The term chronic obstructive pulmonary disease (COPD) is used to describe a number of conditions, including chronic bronchitis and emphysema. Although common, preventable and treatable, COPD was projected to become the third leading cause of death globally by 2020 (Lozano et al, 2012). In the UK in 2012, approximately 30,000 people died of COPD – 5.3% of the total number of deaths (Bit.ly/BLFCOPDdeaths2012). By 2016, information published by the World Health Organization (Bit.ly/WHOtop10deathcauses) indicated that Lozano et al (2012)’s projection had already come true.

People with COPD experience persistent respiratory symptoms and airflow limitation that can be due to airway or alveolar abnormalities, caused by significant exposure to noxious particles or gases, commonly from tobacco smoking. The projected level of disease burden poses a major public-health challenge and primary care nurses can be pivotal in the early identification, assessment and management of COPD (Hooper et al, 2012).

Grace Parker (the patient’s name has been changed) attends a nurse-led COPD clinic for routine reviews. A widowed, 60-year-old, retired post office clerk, her main complaint is breathlessness after moderate exertion. She scored 3 on the modified Medical Research Council (mMRC) scale (Fletcher et al, 1959), indicating she is unable to walk more than 100 yards without stopping due to breathlessness. Ms Parker also has a cough that produces yellow sputum (particularly in the mornings) and an intermittent wheeze. Her symptoms have worsened over the last six months. She feels anxious leaving the house alone because of her breathlessness and reduced exercise tolerance, and scored 26 on the COPD Assessment Test (CAT, catestonline.org), indicating a high level of impact.

Ms Parker smokes 10 cigarettes a day and has a pack-year score of 29. She has not experienced any haemoptysis (coughing up blood) or chest pain, and her weight is stable; a body mass index of 40kg/m² means she is classified as obese. She has had three exacerbations of COPD in the previous 12 months, each managed in the community with antibiotics, steroids and salbutamol.
Diagnosis
Ms Parker was diagnosed with COPD five years ago. Using Epstein et al’s (2008) guidelines, a nurse took a history from her, which provided 80% of the information needed for a COPD diagnosis; it was then confirmed following spirometry testing as per National Institute for Health and Care Excellence (2018) guidance.

The nurse used the Calgary-Cambridge consultation model, as it combines the pathological description of COPD with the patient’s subjective experience of the illness (Silverman et al, 2013). Effective communication skills are essential in building a trusting therapeutic relationship, as the quality of the relationship between Ms Parker and the nurse will have a direct impact on the effectiveness of clinical outcomes (Fawcett and Rhynas, 2012).

In a national clinical audit report, Baxter et al (2016) identified inaccurate history taking and inadequately performed spirometry as important factors in the inaccurate diagnosis of COPD on general practice COPD registers; only 52.1% of patients included in the report had received quality-assured spirometry.

Pathophysiology of COPD
Knowing the pathophysiology of COPD allowed the nurse to recognise and understand the physical symptoms and provide effective care (Mitchell, 2015). Continued exposure to tobacco smoke is the likely cause of the damage to Ms Parker’s small airways, causing her cough and increased sputum production. She could also have chronic inflammation, resulting in airway smooth-muscle contraction, sluggish ciliary movement, hypertrophy and hyperplasia of mucus-secreting goblet cells, as well as release of inflammatory mediators (Mitchell, 2015).

Ms Parker may also have emphysema, which leads to damaged parenchyma (alveoli and structures involved in gas exchange) and loss of alveolar attachments (elastic connective fibres). This causes gas trapping, dynamic hyperinflation, decreased expiratory flow rates and airway collapse, particularly during expiration (Kaufman, 2013). Ms Parker also displayed pursed-lip breathing; this is a technique used to lengthen the expiratory time and improve gaseous exchange, and is a sign of dynamic hyperinflation (Douglas et al, 2013).

In a healthy lung, the destruction and repair of alveolar tissue depends on proteases and antiproteases, mainly released by neutrophils and macrophages. Inhaling cigarette smoke disrupts the usually delicately balanced activity of these enzymes, resulting in the parenchymal damage and small airways (with a lumen of <2mm in diameter) airways disease that is characteristic of emphysema. The severity of parenchymal damage or small airways disease varies, with no pattern related to disease progression (Global Initiative for Chronic Obstructive Lung Disease, 2018).

Ms Parker also had a wheeze, heard through a stethoscope as a continuous whistling sound, which arises from turbulent airflow through constricted airway smooth muscle, a process noted by Mitchell (2015). The wheeze, her 29 pack-year score, exertional breathlessness, cough, sputum production and tiredness, and the findings from her physical examination, were consistent with a diagnosis of COPD (GOLD, 2018; NICE, 2018).

