient ID number will act as the studies master identifier and will be stored separately from the rest of the data collected.

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1. **I would like data to be searched on my practice: YES NO**

   ***If no, please sign the bottom and return to DATA SEARCHER**
   ***If yes, please continue to #2**

2. **PLEASE CHOOSE FROM THE OPTIONS BELOW:**

a) I would like to review the data generated from this search myself.

b) I give permission to the DATA SEARCHER and/or FHT admin staff to use this data as above.

c) I prefer that my own admin staff make use of this data as above.

I AGREE TO THE ABOVE CRITERIA OF DATA SEARCHING AS IT INVOLVES PATIENTS IN MY PRACTICE.

_____ _____ _____

Name (please print) **Signature** **Date**

6.3 Appendix 3. Research Ethics Board Approval Letter

Western Research

Date: 12 October 2021

To: Professor Marc Mitchell

Project ID: 118760

Study Title: Examining Primary Care of Chronic Obstructive Pulmonary Disease in Rural Ontario: A Retrospective Chart Review.

Application Type: HSREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 19/October/2021

Date Approval Issued: 12/Oct/2021

REB Approval Expiry Date: 12/Oct/2022

Dear Professor Marc Mitchell

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above mentioned study as described in the WREM application form, as of the HSREB Initial Approval Date noted above. This research study is to be conducted by the investigator noted above. **All other required institutional approvals and mandated training must also be obtained prior to the conduct of the study**.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
AC3R Data Master Link Table	Other Data Collection Instruments	25/Jun/2021	1
AC3R Search Authorization Form	Other Data Collection Instruments	26/Sep/2021	1.0
AC3R Index Revised wHQOnt	Other Data Collection Instruments	27/Sep/2021	2
Adapted Data Collection Tool Health Quality Ont.	Other Data Collection Instruments	27/Sep/2021	2
Revised Data Collection Decision Making Tool	Other Data Collection Instruments	27/Sep/2021	2
AC3R Protocol Revised	Protocol	28/Sep/2021	2

No deviations from, or changes to, the protocol or WREM application should be initiated without prior written approval of an appropriate amendment from Western HSREB , except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Please do not hesitate to contact us if you have any questions. Sincerely,

Ms. Jhananiee Subendran, Ethics Coordinator on behalf of Dr. Philip Jones, HSREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

6.4 Appendix 4. Maitland Valley Family Health Team Project Presentation Slides

8/29/23

1

Today's Agenda

- Project Background
- Study Objectives
- The Ask
- Questions

Western HealthSciences

2

Examining Primary Care of COPD in Rural Ontario: A Retrospective Chart Review

Western HealthSciences

Department of Kinesiology

3

Background

- 900,000 People with COPD in Ontario. (PHO, 2019)
- In rural Ontario, risk of developing COPD by age 80 is 32%. (Gershon, 2011)
- Those living in rural areas face barriers to care such as lower access to specialist care (3%), smoking cessation programs, pulmonary rehabilitation programs, and travelling greater geographical distances. (Cox 2017, Shah 2020, Brooks 2007, HQONT 2018, Bailunas 2020, Brundisini 2013)
- 80% Of COPD care is provided by the primary care physician. (Perez, 2012)

Western HealthSciences

4

Study Objectives

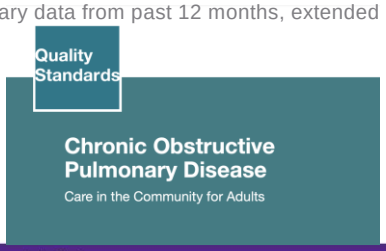
- Examine the current level of care patients with COPD are receiving from their primary care provider → Are Health Quality Ontario standards (HQONT) being met?
- Inform implementation of new pulmonary rehabilitation program → coming soon.
- Inform possible adjustments to care and policy at Maitland Valley Family Health Team (MVFHT).

