PERMANYER

The Canadian Cohort Obstructive Lung Disease (CanCOLD): New Insights for Primary Care Application

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ABSTRACT

The Canadian Cohort Obstructive Lung disease (CanCOLD) study was launched ten years ago, to provide insight on the natural course of chronic obstructive pulmonary disease (COPD). This project, unique on the world scene for its longitudinal evaluation, is based on random sampling of the population as opposed to more traditional cohorts built on convenience samples of clinical patients.

This comprehensive review article has elected to extract and collate from the set of Can-COLD substudies those findings and emerging discoveries that can serve to influence clinical practice, in particular, for primary care. We are presenting findings grouped around three aspects: prevalence of COPD, diagnostic performance, and impacts of COPD. Furthermore, the main results of these studies are supplemented by key messages.

From CanCOLD publications we have already learned much, with sufficient substantive data to warrant translation into our clinical practice, guidelines and health policies for the benefit of our COPD patients. (BRN Rev. 2019;5(4):249-62)

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INTRODUCTION

Stemming from the fact that there existed very few prospective and well-characterised population-based cohorts in chronic obstructive lung disease (COPD) to inform the medical community and provide substantive data for use in clinical practice with particular attention to the primary care setting, the Canadian Cohort Obstructive Lung Disease (CanCOLD) population-based study was launched almost ten years ago, to provide insight on the natural course of COPD and other related comorbid conditions.

The CanCOLD study takes its origin from the Burden of Obstructive Lung Disease (BOLD)[1], a cross-sectional, general population-based survey in 11,985 subjects from 17 cities/countries, describing the impact of COPD. No country other than Canada has taken the extra steps to further study the Canadian Obstructive Lung disease (COLD) cross-sectional/prevalence of COPD with a longitudinal design with prospective follow-ups, detailed assessments using questionnaires, as well as detailed measurements of lung function, cardiorespiratory exercise testing, computerised tomography (CT) scan imaging and biological sampling. Build on the original Vancouver site, COLD expanded initially by adding four additional cities including Montreal, and then again in 2009 to include a total of nine collaborating sites across six provinces in Canada for the implementation of the CanCOLD longitudinal prospective evaluation.

This project, unique on the world scene, is based on random sampling of the population as opposed to more traditional cohorts built on convenience samples of patients seen in a clinical setting. This distinctive feature makes CanCOLD the first population-derived COPD cohort for characterising the progression of the disease from normality, or at-risk because of smoking exposure, on to spirometrically-defined COPD, including mild and/or early disease through moderate disease. Another important feature lies in the geographic spread of its population sample including representation from a diversity of cities set in diverse regions, from coast to coast across Canada.

The CanCOLD initiative has been and continues to serve as a prime driver for training future generations of clinicians, researchers and highly qualified research staff. It has attracted the interest and support from many partners from governments, the industry or other national and international academic institutions to develop novel strategies for improving the diagnosis and care of COPD patients in Canada and worldwide. The multifaceted perspectives in the CanCOLD data set have to date inspired over 60 sub-studies conducted on issues ranging from characterisation of the disease and its trajectory to the assessment of comorbidities, patient exacerbations, symptom and burden of disease on the use and costs of health care services and workforce productivity. In particular, it has allowed us to better assess the diagnostic performance of COPD in Canada, serving to elaborate recommendations for earlier diagnosis of the disease and better guidance for clinical practice from primary care to secondary care settings.

