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An Roinn Coimirce Sóisialaí
Department of Social Protection
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Department of Social Protection

Asthma

Contents

1. Overview and Definition of Asthma

1.1 Overview

Asthma is an extremely common respiratory disease, the prevalence of which has risen exponentially over the past 40 years, and is estimated to be increasing globally at a rate of 50% per decade (Braman, 2006). In the United Kingdom and Ireland, the prevalence of asthma has increased by 5 times over the last 25 years, with around 20,000 new cases presenting each week (GINA, 2003). There are over 4 million consultations for asthma in health services in the United Kingdom (UK) (Asthma UK, 2006) each year, resulting in a cost of approximately £2.5 billion (2003 figures – GINA, 2003).

The condition has considerable effects in terms of global disease and disability burden; morbidity and mortality with around 300 million people worldwide estimated to suffer from the condition, resulting in approximately 255,000 deaths annually (World Health Organisation, 2009).

In terms of global disease burden, asthma results in significant costs. As well as direct costs to healthcare systems in terms of care (e.g. hospital care, medication costs), asthma results in indirect costs in economic and social terms. Studies in the UK and in the US indicate that there is a significant impact in lost work time, productivity and from premature death. Asthma is a significant cause of absence from work, with around 20 million working days lost annually across the UK and Ireland (GINA, 2003), and 100 million working days lost in the US (BMJ Best Practice, 2009). In terms of disability-adjusted life years (DALYs), asthma accounts for 15 million lost days per year, around 1% of all DALY's lost worldwide (Mansoli et al, 2004).

Asthma is not a new disease; it has been recognised since ancient times. The term is derived from the Greek word meaning "short – drawn breath" or "panting," and was in use in the time of Hippocrates. However the rise in prevalence in recent years is not fully explainable. Whilst large variations in global prevalence are becoming more standardised, patterns of prevalence continue to vary globally; prevalence is decreasing or becoming static in certain age or population groups in some locations, whilst rising in others (GINA, 2008). Part of the rise in prevalence can be attributed to improvements in detection or diagnosis; however there are also wide variations in reported prevalence rates.

One of the reasons for this variation is that the diagnosis of asthma is a clinical one; there is no standardised definition of the type, severity, frequency of symptoms, nor of the findings on investigation. This may, in part, account for the reported variability in the prevalence of asthma. Whichever criteria is used to diagnose asthma, there are concerns that asthma continues to be an under-diagnosed and under-treated condition in many countries (including Ireland and the United Kingdom) with many asthmatics having poorly controlled symptoms (World Health Organisation, 2009). Provisional results from the Helping Asthma in Real Patients (HARP) study in Ireland estimated that 60% of asthmatic individuals have poor symptom control, with one death per week being directly attributable to asthma (Barron, 2009). The same study confirmed that compliance with asthma treatment is poor, with many

individuals not taking their medication as prescribed. The results indicated that 75% of individuals were using their reliever inhaler at least once a day, and therefore had uncontrolled asthma (Irish Times, 2009).

It is estimated that occupational asthma accounts for up to 15% of all new cases of asthma developed in adults, resulting in the condition being the most common industrial lung disease in the developed world (SIGN and BTS, 2009).

1.2 Definition of Asthma

Central to all diagnostic definitions of asthma is the presence of symptoms (more than one of wheeze, breathlessness, chest tightness or cough) and of variable airflow obstruction which are potentially reversible with treatment. More recent descriptions of asthma in children and in adults have included airway hyper-responsiveness and airway inflammation as components of the disease (SIGN and BTS, 2009).

The normal diurnal variation of peak expiratory flow rate (PEFR) is increased in people with asthma (Dennis et al, 2007).

The resulting narrowing of the airways is usually an intermittent condition which can be reversed (either spontaneously with time, or with the administration of medication), however in some individuals the inflammatory response in chronic asthma may lead to damage of the airways and irreversible airway obstruction.

Asthma has a wide variation in presentation, and can behave very differently in terms of the course of the condition and its responsiveness to treatment. The different presentations of asthma include:

- Acute asthma – the onset of severe asthma symptoms
- Chronic asthma - asthma requiring ongoing medication to achieve part or total control
- Exercise-induced asthma – exacerbated by physical activity, often an indication of poorly controlled acute asthma.
- Work-aggravated asthma - pre-existing asthma that is aggravated non-specifically by dust and fumes at work
- Occupational asthma - asthma due to exposure to specific substances in a working environment (for example hairdressers, paint sprayers etc).

(Dennis et al, 2007; SIGN and BTS, 2009).

An alternative classification for asthma is the use of the terms “controlled”, “partly controlled”, and “uncontrolled” asthma to indicate an individual’s response to treatment (GINA, 2006).

1.3 International Classification of Diseases; 10th Edition (ICD-10)

Classification

The World Health Organisation, in the 10th Edition of the International Classification of Diseases (ICD-10) (World Health Organisation, 2007); applies the following diagnostic classification for asthma:

J45 Asthma - excludes: acute severe asthma, chronic asthmatic (obstructive) bronchitis, chronic obstructive asthma, eosinophilic asthma, lung diseases due to external agents and status asthmaticus.

J45.0 Predominantly allergic asthma

- Allergic:
  - bronchitis NOS
  - rhinitis with asthma
- Atopic asthma
- Extrinsic allergic asthma
- Hay fever with asthma

J45.1 Non-allergic asthma

- Idiosyncratic asthma
- Intrinsic non-allergic asthma

J45.8 Mixed asthma - a combination of conditions listed in J45.0 and J45.1

J45.9 Asthma, unspecified -

- Asthmatic bronchitis NOS
- Late-onset asthma

J46.0 Status asthmaticus

- Acute severe asthma

2. Epidemiology

Worldwide, asthma is extremely prevalent, with around 300 million individuals suffering from the condition worldwide (World Health Authority, 2009). However, patterns of prevalence are not consistently increasing worldwide; with certain areas and population groups showing decreases in prevalence, including certain age groups in the United States and Western Europe (GINA, 2008).

Ireland has an extremely high prevalence of asthma, being the 4th highest country in the world asthma 'league' tables (after New Zealand, Australia and the United Kingdom). The prevalence of asthma has increased considerably over the last 20 years, and it suggested that asthma now affects 470,000 people in Ireland, with 1 in 8 adults diagnosed with the condition (Asthma Society of Ireland, 2009). Asthma is the most common cause of chronic disease in children in Ireland, and the most common cause of all respiratory disease, being consistently in the top 20 reasons for hospital admission, and resulting in more hospital admissions than myocardial infarction.

It is estimated that of the 470,000 people with Asthma, almost 20% of these do not have their symptoms properly controlled.

The following information is taken from the Asthma Insights and Realities in Ireland study, 2002, which was performed by the Asthma Society of Ireland as an Irish extension of the AIRE study - Asthma Insights and Realities in Europe which had previously collated information in seven other European countries. Their preliminary findings included that for individuals with asthma in Ireland:

- There are between 6,000-7,000 asthma related hospital admissions per year, with over 25,000 Accident and Emergency attendances. Over 50% of these admissions relate to children under the age of 14.
- 80-100 people die in Ireland every year from asthma, 30% under 40 years.
- 25-45% of children in Ireland have asthma, 20% of these have rhinitis
- 1-2% of asthmatic children have peanut allergy (20,000).

With respect to quality of life, individuals with asthma reported that:

- 73% experienced some limitation in their normal daily activities
- 21% felt they had more significant limitations in what they could do
- 55% suffered disturbed sleep as a result of asthma symptoms
- 70% reported they had symptoms when exposed to cigarette smoke
- 79% of the children do not have their asthma symptoms well controlled

With respect to occupational (or educational) factors, the survey found:

- In adults, almost three working days a year are lost to asthma. This represents a cost to the Irish economy of Euro 16.6 million, based on the average industrial wage. (Other studies estimate this to be higher – up to 12 days per year)

- Children aged between 5 and 11 miss on average three and a half days of school a year because of their asthma, and teenagers aged 12 to 16 miss over two days a year. (Other studies estimate this to be higher – up to 10 days of missed schooling per year)

(Asthma Society of Ireland, 2009)

Asthma disproportionally affects people of lower socio-economic groups, and individuals from certain ethnic groups (for example Afro-Caribbean individuals have a higher risk of asthma, and when asthma is present it is more severe than in the general population) (GINA, 2003).

3. Aetiology

3.1 Overview

'Asthma is a complex condition. Development of the condition is thought to be multi-factorial with both genetic influences (in the form of multiple susceptible gene interactions) and environmental factors contributing to risk. The interaction of these genetic and environmental factors will affect not only the development and severity of the condition, but the responsiveness of the asthma to medication and treatment (Choudrhy et al, 2007).

3.1.1 Genetic Factors

It has been suggested that there are a number of genes which are associated with susceptibility for asthma (Ober and Hoffian, 2006). These are mostly genes which are related to the immune system, or which act to modify inflammatory response. Studies have identified up to 100 other genes in a genetic association study which may play a part in the condition; however results have not been consistent across a number of studies, with some genes identified as being responsible for only certain presentations of asthma (e.g. childhood asthma).