Western HealthSciences

5

Study Design

- Retrospective chart review.
- Utilizing HQONT quality standards for COPD care.
- Examining 13 quality standards.
- Primary data from past 12 months, extended as needed.



Western HealthSciences

6

The Ask

- Access to your physician charts for our retrospective chart review of COPD care.
- Partnership for implementation of results.

Western HealthSciences

7

Questions?

Western HealthSciences

8

9

6.5 Appendix 5. Full List of Extracted Data from Electronic Medical Records

Sociodemographic characteristics	Health characteristics and QS indicators
• Age • Sex • Partial postal code (FSA) • Occupation/former occupation	• Spirometry test results • COPD diagnosis date • Date of most recent spirometry test • Number of days between first clinical suspicion of COPD and spirometry test • Assessment of disability in the past 12 months • Assessment of acute exacerbation risk in past 12 months • Charted discussion of goals of care • Patient seen by primary care provider for COPD within past 12 months • Participation in one or more interventions to support self-management • Presence of a written COPD self-management plan • Individuals who smoke created a plan to quit in the past 12 months • Received a counselling intervention to promote smoking cessation in the past 12 months • Received pharmacological intervention to promote smoking cessation in the past 12 months • Received short-acting bronchodilator therapy • Received long-acting bronchodilator if moderate to severe COPD (based on spirometry test results) • Received inhaled corticosteroid monotherapy • Assessment of inhaler medication use shows correct used of inhaled medication system • COPD medications have been reviewed in the past 12 months • Received influenza vaccination in past 12 months • Received pneumococcal vaccine • Seen by a Respirologist

	• Referred to PR (if moderate to severe COPD based on spirometry test results) • Completion of PR with greater than 70% attendance • Access to primary care provider or care team within 24 hours of exacerbation onset • Seen for follow-up assessment within 7 days of hospital discharge (related to COPD) • Seen for follow-up specialist care within 30 days of hospital discharge (related to COPD) • Visited an emergency department within 30 days of hospitalization (related to COPD) • Readmitted to hospital within 3 months of discharge from hospital (related to COPD) • Referred to PR Post discharge for hospitalization of COPD • Began PR within one month of discharge • Oxygen saturation measured with oximetry in past 12 months (for those receiving oxygen therapy) Arterial blood gas measured (for those receiving oxygen therapy).

6.6 Appendix 6. Interrater Reliability Reporting.

Quality Standard	Interrater Agreement Numerator/Denominator (%)	Description of discrepancy between independent extractors
QS #1	7/8 (87.5%)	Initial suspicion of COPD was identified at different timepoints between extractors in one case.
QS #2	14/21 (58.3%)	Issues with agreement between extractors on if assessments of acute exacerbation risk had been performed.
QS #3	15/16 (93.75%)	One extractor missed identifying the presence of a visit to primary care, in the past 12 months.
QS #4	13/16 (81.2%)	One extractor missed identifying participation in a self-management program on two occasions, because of this error the presence of a written self-management action plan was missed in one case.
QS #5	28/32 (87.5%)	One extractor incorrectly identified smoking status in one case, therefore there was a subsequent built-in discrepancy across the three smoking cessation standards and daily smoking status.
QS #6	35/40 (87.5%)	Three discrepancies between extractors on if medication reconciliation had been performed, two discrepancies on assessment of inhaler technique (one extractor missed the charted assessments as they were charted within the Best Care COPD program chart.
QS #7	16/16 (100.0%)	No discrepancies between extractors on vaccinations (influenza and pneumonia).

QS #8	11/16 (68.7%)	Four discrepancies between extractors on if a patient had clinical indications for referral to specialized respiratory care. One discrepancy on if patient had been seen by a Respirologist.
QS #9	19/19 (100.0%)	No discrepancies between extractors on pulmonary rehabilitation referral, program starts, and program completion rate.
QS #10	6/8 (75.0%)	Two discrepancies between extractors on if a patient who had experienced an exacerbation had access to care within 24 hours of exacerbation onset.
QS #11	31/32 (96.8%)	One discrepancy between extractors in identifying a return to the emergency department within 30 days of being discharged from hospital post-hospitalization for COPD exacerbation.
QS #12	15/15 (100.0%)	No discrepancies between extractors on referral to pulmonary rehabilitation post-hospitalization.
QS #14	18/24 (75.0%)	Two discrepancies in identifying eligibility for long term oxygen therapy (home oxygen), this discrepancy than carried over in the next two quality indicators creating 6 discrepancies.