While a comprehensive review of all pertinent data was beyond the scope of this manuscript, we have elected to extract and collate from the set of CanCOLD sub-studies those
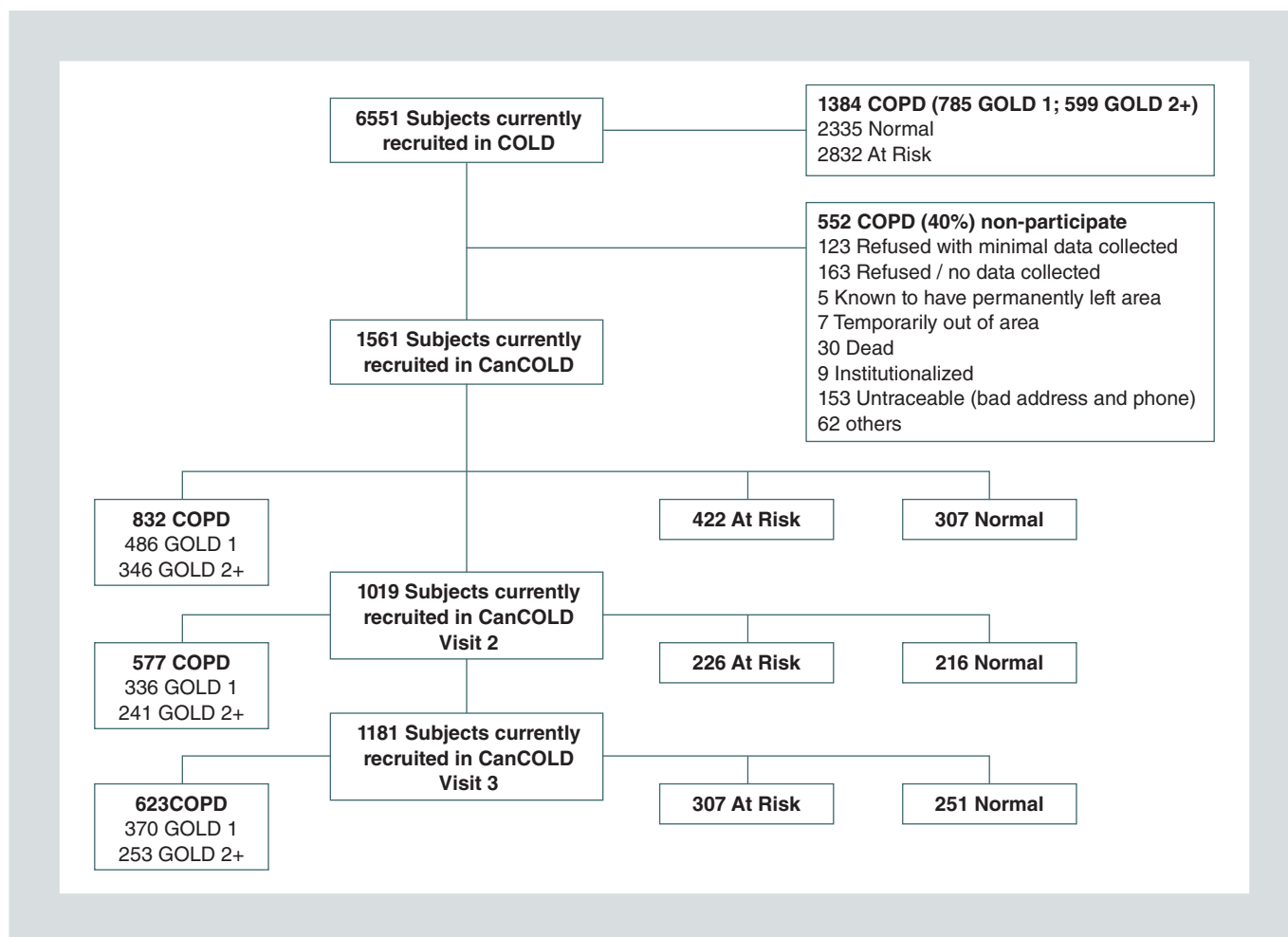
FIGURE 1. Flow diagram of the Canadian Obstructive Lung disease (COLD)/Canadian Cohort Obstructive Lung Disease (CanCOLD) study recruitment.
COPD: chronic obstructive pulmonary disease; GOLD: Global Initiative for Chronic Obstructive Lung Disease.

findings and emerging discoveries that can serve to influence and potentially change clinical practice with specific attention for its relevance to primary care practice for better disease management and patient wellbeing.

METHODS

In CanCOLD, individuals were recruited from the prevalence study COLD. The cross- sectional study COLD randomly sampled over 6500 individuals, non-institutionalised adults of ≥ 40 years old, from nine Canadian cities

(Fig. 1). The COLD study participants were contacted to participate in the CanCOLD longitudinal study if they had airflow obstruction based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria, i.e., the ratio forced expiratory volume in one second (FEV_1)/forced vital capacity (FVC) post bronchodilator < 0.70. Then non-COPD peers (sex- and age- matched ± 2 years) were recruited. More detailed information on the study protocol has already been published[2].