3.1.2 Risk Factors

There are a number of different factors which may pre-dispose an individual to develop a hyper-responsiveness. These areas include the following:

- Family history of atopic disease or existing atopic disease means an individual has a risk of developing asthma that is 3 -4 times greater than in the general population (Ronmark et al, 1997)
- Allergen exposure (e.g. tree pollen, indoor allergens, dust mites)
- Diet
- Perinatal factors (e.g. young maternal age, poor maternal nutrition, prematurity, low birth weight, and lack of breastfeeding)
- Exposure to tobacco smoke (including maternal cigarette smoking)
- Exposure to air pollutants (e.g. traffic) (
- Viral and bacterial infections (rhinovirus, bronchiolitis (respiratory syncytial virus, influenza)
- Certain infections such as bronchiolitis (RSV) occurring in infancy
- Occupational factors (exposure to irritants)
- Gender: Males are more likely to develop infant asthma, females more likely

to develop asthma which persists from child to adulthood.

- Obesity – there appears to be a clear correlation between the increasing prevalence of obesity and the similarly increasing prevalence in asthma

(NHS Institute for Innovation and Improvement, 2008; SIGN and BTS, 2009)

There are a number of trigger factors including exposure to allergens in the form of air pollution and tobacco smoke where different studies report controversial results. For example. some studies have found exposure to air pollution to be a contributory factor to asthma, and some a protective effect.

The "hygiene hypothesis" has been suggested in recent years – which considers that asthma may be an unintentional side effect of the fact that developed countries now have cleaner indoor environments, fewer siblings, and less exposure to illness and disease than several decades ago. This may mean that children are not exposed to bacterial and viral infections in infancy and therefore do not develop a resistance to agents which may result in a pro-inflammatory immune response.

3.1.3 Triggers

Common triggers of an asthma attack include

- Environmental and occupational allergens (numerous)
- Infections - respiratory syncytial virus (RSV), rhinovirus, para-influenza virus infection, upper and lower respiratory tract infections, pneumonia
- Exercise – especially in cold or dry environments
- Inhaled irritants – tobacco smoke, cleaning agents, perfume, poor air quality
- Emotion – panic attacks, anger, excitement
- Aspirin and to a lesser extent NSAIDs
- Gastroesophageal reflux – this may occur by oesophageal acid-induced reflex bronchoconstriction or by micro-aspiration of acid
- Allergic rhinitis – however, it is not clear if this is an additional but distinct allergic reaction or if it is a discrete trigger in itself.

4. Diagnosis

4.1 Overview

As there is no definitive diagnostic definition of asthma, diagnosis of the condition is made using clinical judgement and recognition of signs, symptoms and characteristics which are typical of the condition. Possible alternative conditions should be considered and excluded. The compilation of a careful and comprehensive clinical history is key, as in many cases this will reveal factors (such as a trigger factor, or feature of how the condition behaves) that will confirm the diagnosis of asthma is appropriate. The history may also reveal factors which are key in treatment of the condition, for example exposure to an occupational irritant.

Asthma is a condition which the individual will live with for a significant period of time and therefore it is essential to ensure the diagnosis is correct, and that factors regarding disease behaviour are known in order to ensure that the correct treatment is provided; given that the individual may receive medication over a lengthy period of time (SIGN and BTS, 2009). This is likely to involve repeated assessment rather than a single consultation.

A diagnosis of asthma is confirmed when it is shown that airflow obstruction varies over short periods of time (SIGN and BTS, 2009). The preferred method to demonstrate airway obstruction is spirometry, which identifies airway obstruction more clearly than peak expiratory flow (PEF) readings, and depends less on effort and technique on behalf of the individual. PEF should only be used if spirometry measurement is unavailable; however, it is important to note that as with PEF, a normal spirometry reading does not exclude an asthma diagnosis (SIGN and BTS, 2009).

4.2 Clinical Features

A summary of the clinical features in adults that influence the probability that episodic respiratory symptoms are due to asthma is detailed in the table below.

Features that increase the probability of asthma
• More than one of the following symptoms: wheeze*, breathlessness, chest tightness and cough, particularly if: – they are worse at night and in the early morning – occur in response to exercise, allergen exposure and cold air – occur after taking aspirin or beta blockers * Note that a wheeze may not always be present, even though it is the most common symptom of asthma. Even in the presence of severe airway obstruction a wheeze may only be heard on forcible exhalation.

• History of atopic disorder Family history of asthma and/or atopic disorder Widespread wheeze heard on auscultation of the chest (bilateral, predominantly expiratory) – note the absence of wheeze does not rule out asthma. Otherwise unexplained low FEV1 or PEF (historical or serial readings) • Otherwise unexplained peripheral blood eosinophilia • Prolonged expiration • Increased respiratory rate
Features that lower the probability of asthma
• Prominent dizziness, light-headedness, peripheral tingling • Chronic productive cough in the absence of wheeze or breathlessness • Repeatedly normal physical examination of chest when symptomatic • Voice disturbance • Symptoms with colds only • Significant smoking history (i.e. >20 pack-years) • Cardiac disease • Normal PEF or spirometry when symptomatic* • Repeatedly normal examination of the chest when symptomatic • Clinical features indicating an alternate diagnosis (see ***Section 5***) * A normal spirogram/spirometry when not symptomatic does not exclude the diagnosis of asthma. Repeated measurements of lung function are often more informative than a single assessment.

Table 1 Clinical features in adults that influence the probability that episodic respiratory symptoms are due to asthma (NHS Institute for Innovation and Improvement 2008; SIGN and BTS, 2009)

4.3 Other History

Other factors from the patient history which can suggest a diagnosis of asthma are detailed in the table below.

Subject	Factors
Family and Personal History:	History of asthma, eczema or hay fever
Childhood Asthma:	Has there been a history of childhood asthma? This may be a re-activation of childhood

	asthma in adulthood, even after a remission period of several years the risk of developing asthma is greater if childhood asthma existed.
Home environment:	Smoking and Pets.
Occupation:	Occupational factors which may affect asthma? (See ***Appendix A*** for further information about Occupational Asthma.)
Triggers:	Cold Air, Exercise and Emotion
Response to a Trial of Treatment:	Symptoms and/or Peak Flow Improve
Frequency and Pattern of Symptoms	Do symptoms occur every day? At night? At what times are the symptoms at their worst? Is their a pattern which would identify a specific trigger?
Functional Impact	What is the impact on the individual's lifestyle? Working life? Social and family life? Sleeping habits? How is their psychological wellbeing being affected?
Coexisting Conditions	Coexisting conditions such as gastro-oesophageal reflux disease or allergic rhinitis should be excluded.

Table 2: Patient history aspects suggestive of an asthma diagnosis (NHS Institute for Innovation and Improvement, 2008; SIGN and BTS, 2009).

4.4 Physical Examination

Physical examination may be completely normal unless the individual is having an attack at that time. Additionally, subjects with mild intermittent asthma frequently have no signs or symptoms. However, observation of the individual may indicate exertional wheezing or fast wheezing at rest. The individual may use accessory muscles (scalene and sternocleidomastoid muscles in the neck) to assist their breathing.

Auscultation may reveal diminished air entry and diffuse bilateral wheeze with a prolonged expiratory phase.

Other aspects of the physical examination should include an examination of the nose to detect nasal polyps, and inspection of any allergic skin conditions such as eczema.

4.5 Investigations

4.5.1 Pulmonary Function Tests – Spirometry

Spirometry should be performed in all adults where a diagnosis of asthma is suspected (NHS Institute for Innovation and Improvement, 2009, SIGN and BTS, 2009).

In an acute episode of asthma, the peak flow, FEV1 and FEV1/FVC ratio are all reduced. (They may all return to normal between episodes.) Airway obstruction is confirmed when forced expiratory volume in 1 second (FEV1)/Forced Vital Capacity (FVC) ratio is less than 0.7 (NHS Institute for Innovation and Improvement, 2008).

Reversibility is also a feature which will confirm a diagnosis of asthma. This is detected by improvements in FEV1 within minutes after inhalation of rapid-acting bronchodilator or sustained improvement over a period of time once maintenance treatment has been commenced. The degree of reversibility in FEV1 which indicates a diagnosis of asthma is accepted as >12% (or >200ml) from pre-bronchodilator value (Pellegrino et al, 2005).

Results from spirometry can also aid diagnosis where the individual's history and physical examination means that the diagnosis of asthma is not certain. The approach to diagnosis is different for these individuals, dependent on the degree of airflow obstruction which his present. In individuals where airflow obstruction is not impaired, potential differential diagnoses should be considered and excluded first, although this may be accompanied by a trial of asthma treatment. These differential conditions are usually of a non-pulmonary nature (SIGN and BTS, 2009) and therefore would not respond to a trial of asthma medication such as inhaled corticosteroids or bronchodilators.

In individuals where the when forced expiratory volume in 1 second (FEV1)/Forced Vital Capacity (FVC) ratio of less than 0.7 but the diagnosis is still uncertain; the individual should be managed as if asthma has been diagnosed, and alternative explanations for the symptoms or further testing reserved unless the individual does not respond effectively to treatment.

It should be noted that other conditions may co-exist with asthma which will complicate the diagnostic picture. For example, asthma and COPD often coexist (SIGN and BTS, 2009).

4.5.2 Peak Expiratory Flow

It is not recommend that Peak Expiratory Flow measurements are used to diagnose asthma, although their use may be appropriate in monitoring the progress of the condition (e.g. in the home) or as a temporary alternative should spirometry not be available (NHS Institute for Innovation and Improvement, 2008; BTS and SIGN, 2009).

