Breathing pattern disorders: identifying and managing in primary care

Breathing is a normal vital function which is spontaneous, regular, quiet and effortless and reflects the way that the respiratory system functions. Breathing pattern disorders or dysfunctional breathing, historically known as hyperventilation syndrome, are chronic abnormal respiratory patterns in relation to the efficiency of breathing, often resulting in dyspnoea and other non-respiratory symptoms (Clifton-Smith and Rowley, 2011). It is not a disease process, but alterations in breathing patterns that interfere with normal respiratory processes. Breathing pattern disorders can occur with an absence of disease or co-exist with many diseases such as chronic obstructive pulmonary disease (COPD), asthma, or heart disease, and in some cases, can mimic cardiac symptoms.

Boulding et al (2016) recognised that the frequency of breathing pattern disorders is poorly understood due to the lack of a standardised diagnostic criterion, and that they are probably allied with disproportionately high costs to healthcare providers, due to multiple visits to GP surgeries and other healthcare providers, including secondary care. More than 10 years ago, it was estimated that 10% of the population worldwide were diagnosed as ‘hyperventilators’, with far more having a subtle, yet clinically significant, breathing pattern disorder (Thomas et al, 2005). This level increased to 29% in a sample size of

KEY WORDS:
- Dysfunctional breathing pattern
- Breathing pattern disorders
- Symptoms of breathing pattern disorders
- Breathing exercises

Linda Pearce
Respiratory consultant nurse, West Suffolk NHS Foundation Trust, Bury St Edmunds

Helen Stewart
Respiratory lead physiotherapist, West Suffolk NHS Foundation Trust, Bury St Edmunds
people with asthma have an element of forced end expiration.

Efficient breathing should be nasal only. This helps to filter, warm and humidify the inspired air. It also helps to reduce the turbulent airflow of mouth breathing, and offers a quiet laminar flow, which helps the air to get deeper into the peripheries of the lungs, while reducing irritation to the airways. This ensures quiet breathing, which is energy efficient.

**BREATHING PATTERN DISORDERS**

Breathing pattern disorders should be considered a whole person problem, especially in long-term conditions where this can destabilise mind and muscles, mood and metabolism. Clifton-Smith and Rowley (2011) summarised the range of aetiological factors involved in breathing pattern disorders, breaking them down into:

- Biomechanical
- Physiological/biochemical
- Psychological (Table 2).

While some breathing pattern disorders are for a short period, others are sustained and become habitual, even if the contributing factor has improved. Apart from coexistence with chronic lung diseases, such as chronic obstructive pulmonary disease (COPD), asthma and bronchiectasis, many other conditions can be identified as a cause for a dysfunctional breathing pattern.

Some examples include children and adults with blocked noses, who become habitual mouth breathers and often establish chaotic breathing patterns. With some simple nasal rinsing, this could be addressed and resolve the blocked nose. However, the ‘learned mouth breathing pattern’ could continue, developing further problems (see Box 1) associated with breathing pattern disorders. After acute infection, for example, pneumonia, people develop poor chaotic breathing patterns to respond to the added physiological need to increase their respiratory rate. Commonly, the chaotic breathing pattern continues long after the pneumonia has resolved, particularly if this is combined with the discomfort of pleurisy. Following surgery, poor breathing patterns may develop due to pain and anxiety, resulting in a tendency to brace and have increased tension through the body.

Boulding et al (2016) proposed a classification of breathing pattern disorders to include:

