



Physiotherapy assessment of breathing pattern disorder: a qualitative evaluation

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ABSTRACT

Objectives To explore physiotherapists' opinions of physiotherapy assessment of Breathing Pattern Disorder (BPD).

Methods Qualitative study using focus groups (FGs) with reflexive thematic analysis and survey methods. The survey was distributed via social media and email to UK specialist physiotherapy interest groups. Two FGs, conducted in different settings, included physiotherapists based in hospital outpatients/community, private practice and higher education.

Results One-hundred-and-three physiotherapists completed the survey. Respondents identified a lack of consensus in how to define BPD, but some agreement in the components to include in assessment. Fifteen physiotherapists participated in the FGs. Three themes emerged from FG discussions: (1) nomenclature and language of breathing, (2) BPD and breathlessness and (3) The value of assessment of breathlessness.

Conclusion The inconsistent nomenclature of dysfunctional breathing pattern impacts assessment, management and understanding of the diagnosis. Clarity in diagnosis, informing consistency in assessment, is fundamental to improving recognition and treatment of BPD. The findings are useful in the planning of education, training, future research and guideline development in BPD assessment.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Breathing pattern disorder is an important condition. It is associated with significant morbidity and can be treated with physiotherapy. Limited evidence exists regarding how best to assess and recognise BPD, which may limit the opportunity for patients to be referred promptly to services to receive the care they need.

WHAT THIS STUDY ADDS

⇒ The first qualitative clinician-focused investigation of breathing pattern disorder that includes in-depth evaluation of physiotherapists' opinions of breathing pattern assessment and provides a practical summary of the important components of its assessment to be used in clinical practice

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The study provides a clear description of the need for consistency around terms used and approaches to the assessment of breathing pattern disorder. The themes identified in this study could help to direct future education, training and guidance for this condition and help underpin the development of future research into this area.



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INTRODUCTION

In health, and at rest, human respiration is largely achieved through the subconscious rhythm of breathing at a comfortable tidal volume. Increases in both the rate and depth of breathing are triggered by temporary, physiological responses to stimuli, including sympathetic activity, exertion or anxiety.¹ Disorders in breathing pattern are known most commonly as breathing pattern disorder (BPD) or dysfunctional breathing. Individuals with BPD tend to breathe in a manner that is disconnected from their respiratory or metabolic requirements,² in some cases leading to decreased arterial partial pressure of carbon dioxide through hyperventilation.³ They may also experience breathlessness, air hunger and limitations in function.⁴ Its pathogenesis remains unclear, but probably comprises an interplay between biomechanical and biochemical stimuli and psychopathological cognitive factors.⁵ The condition may be present

in the absence of respiratory disease ('primary' BPD) or it may accompany another respiratory disorder, commonly asthma⁶ ('secondary' BPD) or, more recently, as a cardinal feature of long COVID-19.⁷

The manifestations of BPD are readily misinterpreted—by both patients and clinicians—as those of asthma or similar obstructive and restrictive conditions.⁸ This leads to prescriptions of medications that are neither required nor effective, including inhaled or oral steroids.¹ Furthermore, BPD frequently amplifies other respiratory conditions, increasing the likelihood of excess prescriptions and associated misuse of prescribing budgets.^{1,9} In COVID-19 follow-up clinics, a high proportion of patients reported of disproportionate breathlessness, alongside symptoms of fatigue and decreased exercise tolerance.¹⁰ While most post-COVID-19 clinics request a physiotherapy assessment of BPD as a key management step, diagnosis is hampered by



the absence of universally accepted terminology or method of assessment.¹¹ Moreover, BPD does not always present in the same way, a heterogeneity that may further lead to inconsistent assessment.¹² Various assessment tools can be used to assess BPD but many do not capture the core components across all types of presentation.¹³

Due to the apparent complexity of BPD, it is essential to increase our understanding of how to approach assessment. A consistent assessment will help to recognise the disorder and ensure appropriate treatments are offered to patients. This paper aims to further our understanding of BPD by exploring expert physiotherapists' perspectives on BPD assessment.

METHODS

The study consisted of two parts. An electronic survey was developed and distributed, and two semistructured focus groups (FGs) were undertaken. The electronic survey was distributed in October 2019. The specific objectives were:

1. To evaluate clinicians' preferred descriptors for this condition.
2. To describe components frequently included in the assessment of BPD (objective and subjective).

Table 1 Physiotherapists' preferred term for this condition and frequency of subjective and objective/observational outcomes used

Preferred term to describe condition (n=103)	Percentage (n)
Breathing pattern disorder	43% (n=44)
Dysfunctional breathing	39% (n=40)
Breathing pattern dysfunction	14% (n=14)
Hyperventilation	4% (n=4)
Incomplete response	1% (n=1)
Patient reported outcome measure (n=103)	Percentage
Short evaluation of breathing questionnaire ³⁰	14% (n=14)
Dyspnoea 12 ²⁹	35% (n=36)
BORG (RPE) ³⁹	46% (n=47)
Nijmegen questionnaire ⁴⁰	89% (n=92)
Hospital anxiety and depression	17% (n=18)
Other included PHQ, GAD-7	4 responses
Objective/observational tool (n=101)	Percentage
Breath hold ³¹	61% (n=62)
End tidal CO ₂	0% (n=0)
Exercise Ax (eg, 6MWT)	39% (n=39)
Manual Ax of respiratory motion ³²	11% (n=11)
Breathing pattern assessment tool ¹⁴	58% (n=59)
Other included lung function	1 response
Incomplete response	1% (n=2)

BORG (RPE), The Borg Rating of Perceived Exertion (RPE); GAD-7, Generalised Anxiety Disorder Assessment; 6MWT, six-minute walk test; PHQ-9, Patient Health Questionnaire.

This 24-item survey was developed in collaboration between authors (LG and HS) and a specialist physiotherapist working in BPD (see online supplemental file 1) using SurveyMonkey. Survey items included components of assessments completed within the physiotherapy department and questionnaires available including the Breathing Pattern Assessment Tool (BPAT)¹⁴ and Nijmegen Questionnaire (NQ).¹⁵ The items were selected and informed by clinical expertise and included the common components of physiotherapy assessments in usual accepted practice, with reference to published guidance where physiotherapy assessment had been described.^{14 16 17} The penultimate survey draft was peer reviewed. The survey was piloted by two physiotherapists in a tertiary referral centre. The final version was distributed via UK physiotherapy professional networks, including the Association of Chartered Physiotherapists in Respiratory Care (ACPRC), Physiotherapy for Breathing Pattern Disorders UK (a specialist clinical interest group) and other regional groups via email and social media platforms. Email reminders were sent after 1 month and a week prior to close of the survey. Participation was voluntary and consent was gained at the start of the survey (see online supplemental file 1). A convenience sample was the most pragmatic approach.

Following completion of the survey, LG and AL facilitated two semistructured FGs, to explore physiotherapists' understanding and perceptions of the assessment of BPD. A topic guide was developed by LG/AL, informed by the survey design and results (see online supplemental file 2). Open-ended questions were included within the FGs. Participants were screened by LG. Inclusion criteria included (1) qualified physiotherapist (Agenda for Change Band 6 (specialised physiotherapist with approximately 2–5 years of experience) and above), (2) actively treating patients with BPD (at least one patient a week), (3) able to attend an FG (prepandemic). All participants received a participant information sheet and gave informed consent. FGs were audio-recorded. The researcher's reflections were also recorded (see online supplemental file 2).

