

Current Clinical Practices, Experiences,
and Perspectives of Healthcare
Practitioners Who Attend to Dysfunctional
Breathing: A Qualitative Study

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A thesis submitted in partial fulfilment of the requirements for the degree of Master of
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Declaration

Name of candidate: Jade Shaw

This Thesis/Dissertation/Research Project entitled **Current clinical practices, experiences, and perspectives of healthcare practitioners who attend to dysfunctional breathing: A qualitative study** is submitted in partial fulfilment for the requirements for the Unitec degree of Master of Osteopathy.

CANDIDATE'S DECLARATION

I confirm that:

- This Thesis/Dissertation/Research Project represents my own work;
- Research for this work has been conducted in accordance with the Unitec Research Ethics Committee Policy and Procedures, and has fulfilled any requirements set for this project by the Unitec Research Ethics Committee.

Research Ethics Committee Approval Number: 2014-1063

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Abstract

The under-recognised and often misdiagnosed condition of dysfunctional breathing (DB) requires urgent critical investigation of the practices, experiences, and perspectives that underlie current clinical practice. The objective was to explore current clinical practices, experiences, and perspectives of healthcare practitioners currently attending to DB. This qualitative exploratory study employed interpretive description. Referral and snowball sampling recruited six participants. Data collection methods involved semi-structured in-depth interviews with three osteopaths and three physiotherapists. Interviews were deconstructed and analysed, and themes were developed. The complex journey to optimal breathing emerged as the over-arching theme in narratives of the participants' own experiences. Three sub-themes were developed highlighting the complex nature of DB: 1) missed by both patient and practitioner, 2) re-establishing a mind-body connection, and 3) a multifaceted approach is key. Findings suggest that there is a general lack of awareness surrounding DB by the general population and possibly by many healthcare practitioners. A lack of identification impacts patient quality of life and can lead to chronic musculoskeletal adaptations. Establishing a mind-body connection allows patients to establish a level of body awareness that allows a change in their breathing pattern back to an efficient and relaxed state that impacts presenting symptoms. A multifaceted approach to treatment is critical to making maximum changes and optimising clinical outcomes.

Keywords: Breathing dysfunction; Breathing pattern disorders; Hyperventilation syndrome; Interpretive descriptive; Manual therapy; Osteopathy; Physiotherapy; Practitioner Perspectives; Qualitative research.

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Preface

This research explored current clinical practices, experiences, and perspectives of healthcare practitioners who attend to DB. This thesis is presented in three main parts. Accordingly, Part One consists of two sections. Section One, is a literature review that underpins the topic of DB. Section Two, is a detailed methodology and methods section. Please note that Section One follows APA formatting as followed by Unitec Institute of Technology.

Part Two, is presented in a manuscript prepared in partial accordance with the *International Journal of Osteopathic Medicine (IJOM)* submission guidelines. Please note that *IJOM* allows authors to submit ‘in their own style’ (see Appendix N) and that if accepted, required adaptations to their style will be addressed.

Part Three of this thesis consists of appendices. The appendices contain documentation of: Acknowledgments; ethics approval; participant information; participant consent; confidentiality agreements; participant interview schedule; a detailed break-down with examples of working with the data and formulating the main over-arching theme of this research; questionnaires that are mentioned in the thesis; and, guidelines for journal publication. Formatting in this third and final section follows APA formatting as followed by Unitec Institute of Technology.

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Glossary

Body awareness

‘Body awareness’ is a term associated with mind-body connection and refers to being aware of the connection between the mind and the body. More specifically, body awareness is regarded as a subjective and complex multidimensional construct of one’s awareness of internal body signals/sensations and the ability to recognise subtle physical body cues (Lyons & Hughes, 2015; Mehling et al., 2009).

Dysfunctional breathing

Dysfunctional breathing (DB) is a diagnostic term used to describe a range of signs and symptoms associated with a divergent breathing pattern that does not reflect specific pathology (Barker & Everard, 2015; Niggemann, 2010; Courtney, 2009). For the purpose of this research project, the term DB will be used and will follow a definition proposed by Barker and Everard (2015) as “an alteration in the normal biomechanical patterns of breathing that result in intermittent or chronic symptoms which may be respiratory and/or non-respiratory.”

Mind-body connection

The phrase ‘mind-body connection’ describes a bidirectional connection between a) the body’s biological functioning; and b) mental states such as emotions, thoughts, feelings, beliefs, experiences, and attitudes. The mind and body are considered to be inseparable because all physical systems of the body and emotional responses are constantly communicating by neurological and chemical reactions. Thus, the term ‘mind-body connection’ refers to a mental state that can affect the physical body, and vice versa (Mehling et al., 2009).

Part One: Section One

Introducing the Research

Literature Review

Introduction

Dysfunctional breathing (DB) is a diagnostic term used to describe a range of signs and symptoms associated with a divergent breathing pattern that does not reflect specific pathology (Barker & Everard, 2015; Niggemann, 2010; Courtney, 2009). In the past, DB has been believed to involve hyperventilation syndrome with the presence of hypocapnia (Courtney & Greenwood, 2009; Thomas, McKinley, Freeman, & Foy, 2001; van Dixhoorn & Duivenvoorden, 1985). Now, DB is acknowledged to occur with abnormal breathing patterns in the absence of hypocapnia (Courtney & Cohen, 2008; Courtney & van Dixhoorn, 2014). The idea that ‘proper’ breathing is important for health suggests that ‘dysfunctional’ breathing can have adverse effects on health (Courtney, 2011). It has been reported that addressing DB with breathing therapy reduces signs and symptoms such as respiratory symptoms, anxiety and depression, and improve quality of life (DeGuire, 1996; Grammatopoulou et al., 2011; Holloway & West, 2007; Thomas et al., 2003). The exact mechanisms of DB are still somewhat unclear, although the origin is thought to have biochemical, biomechanical, and psychological aspects, making DB complex and multidimensional (Barker & Everard, 2015). The proportion of persons affected by DB has been estimated to be approximately 5-11% (Chaitow, Bradley, & Gilbert, 2014; Thomas, McKinley, Freeman, Foy, & Price, 2005) of the general population, and 20% of adults with a current diagnosis of asthma (Thomas et al., 2001). Additionally, a significant number of persons diagnosed with asthma has been identified as wrongly diagnosed, and instead may be experiencing their asthma-like symptoms due to DB (Aaron et al., 2008; Marklund, Tunsater, & Bengtsson, 1999).

The acknowledgement that DB can occur in the absence of hypocapnia, has promoted more research exploring the phenomenon to attempt to establish a definition of DB, and develop valid and reliable diagnostic measures. As demonstrated by continued research, there are more people attending to DB (De Groot, 2011; De Groot, Duiverman, & Brand, 2013; Jones

et al., 2015; Lum, 1975; Ringsberg, Wetterqvist, Lowhagen, & Sivik, 1997; Weinberger & Abu-Hasan, 2007), however, investigating the impact of DB and breathing therapy remains hampered due to an uncertainty around a clear definition and minimal validated measures or standardised protocols to assess the condition (Barer & Everard, 2015; Courtney, 2009; Stanton, Vaughn, Carter, & Bucknall, 2008; Thomas, 2003). Although DB has been described in anecdotal reports to randomised control trials (Cliffon-Smith & Rowley, 2011; Henderson, 2007; Jones et al., 2015; Magarian, Middaugh, & Linz, 1983; Perri & Halford, 2003; Ringsberg et al., 1997; Thomas et al., 2003), it is still unclear what is actually happening in a clinical setting. Investigating people's attitudes and perspectives of DB and exploring their own experiences may be necessary to build further awareness around the phenomenon (Hagman et al., 2007; Chaitow, 2004). Therefore, investigating current clinical practice when attending to DB from a qualitative perspective is required.

The following is a summary of literature that contributes to the body of knowledge in the area of DB. First, the respiratory system is discussed with a focus on its structure and function including acid-base balance. A definition of DB being used for the purpose of this study is provided along with a discussion about the terminology and the mechanisms and signs and symptoms of DB. A number of diagnostic measures currently used are named. The relationships between asthma and DB is explored followed by the bidirectional relationship between psychological components and DB. A role of mind-body connectedness to assist in treating DB is reported. Lastly, treatment modalities are identified with a focus on breathing retraining.

Literature Search Strategy

Electronic databases Science Direct, PubMed, EBDSCO, PEDro, the Unitec library database, and Google Scholar were searched for scientific literature published in academic journals. Keywords included 'breathing dysfunction', 'dysfunctional breathing', 'dysfunctional breathing patterns', 'manual therapy', 'hyperventilation', 'hyperventilation syndrome', 'breathing retraining', 'asthma', 'mind-body', 'breathing pattern disorders', and 'body awareness'. Search results varied depending on the database searched and keywords used. Titles and abstracts were scanned for relevance. Potential articles for inclusion were also identified through article reference list searches.

Dysfunctional Breathing

The Respiratory System: Normal Breathing, Structure, and Functions

Breathing is the action of inhaling and exhaling air. The act of breathing allows the respiratory system to exchange oxygen (O₂) and carbon dioxide (CO₂) between air and blood and between blood and tissue fluid. The exchange of O₂ for CO₂ is vital so that cells can receive O₂ to carry out cellular respiration and produce adenosine triphosphate (ATP) which transports energy throughout the body. Just as vital as the intake of O₂ is the elimination of CO₂, a waste product of cellular respiration (Scanlon & Sanders, 2014). Breathing therefore promotes gas exchange associated with the production of energy for the body's cellular processes (Saladin, 2004). Functions of breathing can be further broken into two categories described as biochemical and biomechanical. The primary role of breathing is the gas exchange of O₂ and CO₂ which falls under the biochemical category, as does the homeostatic balance of pH levels, which will be described in more detail at a later stage. The biomechanical category includes the functioning of the respiratory pump such as the diaphragm contracting and relaxing, and additionally the involvement of accessory respiratory muscles (Courtney, 2001; Saladin, 2004). The respiratory system plays a major role as a basic life support to the body by helping maintain homeostatic control of blood gases, pH, blood pressure, and other variables related to body fluids such as venous and lymphatic return (Saladin, 2004). Furthermore, the respiratory system has an effect on motor control, postural stability, organ function, speech production, psychophysiological regulation of stress and arousal (Courtney, 2001; D'Alonzo & Krachman, 1997; Ziemann et al., 2009), in addition to neurological influences (e.g., the autonomic system, trigeminal system, and thoracic outlet) (Bordoni & Zanier, 2013; Courtney, 2009; D'Alonzo & Krachman, 1997; Marieb, 2002; West, 2000). With the respiratory system having such a wide reach within the body's functioning, a dysfunctional breathing pattern may compromise numerous processes throughout the body resulting in adverse effects to one's health.

