Practical Approaches to Identifying Early Chronic Obstructive Pulmonary Disease

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Identifying patients with chronic obstructive pulmonary disease (COPD) at the earliest possible stage can achieve the best symptom control, disease progression and outcomes in COPD. However, in clinical practice, the ability to identify individuals at risk of progressing from early disease to clinically severe disease remains limited. Early COPD does not necessarily predict the progression to pre-COPD, mild COPD, preserved ratio with impaired spirometry or even Global Initiative for Chronic Obstructive Lung Disease (GOLD) 0 COPD. Early COPD should be recognized in adults younger than 50 years with a smoking history of more than 10 pack-years and who met one or more of the following criteria: (1) a forced expiratory volume in 1 second (FEV_1)/forced vital capacity ratio below the lower limit of normal after the use of bronchodilators, (2) compatible computed tomography abnormalities (visual emphysema, air trapping or bronchial thickening of a moderate or worse grade) and/or (3) evidence of a rapid decline in FEV_1 of more than 60 mL/year. However, there are critical issues that contradict these criteria. As a result, other features have been proposed as indicators of early COPD. Although primary care clinicians play a key role in the early identification of asymptomatic people at risk, some experts oppose the detection of COPD in its early stages as it is not a disease and does not need to be identified or treated. Nevertheless, health authorities in several countries believe that COPD should be detected as early as possible and therefore fully support the intervention of trained general practitioners in the early detection of COPD.

Keywords

Chronic obstructive pulmonary disease (COPD), early COPD, latent COPD, mild COPD, pre-COPD, preserved ratio with impaired spirometry (PRISm), young COPD

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Approximately half of all smokers will develop chronic obstructive pulmonary disease (COPD), with a disease progression over several years before the spirometric threshold for diagnosis is reached.[1] There is, therefore, a clear benefit in identifying patients with COPD as early as possible. Early detection, diagnosis and maintenance treatment of COPD, along with smoking cessation and exercise, may help to achieve the best symptom control, disease progression and outcomes in COPD.[2]

However, identifying people at risk of progressing from early stage to severe COPD remains a challenge in clinical practice.[1] Although up to 85% of patients present to primary care clinicians for lower respiratory symptoms within 5 years of being diagnosed with COPD, many cases of COPD remain undiagnosed.[3] This is often due to under-recognition of mild (dyspnoea) or non-specific (fatigue) symptoms.[4]

To overcome this problem, an integrated approach to COPD diagnosis incorporating environmental exposures, clinical signs, computed tomography (CT) imaging and spirometry as disease markers was proposed.[5] Environmental exposures included current and past cigarette smoking and occupational and environmental exposures. Clinical symptoms considered included chronic bronchitis and dyspnoea, graded according to the modified Medical Research Council (mMRC) scale, with a grade of 2 or higher indicating significant dyspnoea.[6] Imaging studies played a crucial role, with criteria such as the presence of emphysema greater than 5%, airway wall thickening or gas trapping greater than 15%. Spirometry results were also integral, with a forced expiratory volume in 1 second (FEV_1) of <80% of the expected value or a ratio of FEV_1 to forced vital capacity (FEV_1/FVC) of <70% indicative of airflow obstruction. By incorporating a growing number of features such as these, a classification system was developed to improve diagnostic accuracy. This approach allowed the diagnosis of 'possible COPD' (requiring two disease features), 'probable COPD' (requiring three disease features) and 'definite COPD' (requiring all four disease features), providing a comprehensive framework for the diagnosis and classification of COPD.

However, routine spirometry is generally not recommended for people who do not have symptoms suggestive of COPD, such as progressive dyspnoea, persistent cough or sputum production.[4] This is because asymptomatic or minimally symptomatic individuals with mild airflow limitation are usually considered unlikely to benefit from treatment.[4] In addition, people in the early stages of COPD often do not have a low FEV_1/FVC ratio, which is the current criterion for airflow obstruction.[7] Instead, they may experience airway or alveolar inflammation along with significant symptoms and

disease progression before meeting the traditional definition of airflow limitation and COPD based on an FEV_1/FVC decline.