Figure 1 shows detailed information about the recruitment and the follow-up visits.
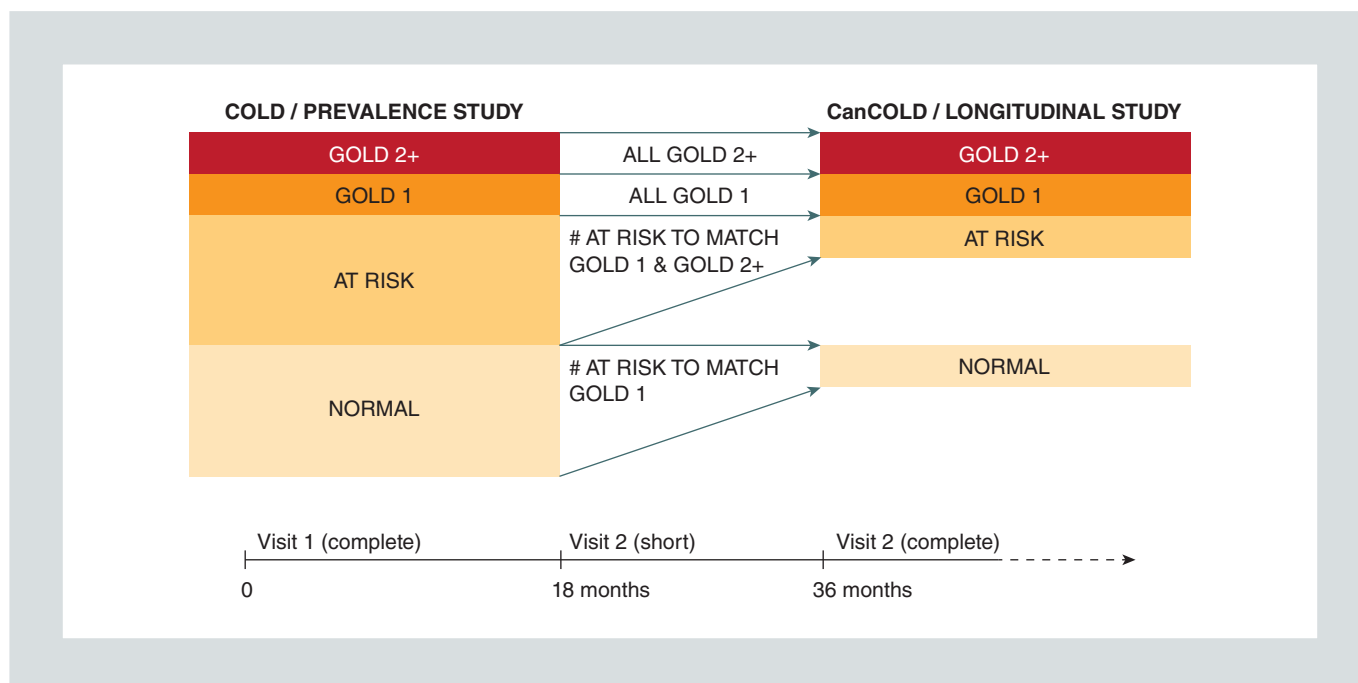
FIGURE 2. Canadian Obstructive Lung disease (COLD)/Canadian Cohort Obstructive Lung Disease (CanCOLD) study design and procedures. A complete visit includes: core questionnaires on symptoms, medication, work and exposures, co-morbidities, health-related quality of life, sleep habits, nutrition and physical activities, spirometry pre- and post- bronchodilator, computed tomography scan of the chest, cardiopulmonary exercise test and blood samples; a short visit includes: same core questionnaires, six-minute walking test, complete pulmonary function tests and blood samples (adapted from Bourbeau J, et al.[2] with permission from Tayylor & Francis Ltd.). GOLD: Global Initiative for Chronic Obstructive Lung Disease.

Among the 1384 COPD individuals in the COLD study, 832 (60%) responded favourably and were enrolled in CanCOLD. A total of 1561 individuals were recruited, 486 GOLD 1, 301 GOLD 2, 45 GOLD 3+, and 422 "at risk" (smoker or ex-smoker with normal spirometry) and 307 healthy individuals, i.e., never smoker with normal spirometry.

Participants in CanCOLD have been followed prospectively and were assessed at baseline (visit 1 between 2009-2015), after 18 months but not for the whole initial cohort (visit 2 between 2011-2015) and three years for the whole initial cohort (visit 3 between 2015-2019). The attrition rate at visit 3 is of $\cong$ 20%; 341 participants were lost in follow-up including 33 deaths. The most common reason for

"dropping out" is withdrawal, reflecting subjects voluntarily declining to participate further in the study.