Structure: The respiratory system is made up of the upper respiratory tract that lies outside the chest cavity including the nose, nasal cavities, pharynx, larynx, and upper trachea, and the lower respiratory tract that lies within the chest cavity including the lower trachea, lungs, bronchial tubes, and alveoli (Marieb, 2002; Scanlon & Sanders, 2014). The pleural membranes, the diaphragm, and intercostal muscles also make up the respiratory system (Scanlon & Sanders, 2014). Gas exchange with the external environment only occurs in the

alveoli, and functions primarily to take up atmospheric O₂ for metabolising tissues and remove CO₂. Conducting structures of the upper and lower respiratory tract are primarily responsible for allowing air to reach the lungs, although these structures also purify, humidify, and warm incoming air (Marieb, 2002). The primary muscle of respiration is the diaphragm. The diaphragm is a thin, dome-shaped muscle that has costal, lumbar, and sternal attachments. With strong diaphragmatic attachments to the thoracic cage and spine, posture and spinal stability is directly affected by breathing and vice versa (Bordoni & Zanier, 2013). Other muscles involved in respiration are referred to as accessory or secondary muscles of respiration (Bordoni & Zanier, 2013; West, 2000). Accessory muscles involved in deep or forced inhalation include the external intercostal, scalene, upper trapezius, sternocleidomastoid, anterior serratus, and pectoralis minor muscles. Muscles involved in forced expiration include the abdominal wall musculature and internal intercostals (D'Alonzo & Krachman, 1997). During inhalation the diaphragm contracts and flattens, increasing the volume of the thoracic cavity, causing a decrease in intrapleural pressure and a flow of air into the lungs. During exhalation the diaphragm relaxes and re-domes, reducing thoracic cavity volume and increasing intrapleural pressure and with the addition of gravitational pull on the thoracic cage and the elastic recoil of the ribs, air is forced out of the lungs (D'Alonzo & Krachman, 1997). With each contraction of the diaphragm a change in pressure differentials throughout the body occurs. The change in pressure draws air into the lungs, anchors the heart within the pericardium, flattens the spinal curves, assists in lymphatic flow and digestive processes, and may contribute to passive diffusion processes throughout the body (D'Alonzo & Krachman, 2010; West, 2000).

Control and Integration: The respiratory system cannot function without the influence of the central nervous system (CNS). The CNS regulates the activity of the respiratory muscles (D'Alonzo & Krachman, 1997). The diaphragm is supplied by the phrenic nerve originating from cervical segments three, four, and five. The diaphragm has a sensory and motor component along with both voluntary and involuntary (also referred to as autonomic) functions. Breathing is the single vital function that is governed by both voluntary and involuntary control. Voluntary control however, only falls within certain limits determined by self-regulatory involuntary parameters (Ley, 1999). The involuntary parameters are primarily maintained by feedback mechanisms involving autonomic visceral mechanisms, the neuroendocrine system, the limbic system, brain stem nuclei, and cortical areas (Brown & Gerbarg, 2005). Breathing rhythm, breathing rate, the supply of blood to the

lungs, and vital reflexes such as coughing and sneezing are governed by autonomic control (West, 2000). Actions such as speech, defecation, and emotional expressions such as laughing and crying are achieved through voluntary control (D'Alonzo & Krachman, 1997).

The cardiovascular, lymphatic, and urinary systems also play an important role in the functioning of the respiratory system (D'Alonzo & Krachman, 1997). The cardiovascular system transports respiratory gases between the lungs and tissue cells via blood. Additionally, the lymphatic system is also responsible for the removal of waste products (Marieb, 2002). The respiratory system also has a close functional relationship with the urinary system, regulating the body's pH balance. Acid-base imbalance in the short term can be compensated by adjusting the rate of ventilation, however, the kidneys have the largest responsibility for maintaining blood and tissue fluid pH within a normal range (Sanders, 2014, p. 473). In its simplest form, the regulatory function of the kidneys, in response to body fluids becoming too acidic, is the reabsorption of bicarbonate from urine and returning it to the blood, and the excretion of hydrogen ions into urine from the kidneys increasing pH. Body fluids that become too alkaline are compensated by reabsorbing hydrogen ions and excreting bicarbonate to lower pH (Sanders, 2014, p. 473). Thus, the respiratory, cardiovascular, lymphatic, and urinary systems have an especially close physiological relationship (Saldin, 2004). If any of these systems fail, cells within the body will begin to die due to O₂ starvation and accumulation of CO₂ (Marieb, 2002).

Acid-base balance: Respiratory alkalosis is characterised by hypocapnia (a decrease in arterial CO₂) and an increase in pH levels, thus producing a more alkaline state within body fluids, especially in the blood (Chaitow, 2004). Although a waste product, CO₂ plays a crucial role in regulating the body's pH and vascular tone (Gilbert, 2005). The partial pressure of arterial carbon dioxide (PaCO₂) reflects the balance between the production and elimination of CO₂ (Laffey & Kavanagh, 2002). Hyperventilation occurs when CO₂ is exhaled at a rate that exceeds the amount being produced (Gilbert, 2005). Hyperventilation is one of the principal physiologic causes of hypocapnia that is characterised by a low level of PaCO₂. Hyperventilation can lead to vasoconstriction that inhibits the transfer of nutrients from the blood to tissues. Prolonged alkalinity can cause a general excitability with the extreme being convulsions (Gilbert, 2005). Mild hypocapnia should not have serious effects in healthy persons, though in many acute disorders, hypocapnia may initiate pathological processes, thus playing a role in the development of systemic disease. However, data

supporting marked hypocapnia as a cause for serious adverse effects are limited (Laffey & Kavanagh, 2002).

In the brain, vasoconstriction as a result of hyperventilation creates hypoxia and reduces brain size. If the brain has swollen and is pressing against the skull (e.g., as a result of stroke, haemorrhage, and closed-head injuries), controlled hyperventilation is often used in the short term to assist in preventing further damage (Gilbert, 2005). Local pH within the brain determines the level of cerebral vasoconstriction, and a buffering response to acute hypocapnia normalises cerebral blood flow, reducing the effectiveness of intracranial pressure (Laffey & Kavanagh, 2002). Alkalosis causes the immediate development of acute hypocapnia. A buffering response to acute hypocapnia occurs in two phases. First, intracellular CO₂ concentration decreases, intracellular chloride ions are transferred to extracellular fluid, and extracellular concentrations of bicarbonate ions is decreased. Second, a renal response occurs within minutes. Renal tubular reabsorption of bicarbonate ions is inhibited and this response can last over a period of hours to days. Within normal renal function and if hypocapnia is prolonged, a decrease in bicarbonate ion begins, and extracellular fluid pH reduces towards a more normal pH of 7.4 (Gilbert, 2005; Laffey & Kavanagh, 2002).

At the tissue level, the metabolic rate can become imbalanced when O₂ supply does not meet the O₂ demand. Hypocapnia may contribute to cellular or tissue ischemia by decreasing the cellular O₂ supply and increasing the cellular O₂ demand (e.g., through cellular contraction or excitation) (Laffey & Kavanagh, 2002). Furthermore, because of the Bohr effect, a decrease in CO₂, thus an increase in alkalinity can cause an increased affinity of haemoglobin (Hb) with O₂, and therefore Hb molecules become less likely to release their O₂ in tissues that have become more alkaline (Chaitow, 2004). Finally, hypocapnia causes systemic arterial vasoconstriction, decreasing both global and local O₂ supply (Laffey & Kavanagh, 2002).

The opposite of respiratory alkalosis is respiratory acidosis that results due to an increase in arterial CO₂ and a decrease in pH levels, causing a more acidic state. When breathing is not sufficient to expel CO₂ such as with hypoventilation, increased PaCO₂ occurs and hypercapnia results (Gilbert, 2005; Lewis, 2016). In addition to hypercapnia, blood pH levels decrease due to the reversible formation of carbonic acid when CO₂ reacts with water

(Gilbert, 2006). Vasodilation occurs as a response to an increase in CO₂ to allow for maximised transfer of glucose and O₂ from the blood to tissues (Gilbert, 2005). A large pH shift towards acidity can cause metabolic problems and should be considered a medical emergency with the extreme being coma (Gilbert, 2005).

Dysfunctional Breathing

For the purpose of this research project, the term DB will be used and will follow a definition proposed by Barker and Everard (2015) as “an alteration in the normal biomechanical patterns of breathing that result in intermittent or chronic symptoms which may be respiratory and/or non-respiratory.” Given that DB has primarily been diagnosed using the NQ that was originally created to investigate hyperventilation (van Dixhoorn & Duivenvoorden, 1985), Courtney (2009), suggests that the term DB has been introduced as a proxy to hyperventilation syndrome. However, the term DB has also been used to describe patients who display a divergent breathing pattern and have signs and symptoms that cannot be attributed to a specific medical diagnosis (Barker & Everard, 2015; Courtney, 2009; Niggemann, 2010). Despite the diagnostic term DB now being used more frequently to describe breathing anomalies, clarity around the term still remains unresolved to some extent (Barker & Everard, 2015; Hagman et al., 2007; Niggemann, 2010).

Hyperventilation was first described by military physicians in soldiers from the American Civil War. Soldiers displayed symptoms such as breathlessness, chest pain, numbness, paraesthesia, light headedness, dizziness, fatigue, and exercise intolerance that could not be attributed to organic pathology (Magarian et al., 1983). Since then similar groups of symptoms have been labelled with numerous diagnostic terms such as hyperventilation syndrome, anxiety related breathlessness, psychogenic functioning breathing disorder, sighing dyspnoea, behavioural breathlessness, somatoform respiratory disorder, and DB (Barker & Everard, 2015; Niggemann, 2010). Over the last decade the term DB has been used more commonly as represented by those involved in breathing research (Courtney, 2009; Stanton et al., 2008; Thomas, 2003). DB has been used more broadly in some cases to replace the term ‘hyperventilation syndrome’ that was previously referred to more readily to describe patients who frequently over-breathe and display an increased respiratory rate (Prys-Picard & Niven, 2008). Prys-Picard and Niven (2008), argue that hyperventilation is a symptom of DB rather than a condition itself which may support a shift in terminology. Furthermore, some symptoms attributed to DB do not relate to the known biochemical effects

of hyperventilation as shown in a study by Courtney & Greenwood (2009). The study shows low correlations between PaCO₂ (a decrease in PaCO₂ can indicate hypertension) and breathing inventories such as the Self Evaluation of Breathing Questionnaire (SEBQ) and Nijmegen Questionnaire (NQ) (Courtney & Greenwood, 2009; Gilbert, 2005).

Mechanisms of DB have been described as complex, including psychological, physiological, and biomechanical involvement. It is thought that DB may result from inappropriate breathing patterns (e.g., paradoxical breathing and upper chest breathing), hyperventilation, hyperarousal, a lack of adaptability and responsiveness of breathing, excessive dyspnoea, musculoskeletal imbalances, psychological influences, and misinterpretation of breathing sensations (Cliffon-Smith & Rowley, 2011; Courtney, 2009). Characteristic signs and symptoms of DB include: hyperventilation; (Barker & Everad, 2015; Bott et al., 2009; Courtney, 2009; Jones et al., 2015; Lum, 1981); abnormal breathing coordination, timing, and volume (Courtney, 2009); breath holding, upper chest breathing, and sighing (Gardner, 1996; Han, Stegen, Schepers, Van den Bergh, & Woestijne, 1998; Han et al., 1997). In addition, respiratory accessory muscles will be overused, and the diaphragm weakened causing musculoskeletal dysfunction (Gilbert, 1998).