Nevertheless, identifying the early stages of COPD is of paramount importance, especially in individuals at an increased risk of rapid disease progression. In line with this, the recent US Preventive Services Task Force recommendation and the Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2023 strategy support case finding as an approach to the early detection of COPD.[8,9]

Early chronic obstructive pulmonary disease

Currently, there is no global consensus on the definition of early COPD. The GOLD 2023 executive summary states that

"the word 'early' means 'near the beginning of a process'. Because COPD can start early in life and take a long time to manifest clinically, identifying 'early' COPD is difficult. Further, a biological 'early' related to the initial mechanisms that eventually lead to COPD should be differentiated from a clinical 'early', which reflects the initial perception of symptoms, functional limitation and/or structural abnormalities noted".[9]For this reason, it is suggested that the use of the term 'early COPD' is restricted to discussions of the 'biological' early stages of the disease in a research setting.[9]

The term 'early' in the context of COPD refers to a phase in the natural history of the disease prior to clinical manifestation or full development of its effects, rather than to a specific clinical stage. It has been correctly emphasized that 'early COPD' refers to the biological initiation of the disease, which poses significant challenges in its identification in individual patients. This distinction should not be confused with the concept of 'mild COPD', which refers to the severity of the disease, typically assessed by the degree of airflow limitation (*Table 1*).[10] Consequently, the presence of early COPD does not necessarily imply the presence of mild COPD.[11]

Patients are often categorized as having mild COPD if they exhibit obstruction characterized by an FEV_1 of ≥80% predicted.[12] However, despite this mild obstruction, they may still experience severe symptoms, physiological decline, emphysema and recurrent exacerbations.[4] Therefore, relying only on lung function to define mild COPD overlooks the critical factors related to disease severity.[13] According to the Latin American COPD guidelines (EPOC-ALAT), mild COPD is described as patients with grade 0–1 mMRC dyspnoea, FEV_1 >80% and no exacerbations.[14] In contrast, the GOLD strategy specifies that the term mild COPD should strictly refer to the severity of airflow obstruction as measured by spirometry.[9] Most patients with mild airflow limitation typically fall into category A of the GOLD staging system, but occasionally, those with mild COPD may fall into one of the new GOLD ABE categories.[9,12] In addition, some people may have had the disease for several years, even if it remains at a mild stage.[1]

Some researchers propose to consider the population at risk of developing COPD previously referred to as 'GOLD 0 COPD'.[15] This group includes individuals exposed to COPD risk factors who have normal spirometry but experience chronic symptoms such as cough, sputum production and/or dyspnoea.[16] However, the prevailing consensus now advocates the use of the term 'pre-COPD' to refer to individuals in whom spirometry does not detect airflow limitation but there is a likelihood of disease progression leading to overt airflow obstruction without intervention.[17]

To identify individuals at risk of developing chronic airflow obstruction, GOLD has introduced the term 'pre-COPD' for symptomatic non-obstructive individuals and proposed the term 'preserved ratio with impaired spirometry' (PRISm).[9,18] Patients with symptoms such as chronic cough and sputum production together with structural (mainly observed by CT) or physiological abnormalities (e.g. low initial lung function followed by a rapid decline, defined as an average annual decline in FEV_1 >40 mL and reduced carbon monoxide diffusing capacity) are classified as pre-COPD, while individuals with a normal FEV_1/FVC ratio (>0.70) but low FEV_1 (<80% predicted) are labelled as patients with PRISm.[19–21] PRISm is associated more with respiratory symptoms, lower exercise tolerance and a higher rate of hospitalizations compared with healthy controls.[22,23] Notably, a significant percentage of people classified as pre-COPD or PRISm will eventually develop obstructive spirometry, although not all individuals in either group will show this progression.[9] In addition, some people with PRISm may also demonstrate restrictive ventilatory abnormalities (FEV_1/FVC >0.70 and FVC <80% predicted).[9]