PEF should be measured first thing in the morning, before treatment is taken, when values are at their lowest and last thing at night when values are usually higher (Holohan and Manning, . The Recommended Technique for Measuring Peak Flow

is described in ***Appendix B.***

4.5.3 Chest X-Ray

A chest x-ray examination is useful to rule out alternative explanations for the individual's symptoms; however this is often normal in asthma.

4.5.4 Other Investigations

There are a number of other tests of airflow obstruction, airway responsiveness and airway inflammation which may provide information to support a diagnosis of asthma; however these are not commonly used.

Allergen testing may also be performed, for example measurement of immunoglobulin IgE, RAST or skin allergy tests. These may not necessarily support confirmation of the diagnosis but may provide information as to what risk factors are causing asthma symptoms in certain patients. Conditions such as allergic rhinitis, eczema or other allergies are all more common in individuals with asthma. It is suggested that skin tests are the most appropriate method of determining allergic status, as immunoglobulin assay is more expensive and is not as reliable as skin tests (Holohan and Manning, 20008).

The figure below summarises actions which should be considered for adults presenting with asthma.

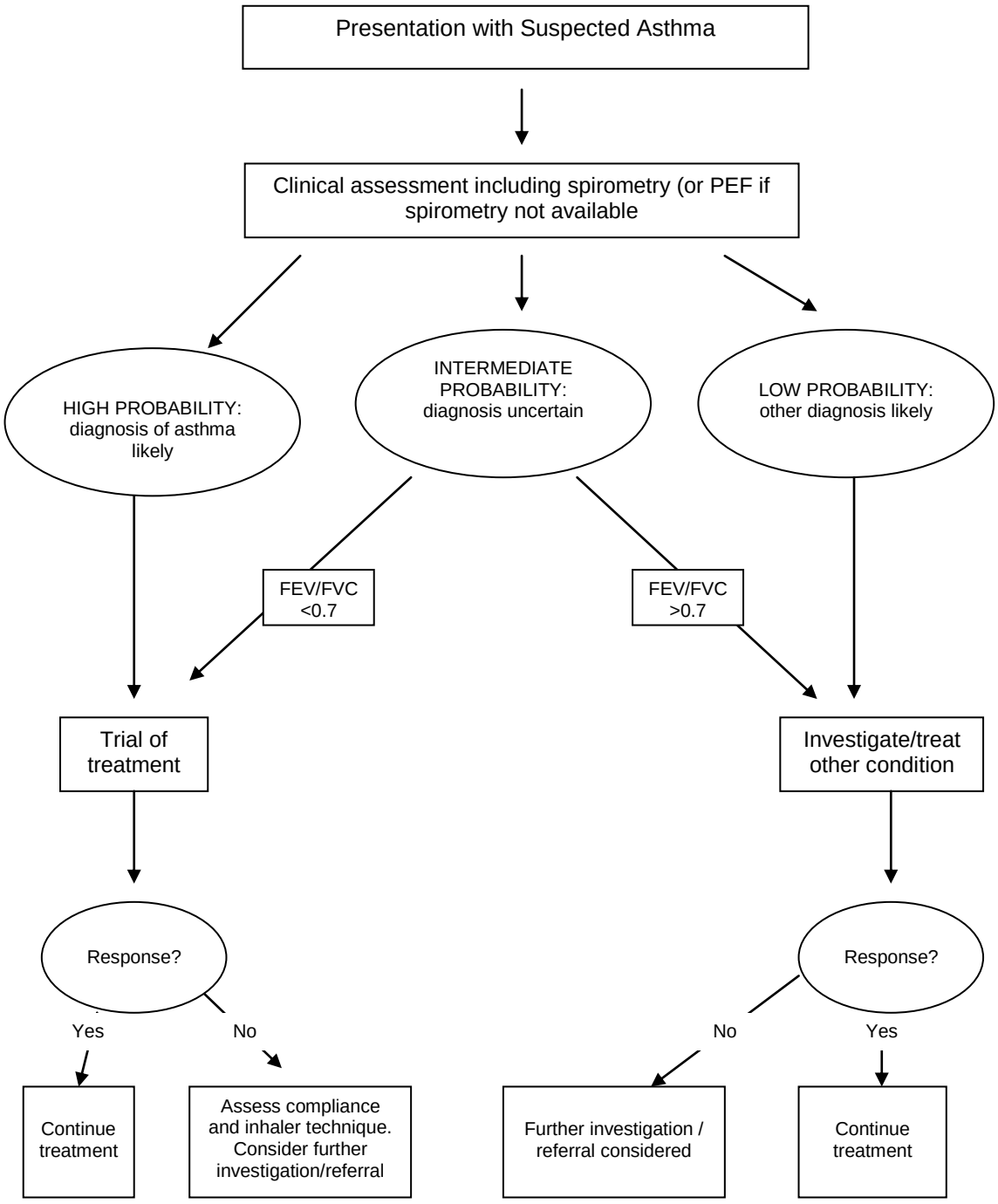


Figure 1: Presentation with suspected asthma in adults (SIGN and BTS, 2009)

5. Differential Diagnosis

'All that wheezes is not asthma, but equally all that is asthma need not wheeze.'

Differential diagnoses can be categorised according to the presence or absence of airways obstruction:

Conditions without airways obstruction:

- Chronic cough syndromes (for example as a side effect of ACE inhibitor use)
- Hyperventilation syndrome
- Vocal cord dysfunction
- Rhinitis
- Gastro-oesophageal reflux
- Heart failure
- Pulmonary fibrosis
- Pulmonary embolism
- Toxic agent inhalation

Conditions with airways obstruction:

- Chronic obstructive pulmonary disease (COPD)
- Bronchiectasis*
- Inhaled foreign body*
- Obliterative bronchiolitis
- Large airway stenosis
- Lung cancer/tumour*
- Sarcoidosis*
- Cystic fibrosis
- Acute bronchitis
- Eosinophilic pneumonia

*May also be associated with non-obstructive spirometry.

6. Treatment

6.1 Treatment Options for Asthma

A number of goals should be achieved in the successful long term management of asthma:

- Control of daytime symptoms
- Normal sleep patterns - no night time disturbance due to asthma symptoms
- Prevention of exacerbations, and no requirement to 'step-up' or use rescue medication
- Normal functional activity including exercise
- Normal lung function (in practical terms FEV1 and/or PEF >80% predicted or best) with minimal side effects
- Prevention of side effects from asthma medications
- Prevention of morbidity and mortality from asthma.

It should be noted however, that an individual may have varying goals and objectives. For example, they may consider hat the potential side effects and inconvenience of pharmacological therapies is an overly burdensome. It is important therefore, that any treatment decisions are made in conjunction with the in individual to provide a plan which they are in agreement with and therefore likely to maintain.

Individuals diagnosed with asthma, or having a trial of treatment for suspected asthma, should have a written management plan detailing the treatment and interventions which have been agreed with the individual. This plan should describe not only the day to day maintenance treatment, but details of how to 'step-up' treatment if the condition becomes exacerbated and 'step-down' when symptoms are controlled; when to seek medical advice and what action/who to contact in an emergency situation.

Guided self management techniques, including the written management plan enable individuals to become knowledgeable and confident about their condition and to be able to take control of the management of their asthma. This approach has been shown to result in improved medication compliance and better asthma control leading to fewer unplanned or emergency attendances – as poor compliance results in a significant cost in terms of emergency treatment (Gibson, 2002).

An overview of the content of a written management plan and on-line resources where example plans may be obtained can be found in ***Appendix D.***

6.2 Guidelines

The information below is drawn mainly from two guidelines – The Scottish Intercollegiate Guidelines Network (SIGN) and the British Thoracic Society (BTS) guideline 'British guideline on the management of asthma: a national clinical guideline' which was revised in 2009; and the Asthma Society of Ireland and Irish College of General Practitioners guideline 'Asthma Control In General Practice' which was adapted from the GINA Global Strategy for asthma Management and Prevention specifically for Irish practice.

Asthma is managed using a 'step-wise' approach that allows treatment to be adjusted to more intensive or less intensive treatment depending on the degree of symptom control which has been achieved.

Although there are some non-pharmacological measures which have been shown to be beneficial in supporting the control of symptoms in an individual with asthma, the majority of individuals will require pharmacological intervention.

6.3 Non-Pharmacological Management - Lifestyle Advice for Asthmatics

The majority of lifestyle recommendations for asthma are based on limited or small studies. More research is required in this area to confirm benefit (NHS Institute for Innovation and Improvement, 2008).

6.3.1 Allergen Exposure

Whilst there is a clear link between exposure to allergens such as house dust mites and an increase in asthma symptoms, there is no clear evidence which suggests that significant benefit will be gained from avoiding allergen exposure alone (SIGN and BTS, 2009). In studies where children and adults were exposed to a low allergen environment (for example at high altitude) some benefit was achieved, but this was probably not attributable to allergen avoidance alone. It is recognised that some strategies (e.g. anti-allergy mattress covers, non-carpet flooring and good ventilation) are easily achieved and may provide some benefit; guidance suggests that many avoidance strategies are not necessarily cost effective or particularly beneficial (Woodcock et al, 2003; GINA, 2006; SIGN and BTS, 2009), and there is no evidence to support the removal of a pet (e.g. cat or dog) in order to improve asthma symptoms.