Proportion of Population Affected by Dysfunctional Breathing

There may be a significant minority of adults affected by DB, for example one in 10 of the general population from a sample size of 300 participants who completed the NQ were reported to have scores suggestive of DB (Thomas et al., 2005). Perri and Halford (2003), conducted a study that aimed to determine the incidence of normal breathing versus DB in a cohort of 94. Participants were observed during relaxed and deep breathing, although no distinction was made between nose and mouth breathing which may produce different findings had there been. The observation findings were combined with results from a questionnaire on pain history. Of the 94 participants, 75% exhibited DB suggesting a normal pattern of breathing to be the exception. Furthermore, it has been reported that patients with DB are more impaired than patients with well-controlled asthma. For example, a study that compared patients with DB and patients with asthma via patient journals, pulmonary function testing, and self-report questionnaires, identified that DB correlated to lower health related quality of life, a lower sense of coherence, a higher prevalence of anxiety, a higher prevalence of hyperventilation, and a larger impact on everyday life than those with controlled asthma (Hagman et al., 2007). There may be a large presence of unrecognised DB

that may impact quality of life with associated morbidity, demonstrating a need for improved recognition and appropriate management (Jones et al., 2015). One of the current difficulties in determining prevalence stems from an inconsistency of methods being used for identification.

Assessment of Dysfunctional Breathing

The multidimensional and dynamic nature of DB makes clinical application of assessment difficult. As a result, a standardised assessment or clinical protocol to evaluate DB is yet to be established, and therefore, evaluation can be difficult (Agache, Ciobanu, Paul, & Rogozea, 2012). Current assessment includes questionnaires that aim to identify breathing abnormalities, identify specific symptoms, and measure the severity of the condition and 'health-related quality of life.' 'Health-related quality of life,' broadly refers to patient reported functional effects due to illness or dysfunction, quantifying the impact on daily life, health, and well-being, usually associated to both physical and psychological aspects (Eakin, Kaplan, & Ries, 1993; Haave, Hyland, & Engivik, 2005). Three questionnaires identified include the NQ (van Dixhoorn & Duivenvoorden, 1985), the SEBQ (Courtney & Greenwood, 2009; Courtney, Greenwood, & Cohen, 2011), and the Rowley Breathing self-efficacy scale (RoBE scale) (Rowley & Nicholls, 2006). Additionally, there are manual assessment techniques used to investigate abnormal breathing patterns such as The Respiratory Induction Plethysmography (RIP), Manual Assessment of Respiratory Motion (MARM) (Courtney, van Dixhoorn & Cohen, 2008), Hi Lo Breathing Assessment (Courtney, Cohen, & Reece, 2009), breathing holding time (Courtney & Cohen, 2008; Thomas et al., 2001), the hyperventilation provocation test (Howell, 1997), and spirometry readings (Balkissoon & Kenn, 2012).

Questionnaires. The 16 item NQ (Appendix K) was originally created and validated to diagnose hyperventilation syndrome, however, it is now commonly used to identify DB (Courtney, Greenwood et al., 2011; Thomas et al., 2005; Thomas et al., 2001; van Dixhoorn & Duivenvoorden, 1985). Of the 16 items, 3 relate to respiratory symptoms and the remaining 13 identify peripheral and central neurovascular or general tension related symptoms (Mitchell, Bacon, & Moran, 2016). Each item is scored on a scale from 0 to 4. A score of 0 indicates that the symptom 'never occurs' and a score of 4 indicates that the symptom occurs 'very often' (van Dixhoorn & Duivenvoorden, 1985). Scores equal to or higher than 20 to 22 have been found to indicate DB. Normal values of 10 in European studies and 5 in Chinese studies have been reported (Courtney, Greenwood et al., 2011). Van

Dixhoorn and Duivenvoorden (1985), assessed the efficacy of the NQ by comparing participants ($n = 75$) with clinically diagnosed hyperventilation to participants ($n = 80$) without hyperventilation. The study reported correct discrimination between the two groups to be 93% accurate. The sensitivity of the NQ was reported to be 91% and the specificity to be 95%. Prys-Picard and Niven (2008), suggest that the NQ may not be credible as a diagnostic tool for DB but rather to identify hyperventilation only. Prys-Picard and Niven (2008), state that hyperventilation may be a symptom of DB and that there is no evidence of a correlation between NQ scores and symptom severity (Prys-Picard & Niven, 2008). Although, if hyperventilation is recognised as a symptom of DB (Prys-Picard & Niven, 2008), identifying a symptom of DB may provide validation to investigate further. However, a number of NQ items overlap with symptoms of asthma, and therefore, may not be specific to DB (Prys-Picard & Niven, 2008). Furthermore, Prys-Picard and Niven (2008) reported the NQ to have 95% specificity to hyperventilation, and if they had compared asthma patients also, different results might have been observed. Finally, Prys-Picard and Niven (2008), report that NQ scores are not reflective of capnography results in patients with asthma. Capnography assesses partial pressure of CO₂ and has also been adopted to assist in the diagnosis of DB, providing an objective measure (McLaughlin, 2009).

The NQ alone may not be enough to confidently diagnose DB, thus, Stanton et al. (2008) suggests diagnostic specificity may be increased when using the NQ in combination with a progressive exercise test, in the form of a stationary bicycle test. The bicycle test provides data on circulatory abnormalities and fitness levels, that if normal may provide more support in a diagnosis of DB (Ringsberg et al., 2007). Stanton et al. (2008), argues that the NQ may overestimate DB in patients with moderate to severe asthma. Only 59% ($n = 10$) of participants with positive NQ scores were reported to have confirmed DB via progressive exercise testing. The cut-off score was 23, with scores below 23 described as showing no evidence of DB (Stanton et al., 2008). Cut-off scores of 20 to 22 have been reported to identify DB (Courtney, Greenwood et al., 2011), and therefore Stanton et al. (2008) may have excluded some participants from having DB who had cut-off scores of 20 and 22. In a later study, Agache et al. (2012) reported similar findings. Of a cohort of 91 adults with diagnosed asthma, 30% ($n = 27$) had positive NQ scores, and of the 27 only 59% ($n = 16$) had inappropriate hyperventilation in a progressive exercise test, confirming DB. Ringsberg et al. (2007), also support the use of a bicycle test in combination with lung function tests to assist in diagnosing patients with asthma-like symptoms, but who have negative asthma tests.

However, a limitation of the bicycle test is that it currently lacks a set of standardised diagnostic parameters to define inappropriate ventilation (Agache et al., 2012). Furthermore, no study explained what basis there is to expect that DB will become worse during exercise for all persons with DB.

The NQ was originally designed to identify hyperventilation syndrome which may only be one facet of DB, therefore, the NQ does not sufficiently identify all related symptoms of DB (Courtney, van Dixhoorn, Greenwood, & Anthonissen, 2011). For example, the NQ does not incorporate symptoms of DB such as abnormal breathing co-ordination (Courtney, 2009), yawning, mouth breathing, difficulties breathing while talking, breathing proportional to fitness (Courtney, Cohen, & van Dixhoorn, 2011; Courtney & Greenwood, 2009), breath holding, upper chest breathing, and sighing (Gardner, 1996; Han et al., 1997; Han et al., 1998). To be more clinically useful, a more extensive questionnaire that identifies a larger range of potential indicators to DB is required.

The SEBQ (Appendix L) has been created to specifically assess for breathing behaviours and respiratory symptoms associated with DB (Courtney, Greenwood et al., 2011). The SEBQ aims to investigate the nature of unexplained symptoms commonly present in DB, that may or may not be associated with hyperventilation syndrome, and are not thoroughly examined via the NQ (Courtney & Greenwood, 2009; Courtney, Greenwood et al., 2011; Mitchell et al., 2016). The SEBQ differs from the NQ in that it is larger, with 25 respiratory items aimed to cover a wider range of potential symptoms of DB (Courtney & Greenwood, 2009; Mitchell et al., 2016). In addition, the SEBQ differentiates two distinct dimensions of DB as: 1) 'lack of air,' that is thought to relate to chemoreceptor inputs; and, 2) 'perception of inappropriate or restricted breathing,' that is thought to relate to biomechanical factors (Courtney & Greenwood, 2009; Courtney, Greenwood et al., 2011). Courtney and Greenwood (2009), reported that incorporating both biochemical and biomechanical dimensions in clinical assessment provide more specific diagnosis and treatment of DB. However, these distinct dimensions were not observed in a later study assessing the test-retest reliability of the tool (Mitchell et al., 2016). Mitchell et al. (2016), have shown a high test-retest reliability and internal consistency of the SEBQ in 180 adults from the general population via an online SEBQ. No difference between test and retest was shown (Mitchell et al., 2016). A limitation of this study is that only a single retest was performed, and therefore, more retests could have provided stronger support of

reproducibility. Additionally, psychological components such as anxiety, depression, stress, and distress were not measured. With a strong link between DB and psychological state (Brown & Gerbarg, 2005; Ley, 1999), future investigation incorporating this component would be useful. Currently the SEBQ requires further studies to provide validity for clinical use as a screening tool for DB (Courtney, Greenwood et al., 2011; Mitchell et al., 2016). Validity may be sought by comparing the SEBQ to other clinical tests. Finally, normative values in healthy persons need to be established (Mitchell et al., 2016).

The RoBE scale (Appendix M) is a questionnaire developed as part of a pilot study. The study aimed to assess self-efficacy relating to the ability to control symptoms of DB in 16 participants currently being treated for DB (Rowley & Nicholls, 2006). The 10 item questionnaire was developed from anecdotal descriptors from clinical settings, and supporting literature identifying activities that persons with DB find difficult and their attitudes (Rowley & Nicholls, 2006). The study proved good reliability when using the RoBE scale for the DB population. A limitation of the RoBE scale is that rather than identifying specific symptoms of DB, and therefore being a tool for diagnosis, the RoBE scale appears to investigate the impact of symptoms one might experience, and may be more appropriate for symptom management opposed to diagnosis (Rowley & Nicholls, 2006). Since the original study was published no further investigations into the questionnaire have been attempted. Larger scale investigations are required to prove reliability and validity for the clinical use of the RoBE scale.

Manual assessments of breathing. In addition to patient-oriented, self-report measures such as the questionnaires previously discussed, there are also practitioner-oriented, manual assessments that can assist in the diagnosis of DB. The RIP and MARM have been used to evaluate and quantify breathing patterns. Optimal breathing is thought to occur when there is an even distribution of breathing movement between the upper rib cage and lower rib cage/abdomen (Courtney et al., 2008). It is reported that the RIP and MARM are both able to differentiate between thoracic and abdominal breathing patterns, however, MARM is also able to differentiate between breathing changes as a result of a slumped versus erect sitting posture (Courtney, van Dixhoorn, & Cohen, 2008). RIP is a device with motion detecting electrode bands that wrap around the upper thoracic region under the axilla, and a second band wraps around the abdomen, both detecting volume change during respiration (Courtney et al., 2008). MARM is performed by palpating the back of the mid thoracic, and lateral

lower rib cage and waist during respiration. Findings are notated via numerical values that identify two variables indicating distribution of breathing motion, and the area of breathing involvement. Qualitative reports can also be made notating the practitioner's general impressions of breathing, symmetry of breathing, and rib cage stiffness (Courtney et al., 2009).