Table 1: A brief overview of the definitions of early COPD, mild COPD, pre-COPD, GOLD 0 COPD, latent COPD and PRISm

Classification	Definition
Early COPD	Represents the initial stages of COPD, typically characterized by the onset of pathological or functional changes before the manifestation of significant airflow limitation as measured by spirometry
Mild COPD	Refers to a stage of COPD where the lung function is only minimally impaired, usually characterized by an FEV_1 of ≥80% predicted and an FEV_1/FVC ratio of <0.70
Pre-COPD	Denotes individuals who have not yet developed airflow limitation as detected by spirometry but exhibit symptoms, structural abnormalities or physiological changes that indicate a predisposition to developing COPD in the future
GOLD 0 COPD	Refers to individuals with chronic respiratory symptoms (e.g. cough, sputum production and dyspnoea) and risk factors for COPD, but normal spirometry results. These individuals may represent the preclinical stage of COPD, indicating susceptibility to future airflow limitation and the development of overt COPD
Latent COPD	Describes individuals with structural and/or functional changes indicative of COPD, such as emphysema or reduced lung function, but who do not yet exhibit significant symptoms or airflow limitation as detected by spirometry
Young COPD	Refers to individuals who develop COPD at a relatively young age, typically before the age of 50 years. These individuals often exhibit symptoms and manifestations of COPD earlier in life than the typical onset age for the disease. They may present with characteristic symptoms, such as cough, sputum production, dyspnoea and reduced lung function. Additionally, young patients with COPD may have unique risk factors, such as early-life exposure to environmental pollutants, occupational hazards or genetic predispositions that contribute to the development of COPD at a younger age
PRISm	Describes individuals with preserved ratio but impaired spirometry, who have a normal FEV_1/FVC ratio (>0.70) but a low FEV_1 (<80% predicted), indicating possible early COPD characterized by symptoms, reduced lung function and increased risk of progression to overt airflow obstruction

COPD = chronic obstructive pulmonary disease; FEV_1 = forced expiratory volume in 1 second; FVC = forced vital capacity; GOLD = Global Initiative for Chronic Obstructive Lung Disease; PRISm = preserved ratio with impaired spirometry.

As a substantial proportion of patients with pre-COPD will not progress to overt COPD, the term 'latent COPD' seems more appropriate for those with structural and/or functional changes and no or minimal symptoms. Indeed, the term 'latent' better describes the ongoing dynamic process than 'pre-COPD', which may not give patients and clinicians certainty about the presence or absence of disease.[24] It is natural to ask whether pre-COPD/latent COPD corresponds to 'possible COPD'.

Given that a significant number of patients with pre-COPD may not progress to overt COPD, the term 'latent COPD' seems more appropriate for those who have structural and/or functional changes with little or no symptoms. Indeed, 'latent' more accurately reflects the ongoing dynamic nature of the process than 'pre-COPD', which may not provide patients and clinicians with certainty regarding the presence or absence of disease.[24] There is a natural tendency to question whether pre-COPD/latent COPD corresponds to the concept of 'possible COPD'.

However, efforts have been made to define and identify the 'at-risk' group in operational terms for research purposes.[25]

How to identify early chronic obstructive pulmonary disease

To date, there is limited evidence indicating the characteristics that are more prevalent in individuals who will develop airflow obstruction or in identifying clinically relevant subtypes of COPD at an early stage. *Table 2* offers a concise overview of emerging methods for detecting early COPD, outlining their respective advantages and disadvantages.