Patient and public involvement

The research question emerged from informal discussions with patients whom LG treated for BPD. Patients expressed frustration that their condition remained under-recognised and expressed concern over delays in diagnosis. Furthermore, LG facilitated a patient and public involvement day involving patients with BPD. Discussions focused on the assessment and treatment of BPD as well as priority research topics. Feedback included: 'This is a condition all in itself, not just one linked to asthma or psychology, therefore it needs describing more clearly' and 'This is a condition that, if untreated, could lead to a lot of wasted money on treatments and investigations, this makes it very important'. This research was completed as part of NIHR (National Institute of

Box 1 Focus group quotes

Nomenclature

'There are so many different words for the same thing... it is so confusing which must impact how the condition is perceived.' (R4)

'I think Dysfunction can feel like a blaming term, I don't think it is popular with patients... this can sound negative, and patients can think it is their fault' (R2)

I use dysfunctional breathing, but I am quite happy to switch between breathing pattern disorder. I think hyperventilation is an element within it which not everybody has (R14)

'So, I think the terminology for me, in my experience with patients, doesn't matter as much as the fact that someone is acknowledging what they are feeling and validating the symptoms they are experiencing' (R6)

'The negative terminology vs the lack of definition is a frustration as it can devalue the experience and the condition greatly'. (R5)

'I don't know that patients actually want a diagnosis or a label as such. If you just tell them, 'Well actually, it is as simple as your breathing pattern has gone wrong,' they all seem to understand that' (R13)

'I think it is frustrating, the terminology. It doesn't help does it, in us trying to help diagnose, doing research, you know having outcome measures, when we sort of don't even have this start point' (R7)

Language

'I think that is quite a key component for your journey into treatment. If you don't get that right, and you don't get that connection and that validation or understanding, if you go straight into putting into boxes...' (R9)

'And I think, like in all of the literature, all of the stuff around dysfunctional breathing, it is all based on like expert opinion..... then almost no patient voice at all. Like there is almost no qualitative research on what the experience of having a dysfunctional breathing pattern is like. We just measure it with like lists of symptoms or a very biomechanical focus' (R12)

'It becomes kind of a shorthand for some quite negative narratives about like difficult patients who are anxious. Like, anxiety isn't just a thing, it is a thing that needs to be treated and you need to manage it in a way that is more than doing a couple of days of CBT training' (R9)

Breathing patten dysfunction and breathlessness

'I feel like the feeling of breathlessness is very different, and it is more transient for BPD than it would be for someone with COPD. It is about managing it with a COPD condition, whereas with disordered breathing it is more trying to get to the root cause and fixing it' (R2)

'I am not sure that many of our patients are able to describe what they are feeling, it is only once we describe BPD to them that they feel their symptoms are validated.' (R8)

'But you know, they have come through such a medical process that sometimes you get to the end and actually it is not that medical, and they need that unpicking and they need releasing from that diagnosis element, from that pathology' (R14)

'I think it is that breathlessness that doesn't make sense and that is not accepted maybe. It doesn't correlate with the objective tests that have been done' (R8)

The value of assessment

Diagnosis and validation of symptoms

'The patients really like how much we validate their symptoms, and just having it explained to them, means so much to them and it is such an important thing to capture' (R14)

'I guess what you are curious about at the beginning of your assessment is, is this breathlessness in excess of something that is existing, or in the absence of something there' (R16)

Components of Ax

Continued

Box 1 Continued

'The patient's own description of the symptoms can be really insightful as quite often they do not understand their symptoms or make connection without the direction from the physiotherapy assessment.' (R11)

'It is a privilege to have the time to fully understand these symptoms, often such time is absent in nursing and medical appointments.' (R14)

Subjective Ax

'Yeah, I think the subjective is probably most important, you are trying to understand the long and winding road that they have taken to get to you' (R4)

'I think it is about recognising (psychology), and very solidly knowing your boundaries, and it is about knowing when you have reached the edge of your boundaries and when to hand over. Because I used to keep people on far too long when in actual fact it wasn't their breathing that was the problem anymore, it was the psychology behind it' (R11)

Observational/objective

'There is often an impact of being watched or putting hands on the patient- important to look at breathing in less obvious ways and not just when the patient is aware of it'. (R10)

Diaphragm

'The diaphragm could be at a mechanical disadvantage due to factors including abdominal tension, upper chest predominant breathing and breathing at a higher lung volume (if a patient was not optimising their expiratory time)' (R2)

'The diaphragm is moving. The fact that you may be holding your thorax or your abdominal compartment more tightly and you see less movement, doesn't mean that the diaphragm isn't actually moving'. (R7)

'No, it isn't weak, it's that the upper chest is being overused' (R7)

Assessment tools

'You know, there is a long way to go before we are in a position to say, 'These are valid outcome measures, they are reproduceable across many different conditions etc.' (R13)

'I find for me, using the BPAT is very flexible with my different patient groups. I find that particularly helpful.....to validate where you feel that the biggest problem is' (R2)

'I can see why the structure of some of those things gives them a sort of foundation to sort of start building stuff on. Helping you to say, 'I am going to look at these things.' (R1)

'Then I think the BPAT combined with kind of a hands on assessment is really the one where we are actually able to then quantify the problems that we are seeing, and I think there is something very helpful in feeding back to our team where we can say, 'Here was their breathlessness scale, and here was my markers in a BPAT. We did treatment and now it is this.' (R16)

Exercise assessment

'They have been so activity avoidant that they are just deconditioned as well, and that is an additional thing that you are treating. You can only do that once their breathing pattern is ready for that essentially'. (R5)

Specialised skills

'Basic skills in breathing pattern observation are not always given the adequate time and perhaps presented as a special skill'. (R4)

'You only get to that point where you can really unpick everything if you have had a lot of support, and training, and exposure to these patients' (R6)

medical teams. There was a strong assumption that the word 'dysfunction' was unpopular with patients.

'The negative terminology versus the lack of definition is a frustration as it can devalue the experience and the condition greatly'. (R5)

For some, the terminology did not matter, so long as the diagnosis was explained well to the patient. The inclusion of the word ‘pattern’ was felt to be important as it describes objective changes in the patient’s presentation.

One of the challenges discussed was undoing the negative assumptions created in the language and explanations of BPD used by clinicians. Frequent associations between BPD and psychological or psychiatric problems were reported to potentially create further diagnostic challenge. This was possibly due to BPD being used as a negative label or not being given the status of a ‘real diagnosis’ by some referring clinicians. The tension between the physiological and/or psychological causes of symptoms often created negative language impacting symptoms where inpatients labelled as ‘trickier’ experienced devaluation of their BPD. Additionally, clinicians were aware of how patients often seemed uncomfortable when their symptoms were attributed to anxiety, depression or other psychological factors.

BPD and breathlessness

Detailed discussion was developed around what BPD was and how it presented within a broader description of breathlessness. BPD most often included a description of feeling out of breath (either self-reported by the patient or observed by others). BPD was different to the physiological breathlessness caused by a gas exchange impairment or a mechanical restriction or obstruction to breathing as in conditions such as chronic obstructive pulmonary disease (COPD) or interstitial lung disease.

I am not sure that many of our patients are able to describe what they are feeling, it is only once we describe BPD to them that they feel their symptoms are validated. (R8)

BPD presentation was often discordant with what one might expect to see. There was also recognition that patients could have heterogeneous symptoms, some clearly linked to their breathing, but other symptoms lacking such an obvious connection. Often BPD was clearly identified by a clinician in the assessment, but the label of BPD itself meant little to the patient until the symptoms and their potential impact were explained to them.