The Hi Lo breathing assessment is similar to MARM in that it investigates rib cage motion via observation and palpation, however, the Hi Lo assesses from the front of the body and MARM assesses from the back (Courtney et al., 2009). The Hi Lo breathing assessment is aimed at assessing upper rib cage and lower rib cage/abdomen motion, detecting the presence of paradoxical breathing, and identifying the rate and rhythm of breathing via observation and palpation (Courtney et al., 2009; Courtney, Greenwood et al., 2011). To perform the Hi Lo breathing assessment, practitioners palpate the upper ribs and upper abdomen and report qualitative findings (Courtney et al., 2009). Unlike MARM, the Hi Lo breathing assessment does not assess lateral breathing patterns, and therefore, may not be a strong screening tool for DB (Courtney, Cohen et al., 2011).

Other measures include assessing breath holding time (Courtney & Cohen, 2008; Thomas et al., 2001), the hyperventilation provocation test (Howell, 1997), and spirometry readings to measure forced expiratory volume (Balkissoon & Kenn, 2012). In those with hyperventilation syndrome or DB, breath holding is thought to be shorter in duration and can correlate with abnormal spirometry readings. The hyperventilation test involves voluntary over breathing, and if symptoms are reproduced hyperventilation syndrome is thought to be present ((Howell, 1997).

In summary, a comprehensive standardised diagnostic tool for identifying DB is yet to be established which may be partly due to the complex nature of the condition. In a study that assessed the relationships between measures of DB in 84 participants who had concerns about their breathing it was found that correlations between measures (spirometry, oxygen and end-tidal carbon dioxide (ETCO₂), MARM, Hi Lo breathing assessment, breath holding time, NQ, and SEBQ) were not significant (Courtney, Greenwood et al., 2011). Courtney, Green et al. (2011), concluded that DB is best to be characterised as multidimensional, and three main dimensions exist all of which need to be screened to provide an accurate account. The three dimensions mentioned were biochemical, breathing pattern, and breathing related

symptoms that may or may not co-exist. It was advised that evaluation should include measures to investigate breathing symptoms, breathing pattern, resting CO₂, breath holding time, and responses of breathing when physically and psychologically challenged (Courtney, Greenwood et al., 2011). Although there has been some progression in the approach to diagnosis, the biggest issue that still remains is the validation of strong assessment measures. Additionally, establishing an assessment protocol may be more appropriate to address the multidimensional character of DB. Therefore, there is a strong need to further validate such tests to aid in establishing clear diagnostic parameters, provide further clarification of the condition, and assist in providing prompt and accurate care to patients.

Asthma and Dysfunctional Breathing

Symptoms of DB can be similar to those of asthma, and reports indicate that DB may be commonly misdiagnosed as asthma (Hagman, Janson, & Emtner, 2007). In a single general practice, it was reported that 29% of patients treated for asthma had additional symptoms suggestive of DB (Thomas et al., 2001). In an earlier study, Marklund et al. (1999) aimed to estimate the number of adult patients wrongly diagnosed with asthma from a sample pool of 86. The authors concluded, 59% ($n = 51$) of participants who had a previous diagnosis of asthma did have asthma, 17% ($n = 15$) had chronic obstructive pulmonary disease without asthma, 7% ($n = 6$) had chronic obstructive pulmonary disease in combination with asthma, 7% ($n = 6$) had other conditions (e.g., bronchitis, changes from tuberculosis, heart in-compensation, and panic disorder), and 10% ($n = 8$) had DB. The sample lacked numbers, although, the study identified a need for improved accuracy when diagnosing patients with asthma. In a later study by Aaron et al. (2008), the over diagnosis of asthma was compared in obese and non-obese participants. It was hypothesised that obese persons are more likely to experience dyspnoea, and that a link may be present between asthma and obesity due to the prevalence of both concurrently increasing over the previous three decades. The longitudinal study investigated 496 participants with a previous diagnosis of asthma over a period of six-months. One-third of the participants in each group were excluded from having current asthma, indicating no between-group difference. The participants excluded from having asthma were weaned off asthma medication and showed no worsening of asthma symptoms, reversible airflow obstruction, or bronchial hyper-responsiveness. A six-month follow up showed 66% of those who stopped all asthma medication had not needed to seek healthcare services, nor restart their medication. Marklund et al. (1999) and Aaron et al. (2008), both report findings that indicate a significant

number of people diagnosed with asthma may not have asthma, but instead may be experiencing their asthma-like symptoms due to DB.

Thomas et al. (2003), recruited 219 participants with a current diagnosis of asthma from a semirural general practice. Of the 219 participants, 29% ($n = 63$) were identified as having hyperventilation syndrome according to the NQ. The study may have lacked generalisability as it was confined to only one general practice, and the presence of asthma was not measured via objective measures. In addition, the NQ alone may not be enough to confidently diagnose DB but in the absence of a standardised clinical test the questionnaire identified substantial characteristic patterns of DB that warrants further investigation. In a similar study by Agache et al. (2012), 91 adults with diagnosed asthma were recruited and screened for DB via the NQ. The aim of the study was to identify phenotypes related to DB. This study recruited participants from six asthma clinics providing greater generalisability. Furthermore, objective measures such as lung function tests were incorporated to diagnose asthma, establishing a more robust study than Thomas et al. (2003). In addition, DB was confirmed by progressive exercise testing. Agache et al. (2012), found 27 (30 %) participants were indicated via the NQ to have characteristics of DB comparable to previous studies by Thomas et al. (2005, 2003, 2001). Of the 27 participants, 16 (59%) were confirmed by progressive exercise testing to have DB. Phenotypes identified as having a link to DB were psychopathology, frequent severe asthma exacerbations, and uncontrolled asthma. Stanton et al. (2008), investigated a cohort of 102 patients recruited from a single asthma clinic with a diagnosis of asthma, and reported findings that coincided with Agache et al. (2012). Sixty-five participants (64%) had originally been identified as having DB via the NQ, although they were not all able to complete the progressive exercise test for varying reasons, and therefore may have provided stronger findings with larger numbers had they been included. Of the remaining participants, 59% ($n = 10$) were confirmed as having DB after positive NQ scores and progressive exercise testing. The results of the preceding studies (Agache et al., 2012; Stanton et al., 2008; Thomas et al., 2003) offers a different perspective and explanation to asthma-like symptoms that are not related to asthma and instead may identify the presence of DB.

Asthma and DB can co-exist, however, it is important to identify and separate the two as patients may experience inappropriate and ineffective treatment as a result of an incorrect diagnosis (Agache et al., 2012; Hagman et al., 2007; Keeley & Osman, 2001; Thomas et al.,

2001). For example, reducing the use of unnecessary medications such as corticosteroids, which are the current most common form of pharmacological therapy for asthma, is important as long-term use can have negative side-effects (Hagman et al., 2007; Saxena & Saxena, 2009). Asthma medication is reported to have no effect on the symptoms of DB and in some cases can make them worse, thus, it may be reasonable to consider DB in all patients displaying asthma-like symptoms (Goyal & Sly, 2013; Henderson, 2007; Ringsberg et al., 1997). Although the presentation of asthma and DB can be similar, Henderson (2007) reports that there are a number of observations that could give cause to suspect DB over asthma. Factors that may indicate DB include a lack of improvement after medication, symptoms disproportionately severe to objective findings, and the presentation of symptoms that are not typical of asthma. Symptoms not typical of asthma include difficulty with inspiration opposed to expiration, a tight feeling across the upper chest and throat regions, and shortness of breath with related tingling in the hands and feet. Although there have been many advances in the treatment of asthma, some asthma patients respond poorly or not at all to current treatment, and it is possible that these patients may instead be experiencing DB (Goyal & Sly, 2013; Ringsberg et al., 1997). Not only is there a personal burden both physical and psychological to someone who is misdiagnosed with asthma (Marklund et al., 1999), but there is also a prevailing economic burden through healthcare costs and lost productivity (“Global Initiative for Asthma,” 2011). The economic burden of asthma to New Zealand was conservatively estimated to be approximately \$825 million per annum in the late 1990’s (Holt & Beasley, 2001). Therefore, the correct diagnosis of DB is imperative for personal, ethical, and economic reasons when related to asthma.

Psychological Relationships to Dysfunctional Breathing

Magarian et al. (1983), highlighted a psychological link to breathing after having observed symptoms of hyperventilation in soldiers that persisted even after being removed from stressful environments. It was later recognised that chronic hyperventilation could occur due to stressors of daily life. Not only those who displayed signs of stress, anxiety, or depression experienced symptoms suggestive of chronic hyperventilation, but people who looked to be calm but who ‘bottled up’ their feelings could also manifest the condition (Magarian et al., 1983).

A primitive instinct as a response to danger can cause inappropriate alterations in breathing such as mouth breathing, breath-holding, upper chest breathing, and increased

depth and rate, however, breathing should return too normal once the danger or perceived danger has passed (Ley, 1999). These alterations in breathing can however be inappropriately maintained as a result of behavioural conditioning to past experiences that have been either physically or emotionally harmful leading to chronic DB (Ley, 1999). Cues that trigger a DB may come in the form of emotional and situational triggers. For example, emotions such as grief, fear, anger, frustration, and anxiety, all of which can occur on a regular basis, can lead to sustained DB (Balkissoon & Kenn, 2012; Gilbert, 1998; Ley, 1999). In a review of yoga effects on mortality, Brown and Gerbarg (2005) claim that a specific sequence of yogic breathing can reduce everyday stress, anxiety, depression, post-traumatic stress, and medical illnesses related to stress. This form of yogic breathing is thought to work via mechanisms that contribute to an increase in parasympathetic drive, reduced stress responses, the release of certain neuroendocrine hormones, and thalamic generators highlighting a relationship between breathing patterns and both physiological and psychological responses (Brown & Gerbarg, 2005). Brown and Gerbarg (2005), claim that voluntary controlled breathing can influence a multitude of functions such as within the autonomic nervous system, for example heart rate variability, cardiac vagal tone, chemo and baro-reflex sensitivity, and excitation of the central nervous system. Additionally, the same authors assert that within the neuroendocrine system, functions such as the release of cortisol, prolactin, and possibly other stress-related hormones may be affected by controlled breathing such as in yogic breathing (Brown & Gerbarg, 2005).

If DB becomes habit, poor O₂ supply to the brain, respiratory alkalosis, and a chain of symptoms can occur (Gilbert, 1998; Laffey & Kavanagh, 2002; Ziemann et al., 2009). Alkalosis that can result due to hyperventilation, induces panic in a large number of patients with panic disorder, and signs and symptoms related to the CNS seen during panic attacks (e.g., dizziness, light-headedness, confusion, and syncope) are consistent with the presence of hypocapnia induced cerebral hypoxia (Laffey & Kavanagh, 2002). In what could be seen as a paradox, a study conducted by Ziemann et al. (2009) gives a possible relationship between DB and adverse consequences such as fear behaviours (e.g., panic, anxiety, and apprehension) in response to acidosis. The study gives an explanation of how the amygdala in the brain is sensitive to increasing pH levels (detecting hypercardbia and acidosis) due to hypoventilation, triggering a fear/panic response (Ziemann et al., 2009). The amygdala processes and directs inputs and outputs that are important to fear behaviour (Chaitow et al., 2014). Ziemann et al. (2009), reports that the acidosis influence on the amygdala may trigger

over-breathing, as over-compensation, to induce respiratory alkalosis as a homeostatic response to excess CO₂. Regardless of what acidosis is a result of, there is an attempt on the body's part to lower CO₂ levels with the onset of rapid breathing. As a result of hyperventilation, one of the first effects the individual will experience is apprehension, anxiety, and fear (Ziemann et al., 2009). With a bidirectional relationship between psychological influences and breathing (Brown & Gerbarg, 2005; Ley, 1999) it is important to emphasise the relevance of treating DB in a way that addresses psychological components in combination with re-establishing an appropriate breathing pattern.