Figure 2 shows the CanCOLD visits with detailed data collection including sociodemographic, clinical, comorbidities, medication, health status, lifestyle and smoking and occupation risk factors and measurements from spirometry and full pulmonary function tests, cardiopulmonary exercise tests, computed tomography (CT) scan of the chest and venous blood samples for blood counts, plasma, serum, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) analyses. Throughout the follow-up, a COPD exacerbation questionnaire that included questions on changes in respiratory symptoms adjustment and/or new medication
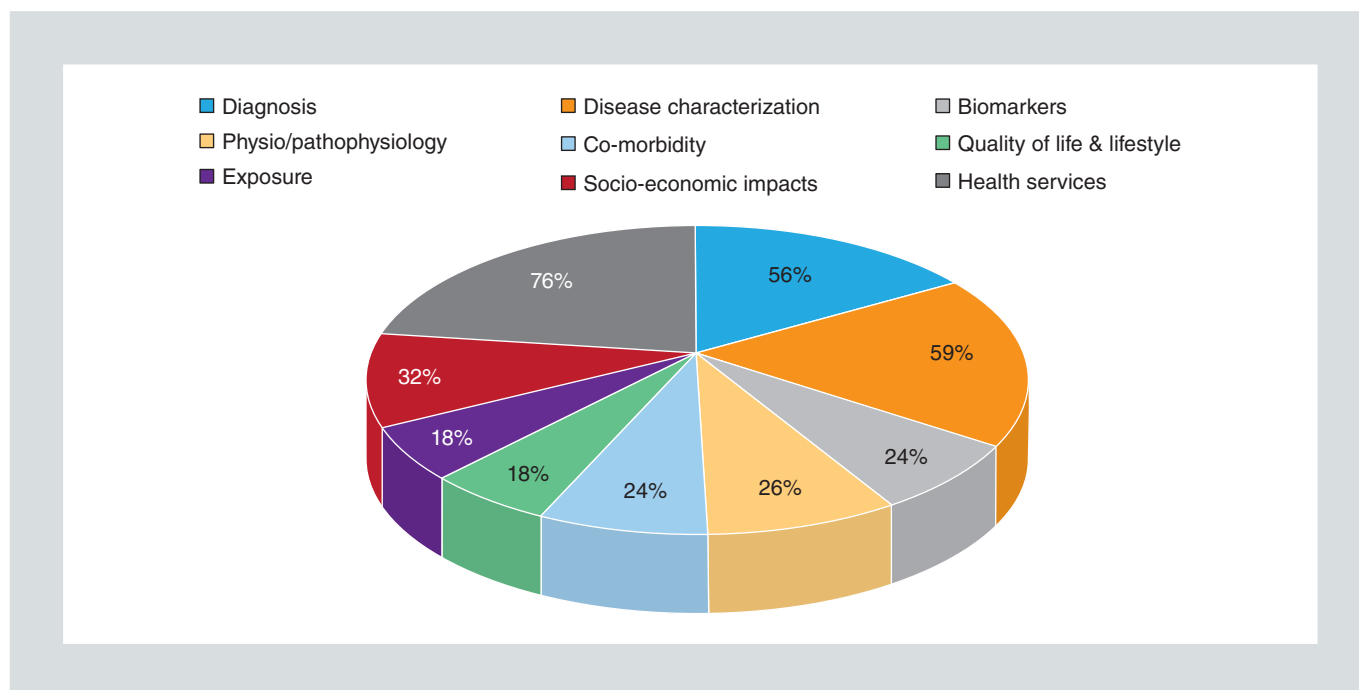
FIGURE 3. Canadian Obstructive Lung disease (COLD)/Canadian Cohort Obstructive Lung Disease (CanCOLD) research contribution domains.

and health service use (physician visits, emergency department visits and hospital admissions) was administered by telephone every three months. Finally, CanCOLD also gives the possibility to access provincial health administrative databases and confirm health service use.

RESULTS

Over the last decade, the comprehensive pan-Canadian multi-year cohort dataset has resulted in many COLD/CanCOLD-related peer-reviewed publications. To date, the publications have significantly advanced knowledge, contributing key findings serving as bases for emerging discoveries, approaches or technologies in a large number of domains (Fig. 3). In turn, the consolidation of these observations can translate into key messages for clinicians, industry partners and policymakers.

The largest contribution of COLD/Can-COLD-related publications may be seen to have advanced knowledge and understanding surrounding appropriate diagnostic approaches and disease characterisation with impact on recommendations for health care services and interventions. More specifically, the larger proportion of studies to date have served to appropriately quantify COPD prevalence and disease determinants[3,4] spirometry testing and prediction equations[5-9], diagnosis performance and early detection[10-15], novel methods of assessing COPD[16,17], and COPD clinical impact[18-22]. Consequently, we have elected for this manuscript to summarise key learnings from the CanCOLD study that are relevant to the primary care setting. These findings are grouped around three aspects: prevalence of COPD, diagnostic performance, and impacts of COPD (exacerbations, symptom burden and health-related quality of life). This is presented