One suggestion is to recognize early COPD in adults under 50 years old with a smoking history exceeding 10 pack-years and exhibiting one or more of the following traits: (1) an FEV_1/FVC ratio below the lower limit of normal (LLN) after the use of bronchodilators, (2) observable CT abnormalities (such as visual emphysema, air trapping or moderate-to-severe bronchial thickening) and/or (3) evidence of a rapid decline in FEV_1 of more than 60 mL/year.[25,26]

Using the two spirometric criteria for early COPD proposed by Martinez et al., a comprehensive retrospective analysis was performed on data from 13,010 consecutive subjects under 50 years of age, all of whom

Table 2: An overview of new methods for detecting early COPD, along with their advantages and disadvantages

Detection method		Advantages	Disadvantages
Pulmonary function tests	Spirometry	- Is a well-established diagnostic tool for assessing airflow limitation and severity of COPD	- May not detect early-stage COPD in some individuals
		- Can identify airflow obstruction and assess lung function	- Interpretation may require specialized training
		- Provides quantitative measures of lung function	- Variability in test results due to patient cooperation and technique
	IOS	- Does not require forced breathing maneuvers, making it suitable for all age groups	- Not as widely available as spirometry, may require specialized equipment
		- Measures resistance and reactance, providing additional insights into lung function	- Requires expertise in interpreting oscillometric parameters
		- Sensitive to changes in small airways, which may occur early in COPD	- Initial setup cost and maintenance may be higher compared to spirometry.
		- Can be performed even in patients who have difficulty performing spirometry	- Interpretation may vary based on available reference data
		- Requires minimal patient effort, making it suitable for routine use in clinical settings	- Some populations, such as young adults, may have less established normative data
			- IOS only measures impedance and hyperreactivity of the lung as a whole, rather than specific areas, and is therefore unable to assess changes in lung function over time
Chest CT imaging		- Can detect structural abnormalities and emphysema early	- Radiation exposure
		- Provides detailed imaging of lung tissue	- Costly
		- Can identify small airway dysfunction	- Requires specialized equipment and expertise
		- Useful for identifying individuals at risk for rapid decline in lung function	- Limited availability in some healthcare settings
Biomarker analysis		- Provides objective measures of disease activity	- Limited availability of validated biomarkers
		- Can detect early biochemical changes indicative of COPD progression	- Some biomarkers may lack specificity or sensitivity
		- Potential for early intervention based on biomarker results	- Interpretation may vary among different laboratories
			- Not suitable for routine screening due to complexity and costliness
AI and machine learning		- Offers potential for automated interpretation of imaging and biomarker data	- Reliance on accurate and comprehensive data for training AI models
		- Can analyze large datasets for patterns and trends indicative of early COPD	- Risk of bias or inaccuracies in AI algorithms
		- May help improve diagnostic accuracy and efficiency	- Limited generalizability across diverse populations and healthcare settings
		- Facilitates early detection and intervention	

AI = artificial intelligence; COPD = chronic obstructive pulmonary disease; CT = computed tomography; IOS = impulse oscillometry.

had undergone current and three previous spirometry tests.[25] The study focused specifically on current smokers with a history of ≥10 pack-years.[27] Early COPD was stratified into three different subtypes: type 1, characterized by FEV_1/FVC < LLN and FEV_1 decline <60 mL/year; type 2, indicated by FEV_1/FVC ≥ LLN and FEV_1 decline ≥60 mL/year and type 3, defined by FEV_1/FVC < LLN and FEV_1 decline ≥60 mL/year. The analysis revealed associations between certain factors and the incidence of different types of early-stage COPD. In particular, a history of elevated body mass index (BMI) and low physical activity correlated with a higher prevalence of early-stage type 2 COPD, while a history of asthma was associated with an increased prevalence of type 3 COPD.[27]

Regardless of the absence of airflow obstruction, patients often have evidence of gas trapping, indicating small airway dysfunction (SAD), which is known to precede the onset of emphysema.[28] Notably, approximately 25% of small airways are already compromised in GOLD 1 disease compared with GOLD 0.[28] Therefore, it is not surprising that nearly 43% of smokers with preserved lung function, as observed in the Genetic Epidemiology of COPD (COPDGene) study, a multicenter observational study designed to identify genetic factors associated with COPD, have chest CT lesions.[29] Thus, even when lung function initially appears normal, CT abnormalities can serve as valuable indicators to identify individuals at risk of a rapid decline in lung function.[30] Recent advances have used CT-derived volumes at baseline, including total lung capacity (TLC_{CT}), functional residual capacity (FRC_{CT}) and the ratio of FRC_{CT} to TLC_{CT}, to identify 'susceptible smokers' who are prone to progress to spirometric COPD and have a decline in the FEV_1/FVC ratio.[31] These lung volume indices have been shown to be instrumental in predicting the rate of spirometric progression and symptom severity in early COPD by distinguishing different physiological and radiographic phenotypes of the disease in tobacco-exposed individuals with intact spirometry.[31]