The value of assessment

The FG discussion described the importance of assessment in diagnosing this condition, to ensure patients could access the right treatments and services to optimise healthcare and outcomes. Additionally, this diagnosis validated the condition to the patient. Discussions also described the power of the assessment as therapy itself.

Components of assessment

The FG expanded on the survey findings, detailing the importance of social, emotional, occupational and family impacts during the subjective patient assessment. FGs

discussed the assessment of sleep quality and evaluation of the emotional components of breathing integral to this subjective examination. These were aspects of the assessment not covered in the survey.

All participants in the FG described the importance of having enough time in a BPD assessment to fully understand the symptoms as experienced by the patient. This was integral to the ability to diagnose ‘BPD’ and to help the patient understand the role of therapy. Clinicians in the FG expressed a need for 45–60 min for the assessment, with any less potentially ineffective. This corroborates the survey results in relation to optimal length for the initial contact with a patient (see online supplemental files).

It is a privilege to have the time to fully understand these symptoms, often such time is absent in nursing and medical appointments (R14).

Observational/objective assessment

While hands on assessments were deemed important, participants noted that during such an assessment of breathing, patients often respond differently, altering their breathing pattern. Respiratory rate, nose versus mouth breathing, upper chest versus lower chest and whether breathing was erratic or rhythmical had high importance, reflecting survey results. In the FG, inspiration and expiration timing were important to determine the inspiratory/expiratory ratio. These components were identified as valuable to teaching self-assessment, an important therapeutic strategy.

There is often an impact of being watched or putting hands on the patient- important to look at breathing in less obvious ways and not just when the patient is aware of it (R10).

The diaphragm

There were some differences of opinion on the importance of, and how to assess or treat, the diaphragm. The survey suggested that diaphragm palpation was unpopular due to the likelihood of discomfort and the additional difficulties of palpation in patients with a Body Mass Index >30. The relevance of this in assessment, discussed in the FGs, centred on the role of the diaphragm in BPD, for which there were differing opinions. These included the possibility of the diaphragm being at a mechanical disadvantage due to tension in other muscles of the abdomen or thorax versus whether the diaphragm is weak causing impaired movement. There was a debate among the experts as to how to assess diaphragm function and its importance as a therapeutic strategy in BPD. There was agreement over the importance of assessing the musculoskeletal system due to the interrelation between breathing, and body tension and movement.



Assessment tools

Assessment tools were an important component of assessment. Despite the NQ not being validated for use in all types of BPD, FG discussion suggested that the symptoms and scores of patients with BPD could be elevated and that this was a useful tool to identify symptoms. The BPAT and Breath Hold (BH) were thought to have particular value when the assessor may have less experience and to help quantify improvements after treatments.

I guess you are trying to be as systematic with outcome measures as possible while acknowledging the complexity of the condition (R9).

Exercise assessment within BPD

Assessment of BPD with exercise was not thought to be essential for all initial assessments of BPD due to time constraints. Different experiences were reported; for some clinicians, problems with exercise BPD could not be predicted from an assessment at rest, and for others resting BPD treatment was always important as resting breathing pattern optimisation was key prior to exercise assessment. Such heterogeneity in presentation made some feel this was an important area to assess, particularly that decreased function and its impact on quality of life was a common report from patients referred with BPD.

They have been so activity avoidant that they are just deconditioned as well, and that is an additional thing that you are treating. You can only do that once their breathing pattern is ready for that essentially (R5).

Specialist skills

It was felt that assessment of BPD and breathlessness should be part of every cardiorespiratory physiotherapist's assessment. Education about assessment of normal breathing and the impact of pattern abnormalities should be taught to undergraduate physiotherapy students as a normal part of their respiratory assessment. Some clinicians reported that, with more experience, it was easier to complete an assessment without detailed referral information, although often this was within an Multi Disciplinary Team/specialist environment where discussion of patients and their symptoms was possible. Increased depth and breadth of experience were keys to increasing both confidence and competence in the assessment of BPD. These specialist skills were particularly important in ruling out pathology or physiological explanation of symptoms ensuring the correct diagnostic label is assigned and other causes of symptoms fully investigated.

Table 2 provides a guide to BPD assessment based on the survey responses and FG discussions. Items recorded in the survey as used 'always' or 'most of the time' are suggested as 'standard for all assessments'. Items used 'sometimes' or with a range of choices are 'recommended

Table 2 Breathing pattern dysfunction assessment: summary

Subjective Assessment	Objective Assessment
<p>Standard for all Ax</p> <p>Subjective report of symptoms</p> <p>Patient description of Sx (record words used by to describe Sx)</p> <p>Patients own awareness of breathing pattern</p> <p>Triggers to Sx</p> <p>Recovery techniques/easing factors</p> <p>Air hunger signs (yawning/sighing/clearing throat/tingling hands/feet)</p>	<p>Standard for all Ax</p> <p>Observation of breathing</p> <p>Mouth/nose breathing</p> <p>Upper/lower chest</p> <p>Respiratory rate</p> <p>Air hunger</p> <p>Accessory muscle use</p> <p>Rhythm of breathing</p>
<p>Recommended for all Ax</p> <p>Sleep</p> <p>Quality/duration</p> <p>Social history</p> <p>Family</p> <p>Work</p> <p>Hobbies</p> <p>Psychological history</p> <p>History of psychological illness</p> <p>Stress and coping mechanisms</p> <p>Nasal symptoms</p> <p>Blocked or runny nose</p> <p>Sinus pain</p> <p>Postnasal drip</p> <p>Altered sense of smell</p> <p>Exercise ability</p> <p>Frequency of exercise</p> <p>Intensity of exercise</p> <p>Time spent on exercise</p> <p>Type of exercise</p> <p>Sx with exercise</p> <p>► SOB/cough/airway closure</p> <p>General physical activity levels</p>	<p>Recommended for all Ax</p> <p>Observation of breathing</p> <p>Sounds on inspiration and expiration</p> <p>Inspiratory/expiratory ratio</p> <p>Exercise/functional symptoms (record method of Ax, for example, walk/ formal test/stairs)</p> <p>Changes to breathing pattern during Ax</p> <p>► Work of breathing</p> <p>► Accessory muscle use</p> <p>► SpO₂</p> <p>► HR</p> <p>► Cough</p>
<p>Optional Ax or if specific history</p> <p>Voice/upper airway</p> <p>Voice changes for example, husky/strained/lost voice</p> <p>Closure/discomfort in throat</p> <p>Cough</p> <p>Effectiveness/ease of clearance</p> <p>Triggers</p> <p>Dry/rattling/productive</p> <p>Feeling of airway closure</p> <p>Sputum</p> <p>Presence</p> <p>Colour/consistency</p> <p>24 hour volume</p>	<p>Optional Ax or if specific history</p> <p>Voice</p> <p>Upper airway sounds</p> <p>Voice quality</p> <p>Cough</p> <p>Nature/Type/Frequency</p> <p>Clearing throat</p> <p>Postural assessment</p> <p>ROM cervical/thoracic spine</p> <p>Core stability</p> <p>Diaphragm assessment</p> <p>Palpation</p> <p>Movement</p> <p>Core strength</p>
<p>Patient reported outcome measures</p> <p>Recommended assessments</p> <p>Nijmegen Questionnaire⁴⁰</p> <p>Optional</p> <p>Short Evaluation of Breathing Questionnaire³⁰</p> <p>Dyspnea-12²⁹</p> <p>Optional PROM for Ax of psychological factors could include:</p> <p>PHQ-9, GAD-7, Hospital Anxiety and Depression scale</p>	<p>Objective/observed outcome measures</p> <p>Recommended assessments</p> <p>BPAT Score¹⁴</p> <p>Optional</p> <p>Breath Hold Ax³¹</p> <p>Manual Assessment of Respiratory Motion³²</p> <p>Exercise test, for example, 6MWT/CPET/SWT/stairs</p>
<p>Ax, assessment; CPET, cardiopulmonary exercise test; HR, heart rate; 6MWT, six-minute walk test; PROM, patient reported outcome measure; ROM, range of movement; SpO₂, saturation levels; SWT, shuttle Walk test; Sx, symptoms.</p>	

for all assessment', whereas items used 'rarely or never' are listed as 'optional or with specific history'.