Mind-body Connection and Dysfunctional Breathing

It is important to distinguish between the mind and the brain when discussing mind-body connection. A widely accepted definition of the mind is: “the element of a person that enables them to be aware of the world and their experiences, to think, and to feel; the faculty of consciousness and thought” (Oxford Dictionaries, n.d.). The brain differs in that it functions as the coordinating centre of sensation, and of intellectual and nervous activity (Oxford Dictionaries, n.d.). Therefore, the brain allows emotions, thoughts, and feelings to be felt in the physical body. Mental states are either unconscious or conscious, and both cause physiological responses that are felt in the body in either a positive or negative way (e.g., the release of stress hormones) (Mehling et al., 2009).

The phrase ‘mind-body connection’ describes a bidirectional connection between a) the body's biological functioning; and b) mental states such as emotions, thoughts, feelings, beliefs, experiences, and attitudes. A mind-body connection occurs in a social and cultural context, and it can be either positive or negative (Mehling et al., 2009). The mind and body are considered to be inseparable because all physical systems of the body and emotional responses are constantly communicating by neurological and chemical reactions. Thus, the term ‘mind-body connection’ refers to a mental state that can affect the physical body, and vice versa (Mehling et al., 2009).

The breath has been described as a channel between the mind and the body due to the bidirectional affect one can have on the other, through emotions, mental processes, body tension, and breathing (Courtney, 2009). Breathing is the single vital function that has both voluntary and involuntary control (Ley, 1999), and is particularly important in promoting body awareness which may allow improved self-regulation. Furthermore, sensing the natural

breath and becoming fully aware of it may allow a deeper connection with the psyche, supporting psychological and physical integration (Courtney, 2009). 'Body awareness' is a term associated with mind-body connection and refers to being aware of the connection between the mind and the body. More specifically, body awareness is regarded as a subjective and complex multidimensional construct of one's awareness of internal body signals/sensations and the ability to recognise subtle physical body cues (Lyons & Hughes, 2015; Mehling et al., 2009). Body awareness allows physiological states to be brought into conscious awareness; therefore, having body awareness allows physiological states to be modified by mental activities (Mehling et al., 2009). Due to the strong working relationship between the mind and the body, disruptions of the mind-body connection can cause dysfunction. Therefore, therapies that address mind-body connection is critical for the prevention of dysfunction such as DB.

Mind-body therapies: Mind-body therapies are therapies and practices that use the mind and/or body to cause a positive effect on the other, through physical, psychological, social, behavioral, spiritual, and expressive approaches. The aim is to teach ways of both becoming more aware of, and counteracting those mental states that may cause a negative physical response (Mehling et al., 2009; Mehling, DiBlasi, & Hecht, 2005). Multiple modalities use mind-body approaches such as yoga, Tai Chi, massage, mindfulness based therapies/meditation, Feldenkrais method, Alexander method, body-oriented psychotherapy, breathing therapy, and mental training. All of these therapies aim to enhance body awareness, therefore establishing a mind-body connection (Mehling et al., 2009; Mehling et al., 2005). Stress-related mental and physical disorders are said to be improved through mind-body interventions; thus, mind-body therapies may assist in the management of DB, due to a strong psychological component in the DB condition (Barker & Everard, 2015; Brown & Gerbarg, 2005).

An example of mind-body therapy is the mindfulness-based stress reduction (MBSR) program aimed at addressing the psychological side of chronic illness, which has been shown to reduce stress, anxiety, and depression (Khoury, Sharma, Rush, & Fournier, 2015). During the 8 to 10-week program, different forms of mindfulness are practised such as mindfulness meditation, mindful awareness during yoga practise, and mindfulness during stressful social interactions and situations. These practices are reinforced with 45-minute homework assignments, as repeated practise is reported as being important to successful outcomes

(Grossman, Niemann, Schmidt, & Walach, 2004). MBSR aims to improve individual's response to stressful thoughts and situations by reducing emotional reactivity and reinforcing cognitive affirmation (Khoury et al., 2015). A meta-analysis reviewed 29 studies, with a total of 2668 participants. The meta-analysis set out to quantify effect-size of MBSR for psychological variables in healthy adults, quantify the role of mindfulness in MBSR, and to investigate moderator variables (Khoury et al., 2015). The authors reported that MBSR assessments post intervention demonstrated a moderate effect-size. Analysis showed large reductions on stress; moderate reductions on anxiety, depression, and distress; and, a small reduction on burnout. Additionally, improvements in quality of life were found. The reported effects were maintained for an average of 19 weeks (Khoury et al., 2015). Additionally, Khoury et al (2015), identified a need for more research investigating the most effective elements of MBSR. Similar findings were reported in a study that was conducted at a mind-body medicine training centre (Fernros, Furhoff, & Wändell, 2008). Three questionnaires (SWEDQUAL, Short-Form 36, and a sociodemographic questionnaire) collected data to assess health-related quality of life and sense of coherence, post completion of a one-week long course in mind-body therapy. Significant improvements in quality of life and sense of coherence in 83 participants compared to a control group ($n = 69$) were found (Fernros et al., 2008). The control group, however, had previously attended the mind-body course and therefore had the potential to affect between-group difference due to the possibility of drawing on knowledge of the same therapies that the study group was undertaking. Additionally, the control group's health-related quality of life, sense of coherence, and sociodemographic baseline data showed more favourable statistics than the study group, which was maintained throughout the study. Therefore, as the control group may have benefited from their previous experience with the mind-body course, but did not show any further improvements, there may be other explanations that have not been identified that might be more likely to explain differences between the two groups. For example, the study group may have shown improvements simply because they were being paid attention to.

Yoga is a practice often associated with building body awareness and creating a mind-body connection. Yoga is a discipline that is more than 5000 years old and involves breath control, meditation, and asanas (specific body poses). Millions of people around the world practise yoga and claim benefits from its restorative and relaxing influence (Infinite Ideas, 2012). Yoga can alter various physiological aspects by adjusting autonomic imbalance and

controlling breathing rate (Sodhi, Singh, & Dandona, 2009). Rani and Rao (1994), investigated whether hatha yoga (a style of yoga) can enhance awareness of bodily processes that are not emotional responses. The Body Awareness Questionnaire was given to 17 yoga-trained participants and a control group of 19. Analysis showed that ideal and actual self-perceptions in the yoga group were more significant, and therefore, an increased sense of body awareness was reported as an effect of long-term yoga training (Rani & Rao, 1994). A limitation to this study is that the control group did not perform any physical activity. Any form of long-term physical activity may show similar or greater effects on body awareness. Valente and Marotta (2005), also studied the effects of yoga. Six psychotherapists were interviewed to investigate their perceptions of the influence yoga training has on their personal and professional lives and preventing career burnout. Four themes emerged that addressed self-care and professional growth: Self-awareness, balance, acceptance of self and others, and yoga as a way of life. Results indicated that yoga helped psychotherapists to balance their lives, have more control over self-thoughts and reacting to emotions, and allow greater acceptance of their clients' needs, as well as their own (Valente & Marotta, 2005). MBSR and yoga are two examples of mind-body therapies that have shown positive results. It is reasonable to expect that because DB has a strong psychological component, mind-body therapies may be useful in treatment (Courtney, 2009).

The Treatment of Dysfunctional Breathing

Despite more people attending to DB, the uncertainty around a clear definition and diagnostic measures has led to poor evidence-based research supporting treatment modalities (Barer & Everard, 2015; Courtney, 2009; Stanton et al., 2008; Thomas, 2003). A common approach to DB is breathing retraining, which has been identified as the appropriate first line of treatment (Bott et al., 2009; Courtney, 2009; Grammatopoulou et al., 2011; Thomas et al., 2003). The aim of breathing retraining is to modify breathing patterns over a period of time, restoring a relaxed and efficient breathing pattern. There are many forms of breathing retraining such as deep abdominal breathing, breathing against airway resistance, breathing in different physical postures, holding the breath at different parts of the breath cycle, or breathing alternately through both nostrils, or one at a time (Brown & Gerbarg, 2009). A number of studies have reported breathing retraining to be an effective treatment approach to reduce respiratory symptoms, reduce anxiety and depression, improve quality of life, and alter breathing frequency in patients with DB (DeGuire, 1996; Grammatopoulou et al., 2011; Holloway & West, 2007; Thomas et al., 2003).

Jones et al. (2015), compared the effects of breathing retraining only ($n = 27$) and breathing retraining plus manual therapy ($n = 28$) in participants with DB. Breathing retraining consisted of DB education including building self-awareness, identification of triggers and strategies to minimise a response, whilst the retraining itself focused on diaphragmatic breathing, with the aid of an audio disc. There was no significant difference observed between the two groups (Jones et al., 2015). However, all the outcome measures (NQ, Hospital Anxiety and Depression Score, and spirometry and exercise tolerance) showed significant improvements within each group. For example, NQ scores showed significant reductions and normalisation in 65% of the participants over both groups compared to baseline data (Jones et al., 2015). The results of the NQ scores were supported with 80% power due to meeting the required number of participants ($n = 25$) in each arm of the study. Additionally, it was reported that improvements were seen in anxiety and depression, breath hold time, bronchodilation, exercise capacity and tolerance, and musculoskeletal measurements such as bilateral shoulder flexion and cervical flexion (Jones et al., 2015). Sham manual therapy was not given to the breathing retraining only group and this may have provided conclusive evidence of the role of manual therapy had it been applied. Notwithstanding, convincing manual therapy shams are very difficult to administer to informed study participants. Furthermore, multiple manual therapy techniques were used making it hard to identify therapeutic benefit from individual or combinations of techniques. A previous study by Han, Stegen, De Valck, Clement, and Van de Woestijne (1996), reported similar findings for the efficacy of breathing retraining to Jones et al. (2015). The uncontrolled interventional trial reported breathing retraining with a physiotherapist reduced NQ scores markedly (Han et al., 1996). Ninety-two participants who were diagnosed with hyperventilation syndrome participated in the physiotherapist led breathing retraining over a two to three-month period. Each participant received 17 training sessions, during which they were shown how to breathe slowly diaphragmatically, rather than using the upper chest (Han et al., 1996). Additionally, anxiety levels reduced as indicated via the State-Trait Anxiety Inventory, and breathing patterns were modified significantly (Han et al., 1996). The results were attributed to a reduced respiratory frequency as a result of slower and deeper breathing (Han et al., 1996).