Outdoor and Environmental allergens (e.g. pollen or air pollution) are difficult to avoid but individuals should be advised to do so where possible.

6.3.2 Smoking

Direct or passive exposure to cigarette smoke is associated with a decrease in lung function, and an increase in acute episodes of asthma and increased long term control using inhaled steroids. There are few studies which have investigated the effect of stopping or decreasing smoking on asthma, however one study has shown

that stopping smoking has a beneficial effect on asthma symptoms and medication requirements in adults (Tannesen et al, 2005). In childhood, exposure to smoke is associated with a 30% increased risk of asthma symptoms (SIGN and BTS, 2009) There is a direct relationship between asthma symptoms, lower respiratory tract infections, and smoking in childhood with Infants four times more likely to develop wheezing illnesses in the first year of life, if they have mothers that smoke (GINA, 2006).

6.3.3 Vaccinations

[Draft Note: May need confirmation from DSP as to Irish Policy]

It is recommended by the Departments of Health in both the UK and in Ireland that individuals with asthma have a pneumococcal and a yearly seasonal influenza vaccination; however studies by GINA suggest that the influenza vaccination does not appear to protect people from exacerbations of their asthma, or improve their asthma control (GINA, 2006). A Cochrane review also found limited evidence to support any specific benefit of the pneumococcal vaccine in individuals with asthma (Sheikh, 2001).

Individuals with asthma have been identified as one of the priority groups for H1N1 Swine Flu vaccination (HSE (Ireland); 2009; NHS Choices, 2009) in both countries.

It should be noted that individuals taking high dose inhaled steroids may not have a full reaction to any vaccine which is administered.

6.3.4 Weight Reduction, Diet and Exercise

There is evidence which suggests that obesity has a negative effect on asthma control, lung function, and symptoms, and limited evidence which shows that asthma control improve if obese individuals reduce their weight. Appropriate healthy weight management advice should be given (NHS Institute for Innovation and Improvement, 2008), but there is no evidence to support any particular exercise or weight management techniques as being beneficial for asthma control (GINA, 2006; SIGN and BTS, 2009).

There is no evidence to suggest a specific diet will have a beneficial effect on an individual's asthma symptoms, although healthy eating should obviously be recommended. There is some evidence to suggest a diet rich in fruit and vegetables helps to protect against the development of asthma in childhood (SIGN and BTS, 2009).

Advice should be provided on avoidance of exercise induced asthma, however exercise in general helps to improve respiratory function.

6.3.5 Complementary Therapies

There is no evidence to strongly support the use of complementary therapies in asthma, and individuals should not be treated using such therapies alone (SIGN and BTS, 2009). This includes the use of dietary supplements. However, this does not mean that there is no benefit from such therapies, and if an individual finds them

beneficial their use should be encouraged to complement existing pharmacological treatment (not replace).

6.3.6 Coexisting Conditions

Advice should be provided regarding any coexisting conditions which may negatively affect asthma, for example, rhinitis, sinusitis or gastrointestinal reflux. There is however no firm evidence that suggests improvement in such conditions will result in significantly improved asthma symptoms (SIGN and BTS, 2009).

6.4 Pharmacological Management

It should be noted that one of the main barriers to effective pharmacological treatment of asthma is the issue of **compliance**. Recent studies in Ireland suggest that 60-75% of individuals have asthma symptoms which are poor or uncontrolled, or need to use a reliever at least once per day. It is estimated around 50% of individuals do not follow their treatment regime correctly, with non-compliance with inhaled steroid being significant issue (Holohan, 2009).

Compliance with regular monitoring using peak flow meters is also poor – some studies report recorded daily use to be as low as 6% (SIGN and BTS, 2009).

Attention should be paid to the number of repeat prescriptions which are required by an individual in general practice as this will give clues as to the individual's compliance with their prescribed medication. In many individuals, their prescription refill rate for their reliever medication will be more frequent than expected, with their refill rate for their preventer medication less frequent than expected. As a guide, 1 canister of reliever medication equates to approximately 2 puffs/week (for a 200 dose canister) over the period of a year. 1 canister dispensed every month is equivalent to 6 puffs/day (Holohan and Manning, 2008).

6.4.1 Relievers and Preventers

A key concept to explain to individuals (and to ensure they understand) is the difference between preventer and reliever medication. "***Relievers"***, such as bronchodilator drugs, are highly effective at temporarily relieving the symptoms of asthma, but for almost all patients, the mainstay of treatment should be the ***regular*** use of "***Preventer***" medication to control or eliminate asthma symptoms. The use of inhaled corticosteroids regularly as preventer medication reduces airway inflammation and reactivity. This should be commenced as soon as possible following diagnosis with the aim of avoiding chronic airway damage, which can be irreversible.

6.4.2 Use of Inhaler and Spacer Devices

A key area of compliance in medication therapy, is the correct use inhalers and spacer devices. The individual should be educated to be confident in their use, and be able to demonstrate their technique back to the health professional.

- Resources regarding the use of inhalers including demonstrations are provided by the following organistions:
- Asthma UK: http://www.asthma.org.uk/all_about_asthma/medicines_treatments/using_your_inhalers.html
- Asthma Society of Ireland: http://www.asthmasociety.ie/inhaler/index.html
- The Global Initiative for Asthma: http://www.ginasthma.org/InteractiveLearning.asp?l1=3&l2=1

6.5 Assessing Levels of Asthma Control

The extent of an individual's asthma control should be regularly monitored, both at the commencement of treatment, and at regular stages thereafter. Part of this role falls on the individual themselves, and a component of their treatment is education is self management techniques regarding their condition.

A simplified overview of asthma control stages is provided below, taken from the Asthma Control In General Practice guidelines published by The Asthma Society of Ireland and Irish College of General Practitioners (Holohan and Manning, 2008).

CHARACTERISTIC	CONTROLLED	PARTLY CONTROLLED	UNCONTROLLED
DAY	None (< twice/week)	More than twice/week	Three or more features of partially controlled asthma per week.
LIMITATION OF ACTIVITIES	None	Any limitation	
NIGHT	None	Any night time symptoms	
RELIEVER TREATMENT	None (< twice/week)	More than twice/week	
LUNG FUNCTION	None	<80% predicted or personal best	
EXACERBATIONS	None	One or more/year	One in any week

Table 3: Assessing the Level of Asthma Control (Holohan and Manning, 2008)

6.6 The Main Treatments for Chronic Asthma

(See ***Appendix B*** for additional details and information about less widely used drugs.)

It should be noted that this protocol is not written with the intent of providing the level of detail necessary for determining treatment options for a specific

individual but merely to provide an overview of the main treatment options available.

6.6.1 Relievers

1. Short Acting β2-Agonists
    - Salbutamol (Ventolin) is the most widely used example.
    - Rapid onset in minutes and lasts for a few hours.
    - Ideal for the rapid relief of symptoms.
2. Long Acting β2-Agonists
    - Salmeterol (Serevent) is the most widely used example.
    - Maximum effect after 2 hours and lasts for 12 hours.
    - Particularly effective for nocturnal and exercise induced symptoms.

6.6.2 Preventers

1. Inhaled Corticosteroids. ("Inhaled Steroids.")
    - Beclomethasone is the most widely used example
    - Must be taken regularly every day.
    - Excellent anti-inflammatory effects.
2. Oral Corticosteroids. ("Oral Steroids.")
    - Prednisolone is the drug of choice.
    - Often used in short courses to treat exacerbations.
    - Serious side effects are associated with regular long-term use. (A last resort in outpatient management.)
3. Leukotriene receptor antagonists.
    - Montelukast (Singulair) is an example.
    - Taken orally once each day.
    - Bronchodilator and anti-inflammatory effects.

6.7 The 'Steps' Approach to Asthma Treatment

The GINA guidelines (both internationally, and within the modified guidelines used in Ireland) and the SIGN and BTS guidelines all base treatment on a stepped approach to asthma management.

Treatment should be assessed over a period of 3-4 months and stepped up or down according to the level of asthma control achieved.

6.7.1 Step 1

This step involves the 'as-needed' reliever medication such as a rapid-acting inhaled b2-agonist for individuals:

- whose symptoms occur ≤ twice weekly, lasting a few hours
- who are asymptomatic between episodes, with normal FEV1
- who do not have disturbed sleep due to asthma symptoms.

Evidence suggests that short-acting beta2-agonists are quicker in action onset and fewer side effects than other reliever drugs (inhaled anticholinergics, short-acting oral beta2-agonists, and short-acting theophylline) (GINA, 2008).

6.7.2 Step 2

This step involves the use of a regular inhaled corticosteroid (ICS) with the short-acting beta2-agonist if symptoms are at least three times weekly, or waking the person one night weekly (Holohan and Manning, 2008). It is suggested this step is also appropriate for individuals who have had an exacerbation of asthma in the past 2 years, or are using reliever medication three times weekly or more (SIGN and BTS, 2009).

6.7.3 Step 3

This step adds a long-acting beta2-agonist (LABA) to the low dose of ICS. For convenience, this can be provided in a combined inhaler. The low dose of ICS is usually sufficient for symptom control but can be increased to a medium dose if required, provided the individual has a good response to the LABA. If this is not the case, the ICS can be increased further, or alternative such as a leukotriene receptor antagonist or modified-release theophylline considered.