DISCUSSION

Nomenclature

In line with previous findings, our study suggests that the diagnosis of BPD is hampered by the lack of universally accepted terminology or methods of assessment.¹¹ Historically 'hyperventilation syndrome' (HVS) was the most common way of describing BPD.¹⁵ The literature supports the idea that BPD is multidimensional, with HVS being just one type of BPD and that different individuals may display different phenotypes.^{5,11} Recent Cochrane reviews^{6,12} have called for consistency in terminology. Our questionnaire and FGs highlighted challenges in agreeing terminology. This is the first qualitative study to report clinicians' opinions on this inconsistency. Clinicians emphasised the importance of clear nomenclature, although perhaps patients place greater value on the description and validation of their symptoms. Our study suggests an agreement from clinicians that hyperventilation is not the correct term to define all BPD and that the word 'pattern' is important. Consensus is now needed for an internationally recognised and adopted term.

Language

FG discussions explored the concept of language in BPD assessment. Language used by clinicians may lead to an apathy or lack of understanding of the patient's experience of BPD as has been shown in other chronic conditions like chronic pain.²⁰ When diagnosis is unclear, this can impact on the patients experience by devaluing the condition to family, carers and other clinicians.

BPD and breathlessness

Prevalence of BPD has been demonstrated in a number of different conditions including patients with asthma,²¹ COPD,²² anxiety,²³ Postural Orthostatic Tachycardia syndrome²⁴ and in post-COVID syndrome⁷ with papers commonly reporting higher breathlessness scores or reduced function/quality of life. Dyspnoea, like pain, has a multidimensional nature containing both sensory and affective components.²⁵ The affective component has been regarded as a non-specific unpleasant or distressing experience of dyspnoea and is thought to be more commonly experienced in medically unexplained shortness of breath,²⁶ which may represent patients with BPD. In a study of patients with medically unexplained breathlessness, the common symptoms were; the urge to breathe, affective aspects of dyspnoea, anxiety and tingling fingers.²⁷ This contrasted with those with COPD and Asthma where wheezing, cough and sputum and palpitations were more common. However, there is limited understanding as to how BPD and breathlessness interlink. Further evidence is required to understand this and if there are differences in how we should assess

and treat both primary and secondary BPD. The newly developed Breathe-VQ may be useful in such assessment accounting for vigilance or breathing.²⁸

The value of assessment

FG discussions described how the subjective assessment creates opportunities for patients to describe symptoms of 'BPD' in detail and the importance of this in validating the patients' experience of these symptoms. This validation has an important role at the start of the therapeutic intervention, underpinning education strategies integral to breathing retraining. Moreover, the anxieties around the label of BPD may be ameliorated by such validation.

Components of assessment

The literature describing BPD assessment suggests it lacks standardisation. Despite this, there has been an increased interest in this area with two systematic reviews registered on prospero in this subject. Many of the currently available outcome measures assess some, but not all of the different presentations of BPD.¹³ Some patient-reported outcome measures are not validated in all presentations of BPD (NQ,¹⁵ D-12²⁹) or have limited validity (Short Evaluation of Breathing Questionnaire³⁰). Objective assessment tools lack sufficient evidence (BH³¹ and BPAT¹⁴) or are perceived to be too complex for general use (Manual Assessment of Respiratory Motion³²). Conversely, our survey shows there are consistencies in which assessment tools are preferred by clinicians including the NQ, BH and BPAT. Our study indicates that the assessment tools are somewhat useful but not valued as central to assessment, rather they are complimentary to the expert 'skill and art' of the clinician. Further studies are needed to confirm validity, reliability and responsiveness to change of assessment tools in populations of individuals with primary BPD. Additionally, the majority of our responses were from B7 physiotherapists (75%) and so it may be important to evaluate individuals of different bands and different levels of experience separately to understand any differences.

Survey results indicated that respiratory rate, upper/lower chest movement, nose/mouth breathing, signs of air hunger were important components of the BPD assessment. These components, included in the BPAT, may support why there has been good clinical uptake of this tool. Additionally, discussions in the FG describe how other assessment tools including the HiLo³³ assessment, BH and other Musculo-skeletal assessments are well used. These techniques may add additional value to an assessment, including having value for the patient to use in self-assessment during remote or virtual assessments which has had increased focus during the COVID-19 pandemic.³⁴ Further research is required to determine the clinical relevance of these measures.

The diaphragm

One area of conflict within the FG was the perceived role of the diaphragm in BPD and how this might inform both



assessment and treatment. Survey results suggested that many clinicians do not routinely assess its function specifically. Dysfunction of the diaphragm is a well-described phenomenon in pathological disease, including obstructive lung disease where the diaphragm can be put at a mechanical disadvantage and neuromuscular disease when the diaphragm can be weak.³⁵ However, its role in BPD is unclear. The literature suggests that the diaphragm has a dual role in both respiration and mechanical stabilisation of the spine via increased intra-abdominal pressure.³⁶ This dual function must involve coordination of the diaphragm and other muscles surrounding the abdominal cavity and may compromise the respiratory motion of the rib cage and abdomen.³⁷

It is unclear how diaphragmatic assessment is currently best performed, whether the diaphragm is at a mechanical disadvantage, or being used excessively to help maintain core control. Further studies are warranted.

Specialist skills

The FG discussion suggested a juxtaposition between the importance of normalising assessment of breathing pattern as part of all education of breathing, against the idea that a breathing pattern assessment is a specialist skill.

To our knowledge, this is one of the first qualitative clinician-focused investigations into this complex and important condition. Much of the literature has described the importance of improving the consistency of assessment and this paper offers unique insights into physiotherapists' experiences of BPD assessment processes. Our methodology enabled detailed exploration of the components of assessments and also included the conflicts in the nomenclature used for this condition, and the different thinking around the assessment of the diaphragm. Furthermore, our survey responses from 103 participants are considered generalisable to UK physiotherapy practice, considering there are over 1500 members of the Association of Chartered Physiotherapists in Respiratory Care with only a minority of these members treating patients with BPD regularly. We also provide practical recommendations for the essential components to include in physiotherapy BPD assessment as summarised from the results in [table 2](#).

We attempted to ensure that the questionnaire was widely accessible, including to international participants. However, there were only seven participants who identified themselves as international. This is important when generalising the results to the international community as our results may not be representative outside the UK. We also acknowledge a potential responder bias, in that those who completed the survey were more likely to have expert experience and may not be reflective of the views of more junior staff. Additionally, there were many opinions shared in the FG that alluded to a perception of how a patient may think or feel about a certain aspect of BPD assessment. However, we did not include patients within

the study design, which would be an essential component for future studies.