**Table 1: Groups of muscles used for breathing (McConnell, 2011)**

<table>
<thead>
<tr>
<th>Muscles of inspiration</th>
<th>Muscles of expiration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main muscles:</strong></td>
<td>Quiet relaxed breathing:</td>
</tr>
<tr>
<td>Diaphragm (dome flattens and moves downwards increasing volume of thoracic cavity; also moves lower ribs upward and forward)</td>
<td>Elastic recoil of diaphragm</td>
</tr>
<tr>
<td>External intercostals (upward and outward movement — known as bucket handle movement)</td>
<td><strong>Active respiration:</strong></td>
</tr>
<tr>
<td><strong>Accessory muscles:</strong></td>
<td>Abdominals — rectus abdominis, transversus abdominis, internal and external obliques (pull ribs down, compress abdominal contents thus pushing diaphragm up)</td>
</tr>
<tr>
<td>Interchondral part of internal intercostals</td>
<td>Quadratus lumborum — not shown above (pulls ribs down)</td>
</tr>
<tr>
<td>Sternocleidomastoid (elevates sternum)</td>
<td></td>
</tr>
<tr>
<td>Scalenes (elevate upper rib)</td>
<td></td>
</tr>
<tr>
<td>Pectoralis minor (elevate rib cage)</td>
<td></td>
</tr>
</tbody>
</table>

**Practice point**

Forced end expiration is an active process which is brought on by active contraction primarily of the muscles of the anterior abdominal wall, which quickly reduces the volume of the thoracic cavity.
Symptoms of breathing pattern disorders can result in fatigue, abdominal bloating, muscular aches and pains, pins and needles in the arms and hands, anxiety, palpitations, muscular fatigue, and headaches. They can also cause people to sigh or yawn, gasp for air during speech, feel that breathing is unnatural or difficult, breath-holding and clenching of the teeth.

- Hyperventilation syndrome (HVS): associated with symptoms both related to respiratory alkalosis and independent of hypocapnia
- Periodic deep sighing: frequent sighing with an irregular breathing pattern
- Thoracic dominant breathing: predominant use of the upper thorax (apical breathing), with lack of lateral costal expansion
- Forced abdominal expiration: inappropriate and excessive abdominal muscle contraction to aid expiration
- Thoracoabdominal asynchrony: delay between rib cage and abdominal contraction causing ineffective breathing mechanics.

These classifications help the clinician to recognise breathing pattern disorders and ensure that the correct treatment is applied.

### Table 2: Aetiological factors involved in breathing pattern disorders [reproduced and adapted by kind permission of Clifton-Smith and Rowley, 2011]

<table>
<thead>
<tr>
<th>Biomechanical</th>
<th>Physical/biochemical</th>
<th>Psychological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postural changes</td>
<td>Lung disease</td>
<td>Anxiety (Tweedle et al, 1994)</td>
</tr>
<tr>
<td>Upper limb movement</td>
<td>Metabolic disorders</td>
<td>Stress (Tweedle et al, 1994)</td>
</tr>
<tr>
<td>Chronic mouth breathing</td>
<td>Postnasal drip, rhinitis, sinusitis</td>
<td>Panic disorders</td>
</tr>
<tr>
<td>Cultural, i.e. tight-fitting clothes around the waist and societal pressure for flat abdomen, particularly younger females</td>
<td>Diet</td>
<td>Personality traits, obsessive, high achiever</td>
</tr>
<tr>
<td>Congenital</td>
<td>Drugs, including caffeine and alcohol</td>
<td>Suppressed emotions, anger</td>
</tr>
<tr>
<td>Abnormal movement patterns</td>
<td>Hormonal</td>
<td>Conditioning — learnt response</td>
</tr>
<tr>
<td>Postoperative pain causing tense/braced posture</td>
<td>Exercise/poor exercise technique</td>
<td>History of abuse</td>
</tr>
<tr>
<td>Chronic pain especially back pain</td>
<td>Speech/laughter</td>
<td>Sustained concentration</td>
</tr>
<tr>
<td>Obesity</td>
<td>Chronic low grade fever</td>
<td>Sustained boredom</td>
</tr>
<tr>
<td>Occupational/hobbies, i.e. divers, singers, swimmers, body builders</td>
<td>Heat</td>
<td></td>
</tr>
<tr>
<td>Vocal chord dysfunction</td>
<td>Altitude</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vocal chord dysfunction</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depression</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phobic avoidance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fear of symptoms</td>
</tr>
</tbody>
</table>

In the authors’ clinical opinion, variable irregular symptoms and lack of definitive assessment tools can make diagnoses difficult. Subjective and objective history-taking are important to exclude any underlying organic disease, such as asthma, gastro-oesophageal reflux (GOR), postnasal drip, or hiatus hernia. Management of these or any other condition should be optimised, but symptoms of breathing pattern disorders may persist. Establishing the onset and cause of symptoms, as well as identifying if they coincide with other trauma — such as fractured ribs, costocondritis, post-surgery, stress/ anxiety due to a traumatic event, increased period of stress or anxiety, or acute infection — and what helps to relieve the symptoms, will help to support an accurate diagnosis.