However, it has been emphasized that because the pathogenesis of COPD can begin at any age and early COPD can theoretically manifest in individuals over 50 years of age, a diagnosis of early COPD could be made in people of any age who have pathological (e.g. emphysema) or functional signs of COPD in the lungs without yet demonstrating significant airflow limitation on spirometry.[32]

GOLD prefers to use the term 'young COPD' to refer to patients with COPD aged between 20 and 50 years.[7] Young patients are not asymptomatic, have a higher symptom burden and poorer health-related quality of life and experience a significantly higher number of exacerbations than older patients with COPD.[33] They also often experience a more rapid decline in FEV_1 and are more likely to be active smokers.[33–35] However, it is worth noting that between 13.7 and 35.3% of patients with COPD may have no symptoms at all.[36,37] It is fundamental to recognize that overall, the complex interplay of genetic, environmental and lifestyle factors contributes to the heterogeneity observed in the trajectories of different forms of early COPD (*Table 3*). Nevertheless, patients with airflow obstruction often share symptoms and health outcomes with individuals at risk who have normal spirometry results.[38] Interestingly, a recent review of the literature found a shift in the age of recruitment for early detection of COPD from 50 to 35 years.[3]

There are several critical issues with the Martinez definition.[25] First, LLN is determined before bronchodilator inhalation, whereas the definition states otherwise. In addition, FEV_1 may decrease during acute lung inflammation but rebound afterwards, leading to potential misinterpretation. The acceptable threshold for abnormalities detected by CT remains unclear. In addition, a significant proportion of adult patients with COPD progress without a rapid decline in lung function, highlighting the complexity of disease progression. Symptomatology, including cough or sputum production, should also be assessed as it is an essential basis for the diagnosis of COPD.[39] In addition, other risk factors, such as exposure to biomass fuels (e.g. wood, charcoal or crop residues), which are particularly relevant for non-smokers and in low- and middle-income countries, need to be considered in COPD case finding.[36]

An alternative perspective suggests that the study of tobacco exposure is of paramount importance in the study of COPD. Smoking significantly influences the natural history of the disease. Young adults with early signs of COPD (i.e. those with FEV_1/FVC < LLN and age <50 years) are at an increased risk of developing clinical COPD depending on their history of tobacco use.[40] Techniques, such as impulse oscillometry (IOS)

or parametric response mapping on chest CT scans, have been used to detect SAD, revealing its presence before the onset of emphysema.[41–43] 'Functional' SAD, defined by voxels less than -856 Hounsfield units on the expiratory scan and greater than or equal to -950 Hounsfield units on the inspiratory scan, can be quantified using advanced analytical methods applied to chest CT images.[44] These imaging abnormalities can

Table 3: Hypothetical trajectories outlining different forms of early COPD

Forms of early COPD	Initial phase	Subsequent phases	Progression
Smoking-induced early COPD	Preclinical phase with chronic respiratory symptoms, such as cough, sputum production and dyspnoea despite normal spirometry	Mild airflow limitation with an FEV_1/FVC ratio below normal but FEV_1 ≥80% predicted	Moderate-to-extremely severe COPD with an accelerated lung function decline
Occupational exposure-induced early COPD	Exposure to occupational hazards, leading to early respiratory symptoms	Respiratory symptoms persist and worsen, accompanied by early airflow limitation despite the cessation of exposure	Progression to moderate or severe COPD due to continued decline
Genetic predisposition-induced early COPD	Onset of COPD at a younger age due to genetic predispositions (e.g. α-1 antitrypsin deficiency)	Rapid progression to moderate or severe COPD	Challenges in management due to aggressive disease progression
Mixed-phenotype early COPD	Combination of smoking, occupational exposure and genetic factors contributing to early COPD	Variable progression among individuals, with some experiencing rapid progression while others have a slower decline in lung function	Tailored management strategies based on individual risk factors