TABLE 1. Emerging discoveries and key learnings that could change clinical practice

Discovery topic	Key learning for the physician
Prevalence of COPD	
Underdiagnosis in national surveys	Important to reaffirm the need for spirometrically measured prevalence as the benchmark for accurate national data on disease prevalence; COPD is a much larger health issue in developed countries than had been previously realised[3].
COPD in never-smokers	COPD in never-smokers represents a substantial health burden in the population requiring special attention in clinical practice; there are gender-specific differences in never smokers with COPD[4].
Diagnosis of COPD	
Diagnostic instability and reversals in mild COPD	More than a single post-bronchodilator spirometric assessment is necessary for diagnosing COPD, in particular for patients with mild airflow obstruction at baseline[10].
Debate around using the fixed ratio versus LLN	A diagnosis established by both a low FEV_1/FVC (according to fixed ratio and/or LLN) and a low FEV_1 is strongly associated with poor clinical outcomes[9].
COPD misdiagnosis	COPD misdiagnosis be "un" or "over" diagnosis contributes significantly to health care burden and should be given proper attention by the physician considering that proper treatment will have an impact on the patient and the health care system[13].
Impact of COPD	
Undiagnosed COPD and exacerbations	Despite experiencing fewer exacerbations, health care uses to treat "exacerbation-like events" in undiagnosed individuals with COPD is similar to that of diagnosed individuals. There is a missed opportunity by the physician to recognize these patients, make a diagnosis of COPD and treat them properly to prevent further exacerbations[20].
Symptom burden and quality of life	
CAT and mild COPD	CAT, originally designed for use in clinically symptomatic COPD patients, can also be used in individuals with mild airflow obstruction[19].
Importance of assessing symptom burden in mild COPD	In COPD individuals with mild airflow obstruction, those with a high symptom burden (CAT ≥10), experience increased work productivity loss (i.e. combined absenteeism and presenteeism) compared to COPD subjects with a low symptom burden (CAT <10), and non-COPD subjects[18].
Importance of psychological distress in COPD	Screening for psychological distress and developing interventions that target these health risk behaviours in this population may be important for improving management and outcomes of COPD, event those with mild to moderate disease[21].

CAT: COPD assessment test; COPD: chronic obstructive pulmonary disease; FEV_1: forced expiratory volume in one second; FVC: forced vital capacity; LLN: lower limit of normal.

in table 1 as a summary with overall key clinical messages.

Epidemiology "distribution and determinants" of chronic obstructive pulmonary disease

Despite the complexities inherent to the understanding of large health-related data sets, new approaches are emerging to enable more accurate estimates of COPD prevalence. Although cigarette smoking is the most studied risk factor for COPD, it is not the only risk factor. Recently, epidemiology studies have turned their attention to explore COPD in "never smokers".

Problem assessing the prevalence of COPD in national surveys. In the present population-based study CanCOLD[3], overall, 16.7% (95% confidence interval [CI] 14.8–18.7) of study subjects met the criteria for GOLD severity 1 or higher, based on the fixed ratio post-bronchodilator FEV_1/FVC. Prevalence of COPD varied by severity across sites (p=0.0025). However, after

age-sex adjustment, the variation disappeared (p>0.16). The spirometry-measured COPD prevalence was at least 2.0 times higher than the self-reported diagnosis in the same study and (three- to four-fold) higher than in national surveys.

Chronic obstructive pulmonary disease in never smokers. The occurrence of COPD in never-smokers has been recognised as a significant problem in developing countries and recently more attention has been given in developed countries. In CanCOLD, prevalence of COPD in never smokers was 6.4% and 15.2% in ever smokers; with "never smokers" accounting for 27% of all COPD subjects[4]. The common independent predictors were older age, self-reported asthma and lower education. In "never-smokers" a history of hospitalisation in childhood for respiratory illness was discriminative, while exposure to passive smoke and biomass fuel for heating were discriminative for women only. Furthermore, COPD in "never-smokers" and "ever-smokers" was characterised by increased respiratory symptoms, "respiratory exacerbation" events and increased residual volume/total lung capacity, but only smokers had reduced diffusing capacity for carbon monoxide divided by the alveolar volume (DLCO/VA) and emphysema on chest CT scans.

Diagnosis of chronic obstructive pulmonary disease

Spirometry should play the lead role in establishing a COPD diagnosis. The diagnosis is based on post-bronchodilator measurement of FEV_1/FVC, which is used to define expiratory airflow limitation. Two criteria have been used to diagnose COPD: 1) the fixed ratio, i.e., a post-bronchodilator FEV_1/FVC <0.70 or 2) the lower limit of normal (LLN) ratio, i.e., a post-bronchodilator FEV_1/FVC ratio < than the lower fifth percentile of the reference value matched to a healthy population.