A budesonide/formoterol combination inhaler can also be considered which ha been shown to result in improved asthma control in adults. This combination can act as both a preventer and a reliever but its use should be re-considered if it is required as a reliever more than once per day.

6.7.4 Step 4

Step 4 involves the increase of ICS from a medium to a high dose and should only

be initiated by a specialist respiratory medicine or in difficult to treat asthma. It is recommended that alternative diagnoses should be considered and investigated (NHS Institute for Innovation and Improvement, 2008).

6.7.5 Step 5

Referral to a specialist in respiratory medicine should be initiated.

6.8 Acute Asthma Exacerbations

One person dies per week in Ireland from an asthma exacerbation (Holoran, 2009).

Acute exacerbations may occur in response to a trigger factor such as a respiratory tract infection. Individuals may have a progressive increase in shortness of breath, or develop cough, wheezing or chest tightness. Respiratory distress is likely to develop.

Signs and Symptoms of acute exacerbations are classified below (From SIGN and BTS, 2009):

SEVERITY	CRITERIA
Near Fatal	Respiratory acidosis (increased arterial carbon dioxide) and/or requiring mechanical ventilation with increased inflation pressures
Life-threatening	Any **one** of the following in someone with severe asthma: • Peak expiratory flow rate < 33% of best or predicted • Oxygen saturation < 92% • Silent chest • Cyanosis • Feeble respiratory effort • Bradycardia • Dysrhythmia • Hypotension • Exhaustion • Confusion • Coma
Acute severe	Any **one** of: Peak expiratory flow rate 33–50% of best or predicted Respiration rate: **2–5 years old:** 40 breaths/min **5–12 years old:** 30 breaths/min **> 12 years old:** 25 breaths/min Pulse: **2–5 years old:** 140 beats/min **5–12 years old:** 125 beats/min **> 12 years old:** 110 beats/min Inability to complete sentences in one breath

	Use of accessory neck muscles (in children)
Moderate asthma exacerbation	Increasing symptoms Peak expiratory flow rate > 50–70% of best or predicted No features of acute severe asthma
Brittle asthma	**Type 1:** wide variability in peak expiratory flow rate despite intensive therapy (i.e. > 40% diurnal variation for > 50% of the time over > 150 days) **Type 2:** sudden severe attacks despite apparently well-controlled asthma

Table 4: Signs and Symptoms of Acute Asthma Exacerbation (SIGN and BTS, 2009)

Individuals who respond well to treatment may not need referral to acute services for an exacerbation of their asthma; however there are a number of circumstances which would mean that even a moderate asthma attack in a specific individual should mean that a referral is made for further assessment. These circumstances include medical and psychosocial factors such as:

- Previous near-fatal exacerbation of asthma
- Previous admission or A&E attendances (especially <12 months)
- Use of several different asthma medications to control symptoms
- Non-compliance with treatment, including failure to attend appointments
- Psychiatric Illness, drug or alcohol misuse, sedative use
- Physical disability or learning difficulty
- Psychosocial factors such as marital difficulties, income or employment problems etc.
- Pregnancy

Treatments aim to relieve airflow obstruction and hypoxemia and include the repeated use of a rapid-acting inhaled b2-agonist bronchodilator, the use of systemic glucocorticosteroids, Oxygen administration and antibiotic therapy if appropriate.

(SIGN and BTS, 2009)

6.9 Specific Circumstances

There are a number of patient groups who have specific circumstances regarding the diagnosis and treatment of their asthma. These include:

6.9.1 Children Aged Less than 5

This patient group may present challenges with both the diagnosis and protocol. Due to the nature of this protocol, details are not covered here with respect to this patient group. For further details however, please refer to the SIGN and BTS guidelines, and to the Irish Asthma Society Guidelines for general practice referenced at the beginning of this section.

6.9.2 The Elderly

Asthma is often a component in respiratory disease in the elderly, and can be the first presentation of the disease in an individual. Diagnosis and treatment of the condition in this patient group is often complicated by coexisting conditions. Differentiation of asthma with COPD is often extremely difficult.

6.9.3 Occupational Asthma

Occupational asthma is often mistaken for COPD or for chronic bronchitis. Occupational asthma should be considered if an individual presents who is previously asymptomatic but has developed new symptoms of rhinitis, cough, and/or wheeze (particularly in non-smokers) (Holohan and Manning, 2008). For further information please see ***Appendix A.***

7. Prognosis (Main Prognostic Factors)

The prognosis for individuals with asthma is good, especially for individuals with mild asthma. Individuals with well controlled symptoms continue to function effectively, and progression to severe forms of the disease is rare in this group.

The extent to which lung function deteriorates is uncertain in well controlled asthmatics. Although there is some impairment to lung function, and airway remodelling is present, it is unclear to what extent this is detrimental.

54% of childhood asthmas disappear within 10 years.

However, some people (possibly up to 5%) have severe disease that responds poorly to treatment. These people are most at risk of morbidity and death from asthma. This group also includes individuals who are not compliant with medication therapies.

In acute asthma attacks, approximately 10–20% of people presenting to the emergency department with asthma are admitted to hospital, with around 10% of these ventilated. Studies indicate that individuals discharged from emergency care are likely to have a further exacerbation of symptoms over the next two week period.

Of these, fewer than 10% receive mechanical ventilation. Those who are ventilated are at 19-fold increased risk of ventilation for a subsequent episode.

It is unusual for people to die unless they have suffered respiratory arrest before they reach hospital.

One study of 939 people discharged from emergency care found that of those available for follow-up 17% (95% Confidence Interval of 14% - 20%) relapsed within 2 weeks.

8. Information Gathering at the In Person Assessment

Asthma is a chronic but variable condition. Both the baseline level of symptoms and their variability must be assessed to arrive at a true picture of a claimant's disability.

8.1 Assessing the Claimant

The assessment should be made using all the information available. This includes information from the claimant's file, informal observations, medical history, activities of daily living, and examination.

To take account of the variability of asthma, it is important to ask about the claimant's illness over time. Considering events in the last 2 years will give a representative impression. There is a wide range of severity amongst claimants with asthma; differing levels of severity are discussed below.

8.1.1 Controlled Asthma

Modern asthma treatment is capable of eliminating or significantly reducing regular asthma symptoms. Activities of the average day are unlikely to be significantly restricted. The asthmatic should be able to live independently and continue with their usual interests and hobbies. The claimant's asthma will probably be monitored and treated in primary care.

8.1.2 Poorly controlled/Uncontrolled Asthma

Poorly controlled asthmatics are likely to require high doses of inhaled and/or regular oral steroids, regular long acting ß-agonists, and one or more of the following:

- Theophylline,
- Leukotriene antagonist,
- Cromoglycate,
- Nedocromil
- Anticholinergic bronchodilator.

Poorly controlled/Uncontrolled asthmatics are likely to experience frequent or severe exacerbations that require additional treatment such as high dose oral steroids, nebulised bronchodilators or courses of antibiotics. Some may have required emergency treatment from their GP or at an Accident and Emergency unit, and the most severe may have experienced hospital admission. Their asthma may be under the supervision of a Consultant.

The main effect of asthma is to impair exercise tolerance. This is particularly likely

to affect the activities of walking and climbing stairs. In the most severe cases, even washing and dressing may become difficult.

Helpful Questions for Assessing Asthma Severity and Related Disability

- Are there any specific triggers for the asthma?
  - (Exercise, cold air, respiratory infections, allergen exposure, drugs, emotional factors.)
- What has been the frequency and duration of attacks over the last 2 years?
- 'Bad Days' – what, in terms of daily activities, makes them different, and how often do they occur?
- Does their asthma interfere with hobbies and interests?
- How do they get around, for instance for shopping or taking the children to school? (Walking, car, bicycle or public transport.)
- Does their asthma cause any difficulty sleeping? Where do they sleep?
- What is the claimant doing about their asthma?
  - Do they attend their GP's asthma clinic?
  - Do they do monitor their peak flow?
  - Do they have a management plan for their asthma?
- How effective is their treatment?
  - Have there been any changes to medication in the last 2 years and why were the changes made?
  - How many courses of oral steroids and antibiotics have they needed in the last 2 years?
  - Have they required the use of a nebuliser in the last 2 years?
- Have they required hospital treatment for their asthma?
  - Do they attend a hospital outpatient clinic because of their asthma?
  - Have they required emergency asthma treatment from their GP or at an Accident and Emergency department?
  - Have they been admitted to hospital because of their asthma in the last 2 years?

8.1.3 Interpreting the Peak Flow Measurement

A peak flow measurement taken in the course of a disability examination is only a snapshot, and may not reflect the typical experience of the claimant. However, it does provide an objective piece of information that can be weighed with all the other data obtained from the claimant's medical history, treatment, examination findings and Typical Day. All this information must be used to build up a picture of their asthma and any disability it may cause.

8.2 Aids to Grading the Disabling Effects of Asthma

8.2.1 The Medical Research Council Dyspnoea Scale

The table below describes a framework to categorise the degree of breathlessness experienced by an individual with asthma.