Healthcare professionals should consider:
- The patient’s past and current medical history
- Medical conditions which may be contributing to the breathing pattern disorder. For example, a history of asthma where the patient is using their reliever inhaler more than usual, with limited effect and no evidence of poor asthma control, i.e. stable peak expiratory flow measurements.

It is also important to explore the patient’s social history, i.e. do they exercise regularly (what sports do they do), have a good diet, what is their caffeine intake, do they have a good sleep pattern, what is their occupation, are they under increased stress, and are they able to relax, etc (Vickery, 2007).

Where usual investigations into the cause of breathlessness, such as spirometry or lung function tests, routine blood tests and chest x-rays are normal or inconclusive, further investigations are required to confirm a breathing pattern disorder (see below).

Boulding et al (2016) suggested that the most common method of diagnosing dysfunctional breathing is the Nijmegen questionnaire. This questionnaire was developed and validated (with a sensitivity of 91%, specificity of 95%) for use in people with hyperventilation syndrome (Van Dixhoorn and Folgering, 2015). Many patients in practice can score negatively (less than 23) with the Nijmegen questionnaire (a list of 14 symptoms, scoring from never, rarely, sometimes, often, very often, where a maximum of 64 can be scored), but do demonstrate a different type of breathing pattern disorder on further clinical assessment.

There are several other methods used to diagnose breathing pattern disorders. These include Self-Evaluation of Breathing Questionnaire (SEBQ) (Mitchel et al, 2016), end tidal carbon dioxide measurement, i.e. breath hold.
AirFluSal® Forspiro® is indicated in the regular treatment of severe asthma in adults where use of a combination product (long-acting β₂-agonist and inhaled corticosteroid) is appropriate (patients not adequately controlled on a lower strength corticosteroid combination product or patients already controlled on a high dose inhaled corticosteroid and long-acting β₂-agonist) and for the symptomatic treatment of adults with Chronic Obstructive Pulmonary Disease (COPD) with a FEV₁ <60% predicted normal (pre-bronchodilator) and a history of repeated exacerbations and who have significant symptoms despite regular bronchodilator therapy.¹

AirFluSal® Forspiro® is only intended for use by adults 18 years of age and older.