The results emphasise the importance of a consistent approach to both terminology and assessment of this condition. Although there are some assessment tools available, there appear to be limitations to these, and further work is required to develop our knowledge with these tools to help us have a clear way of evaluating patients consistently and providing them with relevant therapeutic treatments at the earliest opportunity. Additionally, further understanding is required about how these assessments may help us to recognise the different types of BPD.²

Although not discussed in the FGs, recognition of different types of BPD may have importance to help ensure that the correct types of intervention are chosen.³⁸ This warrants further research. Moreover, discussions have also focused on the problems in objective evaluation, but this may not be as important from the patient perspective, and, therefore, further understanding is required about patients' experiences of having BPD and the important components of assessment.

Conclusion

BPD is not a trivial condition. It is associated with significant morbidity and can be treated with physiotherapy. Limited evidence exists regarding how best to assess BPD. Our research combined online survey results and FG data to explore BPD assessment from clinical experts in the field. We detail the complexities of BPD assessment and remaining uncertainties. There is a clear need for consistency around the terms used, appropriate diagnostic tools and validated outcome measures. These issues could be impacting on the consistency of assessments and the adequate referral of patients to appropriate services. The themes in this study could help to direct future education, training and guidance for this condition and will help underpin the development of future research into BPD.

Twitter Lizzie Grillo @GrilloLizzie

Contributors LG: main author and guarantor of the work, survey design, focus group co-ordination, transcription and thematic analysis. AL: co-author, support with focus group delivery thematic analysis and supervision. A-MR and HS contributed to the writing and review of the manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and was approved by Granted by Imperial College Research Ethics Committee (ICREC) & Science, Engineering & Technology Research Ethics Committee (SETREC). Approval number TRN/19IC5431. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

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REFERENCES

- Morgan MDL. Dysfunctional breathing in asthma: is it common, identifiable and correctable? *Thorax* 2002;57:1131–5.
- Boulding R, Stacey R, Niven R, et al. Dysfunctional breathing: a review of the literature and proposal for classification. *Eur Respir Rev* 2016;25:287–94.
- Malmberg LP, Tamminen K, Sovijärvi AR. Orthostatic increase of respiratory gas exchange in hyperventilation syndrome. *Thorax* 2000;55:295–301.
- Vidotto LS, Carvalho CRFde, Harvey A, et al. Dysfunctional breathing: what do we know? *J Bras Pneumol* 2019;45:e20170347.
- Courtney R. Breathing training for dysfunctional breathing in asthma: taking a multidimensional approach. *ERJ Open Res* 2017;3:00065-2017.
- Jones M, Harvey A, Marston L, et al. Breathing exercises for dysfunctional breathing/hyperventilation syndrome in adults. *Cochrane Database Syst Rev* 2013:CD009041.
- Heightman M, Prashar J, Hillman TE, et al. Post-COVID-19 assessment in a specialist clinical service: a 12-month, single-centre, prospective study in 1325 individuals. *BMJ Open Respir Res* 2021;8:e001041.
- Aaron SD, Vandemheen KL, Boulet L-P, et al. Overdiagnosis of asthma in obese and nonobese adults. *CMAJ* 2008;179:1121–31.
- Hagman C, Janson C, Emtner M. A comparison between patients with dysfunctional breathing and patients with asthma. *Clin Respir J* 2008;2:86–91.
- Lanham D, Roe J, Chauhan A, et al. COVID-19 emergency department discharges: an outcome study. *Clin Med* 2021;21:e126–31.
- Connett GJ, Thomas M. Dysfunctional breathing in children and adults with asthma. *Front Pediatr* 2018;6:406.
- Santino TA, Chaves GS, Freitas DA, et al. Breathing exercises for adults with asthma. *Cochrane Database Syst Rev* 2020;3:CD001277.
- Courtney R, Greenwood KM, Cohen M. Relationships between measures of dysfunctional breathing in a population with concerns about their breathing. *J Bodyw Mov Ther* 2011;15:24–34.
- Todd S, Walsted ES, Grillo L, et al. Novel assessment tool to detect breathing pattern disorder in patients with refractory asthma. *Respirology* 2018;23:284–90.
- Grammatopoulou EP, Skordilis EK, Georgoudis G, et al. Hyperventilation in asthma: a validation study of the Nijmegen Questionnaire–NQ. *J Asthma* 2014;51:839–46.
- Bott J, Blumenthal S, Buxton M, et al. Guidelines for the physiotherapy management of the adult, medical, spontaneously breathing patient. *Thorax* 2009;64:i1–52.
- Hagman C, Janson C, Emtner M. Breathing retraining – a five-year follow-up of patients with dysfunctional breathing. *Respir Med* 2011;105:1153–9.
- Braun V, Clarke V. Can I use TA? Should I use TA? Should I not use TA? Comparing reflexive thematic analysis and other pattern-based qualitative analytic approaches. *Couns Psychother Res* 2021;21:37–47.
- Braun V, Clarke V, Hayfield N. Thematic analysis. In: Liamputtong P, ed. *Handbook of research methods in health social sciences*. Singapore: Springer, 2019.
- Hadi MA, Alldred DP, Briggs M, et al. “Treated as a number, not treated as a person”: a qualitative exploration of the perceived barriers to effective pain management of patients with chronic pain. *BMJ Open* 2017;7:e016454.
- Thomas M, McKinley RK, Freeman E, et al. The prevalence of dysfunctional breathing in adults in the community with and without asthma. *Prim Care Respir J* 2005;14:78–82.
- Connolly CK. Dysfunctional breathing in COPD. *Thorax* 2003;58:460–b-1.
- Han JN, Stegen K, Schepers R, et al. Subjective symptoms and breathing pattern at rest and following hyperventilation in anxiety and somatoform disorders. *J Psychosom Res* 1998;45:519–32.
- Reilly CC, Floyd SV, Lee K, et al. Breathlessness and dysfunctional breathing in patients with postural orthostatic tachycardia syndrome (POTS): the impact of a physiotherapy intervention. *Auton Neurosci* 2020;223:102601.
- Scano G, Stendardi L, Grazzini M. Understanding dyspnoea by its language. *Eur Respir J* 2005;25:380–5.
- Han J, Zhu Y, Li S, et al. The language of medically unexplained dyspnea. *Chest* 2008;133:961–8.
- Han J-na, Zhu Y-jue, Li S-wei, et al. Medically unexplained dyspnea: psychophysiological characteristics and role of breathing therapy. *Chin Med J* 2004;117:6–13.
- Steinmann J, Lewis A, Ellmers T. Validating the breathing vigilance questionnaire for use in dysfunctional breathing. *medRxiv*.
- Yorke J, Moosavi SH, Shuldham C, et al. Quantification of dyspnoea using descriptors: development and initial testing of the Dyspnoea-12. *Thorax* 2010;65:21–6.
- Courtney R, Greenwood KM. Preliminary investigation of a measure of dysfunctional breathing symptoms: the self evaluation of breathing questionnaire (SEBQ). *Int J Osteop Med* 2009;12:121–7.
- Courtney R, Cohen M. Investigating the claims of Konstantin Buteyko, M.D., Ph.D.: the relationship of breath holding time to end tidal CO₂ and other proposed measures of dysfunctional breathing. *J Altern Complement Med* 2008;14:115–23.
- Courtney R, van Dixhoorn J, Cohen M. Evaluation of breathing pattern: comparison of a Manual Assessment of Respiratory Motion (MARM) and respiratory induction plethysmography. *Appl Psychophysiol Biofeedback* 2008;33:91–100.
- Courtney R, Cohen M, Reece J. Comparison of the manual assessment of respiratory motion (MARM) and the HI lo breathing assessment in determining a simulated breathing pattern. *Int J Osteop Med* 2009;12:86–91.
- Bondarenko J, Hew M, Button B, et al. Reliability of the breathing pattern assessment tool for in-person or remote assessment in people with asthma. *Clin Exp Allergy* 2021;51:1218–20.
- Maddocks M, Martolini D. COPD-28247-muscle-function-in-copd-a-complex-interplay. *Int J COPD* 2012;2012:523–35.
- Hodges PW, Gandevia SC. Activation of the human diaphragm during a repetitive postural task. *J Physiol* 2000;522:165–75.
- Hodges PW, Gandevia SC. Changes in intra-abdominal pressure during postural and respiratory activation of the human diaphragm. *J Appl Physiol* 2000;89:967–76.
- Courtney R. The functions of breathing and its dysfunctions and their relationship to breathing therapy. *Int J Osteop Med* 2009;12:78–85.
- Borg G. Psychophysical scaling with applications in physical work and the perception of exertion. *Scand J Work Environ Health* 1990;16:441–554.
- van Dixhoorn J, Folgering H. The Nijmegen questionnaire and dysfunctional breathing. *ERJ Open Res* 2015;1:00001-2015.