Grade	Degree of breathlessness related to activities
1	Not troubled by breathlessness except on strenuous exercise
2	Short of breath when hurrying or walking up a slight hill
3	Walks slower than contemporaries on level ground because of breathlessness, or has to stop for breath when walking at own pace
4	Stops for breath after walking about 100m or after a few minutes on level ground
5	Too breathless to leave the house, or breathless when dressing or undressing

Table 5: Medical Research Council Dysponea Scale (adapted from Fletcher, 1959)

8.2.2 Percentage of Predicted Peak Flow

The percentage of predicted peak flow is one way of assessing the severity of asthma. It is important to remember that there is considerable variability between individuals, and measures of lung function do not always correlate with functional ability.

The following table describes broad categories of functional impairment. Please note this table is provided for guidance only.

% Predicted Peak Flow	Description of Severity	Range of Functional Effects

>75%	Mild	Nil	
50-75%	Moderate	From:	Breathlessness on heavy exertion.
		To:	Breathlessness walking at normal pace on the flat.
33-49%	Severe	From:	Breathlessness on walking 100m.
		To:	Breathlessness on climbing one flight of stairs without stopping.
<33%	Very Severe	From:	Cannot climb one flight of stairs without stopping.
		To:	Bed-bound or chair-bound.

Table 6: Broad categories of functional impairment from asthma

8.2.3 Psychological and Social Aspects

When a person is suffering from a chronic illness such as asthma, psychological problems may result. Emotions such as anxiety or denial may affect their ability to process, remember, or act upon the information they are given. This may hinder their compliance with advice and treatment, and reduce their chances of gaining control of their illness (Bucknall, 1999). The successful recognition and treatment of psychological illnesses may improve quality of life and reduce disability (Lacasse,2001).

Research has demonstrated that the relationship between a person's symptoms and the severity of their asthma is complex. It partly depends on the individual's mental and physical ability to cope with the demands of the condition (Rimington et al, 2001).

Social factors such as income, marital status, alcohol consumption and housing have an important influence on levels of physical functioning among people with chronic illnesses (Mackenbach et al, 2001)

There is some evidence to show that a worker with the label 'asthmatic' may face prejudicial attitudes in the workplace (Cox et al, 2000).

9. Analysis of Effect on Functional Ability

Eligibility to the Department of Social and Family Affairs various Illness-related schemes and the Activation Programme is determined primarily by the degree of Ability/Disability and its expected duration.

The degree of Ability/Disability assessed, using the following Indicators, can be depicted on the Ability/Disability Profile illustrated below.

9.1 Indicators of Ability/Disability

Normal

- No history of exacerbations since childhood
- No regular medication
- No breathlessness on exertion
- No restriction of average day activities especially walking, running or climbing stairs
- No evidence of breathlessness during interview or examination
- Clinical examination normal

Mild

- On regular preventative treatment
- Monitored by GP
- Breathless on heavy exertion
- Breathless on walking uphill or hurrying on level ground
- No evidence of breathlessness during interview or examination
- Clinical examination normal

Moderate

- On regular medication
- May have a history of requiring oral steroids occasionally in the last two years
- Breathless on walking 100 metres at a normal pace or on climbing one flight of stairs at a normal pace

- May show some evidence of breathlessness during examination particularly when climbing on and off the examination couch
- May show some evidence of wheeze on clinical examination

Severe

- On high dosage of inhaled steroids and /or oral steroids, regular long acting B antagonists, and one or more of: theophylline, leukotriene antagonist, cromoglycate nedocromil or anticholinergic bronchodilator.
- History of frequent and sever exacerbations requiring treatment with high dose oral steroids, nebulised bronchodilators and oral antibiotics
- May have required emergency treatment from GP/A&E
- Breathlessness inhibits activities out with the home without assistance or supervision
- Breathless on walking or dressing
- Breathless during interview and examination
- Observed to use accessory muscles of respiration
- Widespread wheeze on clinical examination

Profound

- On maximum medication
- Requires frequent courses of oral steroids and oral antibiotics
- May have a history of regular nebuliser use
- History of hospital admission
- May be under care of a hospital consultant
- Rarely able to participate in activities outside the home due to severely restricted exercise tolerance
- Requires help with self care such as bathing washing and dressing due to breathlessness
- Breathless during interview. May be unable to complete a sentence without becoming breathless
- Observed to use accessory muscles of respiration
- Widespread wheeze on clinical examination

9.2 Ability/Disability Profile

Indicate the degree to which the Claimant's condition has affected their ability in ALL of the following areas.					
	Normal	Mild	Moderate	Severe	Profound
Mental health/Behaviour	☐	☐	☐	☐	☐
Learning/Intelligence	☐	☐	☐	☐	☐
Consciousness/Seizures	☐	☐	☐	☐	☐
Balance/Co-ordination	☐	☐	☐	☐	☐
Vision	☐	☐	☐	☐	☐
Hearing	☐	☐	☐	☐	☐
Speech	☐	☐	☐	☐	☐
Continence	☐	☐	☐	☐	☐
Reaching	☐	☐	☐	☐	☐
Manual dexterity	☐	☐	☐	☐	☐
Lifting/Carrying	☐	☐	☐	☐	☐
Bending/Kneeling/Squatting	☐	☐	☐	☐	☐
Sitting	☐	☐	☐	☐	☐
Standing	☐	☐	☐	☐	☐
Climbing stairs/Ladders	☐	☐	☐	☐	☐
Walking	☐	☐	☐	☐	☐

10. Summary of Scheme Criteria

Scheme eligibility criteria are maintained on the DSP website and are accessible from the following links:

- **Carer's Allowance**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/carers_all.aspx
- **Carer's Benefit**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/carers_ben.aspx
- **Disability Allowance**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/disall.aspx
- **Disablement Benefit**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/oib_disableb.aspx
- **Domiciliary Care Allowance**
  http://www.welfare.ie/EN/Schemes/IllnessDisabilityAndCaring/Carers/DomiciliaryCareAllowance/Pages/DomiciliaryCareAllowance.aspx
- **Illness Benefit**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/illben.aspx
- **Injury Benefit**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/oib_injuryb.aspx
- **Invalidity Pension**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/invalidity.aspx
- **Respite Care Grant**
  http://www.welfare.ie/EN/OperationalGuidelines/Pages/respitegrant.aspx

Appendix A - Occupational Asthma

A.1 Overview

Asthma is one of the commonest occupational lung diseases (Lombardo, 2001) resulting in up to a million days sickness absence annually in the United Kingdom (O'Neill, 1995). About 9-15% of adult-onset asthma is considered attributable to occupational exposures (Neuman Taylor, 1998; Lowhagen, 1999). There is no indication that this figure has changed over the past decade.

Approximately 1160 new cases were reported in the UK in 1999 (Mayer et al, 2001; Macdonald et al, 2000).

Occupational Asthma is defined as: asthma, which is induced by an inhaled agent at work:

- An irritant inhaled in toxic concentration, or
- A hypersensitivity reaction to a **sensitising agent**.

It is commonest amongst:

- Paint Sprayers. (isocyanates)
- Bakers. (flour)
- Plastics and Chemicals Workers. (epoxy resins and azodicarbonamide)
- Hairdressers. (persulphates)

Precautions to prevent occupational asthma are widely used. Examples include enclosure or segregation of the process, exhaust ventilation and the provision of appropriate protective devices such as respirator masks.

COSHH (Control of Substances Hazardous to Health) regulations require employers to institute health surveillance programmes where there is a risk of occupational asthma. These include symptom enquiries, measurements of lung function and reviews of sickness absence (Cox et al, 2000).

Although they are no more likely to develop occupational asthma, it is prudent for asthmatics to avoid working in environments known to contain respiratory sensitisers. The development of occupational asthma would be more difficult to detect, and the symptoms may be more severe (Cox et al, 2000).

A.2 Diagnosis

A detailed, comprehensive history is one of the most crucial steps in reaching a diagnosis.

Occupational asthma should be considered in individuals who develop new symptoms of rhinitis, cough, and/or wheeze, particularly if they are non-smokers. In these individuals, it is appropriate for the patient history to include details regarding:

- Work history and history of occupational exposure to known or suspected sensitising agents (there are approximately 200 different occupational sensitisers recognised at present)
- If there was an absence of asthma symptoms before beginning employment or the individual's asthma symptoms have deteriorated since employment commenced
- If the symptoms improve when away from work, or deteriorate when returning to work – symptoms may improve at weekends or during holiday but return when work is resumed. It may require a period of time (such as a holiday) for the inflammatory reaction to settle, before re-exposure invokes the symptoms again.

A.2.1 Symptoms and Examination

The cardinal symptoms and signs of asthma are described in earlier sections of this document.

A.2.2 Investigations

Cases of suspected occupational asthma are usually referred to a hospital specialist.

Investigations specific to occupational asthma normally include:

- A Work Place Challenge Test. The patient is removed from work for two weeks. They then return to work under clinical supervision. Several peak flow readings will have been taken before returning to work and further readings will be taken during the following three days at work.
- The Laboratory Challenge Test is the definitive test for occupational asthma. A specific agent is inhaled under laboratory conditions, and airway responsiveness is measured. The patient must be supervised for at least 8 hours.

A.2.3 Management

The most important aspect is:

Immediate removal from the exposure.

Removal very early in the disease process may result in complete resolution of the asthma, whilst delay may allow chronic asthma to develop (Ross and Macdonald, 1998).