DeGuire et al. (1996), also investigated long-term effects of breathing retraining in the form of paced diaphragmatic breathing. Forty-one participants had participated in a study three years prior aimed to assess short-term effects of breathing retraining (DeGuire, Gevirtz,

Kawahara, & Maguire, 1992). Lasting improvements were reported by DeGuire et al. (1996) in cardiac and respiratory symptoms, in 10 participants out of 41 who had previously demonstrated functional cardiac symptoms and displayed signs of hyperventilation syndrome. The results of the follow-up study demonstrated significantly lower respiratory rates and higher ETCO₂ levels compared to baseline data collected three years earlier. Additionally, a decrease in frequency of functional cardiac symptoms was found (DeGuire et al., 1996). However, only a quarter of participants demonstrated sustained improvements and there is no strong indication that these improvements were maintained due to the previous breathing retraining. Perhaps the improvements were just due to chance, in that everyone is going to experience fluctuations over that time frame, some improving, some deteriorating. A descriptive study by Herman, Stickler, and Lucas (1981), discuss the long-term follow-up in a review of 34 participants between the ages of 6 to 18 years who were diagnosed with hyperventilation syndrome, and who were seen at a respiratory clinic between 1950 and 1975. The original interventions carried out were varied, however, they are not described in detail. Of the 34 participants originally treated for hyperventilation, 30 returned letters and questionnaires related to their previous diagnosis of hyperventilation syndrome, at varying follow-up periods ranging from 2 to 28 years. It was reported that 40% ($n = 12$) of participants continued to experience signs and symptoms of hyperventilation into adulthood, indicating a substantial percentage to have maintained favourable changes. Although DeGuire et al. (1996) and Herman et al. (1981) reported lasting improvements on respiratory physiology and signs and symptoms of hyperventilation syndrome, there is no strong evidence that breathing retraining was involved, and maybe these results demonstrate that DB can be self-correcting.

Grammatopoulou et al. (2011), Holloway and West (2007), Slader et al. (2006), Thomas et al. (2008), and Thomas et al. (2003) all conducted randomised control trials to examine the effect of breathing retraining techniques in participants with asthma compared with control groups. Breathing retraining techniques included: Breathing education (Grammatopoulou et al., 2011; Holloway & West, 2007; Slader et al., 2006; Thomas et al., 2008; Thomas et al., 2003); diaphragmatic breathing (Grammatopoulou et al., 2011; Holloway & West, 2007; Slader et al., 2006; Thomas et al., 2008; Thomas et al., 2003); nasal breathing (Grammatopoulou et al., 2011; Slader et al., 2006; Thomas et al., 2008); short hold of breath (Grammatopoulou et al., 2011; Holloway & West, 2007); relaxation techniques (Holloway & West, 2007); recognition and physical management of stress responses with

relation to breathing patterns (Grammatopoulou et al., 2011; Holloway & West, 2007); and, non-specific upper body mobility exercises (Holloway & West, 2007; Slader et al., 2006). Control groups all received their usual asthma care, in addition, three groups received asthma education with an asthma nurse. The longest active intervention ran for 12-months (Holloway & West, 2007), twice as long in contrast to the other four studies that had six month active interventions. Participants ranged from 15 to 80 years of age and all but one study met sample size estimates designed to detect a significant change in outcome measures. Due to the nature of treatment, blinding of participants and practitioners was difficult across all the studies, although assessments were carried out by assessors who were unaware of the allocation. Holloway and West (2007), lacked any blinding introducing the possibility of bias, this was the opposite too Slader et al. (2006) achieving double blinding.

Quality of life was measured in a subgroup of participants with asthma and DB, recruited from a semirural practice by Thomas et al. (2003). The purpose of this study was to assess the effectiveness of breathing retraining by a respiratory physiotherapist compared with nurse led asthma education. The study revealed that 56% ($n = 16$) of participants who received breathing retraining showed improvement in the Asthma Quality of Life questionnaire (AQLQ) scores one-month post-treatment and this was maintained for 25% at six-months. The decline from 56% to 25% in retained beneficial effects was reported to be due to breathing techniques not being maintained. Twenty participants were required in each arm of the study in order to detect a clinically significant mean change in quality of life between the two groups with 80% power. The study lacked breadth and statistical power as this number was not met at the beginning of the study with only 33 participants in total. The number decreased further at six-months post-treatment to 28 participants. Another limitation was that pulmonary function was not measured. A combination of hypoventilation, shallow nasal breathing, and breath holding was the active intervention ($n = 28$), and a combination of non-specific upper body exercises was the control intervention ($n = 29$) in the Slader et al. (2006) study. Both interventions were learned from instructional video. Participants were recruited from a volunteer database and newspaper advertisements. Significant and similar improvement in both groups was observed. Like Thomas et al. (2003), improvements in the AQLQ scores were also observed by Slader et al. (2006), along with reduced medication dosage. The authors concluded that breathing techniques may be useful in the management of patients with mild asthma symptoms, but there is no evidence to favour shallow nasal breathing over non-specific upper body exercises.

A physiotherapist-led breathing technique (Papworth method) plus usual care ($n = 39$) versus usual care only ($n = 85$) in a cohort with mild to moderate asthma from a semirural general practice was examined by Holloway et al. (2007). At both six and 12-month follow up, there was significant improvement in the St George Respiratory Questionnaire symptom scores, hospital anxiety and depression (HAD) questionnaire scores, and NQ scores. Thomas et al. (2008), also examined physiotherapist led breathing training versus nurse led asthma education in a larger cohort of subjects ($n = 152$) with reduced AQLQ scores recruited from 10 general practices. At a six-month follow up, significant improvements in AQLQ scores, NQ scores, and HAD questionnaire scores in the breathing retraining group compared with the asthma education group was found. More recently, Grammatopoulou et al. (2011) examined the effect of 12 physiotherapist led breathing sessions plus usual asthma treatment in 40 adults. Twenty-seven of the 40 participants had mild to moderate asthma and 19 had hyperventilation, all of whom were recruited from a hospital asthma clinic. Significant improvements were found in the treatment group at each follow up assessment (one, three, and six-months). The authors reported a reduction in airway bronchoconstriction, increased $ETCO_2$ levels, reduced hyperventilation and breathlessness, increased forced expiratory rate, improved NQ scores, improved SF-30 scores, improved Medical Research Council breathlessness scale scores, and improved asthma management compared with the control group ($n = 20$) that continued with usual asthma care only. Change in physiological facets across time was identified which lacked in similar studies, in addition, seven outcome measures were used over four time points making this a robust study.

Significant improvement in asthma symptoms and quality of life was consistently seen throughout the studies. Slader et al. (2006), also showed a decrease in inhaled reliever use (86%) and inhaled corticosteroid dose (50%), but pharmacological information was lacking in Holloway and West (2007), Thomas et al. (2008), and Grammatopoulou et al. (2011) studies. Physiological changes were not as obvious, as Grammatopoulou et al. (2011) was the only study to show changes in $ETCO_2$, Holloway et al. (2007) showed a decreased breathing rate as a result of breathing modification treatment, but no studies showed changes in pulmonary function. The mechanism of improvement following breathing retraining is still not fully understood, therefore more rigorous research is needed. However, sustained improvements as a result of breathing retraining have been shown and suggests breathing retraining to be an effective non-pharmacological approach to DB in patients with and without asthma (Hagman et al., 2007). Other treatment approaches for DB that have been

proposed for use include advice on postural correction (McLaughlin, 2009; McLaughlin, Goldsmith, & Coleman, 2011), relaxation techniques (Holloway & West, 2007) manual therapy (Barer & Everard, 2015; McLaughlin, 2009), education (Cluff, 1984; Howell, 1997; Stewart, 1995), yogic breathing (Cooper et al., 2003; Sodhi et al., 2009; Vempati, Bijlani, & Deepal, 2009), the Buteyko method (Cooper et al., 2003), counselling (Ley, 1999), and capnography (to be used as biofeedback to guide breathing retraining) (McLaughlin, 2009).

Conclusions

The literature review reveals that DB is complex in nature with multiple facets and is still widely unrecognised as a phenomenon. Validated assessment measures and treatment protocols are yet to be established with little known about current clinical practice when attending to DB. Therefore, it is crucial to build awareness of DB to provide appropriate patient care. Studying DB comes with challenges as there has previously been no agreement among healthcare practitioners about a definition or a diagnostic test, nor is there consensus that it manifests into identifiable symptoms (Hagman et al., 2007). There is however a growing interest in the phenomenon with some practitioners beginning to recognise DB as an entity of its own (Cliffon-Smith & Rowley, 2011; Courtney, 2009). Furthermore, there are numerous research studies investigating DB (De Groot, 2011; De Groot, Duiverman, & Brand, 2013; Jones et al., 2015; Lum, 1975; Ringsberg et al., 1997; Weinberger & Abu-Hasan, 2007) and therefore more research in support of the phenomenon. Some writers, however, suggest that poor recognition, under-diagnosis, and misdiagnosis of DB may be contributing to the lack of consideration given to the phenomenon within a clinical setting despite a growing interest (Barker & Everard, 2015; Henderson, 2007; Keeley & Osman, 2001; Magarian et al., 1983). Furthermore, there is a gap in the literature investigating DB in the form of qualitative research and from the perspective of healthcare practitioners. Investigating people's attitudes and perspectives of DB and exploring their own experiences may be necessary to build awareness around the phenomenon (Chaitow, 2004; Hagman et al., 2007). This study begins to explore these issues. The overall aim of my research is to investigate current clinical practice when attending to DB from a qualitative perspective and the research question developed is: What are current clinical practices, experiences, and perspectives of healthcare practitioners who attend to dysfunctional breathing?

Part One: Section Two

Conducting the Research

Note: This section provides a review of methodology in support of the methods reported in Section 2 (Manuscript). In addition, it provides a comprehensive description of the methods and procedures of content analysis and thematic analysis.

Methodology to Method

The following section outlines the research methodology used in constructing and presenting all relevant aspects of this project. First, an explanation of why the chosen methodology has been applied is provided in order to clarify its appropriateness to this study. Second, participant involvement is discussed in relation to recruitment and sampling, inclusion/exclusion/withdrawal criteria, and ethical considerations. Third, the data collection process is identified. Fourth, data analysis processes and findings are presented. Last, the application of rigour is explored.

Methodology

Following the extensive literature review conducted to establish the state of the literature currently available addressing DB, the following research question was designed: What are current clinical practices, experiences, and perspectives of healthcare practitioners who attend to DB? The nature of the research question being asked strongly dictates the research methodology best suited to answer the question and thus had to be identified once a research question had been established. For example, a question such as “To what extent does treating DB with manual therapy produce improved outcomes for patients?” would be best suited to quantitative research methods. A question, however, that sought descriptive rather than numerical data such as “What are manual therapists seeing and doing when DB exists in patients?” could only be thoroughly and effectively investigated with qualitative systems (Thomson, Petty, Ramage, & Moore, 2011). Adopting an appropriate research approach so that the method being used matches the question being asked is essential in producing research of a high standard (Thorne, 2008). The purpose of qualitative research is to answer questions that cannot be answered through numerical analysis, such as in quantitative research. Additionally, qualitative research aims to establish an understanding of phenomena in participants’ natural environment by investigating with open-ended questions relative to the context of the phenomena. In contrast, quantitative research investigates predetermined hypotheses (Carter & Little, 2007; Guba & Lincoln, 1994). Qualitative data analysis involves systematically detailed examination, summary, and interpretation of information collected by a researcher to understand what has been found and to present this to others. There is a particular emphasis in qualitative research on documenting what people currently know and exploring subjective experiences that are reflected upon, thereby allowing meaning to be given to such descriptions (Minichiello, Sullivan, Greenwood, & Axford, 1999).