Prescribing Information: AirFluSal® Forspiro®

(Please refer to the full Summary of Product Characteristics (SPC), before prescribing.) AirFluSal® Forspiro® 50/500 (50 mcg salmeterol xinafoate and 500 mcg fluticasone propionate) Indications: For use by adult patients aged 18 years and older only. Asthma: Regular treatment of severe asthma where use of a combination of LABA and ICS is appropriate, i.e. patients not adequately controlled on a lower strength corticosteroid combination product or patients already controlled on high dose ICS and LABA. COPD: Symptomatic treatment of patients with COPD with a FEV₁ <60% predicted normal (pre-bronchodilator) and a history of repeated exacerbations and who have significant symptoms despite regular bronchodilator therapy. Dosage and administration: Inhalation only. Asthma: one inhalation b.d. of AirFluSal Forspiro 50/500. Regularly review patients and reduce dose to lowest that maintains effective symptom control. Once control of asthma is attained treatment should be reviewed and considered given as to whether titrate downwards the dose of inhaled corticosteroid as appropriate to maintain disease control. AirFluSal is not available in any strengths lower than salmeterol 50 mcg/fluticasone propionate 500 mcg per metered dose. Therefore, when titrating down to a lower strength, a change to an alternative fixed dose combination of salmeterol and fluticasone propionate containing a lower dose of the ICS is required. COPD: one inhalation b.d. of AirFluSal Forspiro 50/500. Paediatric population: not recommended for either children or adolescents. Contraindications: Hypersensitivity to the active ingredients or to any of the excipients. Precautions: Pulmonary tuberculosis, fungal, viral or other infections of the airway, severe cardiovascular disorders, heart rhythm abnormalities, diabetes mellitus, hypokalaemia and thyrotoxicosis. An increase in the incidence of pneumonia, including pneumonia requiring hospitalisation, has been observed in patients with COPD receiving inhaled corticosteroids. Physicians should remain vigilant for the possible development of pneumonia in patients with COPD. Risk factors for pneumonia in patients with COPD include current smoking, older age, low body mass index (BMI) and severe COPD. Paradoxical bronchospasm post-dose. Severe unstable asthma: Warn patients to seek medical advice if short-acting inhaled bronchodilator use increases. Consider increased inhaled/ additional corticosteroid therapy. Acute symptoms: Not for acute symptoms. Use short-acting inhaled bronchodilator. Systemic effects: Systemic effects of inhaled corticosteroids may occur, particularly at high doses for prolonged periods, but much less likely than with oral corticosteroids. May include Cushing’s syndrome, cushingoid features, adrenal suppression, adrenal crisis, growth retardation in children and adolescents, decrease in bone mineral density, cataract, glaucoma and, more rarely, a range of psychological or behavioural effects including psychomotor hyperactivity, sleep disorders, anxiety, depression or aggression. Tremor, palpitations and headache, have been reported with β₂-agonist treatment. In asthma, therapy should be down titrated under physician supervision to lowest effective dose and treatment should not be abruptly stopped due to risk of exacerbation. Serious asthma-related adverse events and exacerbations may occur during treatment with AirFluSal. Patients should not be initiated on AirFluSal during an exacerbation or if they have significantly worsening or acutely deteriorating asthma. Data from a large clinical trial suggested patients of black African or Afro-Caribbean ancestry were at increased risk of serious respiratory-related events or deaths when using salmeterol. All patients should continue treatment but seek medical advice if symptoms remain uncontrolled or worsen when initiated on AirFluSal or using AirFluSal. In COPD cessation of therapy may also be associated with decompensation and should be supervised by a physician. Transfer from oral steroids: Special care needed. Consider appropriate steroid therapy in stressful situations. Drug interactions: Avoid beta-blockers. Avoid concomitant administration of ketoconazole or other potent (e.g. itraconazole, telithromycin, ritonavir) and moderate (erythromycin) CYP3A4 inhibitors unless benefits outweigh potential risk. β₂ adrenergic blockers may weaken or antagonise the effect of salmeterol. Potentially serious hypokalaemia may result from β₂-agonist therapy, particular caution is advised in acute severe asthma. This effect may be potentiated by concomitant treatment with xanthine derivatives, steroids and diuretics. Pregnancy and lactation: Experience limited. Balance risks against benefits. Side effects: Very Common: headache, nasopharyngitis. Common: candidiasis of the mouth and throat, hoarseness/dysphonia, throat irritation, pneumonia (in COPD patients), bronchitis, hypokalaemia, snuff-like, cutaneous hypersensitivity reactions, hyperglycaemia, sleep disorders, cataract. Rare: angioedema, respiratory symptoms (bronchospasm), anaphylactic reactions including anaphylactoid shock, Cushing’s syndrome, cutaneous features, adrenal suppression, growth retardation in children and adolescents, decreased bone mineral density, oesophageal candidiasis, behavioural changes including psychomotor hyperactivity and irritability, glaucoma, cardiac arrhythmias and paradoxical bronchospasm. Not known: depression or aggression. Paradoxical bronchospasm: substitute alternative therapy. Prescribers should consult the SPC in relation to other adverse reactions Legal category: POM. Presentation and Basic NHS cost: AirFluSal Forspiro 50/500 60 inhalations. £32.74. Product Licence (PL) no: PL 04416/1431. PL holder: Sandoz Ltd, Frimley Business Park, Frimley, Camberley, Surrey, GU16 7SR. Last date of revision: February 2017. UK/ MKT/AFS/17-0003b.