COPD = chronic obstructive pulmonary disease; FEV_1 = forced expiratory volume in one second; FVC = forced vital capacity.

identify individuals without airflow obstruction who are at risk of both FEV_1 decline and further disease progression on imaging.[45]

Siafakas et al., considering the acute respiratory events, activity limitation and abnormal CT results in elderly smokers with respiratory symptoms despite normal lung function, as well as the significant false-positive rates in the elderly and false-negative rates in those younger than 45 years when using a fixed FEV_1/FVC ratio to define airflow obstruction, suggested the use of the previously proposed GOLD stage 0 for early detection of COPD.[11,29,46,47] They suggested that GOLD 0 represents a preclinical stage consistent with the early stages of the disease. However, GOLD 0 diagnosis is based on chronic symptoms (such as cough, sputum production and/or dyspnoea) in individuals with risk factors for COPD but normal spirometry, and cough, sputum production and dyspnoea are common symptoms or precursors of several chronic respiratory diseases.[48] Considering people with persistent cough, sputum production and/or dyspnoea as GOLD 0 without airflow limitation may reduce and delay the detection of other lung diseases.[46] In addition, smoking cessation emerges as a significant predictor of later absence of chronic symptoms in GOLD 0 patients.[49] The idea that GOLD 0 represents an early stage of COPD was rejected in 2006 because there was insufficient evidence that people classified as GOLD 0 were more likely to develop COPD.[50]

The Lancet Commission Towards the Elimination of COPD recently emphasized that reliance on spirometry alone to define COPD is both misleading and potentially harmful.[51] This is because early airway changes and emphysematous destruction do not always manifest as spirometric airflow limitation. Instead, the Commission recommended the adoption of diagnostic tools, such as blood and radiological biomarkers, to identify early-stage COPD before irreversible changes occur. It also suggested chest CT and biomarker interpretation using artificial intelligence to increase the feasibility of implementation in low-resource settings.

Following the recommendation by the Lancet Commission, Sin has proposed an approach in which individuals with significant COPD risk factors (such as smoking, a history of childhood asthma or exposure to air pollution) undergo an initial assessment with spirometry.[32] If the spirometry results are normal, they are then classified as symptomatic or asymptomatic based on a COPD Assessment Test score threshold of 10.[52] Symptomatic individuals may require further testing, including body plethysmography, chest CT or magnetic resonance imaging, IOS and/or multi-breath washout lung clearance index that can detect ventilatory heterogeneity, a characteristic of early COPD.[53] Any significant abnormalities in these tests would suggest the presence of 'early COPD'.

Innovative technologies, such as X-ray phase contrast (XPC), photoacoustic tomography (PAT), ultrasound computed tomography (UCT), electrical impedance tomography (EIT), forced oscillation (FOT) and IOS, are emerging as novel solutions for the early detection of COPD.[54] Robust artificial intelligence and machine learning analysis capabilities support these techniques. XPC can measure the air volume capacity of the lungs by capturing dynamic images of the lungs, allowing changes in lung function to be monitored at both a regional and global level.[55] PAT and UCT have the advantage of revealing several structural changes or alterations in the lung without exposing the patient to harmful radiation or toxicity. PAT uses nonionizing radiation, while ultrasound waves are used rather than radiation or magnets in UCT.[56,57] EIT has several benefits as it is the only modality that can measure variations in regional lung function non-invasively using 3D reconstruction and electrical impedance data processing.[58] There is a low risk because the patient is not subjected to damaging radiation, hazardous chemicals or contrast substances. Furthermore, real-time assessment of regional changes in lung function may be acquired without requiring patient compliance.[54] As FOT/IOS needs less patient cooperation than spirometry, it is more beneficial for those who show low compliance, particularly patients who are elderly or have a chronic illness.[38]