Notes. QS = Quality Standard

6.7 Appendix 7. Comparison To Similar Literature

First, Lee *et al.* (2021) utilized a cross-sectional retrospective chart review study design with EMR data from 6995 Ontario patients to measure adherence to standard quality of care criteria for COPD management in primary care using primary care EMRs. The authors performed an assessment of COPD quality standards related to vaccination (influenza and pneumococcal), spirometry, inhaled medication prescriptions, long term oxygen assessment, referral to PR, and smoking cessation. Lee *et al.* (2021) reported levels of vaccine usage similar to that reported here. Influenza vaccine usage (60.5% Lee. *et al. (2021)* vs. 58.7%) and pneumococcal vaccine usage (66.0.% Lee. *et al. (2021)* vs. 67.5%). Spirometry use for the diagnosis of COPD was lower in Lee *et al.* (2021) than reported here (54.7% vs 72.1%, respectively). Prescription of both short- and long-acting bronchodilator inhalers were performed at a higher rate in the present study than found by Lee *et al.* (2021), short-acting bronchodilator prescription (73.4% Lee *et al.* (2021) vs. 80.0%) and long-acting bronchodilator prescription (76.9% Lee *et al.* (2021) vs. 85.3%). However, Lee *et al.* (2021) reported higher levels of smoking cessation interventions (64.3% Lee *et al.* (2021) vs. 21.2%). Lee *et al.* (2021) also found a higher rate of referral to PR (4.0% Lee *et al.* (2021) vs 0.0%). Second, Martinez *et al.* (2021) used a mixed methods approach (both retrospective EMR review combined with provider and patient surveys) with 150 U.S.-based patients to assess the quality of COPD care. Martinez *et al.* (2021) also implemented a webinar intervention to increase the rate that quality standards were being met. This was then assessed using a pre- and post-intervention phase. They assessed the rate of spirometry use, COPD symptom and comorbidity assessment, self-

management program participation, referral to PR, assessment of inhaled medication technique, and if inhaler technique was correct. Martinez *et al.* (2021) found that spirometry was not well utilized (13.0% Martinez *et al.* (2021) vs. 78.0%). COPD symptom assessments were performed at lower rate than found by Martinez *et al.* (2021), (35.0% Martinez *et al.* (2021) vs 31.9%). However, we found that assessments of COPD comorbidities were completed at a higher rate than by Martinez *et al.* (2021), (38.0% Martinez *et al.* (2021) vs. 88.3%). Martinez *et al.* (2021) reported a lower level of self-management program participation (23.0% Martinez *et al.* (2021) vs. 48.1%). Martinez *et al.* (2021) reported a higher level of referral to PR (2.0% Martinez *et al.* (2021) vs 0.0%). Assessments of inhaled medication delivery technique were found to be performed at a higher rate by Martinez *et al.* (2021) (35.0% Martinez *et al.* (2021) vs. 25.0%). Of the assessments of inhaler technique completed, Martinez *et al.* (2021) found that 30.0% of patients had correct inhaler technique when assessed. We found that 40% of patients had correct inhaler technique when assessed. Third, the retrospective EMR chart review study by Belletti *et al.* (2013) assessed three COPD care components ("diagnosis", "comorbid conditions", and "risk reduction") amongst 1517 U.S.-based patients. They reported a 10% higher level of smoking cessation usage (34.0% Belletti *et al.* (2013) vs. 23.8%), 17% lower level of pneumonia vaccine usage (51.0% Belletti *et al.* (2013) vs. 67.5%) and the same level of influenza vaccine usage (57.0% Belletti *et al.* (2013) vs. 58.8%). The overall rate at which quality standards were met reported by Belletti was 37.6% compared to 50.0% for the same care components in the present study. Fourth, the prospective cross-sectional study by Bourbeau *et al.* (2008) evaluated self-reported physician data from 1090 patients in Ontario and Quebec using the 2003 Canadian