Enquiry in qualitative research provides description and description requires interpretation to become accessible to others. To interpret description an understanding of the phenomenon is essential and for this reason a literature review was carried out prior to the research project being undertaken to familiarise myself with the phenomenon as recommended by Sandelowski (2000). Until the phenomenon is well known it is hard to judge what parts of the data gathered are relevant. The literature review undertaken allowed a broad scan of a wide range of possibly relevant information, which provided a clear idea of how the phenomenon currently is understood, what information was directly related, and what was peripherally relevant, providing a guide to data collection (Thorne, 2008). The literature reviewed, as presented in the preceding section, revealed that it is still unclear what healthcare practitioners are doing in clinical practice with patients who have DB and, furthermore, that there is a lack of consensus around assessment, diagnosis, and management. There are individual studies that investigate different facets of breathing and DB such as the importance of good breathing (Courtney, 2013), hyperventilation (Courtney, 2009; Gilbert, 1999; Lum, 1981; Magarian et al., 1983), breathing retraining and exercises (Barker, Jones, O'Connell, & Everard, 2013; Hagman, Janson, & Emtner, 2007; Jones, Harvey, Marston, & O'Connell, 2013; McLaughlin, Goldsmith, & Coleman, 2010), nasal versus mouth breathing (Jefferson, 2009; Petruson, 2007) and so on, but it is still unclear what is actually being practised in a real clinical setting and if current practice is producing optimal patient outcomes. Being unaware of what may or may not actually occur within a real clinical setting becomes critical when trying to provide optimum patient outcomes. Therefore, the literature review confirmed the urgent need for further investigation of the DB phenomenon with an appropriate research approach to gain a deeper insight into current clinical practice. In particular, there is a need for qualitative research in order to gain pure description and insight into DB from the perspectives of those who attend to the phenomenon.

Research types may be classified by their relative contribution to knowledge and choosing the most appropriate method becomes important to access the desired information. Classifications are hierarchical starting with description, explanation, prediction, and last, control. Qualitative descriptive research “involves identifying the nature and attributes of phenomena and sometimes the relationship among these phenomena” (Minichiello et al., 1999, p. 4). When pure description is desired to access raw experiences, qualitative descriptive designs may be necessary (Sandelowski, 2000). Through descriptive research an explanation of current practice may be made, new information may be discovered, and/or an

improved model for clinical practice may result (Thorne, 2008). Outcomes achieved by descriptive research are specifically important for the area of DB as there is currently a lack of literature on clinical practice in all facets, including assessment, diagnosis criteria, treatment modalities, and cause for referral.

Choosing interpretive description. There is a variety of qualitative research approaches and choosing the most suited to a specific question can become difficult if there is not a clear focus for the research. Three potentially useful approaches include ethnography, grounded theory, and phenomenology. Ethnography began as a way of investigating other cultures but is now used to give meaning to behaviour through direct observation and interviews with participants (Gobo, 2008). Over time, grounded theory has evolved and differing versions to the approach have emerged (Heath & Cowley, 2004). However, despite there being different approaches to grounded theory, overall it seeks to explore phenomena and construct theory based on hypotheses about what might be going on (Charmaz & Bryant, 2008). Phenomenology is guided by an exploration aimed at seeking out true nature and is useful when there is little known about the phenomenon (Van Manen, 1997). Phenomenology has been described as an anti-traditional approach that attempts to seek out truths in a broad manner that allows truths to appear in whatever form they appear in and to take into consideration the manner in which they do so (Morgan, 1999). In addition, differentiation between a true description and a researcher's interpretation of data is meticulously sought within phenomenology in order to remain true to the experiences being shared (Thorne, 2008).

Allied health fields such as nursing found a need for a research approach that was more open to experience-based questions that would be applicable to a real clinical setting (Thorne, Kirkham, & O'Flynn-Magee, 2008). Thorne, Kirkham, and MacDonald-Emes (1997) developed the research method of interpretive description to respond to the need of an alternative qualitative research method to fit the context of a clinical nursing setting. Interpretive description is a qualitative research approach that involves a small scale exploration of a clinical phenomenon of interest to a discipline. It requires a purpose deriving from 1) an actual clinical practice goal and 2) an understanding of what we know and what we do not know on the basis of the available empirical evidence. This approach seeks not only to find pure description but also to discover associations, relationships, and patterns within the phenomenon (Thorne, 2008). The purpose of this approach is to capture themes

and patterns within a subjective realm from which an interpretive and explanatory description is generated that is capable of informing current clinical understanding of the phenomenon (Thorne, Kirkham, & O'Flynn-Magee, 2004). Furthermore, the interpretive descriptive approach builds on current established knowledge and assumed knowledge, and allows an opening to see what else might be happening. Prior knowledge or assumptions may also be deconstructed and with new-found insights changes may be made to current applications of evidence to practice (Thorne, 2008). Following an interpretive descriptive approach to qualitative research within a healthcare setting may contribute directly to how people understand their health and illness and how health practitioners can make a difference (Thorne et al., 1997).

It was established prior to the research project's commencement that both descriptive and interpretive elements would be present. Thick description would be necessary to explore problematic accounts and extract deep and complete narratives that may provide intention and meaning to actions. In contrast, a thin description that simply stated facts would not provide sufficient insight into the phenomenon. Furthermore, thick description would make visible the participants' voices, feelings, context of the situation, and social relationships through the act of interpreting and giving rise to meaning (Denzin, 2001). With a limited body of qualitative research investigating DB, a need of thick description and interpretation was recognised, thus, interpretive description was chosen as the most suitable research approach to proceed with.

Recruitment and Sampling

Participants were recruited using referral and snowball sampling, beginning with previously established contacts in the field who had an interest in the area of DB. An email was sent to current contacts in the field with an invitation to participate in the research. Snowball sampling resulted from initial participants suggesting others who may have been interested. Purposive sampling was employed which involved the researcher making decisions about who will be able to provide the desired information and sampling from only these individuals. Purposive sampling is used when it is likely that only certain individuals will be able to provide the information required or when the population of interest is extremely small. In the case of this study only participants with the most clinical experience in DB were selected. (Minichiello et al., 1999). In total, 10 participants were contacted and recruitment was discontinued once six participants had been confirmed. Only one other

potential participant had responded, who later withdrew due to time constraints. Six participants who indicated substantial experience/insight in DB and were willing to participate were invited to take part in the study. Of the six participants recruited, three were osteopaths and three were physiotherapists.

Inclusion, Exclusion, and Withdrawal Criteria

The participant inclusion criteria: The participants were required to be New Zealand registered in their profession and hold a current annual practicing certificate. Additionally, the participants must have had a minimum of five years' clinical experience in their respective healthcare profession. This time period was expected to provide a satisfactory level of clinical experience from which an adequate depth of knowledge and experiences could be explored. Furthermore, it was required that participants must have had an interest and/or experience in working with patients with DB. The participants were also required to understand the research process and consent to all aspects of the study.

The participant exclusion criteria: Participants that did not have the clinical experience to successfully contribute to this research project would have been excluded from the study. In addition, if the participants did not meet all of the inclusion criteria they would have been excluded from the study.

Withdrawal criteria: The participants were able to withdraw their own data from the study up to two weeks after they had reviewed their transcribed interview.

Ethical Considerations

Ethical approval for this research project was gained on the 24th of July 2014 by the Unitec Research Ethics Committee (UREC 2014-1063). Due to minor amendments to the research project, a second letter of approval addressing amendments that had been requested was gained on the 18th of March 2015. Please refer to Appendix B and Appendix C for the ethics approval letters. The research process included the following procedures and guidelines to uphold ethical standards of the research project.

Participant consent. The participants were informed of their role and all aspects of the research project prior to their inclusion. A document with all relevant information and a consent form including statements in regarding being fully informed, voluntary choice,

confidentiality, participants' rights, and complaints processes was provided to the participants. Both verbal and written consent were obtained prior to commencing data collection. The participants were informed that at any stage of the data collection they had the right to withdraw without providing an explanation or being at risk of prejudice to services offered by the Department of Osteopathy or Unitec, NZ. In addition, participants were informed that they had the right to withdraw their data from the research project up until two weeks after they had reviewed their transcribed interview.

Respect for rights, confidentiality, and preservation of anonymity. All information, either personal or general, was kept confidential at all times. An electronic password-protected folder was created to store data files and only the researcher and named supervisors had access to the data at any time. Names and personal information concerning participants were kept confidential and removed as soon as practicable.

As participants discussed their personal viewpoints and experiences, issues of sensitivity and withdrawal were considered and the participant's rights surrounding this were discussed with them. If at any point the participants had become distressed during the interview process they would have been given the option of withdrawal or a moment to pause at any time. In addition, any interview material they did not wish to be used would have been deleted during the interview or up until two weeks after they had reviewed their transcribed interview.

Data Collection

Setting. The interviews took place in the respective participants' place of work and only the researcher and participant were present.

Description of sample. Interpretive description generally builds on relatively small samples, therefore six participants were recruited for face-to-face interviews (Minichiello et al., 1999). Three osteopaths and three physiotherapists participated in interviews that ranged from 45 minutes to 93 minutes. Three participants were males and three were female with clinical experience in their respective fields ranging from nine to 37 years (refer to Table 1). Five participants were based within the Auckland region and one in the Coromandel region.

Table 1*Participant characteristics*

Practitioner	Gender	Clinical profession	Years of clinical experience	Approximate number of patients seen per week
1	M	Osteopath	9	12
2	F	Physiotherapist	23	30
3	F	Respiratory Physiotherapist	23	26
4	M	Osteopath	11	35
5	F	Cardio Respiratory Physiotherapist	37	12
6	M	Osteopath	8	45

Researcher's characteristics. Descriptions and interpretations always depend on both the describer's and the researcher's own perceptions, experiences, sensitivities, values, beliefs, interests, and disciplinary background (Houghton, Casey, Shaw, & Murphy, 2013; Sandelowski, 2000). Therefore, outline my own characteristics, beliefs, and assumptions to enhance the credibility and transparency of the study by allowing the readers insight into why I as the researcher may have interpreted the data in the way I did (Tong, Sainsbury, & Craig, 2007). Prior to data collection, I identified my personal characteristics, beliefs, and assumptions that might influence data collection and analysis (see Appendix I). Constant referral to this information throughout the data exploration process allowed me to constantly monitor potential influences on data gathering, question bias, interpretation, and weighting of findings (Houghton et al., 2013).

Interview process. Face-to-face interviews that were audio recorded were identified as the most appropriate form of data collection, in contrast to taking a survey approach. In-depth interviews aimed to allow access to the participants' motives, meanings, and actions, in the context of current clinical practice when DB may exist in a patient. This methodological approach facilitates an understanding of the participants' perceptions providing deeper insight (Minichiello et al., 1999).

The interviews were structured in a way that allowed the participants to ease into the interviewing process by starting with a selection of more general questions about the phenomenon that were then built upon. The proceeding questions were divided into categories that included assessment, diagnosis, treatment, and management. Structuring the questions in specific categories allowed an exploration of each category with a more focused line of conversation. Moving through each category allowed all aspects of a clinical experience to be explored with the participant. The interview had the style of a conversation between the researcher and participants that encouraged the participants to share experiences and perceptions that were more personal to them and allowed them to disclose details that may not have arisen if having stringently followed the pre-set questions. The researcher ensured that all relevant areas were addressed by using guiding questions or a change of topic as needed. Data from the interviews were transcribed verbatim by an outsourced transcriber and sent to the participants for them to check the accuracy of the information and to give them an opportunity to add/delete/clarify the data they had provided. No changes were made to the transcriptions by any of the participants.