An analysis of Breathing Pattern and its assessment by Physiotherapists working in this field

Welcome to this survey on Breathing Pattern assessment

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish.

Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

What is the purpose of the survey?

Breathing Pattern Dysfunction (BPD- sometimes called 'Dysfunctional Breathing') is a condition in which people experience dyspnoea, air hunger and often limitation in function. In addition, it is often characterised by other symptoms including tachycardia, dizziness and parathesia. Diagnosis is difficult due to there being no gold standard terminology or method of assessment. Heterogeneity in presentation of BPD can further lead to inconsistencies in how patients are assessed and in turn treated. Evidence suggests there is modest agreement of the important components needed for an assessment; despite this, the evidence often concludes that further consensus is required. Moreover, inconsistency of terminology adds to this complexity. This survey and focus group aim to collate physiotherapists' views on the most important aspects of an assessment and gain a consensus on terminology.

With this survey we aim to evaluate physiotherapy services for BPD and to look at the components included in an assessment. This survey aims to gain an insight into the frequency of BPD assessments occurring in respiratory physiotherapy services and to look at common components included in an assessment. It will also aim to gain understanding of the preferred terminology used to describe this condition.

Why have I been invited?

You have been asked to take part as you are a physiotherapist working in BPD. We are inviting physiotherapists whom treat patients with this condition to fill in the online survey.

Do I have to take part?

Your participation is entirely voluntary. It is up to you to decide whether to take part.

Will my information be confidential?

Your responses will be collected anonymously. Please be as honest as possible as we are keen to look at responses in general and explore if further consensus building is required.

The Focus group

An *optional* second stage of this survey will occur as a focus group. This Focus Group will aim to explore the responses of this questionnaire in more detail. Please see the end of the survey for more information about the focus group.

Data Protection

Responses are collected through Survey Monkey and not identifiable to the researchers. Your data will be processed as part of Survey Monkey privacy policy which can be reviewed here (<https://www.surveymonkey.com/mp/legal/privacy-policy/>). As this survey is supported by imperial college, their own data protection policies will also be relevant. more information on these can be found here: <http://www.imperial.ac.uk/admin-services/secretariat/information-governance/data-protection/>

Thank you in advance for your input.

Version 1 4/10/19

1. Do you agree to the above terms, by clicking Yes, you consent that you are willing to answer the questions in this survey.

Yes

No



An analysis of Breathing Pattern and its assessment by Physiotherapists working in this field

Please fill in your responses as honestly as possible and feel free to expand on your responses in the 'other' boxes.

2. What is your level of experience

- Band 5 or 'newly qualified'
- Band 6 or 'rotational staff member'
- Band 7 or 'specialist physiotherapist'
- Band 8 or 'highly specialist physiotherapist'
- Other (please specify)

3. What age of patients do you see? (tick all that apply)

- Adults
- Paediatrics

4. Do you assess and treat inpatients (IP), outpatients (OP) or both?

- IP
- OP
- Both

5. What is your place of work (tick all that apply)

- Teaching hospital
- General hospital
- Community
- Private
- Other (please specify)

6. How many patients are referred for a breathing pattern assessment to your service per week

- 1 or fewer
- 1-5
- 5-10

7. How many patients do you assess for breathing pattern problems per week

- 1 or fewer
- 1-5
- 5-10

8. Do you have access to a respiratory consultant/GP with a special interest in breathing pattern?

- Yes
- No
- Other/comments

9. How confident do you feel in assessing breathing pattern (scale 1-10)

unconfident confident

10. If you have an Outpatient Service, how long do you have per assessment

- 30 mins
- 45 mins
- 60 mins
- Other

11. How often do you include the following subjective elements in your first assessment of breathing pattern

	Never	Rarely	Sometimes	Most of the time	Always
Description/discussion of onset of the breathing pattern symptoms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discussion of triggers for breathing pattern symptoms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Description/discussion of what makes their breathing pattern symptoms worse/better	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nose/sinus Symptoms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cough/throat symptoms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Voice symptoms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discussion about how your patient manages their breathing pattern symptoms?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Symptoms of breathing pattern with activity/exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please describe any other elements that you routinely include in your assessment

12. How often do you include the following objective elements in your first assessment of breathing pattern

	Never	Rarely	Sometimes	Most of the time	Always
Respiratory Rate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Method of breathing: nose/mouth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Upper Chest v Lower chest movement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Erratic/rhythmical breathing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Air hunger frequency (sighs/yawns)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sounds or flow on inspiration and expiration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inspiration/expiration ratio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Breath holding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessory muscle use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cough/throat clearing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Breathing Pattern observation on movement (walking, stairs, steps, exercise)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diaphragm palpation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Musculoskeletal Ax (this may include posture, thoracic spine assessment etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please describe any other elements that you routinely complete as part of your assessment

13. Please tick all the subjective assessment tools you complete in your assessment

- Short Evaluation of Breathing Questionnaire (SEBQ)
- Dyspnea-12
- BORG scale
- Nijmegen Questionnaire
- Hospital Anxiety and Depression Scale (HAD)
- None
- Other (please specify)

14. Please tick all the objective assessment tools you complete in your assessment

- Breath hold
- End Tidal CO₂
- Exercise test e.g. 6MWT/SWT/Step Test
- Manual Assessment of Respiratory Motion (MARM)
- Brompton Breathing Pattern Assessment Tool (BPAT)
- None
- Other (please specify)

15. Do you have access to any of the following assessments at your place of work

- Cardiopulmonary exercise testing (CPET)
- Continuous laryngoscopy during exercise (CLE)
- Provocation Laryngoscopy
- Lung Function (spirometry)
- Other (please specify)

16. On average, how many sessions do your patients complete

- 1-2
- 2-4
- 4+

17. Are you referred patients with Inducible Laryngeal Obstruction (ILO) or Exercise Induced Laryngeal Obstruction (EILO)?