Thoracic Society COPD guidelines – Recommendation for Management of COPD. They evaluated pharmacological treatment, spirometric confirmation of diagnosis and non-pharmacological management (i.e., smoking cessation counselling, influenza immunization and, referral to PR). Bourbeau *et al.* (2008) found that short-acting bronchodilators were well used (76.0% Bourbeau *et al.* (2008) vs. 80.0%). However, long-acting bronchodilators were less often used by comparison (41.9% Bourbeau *et al.* (2008) vs. 85.3%). Bourbeau *et al.* (2008) found that spirometry was used in over half of patients (58.9% Bourbeau *et al.* (2008) vs 72.1%). Smoking cessation interventions were found to be exceedingly well utilized by Bourbeau *et al.* (2008). They report that 94.8% of patients who smoke received smoking cessation interventions compared to 21.2% in the present study. Bourbeau also reported a higher level of referral to PR programing (7.8% Bourbeau *et al.* (2008) vs. 0.0%).

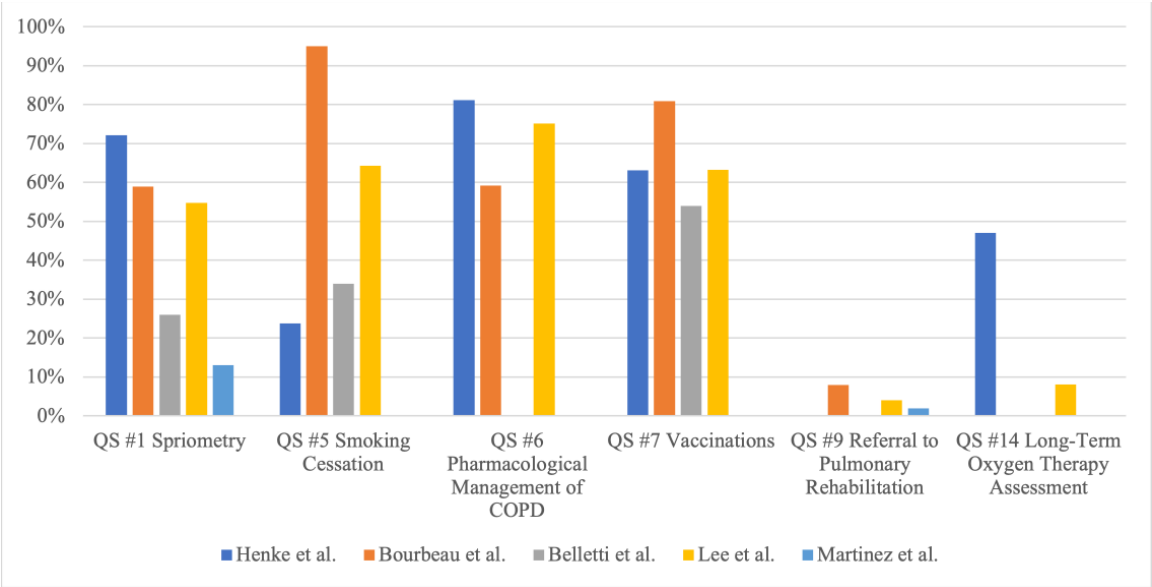


Figure 4. Proportion of patients in this study receiving Health Quality Ontario standard-level COPD care versus other similar studies.

Notes. QS = Quality Standard, COPD = Chronic Obstructive Pulmonary Disease. (Bourbeau et al., 2008), (Belletti et al., 2013), (Lee et al., 2021), (Martinez et al., 2021)

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