It is estimated that approximately 50% of those affected by occupational asthma

stay with the same employer.

Occupational asthma is a Prescribed Disease under the Industrial Injuries Provisions of the Social Security Contributions and Benefits Act 1982.

A.3 Differential Diagnosis (Reactive Airway Dysfunction Syndrome)

A Differential diagnosis to Occupational Asthma is Reactive Airways Dysfunction Syndrome (RADS). This condition is a chronic asthma like condition, which is thought to be a form of occupational asthma but has different features.

Indoor exposures to high levels of irritants such as nitrogen oxide and volatile organic compounds are associated with the development of RADS, a persistent asthma-like syndrome in people with no history of asthma. RADS appears to be distinct from asthma and may be, on occasion, a form of environmental lung disease. However, RADS and asthma have many clinical similarities (e.g. wheezing, dyspnoea, cough), and both may respond to corticosteroids.

The diagnosis of RADS requires:

- The presumption of previously normal respiratory physiology, without bronchial hyperactivity.
- Typical symptoms are cough, wheeze and dyspnoea.
- It follows exposure to **high** concentrations of gas, smoke, fumes, or vapour with irritant properties.
- There is no latent period. The onset of symptoms is within 24 hours of exposure and they may persist for a period of a few days or for as long as 12 years.

Appendix B - Peak Expiratory Flow Monitoring (PEF)Error! Bookmark not defined.

B.1 Resources

There are a number of internet resources available which demonstrate the correct technique for measuring PEF for both patients, and health professionals.

A video of the technique is available from the Asthma Society of Ireland at the following link:

http://www.asthmasociety.ie/inhaler/inhaler-peakflow-video.html

B.2 Recommended Technique for Measuring Peak Flow

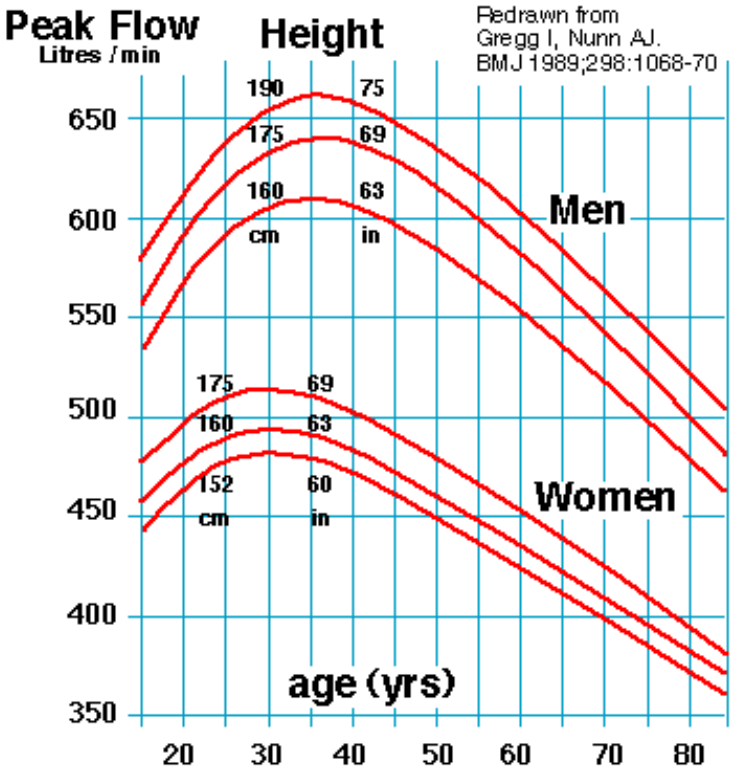
- Use equipment that functions correctly. In examination centres, report worn-out or defective equipment to the Medical Examination Assistant (MEA) so that it can be replaced.
- The type of meter used (Wright or EU) should be recorded.
- Explain the procedure and demonstrate it to the subject.
- Move the pointer to the bottom of the scale.
- The subject should be sitting up straight or standing.
- The subject should hold the peak flow meter horizontally, and the subject's fingers must not impede the movement of the pointer along the scale.
- Ask the subject to take a deep breath, seal their mouth around the mouthpiece, and blow as hard and as fast as they can. (Like blowing out a candle.) Pursed lips or air leaks will invalidate the reading.
- The result should be compared to a graph of predicted peak flow according to the subject's age, sex and height. Both the actual and the predicted peak flow should be recorded with a brief explanation to help the Decision Maker to interpret the result.
- If the subject is not able to achieve good technique, then this must be noted for the benefit of the Decision Maker.

PEF should be recorded as the best of three forced expiratory blows from total lung capacity with a maximum pause of two seconds before blowing. The subject can be standing or sitting. Further blows should be done if the largest two PEF are not within 40 l/min.

PEF is best used to provide an estimate of variability of airflow from multiple

measurements made over at least two weeks. Increased variability may be evident from twice daily readings. More frequent readings will result in a better estimate but the improved precision is likely to be achieved at the expense of reduced subject compliance.

PEF variability is best calculated as the difference between the highest and lowest PEF expressed as a percentage of either the mean or highest PEF.



The upper limit of the normal range for the amplitude % highest is around 20% using four or more PEF readings per day but may be lower using twice daily readings. Epidemiological studies have shown sensitivities of between 19 and 33% for identifying physician-diagnosed asthma.

PEF variability can be increased in subjects with conditions commonly confused with asthma so the specificity of abnormal PEF variability is likely to be less in clinical practice than it is in population studies.

PEF records from frequent readings taken at work and away from work are useful when considering a diagnosis of occupational asthma.

Peak flow records should be interpreted with caution and with regard to the clinical context. They are more useful in the monitoring of patients with established asthma than in making the initial diagnosis.

Appendix C - Treatments for Chronic Asthma Error! Bookmark not defined.

C.1 Treatments

C.1.1 Short Acting ß-Agonists

This group refers to the selective $ß_2$ agonists. Salbutamol (Ventolin) and Terbutaline (Bricanyl) are common examples. They are taken by inhalation, and have a rapid onset of action. (The effects begin after 15 minutes, and last about four hours.) The $ß_2$ agonists cause bronchodilation, and are used as **relievers.** Possible side effects include tremor, palpitations and muscle cramps, although these are uncommon when the drugs are taken in inhaled form.

C.1.2 Long Acting ß-Agonists

Examples include Salmeterol (Serevent) and Eformoterol (Oxis). They achieve their maximum effect in 2 hours and last for about 12 hours. Thus, they are particularly effective for nocturnal symptoms, but they should not be used for the relief of acute symptoms. The long acting ß-agonists do not suppress inflammation, so they should always be used with inhaled corticosteroids. Indeed there is evidence that given as monotherapy there is an increase in asthma related mortality. Inhalers which provide a combination of steroid and Long Acting ß-Agonist increase compliance and remove any concerns about only giving Long Acting ß-Agonists. This combination can achieve excellent symptom reduction and peak flow control.

C.1.2 Anticholinergic Bronchodilators

The commonest example is Ipratropium Bromide (Atrovent). These drugs block the cholinergic bronchoconstrictor effect of the Vagus nerve. Maximum effect is achieved 30 – 60 minutes after use, and it lasts for about 4 hours. Anticholinergic bronchodilators are not as effective as ß-agonists in asthma, but can be used as an adjunct if control is incomplete, or ß-agonists are not tolerated. They are particularly suitable for very young children or older adults.

C.1.3 Theophyllines

These drugs are effective bronchodilators. They are taken orally as sustained release formulations. The theophyllines have a narrow therapeutic index, with considerable individual variation in the necessary dose. Therefore, it is necessary to monitor blood concentrations. For these reasons, they are used much less now that long acting ß-agonists are available. Common side effects include nausea and vomiting, abdominal discomfort, headache, malaise, tachycardia and fits. There are numerous drug interactions with other common treatments such as erythromycin, phenytoin and cimetidine.

C.1.4 Sodium Cromoglycate and Nedocromil Sodium

These drugs are sometimes known as Mast Cell Stabilisers, although this may not be their main mode of action in asthma. They block bronchoconstriction to the stimuli of exercise and antigens. They are sometimes used as first line prophylactic agents, particularly in young children, or as an addition to inhaled corticosteroids when control is poor. They are less effective than steroids in adults, and are not useful as relievers.

C.1.5 Inhaled Corticosteroids

Beclomethasone and budesonide are the most common examples. Fluticasone is a more potent drug, and is used at half the dose. The majority of their benefits are seen at low to moderate doses, (up to 800 mcgs), with relatively little additional benefit from high doses. They are highly effective at reducing bronchial reactivity and inflammation and at controlling symptoms. Peak effect usually occurs 3–7 days after initiation of treatment. Side effects are dose-dependent, inhaler device-dependent, and technique-dependent. In adults, adverse effects become more likely once a daily dose of 1000 mcgs of beclomethasone is reached:

- Oropharyngeal Candidiasis.
- Dysphonia, Sore Throat and Cough.
- Purpura and Thinning of the Skin.
- Cataracts.

Large volume spacers should be used at doses above 800 mcgs to reduce pharyngeal deposition.

Inhaled corticosteroids should be taken regularly for the prevention of symptoms. Doubling the dose at the first sign of a respiratory infection is a frequently used tactic, and seems to reduce the risk of a severe exacerbation of asthma.