- Yes
 No
 Don't know

18. How confident do you feel in **assessing ILO** (scale 1-10)

Unconfident Confident

19. How confident do you feel in **treating ILO** (scale 1-10)

Unconfident Confident

20. How confident do you feel **assessing EILO**

Unconfident Confident

21. How confident do you feel **treating EILO**

Unconfident Confident

22. How do you most frequently manage patients with ILO (tick all that apply)

- I refer to a Speech and Language Therapist with an interest in Upper Airway (UA SLT) in my trust/department
- I refer to an UA SLT outside of my trust/department
- I see ILO patients jointly with an UA SLT
- We treat ILO in our physiotherapy service
- Other (please specify)

23. How do you most frequently manage patients with EILO

- I refer to an UA SLT in my trust/department
- I refer to an UA SLT outside of my trust/department
- I see ILO patients jointly with an UA SLT
- We treat EILO in our physiotherapy service
- Other (please specify)

24. Do you have access to a psychologist?

- Yes
- No
- Other (please specify)

25. Would you be willing to take part in a focus group to explore these responses in more detail. This will be held in central London on the 14th November 1000-1400. An honorarium towards travel will be paid.

If you indicate yes, please email I.grillo@imperial.ac.uk to confirm your interest.

- Yes
- No

26. Thank you for completing this questionnaire.

One final question; What is your preferred term for this condition?

- Hyperventilation
- Dysfunctional Breathing
- Breathing Pattern Disorder
- Breathing Pattern Dysfunction
- Other (please specify)

Supplementary information

Methodology info**Email/Social Media recruitment for Survey and Focus group**

Email to 'ACPRC' and 'Physiotherapy for Breathing Pattern'

To.....

Title of Study: **An analysis of Breathing Pattern and its assessment by physiotherapists working in this field**

My name is Lizzie Grillo and I am an advanced Physiotherapist working clinically at the Royal Brompton Hospital within the Adult Specialist Respiratory Medicine Team. Additionally, I am undertaking a Pre-Clinical Academic Fellowship (PCAF) as part of the NIHR ICA Programme. As part of my PCAF award I am completing a project looking at Dysfunctional Breathing Assessment. The title of this study is: **"An analysis of Breathing Pattern and its assessment by physiotherapists working in this field"**. This project is in two parts, the first a survey to be completed by physiotherapists whom undertake BPD Assessments, and the second a focus group to be completed after analysis of the survey to understand some of the responses and opinions within this area in more detail. I would be grateful if you could share this survey via your newsletters and social media. The survey has details of the focus group within it where you can indicate if you are able to attend. It would be great if one of your committee could also attend the focus group to ensure your organisation is represented. Please could you let me know if this is possible?

This project has been supported by Imperial College ethics committee. Please let me know if you need any more detail.

Lizzie Grillo

Information for the Newsletter/Social Media

My name is Lizzie Grillo and I am an advanced Physiotherapist working clinically at the Royal Brompton Hospital within the Adult Specialist Respiratory Medicine Team. Additionally, I am undertaking a Pre-Clinical Academic Fellowship (PCAF) as part of the NIHR ICA Programme. As part of my PCAF award I am completing a project looking at Breathing Pattern Dysfunction (BPD) Assessment. The title of this study is: **"An analysis of Breathing Pattern and its assessment by physiotherapists working in this field"**. This project is in two parts, the first a survey to be completed by physiotherapists whom undertake BPD Assessments, and the second a focus group to be completed after analysis of the survey to understand some of the responses and opinions within this area in more detail. If you are a physiotherapist (of any level of experience) whom completes BPD Assessments, I would be grateful if you could spend 5-10 minutes this survey (insert link). The survey has details of the focus group within it where you can indicate if you are able to attend.

This project has been supported by Imperial College ethics committee. Please let me know if you need any more detail.

Lizzie Grillo

Follow up emails

To.....

This is a follow up email to my original email dated (insert date of first email). My name is Lizzie Grillo and I am an advanced Physiotherapist working clinically at the Royal Brompton Hospital within the Adult Specialist Respiratory Medicine Team. Additionally, I am undertaking a Pre-Clinical Academic Fellowship (PCAF) as part of the NIHR ICA Programme. As part of my PCAF award I am completing a project looking at Dysfunctional Breathing Assessment. The title of this study is: **“An analysis of Breathing Pattern and its assessment by physiotherapists working in this field”**. This project is in two parts, the first a survey to be completed by physiotherapists whom undertake BPD Assessments, and the second a focus group to be completed after analysis of the survey to understand some of the responses and opinions within this area in more detail. I would be grateful if you could share this survey via your newsletters and social media. The survey has details of the focus group within it where you can indicate if you are able to attend.

This project has been supported by Imperial College ethics committee. Please let me know if you need any more detail.

Lizzie Grillo

Focus Group email (individuals)

To.....

Thank you for your interest in attending the Focus Group for the study: **“An analysis of Breathing Pattern and its assessment by physiotherapists working in this field”**.

I have attached the participant information sheet for you to read. Please take time to read this and I invite you to ask any questions prior to agreeing to attend.

The focus group will be held at Imperial College, Emmanuel Kaye Building, Manresa Road on (insert date) from 1000 until 1400. You will be provided with lunch, so please indicate any dietary requirements. We will also be providing an honorarium for up to £60 for your travel on the day.

Please confirm via email if you can attend and you will receive further information about the day.

Thank you in advance for your time.

Focus Group (specific group email)

To ACPRC/Physiotherapy for BPD (delete as appropriate)

Thank you for providing a representative to attend the Focus Group for the study: **“An analysis of Breathing Pattern and its assessment by physiotherapists working in this field”**.

I have attached the participant information sheet for you to read. Please take time to read this and I invite you to ask any questions prior to agreeing to attend.

The focus group will be held at Imperial College, Emmanuel Kaye Building, Manresa Road on (insert date) from 1000 until 1400. You will be provided with lunch, so please indicate any dietary requirements. We will also be providing an honorarium for up to £60 for your travel on the day.

Please confirm via email if you can attend and you will receive further information about the day.

Thank you in advance for your time.

Demographic information

We collected 103 responses. 75% of responders were a Band 7 or higher (highly specialist physiotherapists), 20% B6 (specialist physiotherapists) or below and 5% other (lecturer practitioner, private physiotherapists). 65% saw both inpatients and outpatients, with 25% just seeing outpatients alone. 57% worked in a tertiary or teaching hospital, 25% in secondary care, 25% in primary care and 14% privately. There was a range of experience based on patients seen per week with approximately 1/3 seeing less than one patient with BPD per week, 1/3 seeing 1-5 patients with BPD per week and 1/3 seeing more than 5 patients with BPD per week.