"COPD is a major public-health challenge; nurses can be pivotal in early identification, assessment and management”

Spirometry
Spirometry is a tool used to identify airflow obstruction but does not identify the cause. Commonly measured parameters are:

- Forced expiratory volume – the volume of air that can be exhaled – in one second (FEV1), starting from a maximal inspiration (in litres);
- Forced vital capacity (FVC) – the total volume of air that can be forcibly exhaled – at timed intervals, starting from a maximal inspiration (in litres).

Calculating the FEV1 as a percentage of the FVC gives the forced expiratory ratio (FEV1/FVC). This provides an index of airflow obstruction; the lower the ratio, the greater the degree of obstruction. In the absence of respiratory disease, FEV1 should be ≥70% of FVC. An FEV1/FVC of <70% is commonly used to denote airflow obstruction (Moore, 2012).

As they are time dependent, FEV1 and FEV1/FVC are reduced in diseases that cause airways to narrow and expiration to slow. FVC, however, is not time dependent; with enough expiratory time, a person can usually exhale to their full FVC. Lung function parameters vary depending on age, height, gender and ethnicity, so the degree of FEV1 and FVC impairment is calculated by comparing a person’s recorded values with predicted values. A recorded value of >80% of the predicted value has been considered ‘normal’ for spirometry parameters but the lower limit of normal – equal to the fifth percentile of a healthy, non-smoking population – based on more robust statistical models is increasingly being used (Cooper et al, 2017).

A reversibility test involves performing spirometry before and after administering a short-acting beta-agonist (SABA) such as salbutamol; the test is used to distinguish between reversible and fixed airflow obstruction. For symptomatic asthma, airflow obstruction due to airway smooth-muscle contraction is reversible: administering a SABA results in smooth-muscle relaxation and improved airflow (Lumb, 2016). However, COPD is associated with fixed airflow obstruction, resulting from neutrophil-driven inflammatory changes, excess mucus secretion and disrupted alveolar attachments, as opposed to airway smooth-muscle contraction.

Administering a SABA for COPD does not usually produce bronchodilation to the extent seen in someone with asthma: a person with asthma may demonstrate significant improvement in FEV1 (of >400ml) after having a SABA, but this may not change in someone with COPD (NICE, 2018). However, a negative response does not rule out therapeutic benefit from long-term SABA use (Marín et al, 2014).

NICE (2018) and GOLD (2018) guidelines advocate performing spirometry after administering a bronchodilator to diagnose COPD. Both suggest a FEV1/FVC of <70% in a person with respiratory symptoms supports a diagnosis of COPD, and both grade the severity of the condition using the predicted FEV1. Ms Parker’s spirometry results showed an FEV1/FVC of 56% and a predicted FEV1 of 57%, with no significant improvement in these values with a reversibility test.

GOLD (2018) guidance is widely accepted and used internationally. However, it was developed by medical practitioners with a medicalised approach, so there is potential for a bias towards pharmacological management of COPD. NICE (2018) guidance may be more useful for practice nurses, as it was developed by a multidisciplinary team using evidence from systematic reviews or meta-analyses of randomised controlled trials, providing a holistic approach. NICE guidance may be outdated on publication, but regular reviews are performed and published online.

NHS England (2016) holds a national register of all health professionals certified in spirometry. It was set up to raise spirometry standards across the country.
Clinical Practice

Case study

Assessment and management

The goals of assessing and managing Ms Parker’s COPD are to:
- Review and determine the level of airflow obstruction;
- Assess the disease’s impact on her life;
- Risk assess future disease progression and exacerbations;
- Recommend pharmacological and therapeutic management.

GOLD’s (2018) ABCD assessment tool (Fig 1) grades COPD severity using spirometry results, number of exacerbations, CAT score and mMRC score, and can be used to support evidence-based pharmacological management of COPD.

When Ms Parker was diagnosed, her predicted FEV1 of 57% categorised her as GOLD grade 2, and her mMRC score, CAT score and exacerbation history placed her in group D. The mMRC scale only measures breathlessness, but the CAT also assesses the impact COPD has on her life, meaning consecutive CAT scores can be compared, providing valuable information for follow-up and management (Zhao et al, 2014).

After assessing the level of disease burden, Ms Parker was then provided with education for self-management and lifestyle interventions.

Lifestyle interventions

Smoking cessation

Cessation of smoking alongside support and pharmacotherapy is the second-most cost-effective intervention for COPD, when compared with most other pharmacological interventions (BTS and PCRS UK, 2012). Smoking cessation:
- Slows the progression of COPD;
- Improves lung function;
- Improves survival rates;
- Reduces the risk of lung cancer;
- Reduces the risk of coronary heart disease risk (Qureshi et al, 2014).