Adverse events should be reported. Reporting forms and information can be found at www.mhra.gov.uk/yellowcard. Adverse events should also be reported to Sandoz Ltd, 01276 698020 or uk.drugsafety@sandoz.com

time at end of expiration, where a short time at functional residual capacity is considered an indicator for dysfunctional breathing, and manual assessment of respiratory motion. These types of tests would generally be undertaken by breathing disorder specialists.

However, objective assessment, which can be undertaken in non-specialist clinics, is also important. While evaluating patients, healthcare professionals should consider:
- The patient’s general appearance, posture, calmness
- If they can make eye contact
- If they are capable of conversing in full sentences
- If they have any of the symptoms described in Box 1.

The necessity of breathing will always win, and the body will adapt to cope with this requirement, often presenting as breathlessness, fatigue, sighing, yawning, altered voice or ‘not being able to get enough breath in’ — all of which are frequently described symptoms (Courtney and Greenwood, 2009).

Observing the breathing pattern should also form part of assessment:
- Is the patient initiating the breath from the upper chest or diaphragm, as overusing the upper chest to breathe means that the wrong muscles are being used, and is less energy efficient?
- Is the pattern of breathing erratic or rhythmical; shallow or deep?

### Top tips for management

- Education of symptoms and cause
- Education of stress and tension in the body
- Reassurance and explanation that improvement can take time/effort
- Explanation of how the diaphragm and accessory muscles work
- Explanation of normal good breathing
- Restoration of relaxed, rhythmical nose-breathing pattern
- Posture correction
- Breathing with movement and activity
- Breathing with talking
- Breathing through an acute episode
- Review of lifestyle

- Does the patient sigh or yawn frequently to help the body move more air in and out of the lungs?
- What is their respiratory rate? Are they breathing too much/too fast?
- Do they nose or mouth breathe? Mouth breathing exposes the body to more pollutants, and particles, and means the airflow is more chaotic, irritating the airways
- Is it noisy or quiet? Noisy breathing may mean breathing too much or straining the vocal chords.

### ROLE OF HEALTHCARE PROFESSIONALS

Clinicians working in primary care, such as general practice nurses (GPNs), are best placed to identify breathing pattern disorders. Chenivesse et al (2014) reported that the average length of time for a diagnosis is two to seven years. In the authors’ clinical experience, this patient group are likely to be frequent attenders at general practice with a multitude of non-specific disabling symptoms. Commonly, respiratory medications are escalated, i.e. for asthma with limited effect. Once other causes of altered breathing patterns have been excluded or treated, recognition of the symptoms and discrete observation of the person’s breathing pattern may identify an altered breathing pattern.

Respiratory physiotherapy is an evolving practice. During 2009, the British Thoracic Society/Association for Chartered Physiotherapists in Respiratory Care (BTS/ACPRC) guideline, *Respiratory Physiotherapy for people with Hyperventilation or Disordered breathing*, was published. This supported a better understanding and wider recognition of breathing pattern disorders and treatment.

### MANAGEMENT

Most clinicians agree that there is no right or wrong approach of where to start. However, relaxation and avoidance of stress is a good place (see ‘top tips’ box). The British Thoracic Society/Scottish Intercollegiate Guidelines Network (BTS/SIGN) asthma guidelines, have shown grade A evidence for the use of breathing exercise programmes to improve quality of life and reduce symptoms in asthma (BTS/SIGN, 2016).

### Box 1

**Common symptoms of BPD include:**

- Cough
- Breathlessness
- Dry mouth
- Fatigue
- ‘Foggy head’
- Dizziness
- Gastric problems
- Headaches
- Unable to breathe
- Hearing sensitivity
- Visual problems
- Poor concentration
- Throat clearing
- Tingling
- Throat sensations
- Yawning
- Sighing
- Palpitations
- Joint stiffness
- Chest pain
- Aches and pains
- Anxiety
- Tension
- Panic attacks
- Erratic pattern
- Mouth breathing
- High respiratory rate
- Chest breathing pattern
- Noisy breathing
- Feeling of weight on chest
- Poor recovery with exercise
Education for Health Quality Assured Spirometry training

Spirometry is an essential tool in the diagnosis and management of respiratory disease but do you feel confident or assured when you or your team are performing this?