Diagnostic instability and reversals of COPD diagnosis based on spirometric criteria. Diagnostic reversals of COPD (defined as a subject who met criteria for diagnosis of COPD at the study outset but whose spirometry had reversed to normal by the end of the study) occurred in the CanCOLD study in 27.2% (95% CI, 21.2–33.8%) of individuals from the beginning to the end of the 4-year study when the LLN criterion was used and in 21.5% (95% CI, 17.2–26.3%) when the fixed ratio was used[10]. The prevalence of both diagnostic instability and reversal was higher for subjects who entered the study with GOLD 1 severity than for subjects with GOLD 2 severity (19.7% versus 10.1%, p=0.001; 11.6% versus 4.8%, p=0.001, respectively).

Debate around using the fixed ratio versus LLN. The debate around the two main spirometric assessment criteria of the fixed ratio and the LLN for diagnosis of COPD has been ongoing for some time. The CanCOLD study provided us with a large population-based database to further explore the clinical relevance of these criteria in mild COPD[9]. Compared with peers who met neither criterion for airflow limitation, patients having airflow limitation based on fixed ratio only were significantly more likely to have physician-diagnosed wheeze (odds ratio [OR]=1.54) and cardio-vascular disease (OR=1.52). In contrast, patients who met both the fixed ratio and LLN criteria for airflow limitation were at significantly increased

risk for seven of the outcomes studied, with particularly strong associations seen for wheeze (OR = 3.25), chronic bronchitis (OR = 3.14), and chronic phlegm (OR = 3.04). Additionally, these patients meeting both criteria also had elevated risk when compared with peers meeting the fixed ratio criterion alone. The addition of a low FEV_1 (< 80% predicted) to either or both criteria greatly strengthened the associations; patients having such airflow limitation had 2 to 5 times higher odds of most adverse outcomes relative to counterparts having no airflow limitation.

Misdiagnosis of COPD and the use of health care services. Misdiagnosis of COPD, i.e., "un" and "over" -diagnosis, is considered to be a common problem and the impact on the health care system remains incompletely documented. Using CanCOLD and the provincial health administrative databases, it was possible to quantify the health services burden of undiagnosed and overdiagnosed COPD in a real-world[13]. Fourteen percent (13.7%) had undiagnosed COPD, 5.1% were over diagnosed, and 3.7% had correctly diagnosed COPD. Subjects with overdiagnosed COPD had significantly higher rates of hospitalisations, emergency department visits, and ambulatory care visits, and subjects with moderate-to-severe undiagnosed COPD had higher rates of hospitalisations, than subjects in the non-COPD population.

Impact of chronic obstructive pulmonary disease: exacerbations

The natural course of COPD is often disturbed by episodes of acute symptom worsening, known as exacerbations. Little is known about such events in individuals with undiagnosed COPD in the general population and their potential burden on the health care system.

Undiagnosed COPD and exacerbations. In a population-based study such as CanCOLD we have been able to assess undiagnosed COPD with results showing that two-thirds of subjects with spirometrically-defined COPD had not previously received a COPD diagnosis by a physician[20]. Overall, at least one exacerbation-like event was reported by 40% of the individuals in the diagnosed group and 22% in the undiagnosed group (p=0.001). For both subgroups, reporting exacerbation-like respiratory events was associated with lower health status. Factors associated with reporting exacerbation-like respiratory events only in undiagnosed subjects with COPD included decreased lung function, and reporting allergy and anxiety comorbidities; in diagnosed subjects with COPD it included increased dyspnoea, a history of exacerbation-like events at study entry, and reflux-heartburn. However, with respect to the burden of these exacerbations on the health care system, the proportion of hospitalisations, emergency department visits, and unscheduled doctor visits, were similar in individuals with undiagnosed and diagnosed COPD.

Impact of chronic obstructive pulmonary disease: symptom burden and quality of life

A personalised approach has been proposed by many national and international societies to initiate and escalate/de-escalate a patient's treatment based on their level of symptoms and risk for exacerbations. Symptom burden

is recommended to be assessed using different questionnaires. Because of its comprehensiveness, the COPD assessment test (CAT) stands as a favourite by many.