Focus Group Topic Guide

Question	Prompts
What is your preferred terminology for describing Breathing Pattern problems?	Likes/Dislikes of terms Problems with variation of nomenclature
What is BPD	BPD v Breathlessness Diagnosis v assessment
What are the important components of a Breathing Pattern Assessment?	Subjective Assessment components Objective assessment components Assessment Tools How do you diagnose BPD
Can you discuss the role of exercise (assessment) in BPD	Limitation to including exercise assessment What components of assessment do you include
Describe an optimal assessment of BPD	Skills required Equipment required Barriers/enablers

Table 5: Additional Quotes from the Focus groups

Nomenclature and Language
I think it is frustrating, the terminology. It doesn't help does it, in us trying to help diagnose, doing research, you know having outcome measures, when we sort of don't even have this start point (R2)
"it is highly important to define and be clear going forward with what the condition is and how it is described." (R7)
"But it is what we want to define it for. Is it useful for us to define it, or is it useful for the patient? And I guess maybe that is where we are having a bit of a problem. I don't know, but that is how it feels, that we are trying to get it the best, but for whom?". (R4)
'I don't really mind what it is called because I think the art of being a good clinician is then to follow it up with an explanation in lay terms that buys the patient in to what you are going to teach them'. (R1)
"Patients can often come in thinking "I have done all this stuff, and everybody says there is nothing wrong with me." And I say, "Actually, you are just not breathing well. You're okay, but you're not crazy." And I think a lot of patients think, "They all think it's in my head." (R4)
'There are a lot of patients like this that have kind of got themselves a bit of a reputation, and as clinicians we have kind of earmarked them as that, "Ah, they are probably breathing pattern' (R9)
They both (BPD and DB) surmise a myriad of different altered presentations of breathing leading to a range of symptoms. But hyperventilation is a symptom, not the cause as such. (R4)
But I agree, hyperventilation isn't a useful term, I don't think. It doesn't actually describe a lot of our patients. (R2)
"I think patients often arrive with terms themselves don't they, they have been told things like hyperventilation. I think often patients don't label themselves even after treatment with me, do they? They don't go around saying, "I have a breathing pattern disorder," like people often do with COPD or asthma, they will like label themselves" (R12)
So, I think we are nit-picking, and language is a problem, but it is working out who we are aiming the language at really and how the doctors describe it to patients in order to get them to engage with physio, and it is a minefield (R7)
"I have had a few patients that have wanted the diagnosis. When the original asthma diagnosis has been questioned and their asthma has been down on a piece of paper to say they can't work, then you take that away and what have they got? Because their breathing pattern could be so horrendous that that is a barrier for them doing a normal job, and you are working with them to overcome that" (R15)
"I think it is also important to align it with national and international consensus" (R16)
"I always say, "You can use any language you like." Because a lot of my patients won't have technical language, so I say to them, you know people will say to me, "I feel like I have got a double decker bus parked on my chest." So, I think, "Maybe that is chest tightness." It's about allowing them to use whatever language they like" (R17)
"There is a lot of patients like this that have kind of got themselves a bit of a reputation, and as clinicians we have kind of earmarked them as that, "Ah, they are probably breathing pattern." (R10)
BPD & Breathlessness
"So, it's maybe a large group of symptoms that do not necessarily fit in with any other standardised or recognised patterns of breathlessness, and are not responsive to certain conditions, medications, or management" (R5)
"If you physiologically think of breathlessness, it is a combination of insufficiency of gas exchange at some level, whether it is at the lung or the cell, it doesn't matter. So they come to you and say, "I don't feel that I can get enough breath. What do I call that? I am breathless." (R7)
Personally I spend quite a lot of time asking patients to describe symptoms and trying to work out what is it that actually is bothering them? And sometimes it is just 'I have become really aware of my breathing'. So, there is a whole kind of range from mechanical type symptoms to a kind of cognitive awareness, but it gets sort of put under this umbrella or breathlessness when they first come to see you" (R3)
'Breathing is not just a sensation it is an emotion' (R1)
Diagnosis and validation of symptoms

<p>“When we have done our assessment this not only helps us diagnose it but it also shows us that they are breathing too fast or their breathing’s irregular. The causes are something different and the treatment is something different, but you are diagnosing BPD.” (R13)</p>
<p>“And it was weekly that someone would come and sit down and cry, that’s the first thing they did, because they felt that they were wasting everyone’s time, and that they were being blamed for whatever was going on, and that they were sitting in a clinic with people who were genuinely sick, but their symptoms were so difficult” (R8)</p>
<p>“I think very much like you said, the issue is, is this breathlessness in excess or breathlessness in the absence of a diagnosis? And 99% of what I see is the two together, there is at least one diagnosis underlying” (R14)</p>
<p>“But I think there is such a roll of it happening in primary care before ... and that is I don’t think where we are getting involved enough yet, and I think that would be a really exciting place that this could be picked up earlier, alongside other potential investigations” (R10)</p>
<p>Components of Assessment</p>
<p>“I think the subjective is probably most important, you are trying to understand the long and winding road that they have taken to get to you.” (R1)</p>
<p>“I think probably the most transformative thing that we have had in our service, that I am sure many of you have, is just electronic record sharing. It is amazing, because the relevant stuff is often what you are searching for very specifically. And we are on the same record as the GPs, so you get all sorts of mental health history that no-one would have asked the patient about, that becomes super relevant for your assessment” (R5)</p>
<p>Assessment Tools</p>
<p>“I’m not saying they are not useful. I’m saying we need to be mindful of the fact that we are on a journey with all these outcome measures and it is certainly not the finished article” (R11)</p>
<p>“The NQ is obviously centred around HVS, but I find I am not really bothered about the result, but the patients find it really powerful. It often pools together some symptoms and brings out symptoms they wouldn’t have necessarily thought were related, and to be able to say, “Oh, yes that’s me, that’s me,” and they get quite excited” (R8)</p>
<p>I think if you have been doing it for a very long time and you have seen many patients, a lot of that is happening anyway, you are just putting in what you were already doing and thinking about into a structural form”. (R11)</p>
<p>“I could quite happily not use any of the outcome measures that are available at the minute and just look at the patient and how they are breathing and assess their breathing pattern and then put your hands on the patient. I think that gives us far more information than any of the written stuff at the minute” (R17)</p>
<p>“ I think there is a real dangerous route that we could potentially go down where we are trying to show value in the service that we are providing based on measures that aren’t fully” (R11)</p>
<p>“Although there is limited data in the (clinical) value of the breath hold, it is a quick, easy assessment to complete- often improving with treatment and therefore providing important feedback to both the patient and clinician through recovery”. (R12)</p>
<p>Diaphragm</p>
<p>“The diaphragm is hardly contracting at all-, so it is fixed and holding onto all that air”. (R8)</p>
<p>“So, I will often get patients and the way that I can kind of, I call it the hook, is I will lie them on the bed, and I will say to them, “I want you to let go,” and their diaphragm will kick in and they will go, “That feels so much better.” And I’m like, “Right, that’s what you need to get” (R13)</p>
<p>BPD and Exercise</p>
<p>“Quite often when they come to do the exercise bit it either all goes pear-shaped and you have to address it very specifically, or actually they morph into it quite naturally because you have improved their breathing pattern, therefore they go on their demand, not what they think their breathing pattern should be.” (R4)</p>
<p>Specialist Skills</p>
<p>‘I think you need a certain level of testing. I think the best referrals I get are from the respiratory consultants. This can make the assessment easier at the beginning and help with decision making’ (R1)</p>
<p>“I like to know what their label is, and what tests have been ran, and what has been excluded. The more experience you have, the more speedily you can filter the information”. (R13)</p>
<p>‘If you have been referred someone with the diagnosis of BPD, it shouldn’t stop you being curious about something else going on’ (R14)</p>

'I think we have got to be really careful of presuming BPD, or presuming dysfunctional breathing, and I am very cautious that we don't have a culture where we are so quick to promote that BPD exists that we want to label people with it. I think we have to be really careful.... making sure that those comorbidities are properly managed within a label of BPD'. (R8)

"perhaps these people don't have the exposure or the skills to be able to pick up on small nuances that might be wrong to be able to tweak things in the management" (R15)

"And that is an art I think, and that is where the experience of specialism comes in, where you have just seen, and tried, and done, and thought about it in a different way, and put it in a slightly different way, and it has worked for that one or two people, and you have got another skillset" (R17)