Our Spirometry modules are developed with the Association of Respiratory Technology & Physiology (ARTP) and supported by the British Thoracic Society (BTS). Successful completion of a Performing course secures a place on the National Register at Foundation Level, and successful completion of a Performing and Interpreting course secures a place on the National Register at Full Level.

* **Performing and Interpreting Quality Assured Spirometry** - dates open for booking now with study days in Warwick, Newcastle, Liverpool or Stirling.

* **Performing Quality Assured Spirometry Level 5 module** - dates open for booking now with study days in Stirling, London, Warwick or Newcastle.

Visit our website at www.educationforhealth.org/spirometry to see full course details and discover dates to suit, or contact our NHS Liaison team on nhsteam@educationforhealth.org to bring training to your local area.

And if you're not sure what level to study at, or think an Interpretation Only workshop might be right for you, contact us on contact@educationforhealth.org for a friendly chat, support and guidance.
Research into the use of handheld fans has proven to reduce the perception of dyspnoea (shortness of breath) (Galbraith et al, 2010). This may also be used as a distraction technique in the management of dysfunctional breathing, when breathlessness is one of the main symptoms.

Other techniques that may be used by skilled clinicians include the Buteyko Breathing Technique (BBT) — a systematic approach to breathing retraining, which aims to restore an efficient breathing pattern. This has been shown to be effective in reducing asthma symptoms and to reduce bronchodilator usage, without changing lung function (Opal et al, 2009; Prem et al, 2013).

In the past fifty years, inspiratory muscle training has been researched and proven to be beneficial. In 2000, Alison McConnell developed powerbreathe (www.youtube.com/watch?v=qelK5NS6h5A). This is resistance training for the diaphragm and other inspiratory muscles.

Disordered breathing problems may lead to inspiratory muscle weakness, or vice versa. Training these muscles will help to increase their strength and endurance, thereby improving respiration.

Hagman et al (2011) undertook a five-year follow-up study of 25 people with breathing pattern disorders and 25 matched with the aim of identifying if improvement in breathing pattern disorders are sustained. The study identified:

- A reduction in emergency visits
- A decrease in symptoms
- An improvement in quality of life
- Less impairment caused by breathing problems.

Although this was a small study, it supports the value of breathing pattern disorder interventions.

CONCLUSION

Disordered breathing patterns are common and frequently impair quality of life. GPNs are ideally placed to identify this population. If basic breathing pattern exercises are taught early, there is the potential to enhance wellbeing. However, more complex cases will require skilled intervention supported by the evolving role of the respiratory specialist physiotherapist. GPN

REFERENCES


British Thoracic Society, Association for Chartered Physiotherapists in Respiratory Care (2009) Guideline for physiotherapy management of the adult, medical, spontaneously breathing patient. Thorax 64: Supplement 1


Revalidation Alert

Having read this article, reflect on:

- Your understanding of breathing pattern disorders
- How to identify them
- The different management techniques you can explore with your patients to improve their breathing patterns.

Then, upload the article to the new, free GPN revalidation e-portfolio as evidence of your continued learning: www.journalofpracticenursing.co.uk/revalidation
GET IN THE ZONE

Panic Zone
Learning Zone
Comfort Zone

THE NEW GPN DIGITAL LEARNING ZONE

Wide range of topics in four categories:

- INSIGHTS
- MODULES
- LZ:TV
- PRODUCTS IN PRACTICE

- Easy-to-use, module format
- Searchable by category and topic
- Learning activity counts towards your revalidation requirements
- Log your learning in our free revalidation e-portfolio
- Desktop, tablet and mobile-friendly
- Content compliments our free-to-access journal archives and regional study days

www.journalofpracticenursing.co.uk/learning-zone/