The CAT can be used in mild COPD. The CanCOLD study was used to assess how CAT can perform when it is used in mild COPD[19]. The majority of individuals (72.5%) were not previously diagnosed with COPD. The mean CAT scores were 5.8 ± 5.0, 9.6 ± 6.7 and 16.1 ± 10.0 for GOLD 1, 2, and 3 and higher, respectively. Higher CAT scores were observed in women, current smokers and ever-smokers, and in subjects with previous diagnosis of COPD. The CAT was also able to distinguish between subjects who experience exacerbations versus no-exacerbations.

Importance of assessing symptom burden in mild COPD. CanCOLD provides a comprehensive overview of work productivity loss (absenteeism and/or presenteeism) among a representative population-based sample of individuals with mild-to-moderate COPD[18]. Work productivity loss in subjects with a high symptom burden (CAT ≥ 10) was about 3-fold higher than in COPD subjects with a low symptom burden (CAT < 10) and in non-COPD subjects. Among the COPD subjects reporting presenteeism, the most frequent type of impairment reported was a difficulty in concentrating (64%) and a slower than usual pace at work (64%), followed by difficulties making decisions (57%), postponement of work (36%) and the need for assistance (21%).

Importance of psychological distress in COPD. The CanCOLD study has assessed relationships between levels of psychological distress (depression, anxiety) and poor health behaviours (smoking, reduced physical activity) in individuals with and at risk for COPD[21]. Psychological distress was measured with the Hospital Anxiety and Depression Scale (HADS-A or HADS-D), higher scores defining more disorders. Behaviours included patient self-reports of physical activity level measured by the Community Healthy Activity Model Program for Seniors (CHAMPS) questionnaire, and of pack-years smoking. Results showed elevated depression (HADS-D) in individual with GOLD 3 compared to those with GOLD 1 and 2, and those not categorised as having GOLD score. No effect was seen for HADS-A. Current smoking status was associated with both increased HADS-D and HADS-A. The highest scores were observed in current smokers, and these were significantly higher than scores for never and ever (past) smokers. As well depressive and anxiety symptoms were higher in individuals with lower levels of physical activity.

DISCUSSION

Clinically relevant new insights from the COLD/CanCOLD study have been expressed with respect to several aspects including the prevalence of COPD, COPD in never smokers, COPD diagnosis using spirometry, COPD misdiagnosis and health care burden, undiagnosed COPD, exacerbations, symptom burden and health status evaluation to personalised treatment in COPD.

A key advantage of CanCOLD is that it uses the same sampling methodology for prevalence assessment as the multinational BOLD study, which was applied across over 25 studies worldwide. This allows for interpretation

of results not only across Canada but also for their extrapolation to the rest of the industrialised countries. The extent to which results apply to other countries, may be dependent on the degree of similarity in health service organisations and health care access. If we consider that Canada has public and free access to health care for the whole population, the results seen from CanCOLD are not likely to be overestimated compared to other countries with private and/or public-private mixed system. Similarly, implementation of new knowledge into practice can apply differently depending on the country and health care organisation.

The *problem of assessing prevalence of COPD* by self-reported diagnosis compared with objective spirometrically-defined COPD should be given proper attention in every country. The real prevalence of COPD is much higher than previously estimated by national surveys; there is an underappreciation of the importance of this disease from the public health and from the health care system perspectives.

"Never-smokers" and "ever smokers". Although smoking still remains the major risk factor, *"never-smokers"* particularly in women account for nearly 30% of the total burden of COPD in developed countries such as Canada. Thus, physicians should be aware of an increased risk of COPD in "never smokers" reporting a diagnosis of asthma and severe childhood respiratory disease. Our observations also indicate a particular role for passive smoking and exposure to biomass fuel heating as independent factors for COPD, mainly in women. More targeted studies are of course needed to assess the role of other risk factors, including air ambient pollution.

Diagnosis of COPD requires the use of spirometry. It is essential for a family physician to confirm a suspected diagnosis of COPD with spirometry. However, there is considerable variability of spirometry results around the FEV_1/FVC threshold and a single spirometric assessment may not be reliable for diagnosing COPD, particularly in patients with mild airflow obstruction. The GOLD 2019 Update has recommended that an assessment of the post-bronchodilator FEV_1/FVC ratio should be confirmed by a repeat spirometry on a separate occasion if the value is between 0.60 and 0.80, because the ratio may change as a result of biological variation when measured at a later interval. Findings however indicate that if the initial post-bronchodilator FEV_1/FVC ratio is less than 0.60 it is very unlikely to rise above 0.70 spontaneously.