Regrettably, there are numerous limitations that prevent the routine use of these innovative technologies. Despite advances in artificial intelligence and algorithmic analysis, resolution and radiation exposure concerns remain significant barriers to the clinical integration of XPC imaging.[54,59] In addition, the reliance on complex and expensive radiological equipment makes XPC less feasible for rapid intervention or real-time monitoring of respiratory disease progression at the patient's bedside.[54,60] The imaging capabilities of PAT are limited by its dependence on the tissue attenuation limit.[61] PAT is also limited by its long imaging times, which depend on the pulse repetition frequency of the laser beams used for optical excitation.[62,63] In addition, PAT estimates functional changes based on structural abnormalities of the airways similar to traditional imaging techniques.[54] The use of UCT in lung imaging remains limited, necessitating the development of robust processing techniques to mitigate excessive signal-to-noise ratios and improve resolution accuracy.[54] Early prototypes of EIT as a diagnostic and monitoring system proved inadequate due to their relatively poor spatial resolution, resulting in reconstructed images that lacked intricate detail compared with conventional techniques.[54] Current clinical EIT prototypes only provide images of axial sections of the chest, excluding a significant portion of the lung parenchyma.[64] The effects of extra-thoracic upper airway artefacts, which can alter results and prevent accurate estimation of lung function and structural changes, and the need for other diagnostic tools or concomitant bronchodilator use to verify the presence of COPD are significant limitations to the use of FOT.[65,66] In addition, FOT/IOS only measures impedance and hyperreactivity of the lung as a whole, rather than specific areas, and is, therefore, unable to assess changes in lung function over time.[54,67] Another limitation of the IOS is that the pulse pressure differences between IOS and the continuous waves of FTO may cause discomfort.[67]

The early detection of chronic obstructive pulmonary disease in general practice

Primary care clinicians play a pivotal role in the early identification of at-risk asymptomatic subjects. However, they often lack knowledge about COPD prevention and treatment. Interpreting imaging and pulmonary function data is often difficult for them. In any case, these data are often unavailable.

Since 2007, the Danish National Board of Health has advocated offering spirometry to smokers/former smokers, those with relevant occupational exposure, those who are over 35 years of age and those who have at least one respiratory symptom, with the aim of facilitating the early detection of COPD.[68] Accordingly, a group of Danish researchers adopted the following inclusion criteria for the early diagnosis of COPD in general practice: (1) age ≥35 years, (2) smoker/former smoker or relevant occupational exposure and (3) one or more respiratory symptom (dyspnoea, cough, wheezing, sputum production and/or recurrent chest infections).[69] Inclusion criteria also included the ability to perform spirometry and no history of obstructive lung disease (asthma and/or COPD) or other chronic respiratory disease. However, the willingness to undergo spirometry seems to depend on where the screening occurs. In Denmark, the participation rate was significantly higher among those invited to perform spirometry at a local health centre than among

those invited to perform spirometry by their general practitioner (GP).[70] Although the reasons for this choice may vary, it is likely to be due to the local nature of doctor–patient interaction. Nevertheless, the early detection of COPD can be improved if the use of spirometry in primary care practices is increased.[71]

Recently, a group of Chinese researchers proposed the use of screening questionnaires in addition to pulmonary function tests as a strategy for detecting COPD.[72] Their questionnaire included several observational indicators, including age, smoking history, BMI, respiratory symptoms (such as cough and dyspnoea), family history of respiratory disease and others. Inclusion in the study required the presence of FEV_1/FVC <0.7 after bronchodilator inhalation, FEV_1% predicted ≥50% and a negative bronchodilator test result. However, the effectiveness of such an approach in facilitating the early detection of COPD is questionable.

The French study Détection Précoce en Soins Primaires de la BPCO, conducted in primary care, showed that using questions adapted from the symptoms and risk factors identified in the GOLD reports and COPD coordination to facilitate access to spirometry, either alone or in combination, enabled early detection of COPD.[73] Being >40 years of age was an inclusion criterion for the study. Of the four GOLD questions, three were about COPD symptoms and one was about smoking and/or exposure to other air pollutants. A positive response to any of these questions was considered sufficient to raise suspicion of COPD and warrant spirometry assessment.