Unfortunately, commonly discussed side effects of corticosteroids, the lack of an instant improvement in symptoms, and the need to take them regularly, at least twice a day, all conspire to make poor compliance extremely common.

C.1.6 Oral Corticosteroids

Regular long-term oral corticosteroids are the last resort in the out-patient management of asthma treatment. However, short courses are very valuable for controlling exacerbations of asthma.

Short courses of oral steroids are used in the following situations:

1. As a diagnostic test.
2. To gain control when starting treatment in severe cases.

3. When inhalers are ineffective.

4. During exacerbations of asthma.

Patients prone to severe exacerbations of asthma often keep a supply of prednisolone tablets in reserve so that they can be used, (according to their individual management plans), should an exacerbation develop.

In long-term use, a regime of alternate daily dosing is preferable. Inhaled corticosteroids should be continued to keep the dose of oral steroids as low as possible.

The prevention of osteoporosis is particularly important for patients using long-term steroids. Treatments such as Hormone Replacement Therapy, and Bisphosphonates should be considered.

The body's immune and stress responses are blunted by regular steroid use. Patients should carry 'steroid cards', and avoid contact with chickenpox or shingles.

C.1.7 Leukotriene Antagonists

Leukotrienes are one of the key inflammatory mediators responsible for bronchoconstriction. The leukotriene antagonists are an exciting and relatively new class of treatment for asthma. Examples include Montelukast (Singulair) and Zafirlukast (Accolate). They are taken by mouth, once daily, and are generally very well tolerated. (So, compliance is better.) They are useful in mild asthma or in moderate asthma in addition to inhaled steroids. (They are too new to feature in the BTS guidelines, but they are often considered for use as an alternative to long acting ß-agonists at step 3.)

C.1.8 Desensitisation and Avoidance of Allergens

Trials of these treatments have been disappointing, except where a patient has an obvious precipitating factor. More common are asthmatics who are sensitive to a variety of ubiquitous allergens such as pollen, house dust mite, and fungal spores. Unfortunately, it is impractical to entirely avoid these.

Appendix D - Individual Management Plan

D.1 Example of an Individual Management Plan for an Adult Asthmatic

The headings below provide an outline of the information which may be included in an individual management plan. An example of an individual management plan is provided by the Asthma Society of Ireland, and is included in the Irish Asthma 'Guidelines for General Practice' adapted from the Global Initiative GINA Global Strategy for Asthma Management and Prevention developed by the Irish College of General Practitioners and the Asthma Society of Ireland. The example plan is available for download at http://www.asthmasociety.ie/resources/Written-Action-Plan.pdf.

Alternative examples of written management plans can be downloaded from the UK National Asthma Campaign (www.asthma.org.uk).

Written plans provide individuals with self management techniques to help them continue to control their asthma symptoms and reduce exacerbations/severe attacks and the need for emergency or unplanned treatment.

- Details of regular treatment
  - When to increase treatment
- Assessing level of asthma control
  - How to increase treatment (see below)
- Step up treatment
  - Assess improvement
  - When to decrease treatment and return to regular maintenance doses
- When to contact GP if response not adequate
- What to do in an emergency situation & emergency contact details

Details of when and how to increase treatment may be based either on worsening symptoms over a 48 hour period, or a decrease in PEFR. For example, the following approach may be suggested (note this example is provided for illustrative purposes only):

- If PEFR is > 75% usual measurement - advise regular use of a short-acting beta2-agonist for 1–2 days until symptoms improve. If there is no benefit, start a course of oral prednisolone.
- If PEFR is 50–75% usual measurement - advise starting a course of oral

prednisolone with regular use of their short-acting beta2-agonist. If no benefit is seen after 1–2 days, seek medical help.

- If PEFR is < 50%, advise starting a course of oral prednisolone along with regular use of their short-acting beta2-agonist and seek medical help.

(NHS Institute for Innovation and Improvement, 2008; SIGN and BTS, 2009)

Appendix E - Example Asthma diary

Purpose: To use a diary card to keep track of a patient's daily asthma symptoms.

Citations with documentation. 01.15.02

Sriram and Svirbely 1998

enter an "x" in the appropriate column for each question (give only 1 answer per row)						
Sleep disturbance	no sleep disturbance due to asthma	awoken once during the night, for less than 1 hour, because of asthma	awoken 2 or 3 times or once for more than an hour because of asthma	awake most of the night because of asthma		
			x		Yes	2
Chest tightness on awakening	not present and didn't require extra bronchodilator during the night	not present but did require extra bronchodilator during the night	present			
			x		Yes	2
Duration and frequency of daytime wheeze and breathlessness	none	occasional	frequent but not all day	most or all of the day		
			x		Yes	2
Severity of daytime wheeze and breathlessness	none	mild; not incapacitating or distressing	moderate to severe; distressing and/or had to limit activities			
			x		Yes	2
Cough during the day	none	occasional	more than occasional			
			x		Yes	2

calculate	**result**	
data complete?	Yes	
asthma diary card score	10	out of 12
asthma severity based on score	moderate	

Appendix F - Drug Delivery Systems

F.1 Drug Delivery Systems

A wide variety of devices have been developed in an attempt to provide simple, efficient and cheap methods of administering inhaled drugs. Inhalation delivers the drug directly to the airways. The necessary dose is smaller than for drugs given by mouth, and the incidence of side effects is reduced.

F.1.1 Metered Dose Inhaler (MDI)

This device uses compressed gas to dispense a metered dose of drug in aerosol form. MDIs are very widely used, with about 400 million prescribed annually, worldwide. Recently devices using CFC free gas have been introduced. MDIs are cheap to produce, but they are inefficient. Only 10% of the metered dose reaches the lungs (the rest is swallowed and metabolised by the liver), and about 25% of patients are unable to co-ordinate the triggering of the device with the necessary intake of breath. MDIs work more efficiently in conjunction with a spacer device such as a Volumatic, and this combination is often used for young children and the elderly. Because of the potential difficulties of using MDIs, it is particularly important to teach and then regularly check inhaler technique.

F.1.2 Breath Actuated Aerosol Inhalers

These inhalers do not require skilful co-ordination. Inspiration triggers the device. This makes them easier to use, especially for children.

F.1.3 Dry Powder Inhalers

These do not rely on co-ordination, and are easy to use. The improved efficiency of lung deposition compared with an MDI means that the use of lower doses might be possible.

F.1.4 Nebulisers

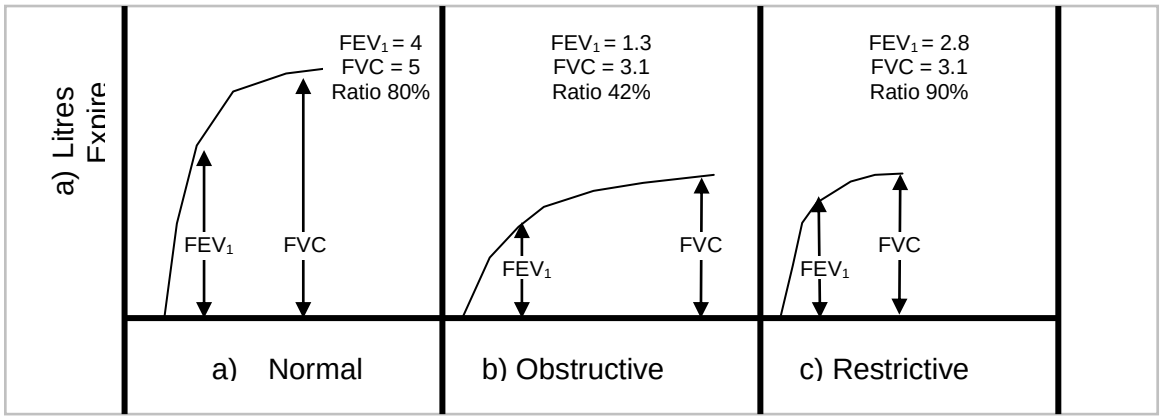
Nebulisers are capable of delivering a high dose of bronchodilator. These machines produce a fine mist of liquid medication that can be easily inhaled from a mask or mouthpiece. The dose is delivered over about ten minutes. However, only about 12% of it reaches the lungs, as the majority escapes into the atmosphere, or is trapped in the nebuliser tubing.

F.1.5 Tablets and Syrups

This route is used for the leukotriene antagonists and the theophyllines.

Appendix G - Glossary of Terms

Term	Meaning
Forced Expiratory Volume in the first second (FEV_1)	The amount of air that can be expelled in one second from a maximal inspiration using maximal effort.
Forced Vital Capacity (FVC)	The total amount of air expired from the lung using maximal effort from a maximal inspiration.
Peak Expiratory Flow (PEF)	A measure of lungpower using a simple apparatus. Useful in monitoring asthma.
Total Lung Capacity (TLC)	Total amount of air in the lung. It can only be measured by indirect means.
Gas Transfer Factor (DL_{CO})	A measure of the ability to transfer a respiratory gas from atmosphere to blood in a given time. Useful in lung fibrosis.
Obstructive Spirometry	Fev_1 is reduced more than FVC causing a reduced FEV_1 : FVC ratio. Examples: Asthma & COPD.
Restrictive Spirometry	Suggests FVC is reduced. Causes a normal or increased FEV_1 : FVC ratio. Examples: chest wall abnormalities & lung fibrosis.



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