Diagnosis using fixed ratio versus LLN is still a matter of a debate although many national and international societies have recommended using the fixed ratio for symptomatic patients seen in a clinical setting. We have demonstrated in CanCOLD that, from a population perspective, patients meeting either criterion for spirometric confirmation of airflow limitation (fixed ratio or LLN) and in addition having a low FEV_1 are the most likely to experience poor outcomes. Physicians should be giving special attention to these patients because they also have increased risk of cardiovascular disease. However, recently from a pool cohort analysis, it has been shown that defining airflow limitation as fixed ratio provide discrimination of COPD-related hospitalisation and mortality that was not significantly different or was more accurate than LLN[23]. These results support the use of fixed ratio less than 0.70 to

identify individuals at risk of clinically significant COPD.

The *burden on health service uses of undiagnosed and overdiagnosed COPD* should be given full attention by physicians in their practice. New knowledge from CanCOLD allowed us to quantify the burden of COPD misdiagnosis, which is quite common, on health services. For patients who are overdiagnosed, in addition to the health services they are receiving for their presumed COPD, their true condition is untreated or undertreated, which is problematic because patients therefore also remain symptomatic. For many, this condition is likely a restrictive lung condition or reactive airways disease, as suggested by other spirometry values. Encounters for cardiac disease may be opportunities to correct the misdiagnosis of COPD. Collectively, these results should serve to advocate for the implementation of strategies to decrease the burden of respiratory disease.

Undiagnosed COPD and exacerbations are under-recognised by physicians and these represent a missed opportunity to diagnose COPD and treat the underlying disease.

Emphasis has been given primarily once COPD has been diagnosed to assess the risk of future exacerbations. Physicians should be giving more attention to any exacerbation-like respiratory events seen in an emergency setting; CanCOLD has shown that these events have substantial impact on health service in individuals with undiagnosed COPD. This is especially important when considering that these are often treated as isolated acute events without awareness of the need for future management of underlying COPD. If these patients were recognised as having COPD, providing proper preventive therapy would have the potential to reduce or prevent complications, such as emergency department visits and hospital admissions.

Symptom burden assessment (using either the modified Medical Research Council questionnaire [mMRC] or CAT) is now recognised as essential in the evaluation of the COPD patient and in the elaboration of a personalised treatment approach. Two measures to assess symptom burden are most widely used, the mMRC that assess dyspnoea and the CAT an 8-item uni-dimensional measure of health status impairment in COPD. Considering that COPD impacts patients beyond just dyspnoea, a comprehensive assessment of symptoms such as CAT is now recommended rather than a simple measure of breathlessness. The CAT can be used in primary care in individuals with mild disease as CAT scores are higher in individuals with worsening airflow limitation and in those with exacerbations. It has been recommended that a symptom score of 10 for the CAT (equivalent to St. George's Respiratory Questionnaire [SGRQ] score ≥ 25) should be used as the threshold for considering regular treatment for symptoms including breathlessness[24,25]. Until recently, substantive evidence for the CAT threshold ≥ 10 for treatment recommendations was lacking. Using the CanCOLD study we have demonstrated through the assessment of symptom burden of COPD using the CAT scores that a high symptom burden i.e. a CAT ≥ 10 was associated with experiencing increased losses in work productivity (i.e., combined absenteeism and presenteeism). These patients in clinical practice should be given more attention and treated

appropriately with maintenance long-acting bronchodilators.

Importance of psychological distress in COPD has been recognised in previous studies. Of note, the CanCOLD longitudinal study is the only one to date to assess the association between symptom levels of psychological distress and health behaviours such as smoking and physical activity among patients with or at risk for COPD. Like other studies, CanCOLD showed that higher symptoms of depression and anxiety were related to higher smoking volume and lower levels of physical activity. Screening for psychological distress and developing interventions that target these health risk behaviours in this population may be important for improving management and outcomes

The results from selected published peer-reviewed articles resulting from CanCOLD longitudinal study or related ancillary and sub-studies have been presented in this review within the context of wide-ranging categorical descriptors based on parameters related to study goals, general or clinical application, emerging research questions or message outcome. The largest contribution of CanCOLD-related publications may be seen to have advanced our understanding of appropriate diagnostic approaches and disease characterisation with impact on recommendations for health care services and interventions. More specifically, the larger proportion of studies to date have served to appropriately quantify COPD prevalence, providing indications for better assessment and diagnosis performance, approaches for early detection, normative data and advice for interventions in primary and secondary care. These findings have also enabled to

report on psychosocial correlates of COPD such as quality of life and psychological wellbeing in its various phases of development and its impacts in terms of absenteeism and workforce contributions

From CanCOLD publications we have already learned much, with sufficient substantive data to warrant translation into our clinical practice, guidelines and health policies for the benefit of our COPD patients.

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