It is interesting to note that some experts oppose the idea that GPs actively seek to detect COPD in the early stages of the disease.[74] According to this view, 'early COPD', 'pre-COPD' and 'mild COPD' are not diseases and do not need to be identified or treated. This position is based on the recognition that no combination of inhaled medicines has been shown to slow the progression of COPD in people who continue to smoke regularly. There is also concern that patients may be receiving inappropriate, potentially harmful and costly medications with little or no benefit, while the underlying cause of their symptoms is being overlooked.[75] The development of clinically significant COPD in susceptible smokers is typically a long process; it can take decades. Although certain pulmonary function tests and cardiopulmonary exercise tests show borderline abnormalities in susceptible smokers before evidence of airflow obstruction is seen on spirometry, these findings do not reliably predict the progression to clinically significant COPD.[76,77]

Nevertheless, health authorities in several countries are advocating the early detection of COPD. In addition to the proposal of the Danish National Board of Health, the UK National Institute for Health and Care Excellence guidelines also state that COPD should be suspected in people aged over 35 years who have a risk factor (current or former smoker) and one or more chronic respiratory symptoms.[68,78] In this case, spirometry should be performed by trained primary care health professionals. Local commissioners, who are doctors and nurses appointed by the National Health Service to match local healthcare with demand, ensure that eligible patients seen in health centres receive the recommended spirometry tests. The Canadian Thoracic Society recommends that family physicians perform spirometry on patients over the age of 40 years who smoke or have a history of smoking, especially if they affirmatively respond to any of the following questions: do you cough regularly? Are you coughing or spitting up regularly? Are you short of breath, even with simple tasks? Do you have wheezing during exertion or at night? Do you often have colds that last longer than other people around you?[79] Similarly, in France, the national health authority (Haute Autorité de Santé) recommends offering spirometry to people over 40 years with risk factors or early symptoms of COPD.[52,80] These people can be identified through a self-administered questionnaire administered by health professionals. While spirometry is usually performed by respiratory specialists, it is occasionally performed by trained GPs (about 2% of spirometries) or primary care nurses.

Conclusion

Early detection of COPD remains a complex challenge due to the multifaceted nature of the disease and the lack of a universally agreed definition of its early stages. Despite significant advances in the understanding and diagnosis of COPD, there is still no global consensus on what constitutes early COPD. Various definitions and diagnostic criteria have been proposed, ranging from spirometric abnormalities to imaging findings and symptomatology.

Efforts to identify individuals at risk of developing COPD have led to the recognition of pre-COPD and PRISm as potential stages preceding overt airflow obstruction. These stages highlight the importance of considering not only spirometric parameters but also symptoms, imaging findings and physiological abnormalities in the early detection and classification of COPD.

Innovative technologies, such as XPC, PAT and EIT, offer promising avenues for early detection, but their routine clinical implementation faces significant challenges related to resolution, cost and accessibility.

Primary care clinicians play a crucial role in the early identification of individuals at risk, but they often lack the knowledge and resources to prevent and diagnose COPD. Screening strategies using spirometry, questionnaires and symptom assessment have been proposed, but their effectiveness and feasibility vary in different healthcare settings.

While some experts argue against the early detection and treatment of COPD in its preclinical stages, citing potential harms and uncertainties, many health authorities advocate for early intervention to mitigate disease progression and improve outcomes. Clear guidelines and standardized approaches are needed to facilitate early detection efforts and ensure appropriate management of individuals at risk of developing COPD.

In conclusion, improving our understanding of early COPD and implementing effective screening strategies are crucial steps towards improving outcomes for patients with this debilitating disease. Collaborative efforts involving healthcare providers, researchers, policy-makers and patients are essential to address the challenges associated with early detection and management of COPD effectively. ❑

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