Ms Parker accepted a referral to an All Wales Smoking Cessation Service adviser based at her GP surgery. The adviser used the internationally accepted ‘five As’ approach:
- Ask – record the number of cigarettes the individual smokes per day or week, and the year they started smoking;
- Advise – urge them to quit. Advice should be clear and personalised;
- Assess – determine their willingness and confidence to attempt to quit. Note the state of change;
- Assist – help them to quit. Provide behavioural support and recommend or prescribe pharmacological aids. If they are not ready to quit, promote motivation for a future attempt;
- Arrange – book a follow-up appointment within one week or, if appropriate, refer them to a specialist cessation service for intensive support. Document the intervention.

NICE (2013) guidance recommends that this be used at every opportunity. Stead et al (2016) suggested that a combination of counselling and pharmacotherapy have proven to be the most effective strategy.

Pulmonary rehabilitation

Ms Parker’s positive response to smoking cessation provided an ideal opportunity to offer her pulmonary rehabilitation (PR) – as indicated by Johnson et al (2014), changing one behaviour significantly increases a person’s chance of changing another.

PR – a supervised programme including exercise training, health education and breathing techniques – is an evidence-based, comprehensive, multidisciplinary intervention that:
- Improves exercise tolerance;
- Reduces dyspnoea;
- Promotes weight loss (Bolton et al, 2013).

These improvements often lead to an improved quality of life (Sciriha et al, 2015).

Most relevant for Ms Parker, PR has been shown to reduce anxiety and depression, which are linked to an increased risk of exacerbations and poorer health status (Miller and Davenport, 2015). People most at risk of future exacerbations are those who already experience them (Agusti et al, 2010), as in Ms Parker’s case. Patients who have frequent exacerbations have a lower quality of life, quicker progression of disease, reduced mobility and more rapid decline in lung function than those who do not (Donaldson et al, 2002).

Pharmacological interventions

Ms Parker has been prescribed inhaled salbutamol as required; this is a SABA that mediates the increase of cyclic adenosine monophosphate in airway smooth-muscle cells, leading to muscle relaxation and bronchodilation. SABAs facilitate lung emptying by dilating the small airways, reversing dynamic hyperinflation of the lungs (Thomas et al, 2013). Ms Parker also uses a long-acting muscarinic antagonist (LAMA) inhaler, which works by blocking the bronchoconstrictor effects of acetylcholine on M3 muscarinic receptors in airway smooth muscle; release of acetylcholine by the parasympathetic nerves in the airways results in increased airway tone with reduced diameter.

At a routine review, Ms Parker admitted to only using the SABA and LAMA inhalers, despite also being prescribed a combined inhaled corticosteroid and long-acting beta,-agonist (ICS/LABA) inhaler. She was unaware that ICS/LABA inhalers are preferred over SABA inhalers, as they:
- Last for 12 hours;
- Improve the symptoms of breathlessness;
- Increase exercise tolerance;
- Can reduce the frequency of exacerbations (Agusti et al, 2010).

However, moderate-quality evidence shows that ICS/LABA combinations, particularly fluticasone, cause an increased risk of pneumonia (Suissa et al, 2013; Nannini et al, 2007). Inhaler choice should, therefore, be individualised, based on

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**Fig 1. ABCD assessment tool**

<table>
<thead>
<tr>
<th>Spirometrically confirmed diagnosis</th>
<th>Assessment of airflow limitation</th>
<th>Assessment of symptoms and risk of exacerbations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOLD grade FEV1/FVC &lt;70%</td>
<td>Moderate/severe exacerbation history</td>
<td></td>
</tr>
<tr>
<td>GOLD 1</td>
<td>a2 or a1 leading to hospital administration</td>
<td></td>
</tr>
<tr>
<td>GOLD 2</td>
<td>0 or 1 not leading to hospital administration</td>
<td></td>
</tr>
<tr>
<td>GOLD 3</td>
<td>mMRC 0-1</td>
<td></td>
</tr>
<tr>
<td>GOLD 4</td>
<td>mMRC ≥2</td>
<td></td>
</tr>
<tr>
<td>CAT &lt;10</td>
<td>CAT ≥10</td>
<td></td>
</tr>
</tbody>
</table>

Source: Global Initiative for Chronic Obstructive Lung Disease (2018)
Case study

Ms Parker was given a self-management plan that included:

- Information on how to monitor her symptoms;
- A rescue pack of antibiotics, steroids and salbutamol;
- A traffic-light system demonstrating when, and how, to commence treatment or seek medical help.

Self-management plans and rescue packs have been shown to reduce symptoms of an exacerbation (Baxter et al, 2016), allowing patients to be cared for in the community rather than in a hospital setting and increasing patient satisfaction (Fletcher and Dahl, 2013).

Improving Ms Parker’s adherence to once-daily inhalers and supporting her to self-manage and make the necessary lifestyle changes, should improve her symptoms and result in fewer exacerbations.

The earlier a diagnosis of COPD is made, the greater the chances of reducing lung damage through interventions such as smoking cessation, lifestyle modifications and treatment, if required (Price et al, 2011).