Data Analysis

Data included quotes from participants and interview transcriptions. Analysis began by reviewing the transcriptions with an aim to interpret the participants' perceptions and begin to extract common themes. The first stages of data analysis were to systematically organise and prepare the data (Tracy, 2012). With a large amount of data to analyse from different sources, it was necessary to make decisions about what to include in each particular analysis. Not all data gathered were relevant to the study and therefore closely analysing all the collected data was unnecessary. For example, the participants were asked to describe what they believed the correct way to breathe is and it was decided that these data did not contribute to the intended objectives of the study, and were thus excluded from further analysis. Identifying the relevant data became important to allow a more thorough and efficient analysis. The organising process became an interpretive process in itself, in that organising the data in a certain way exposed similarities and allowed for comparisons (Tracy, 2012). In addition, remembering common themes that had emerged during the interview process allowed attention to be first guided to the questions that prompted these themes to emerge.

The three main forms of coding presented by Strauss and Corbin (1998) that are commonly applied in grounded theory include: 1) open coding; 2) axial coding; and 3) selective coding. Open coding is the earliest phase that starts to pull apart the data and extract similarities and differences. Axial coding begins by reassembling the data into categories and is followed by selective coding that involves linking subcategories, which is essential to building a story about what has been found (Benaquisto, 2008). When all three forms of coding are incorporated they are able to link early analysis to the larger purpose of the research and explain variation within the phenomenon (Strauss, 1995). It has been stated that using a subset of this coding approach may not provide satisfactory analysis and therefore utilising all three forms provides rigour to the analysis process (Strauss, 1995). In contrast to the grounded theory approach to coding and analysis, it has been proposed that interpretive description may be better suited to using a less restrictive approach to coding and to engage a certain level of plasticity to allow themes and ideas to evolve (Thorne, 2008). This differs slightly from the fine-tuned words and expressions that may be sought out in other forms of qualitative research (Thorne, 2008).

Initially this study adopted a combination of open coding and broad-based coding system. Open coding took place, breaking down the data and extracting similarities that allowed the data to be categorized into conceptual ideas. Using an open process allowed the researcher to proceed in a way that respected the data and human experience more so than with a tighter structured and more closed coding approach (Thorne, 2008). Simultaneously, a broad-based coding system organised data using the type of data as a criterion, for example, by filing quotes together according to category such as assessment, diagnosis, treatment, and management (Thorne et al., 2004). In addition, by formatting and labelling data and creating lists of pseudonyms (e.g., participant one, participant two etc) in the early stages of data collection analysis was made easier (Tracy, 2012). Each transcription was read numerous times so that comprehensive familiarisation of the data was achieved, making extraction of the relevant information easier and supporting a deeper analysis evolved (Finlay, 2011). Becoming familiar with the collected data allowed the first preliminary themes to emerge and be recorded.

Axial and selective coding were able to be applied at later stages of data analysis but the researcher retained a relaxed interpretation of these coding approaches to allow for the application of interpretive description and a more open perspective towards the data. Each

interview was summarised into the participants' key experiences and categorised under topic headings for developing theme identification. In addition, emerging themes were discussed and developed with the guidance of the study's supervisors. Emerging themes were transformed using language of the practice field so that the participants' descriptions and experiences become more accessible to others who have not been involved in the research (Minichiello, Fulton, & Sullivan, 1999). Reflecting and interpreting the data in a deep manner allowed extraction of cognitive meaning from the data. When interpreting the data, it was important not to transform the description out of context and therefore retain a low-inference so that a true description of the participants' experiences was honoured (Sandelowski, 2000). Retaining true description was achieved by the researcher referring back to her own assumptions (Appendix I) prior to data collection to ensure interpretations were not misguided. In addition, when extracting direct quotes, the researcher regularly referred back to the original transcriptions to ensure the context of the quotes were not misrepresented.

As Thorne (2008) has observed, one's mind often responds to the unexpected with a strong sense of curiosity, causing a desire to explore further: this occurred during the data collection and analysis process of this study. During the data phases of the study the researcher had certain expectations of what was likely to be found based on previous assumptions; however, attention was quite quickly drawn to data that had not been expected to be as influential. For example, questions within the interview that had been expected to provoke deep thought and elicit full descriptions by the participants did not and, as a result, did not provide as comprehensive accounts. In contrast, interview questions that were not expected to extract information most relevant to answering the initial research question, became the most relevant, full, and interesting. After a thorough analysis process, it was found that the initial research question had been answered, but in a much different way than had been first expected that as a result, uncovered stronger themes with rich description.

Findings

Drawing from the information shared by the participants the study uncovered an over-arching theme involving a general lack of awareness surrounding DB from identifying the issue to managing it. The over-arching theme that is 'the complex journey to optimal breathing' was developed with three main interconnected sub-themes that loosely relate to the three clinically relevant phases of identification/diagnosis, treatment, and management. The

sub-themes identified are: 1) missed by both patient and practitioner, 2) re-establishing a mind-body connection, and 3) a multi-faceted approach is key.

It is important to note that the participants involved in the research all had an interest and an awareness of DB in their own clinical practice and ‘the complex journey to optimal breathing’ became apparent throughout all six interviews. Through in-depth interviews however, it also became apparent that this deeper awareness may be limited to only some practitioners, who are the exception. The participants’ perception was that the general population and many healthcare practitioners do not fully recognise the effects DB can have on quality of life. It was identified that ‘the complex journey to optimal breathing’ was first evident when patients presented to a healthcare practitioner often unaware of their breathing to any extent. Following this, the opinion that many healthcare practitioners also were not identifying DB as a possible cause for patients’ symptoms in the first instance was expressed by the participants. The first sub-theme then evolved, ‘missed by both patient and practitioner’. The next phase of the participants’ experiences was the treatment of DB and it was here that the second sub-theme was formed, ‘re-establishing a mind-body connection’. Once DB was identified as being present in a patient, all participants stressed the importance of the patient building a better self-awareness of not only their breath but all aspects of their life as being key to successful treatment. Furthermore, due to the patient having to re-connect and identify different areas of their mind-body connection, the third sub-theme became clear, being that ‘a multi-faceted approach is key’ often requiring different avenues of treatment for optimal clinical outcomes.

Rigour

The process of rigour may be explained through the simple definition of the word in which rigour is the quality of being extremely thorough and careful (Oxford Dictionaries, n.d.). To further explore what rigour stands for in evidence-based research a historical definition by Reynolds provides further insight: “the use of logical systems that are shared and accepted by relevant scientists to ensure agreement on the predictions and explanations on the theory (as cited in Ryan-Nicholls & Will, 2009, para. 2). Ryan-Nicholls and Will (2009) state that applying rigour to research involves thorough data collection, a systematic analysis, and findings that should be open to evaluation and replication. Difficulties can arise when inappropriate mechanisms of evaluation drawn from quantitative research are applied to qualitative research. The nature of qualitative research is the exploration of experiences

lived by individuals; therefore, qualitative research is not so easily replicated because it involves a process of discovery rather than the verification of a hypothesis such as in quantitative research (Thorne, 2008). The application of an appropriate research method for this research project was imperative to promote rigour and, as a result, an interpretive descriptive method was followed giving an opportunity to explore experiences (Thorne, 2008). A researcher must build a certain level of rapport with participants to gain an honest insight into the phenomenon. In qualitative research rigour may be thought of as trustworthiness (Koch, 2006). With the researcher being the instrument of data-collection, it is the researcher's responsibility to remain unbiased, open-minded, and to interpret the data in a way that allows themes to be found rather than sought out, avoiding the transcendence of bias and opinion over truth even if this was not the intention of the researcher (Ryan-Nicholls & Will, 2009). Therefore, it is important for the research to provide thorough documentation of their process providing insight into the researcher's impartiality throughout (Koch, 2006).

Although there are differences between qualitative and quantitative research, it is now widely accepted that qualitative research contributes to science in a way that quantitative research cannot, rather than having shortcomings comparatively. As a result of recognising and accepting the differences between the two methodological approaches it is now understood that they cannot be judged against the same criteria. Quantitative research has an emphasis on validity and reliability (Houghton et al., 2013), whereas the common criteria used to assess qualitative research include credibility, dependability, confirmability, and transferability, originally proposed by Lincoln and Guba (Houghton et al., 2013).

Credibility. Credibility of research is based on the consistency, reliability, and believability of the researcher's approach. Engaging in a reflective process and identifying possible biases allow a researcher to remain true to the data. Additionally, an audit trail being available for readers to view allows trust in the researcher to be built (Houghton et al., 2013; Ryan-Nicholls & Will, 2009). Prolonged engagement can enhance credibility (Houghton et al., 2013) and this was achieved in the current study in a number of ways. The researcher spent more than six and a half hours in the field interviewing six participants over a two-month period in addition to approximately eight-months of data analysis that commenced at the beginning of the first interview and was ongoing and evolving. At the completion of the final interview it was clear that ideas, experiences, and concepts recurred frequently, with no new experiences being recounted, which was further confirmed during data analysis when

very obvious themes emerged with minimal conflicting data between participants overall. The participants were sent their verbatim transcripts to provide feedback and clarify what they had said, and no changes were requested, this process is referred to as member-checking (Houghton et al., 2013). Additionally, direct quotes from the transcriptions are included in the manuscript section of this study, providing the reader an opportunity to make their own interpretation of the data and therefore the fittingness and confirmability of the researcher's interpretations and descriptions. Furthermore, peer debriefing added to the credibility of the research via discussions between the researcher and supervisors in regards to themes that were emerging and how these were being captured and portrayed.

Dependability and confirmability. As it was found that a number of the participants had the same opinion and experiences when dealing with patients with DB, dependability in differing contexts was achieved (Houghton et al., 2013). Keeping a thorough record that outlines the process and decisions made throughout by the researcher allows for a reader to understand how the researcher came to their conclusions and how they applied their methodology. Being transparent in the research process allows an assessment of trustworthiness, which is essential in a rigorous study (Houghton et al., 2013; Koch, 2006). To add to the transparency of the research process and resulting confirmability, reflexivity was practised with the researcher identifying values, beliefs, interests, and disciplinary background that could pose a possible influence on the interpretation of data. Remaining true to the participants' experiences and therefore the data, was achieved by the researcher acknowledging reflexivity, and in turn, making a conscious effort to remain unbiased (Houghton et al., 2013). Keeping a detailed reflective diary allowed the researcher to maintain a certain level of self-awareness throughout (Oliver, 2012). Documentation showing the audit trail of the processes applied to this study in addition to diary records can be found in the appendix section (Appendix J).

Transferability. Transferability refers to whether or not a reader is able to transfer particular findings from the research into their own context. Transferability is not an attempt to generalise findings to a whole population or section of a population, but rather it holds that ideas or concepts may be useful in similar situations to inform practitioners of ways of understanding human experience in a related situation. To achieve transferability, the researcher is required to provide rich descriptions that include the context in which the research took place, research methods applied, themes identified, quotations, and examples of

raw data so that the reader can reflect on the researcher's interpretations, all of which allow the reader to make informed decisions to the transferability to another context (Houghton et al., 2013). In this study, rich descriptions were offered to enhance transferability. Accounts of the context of the research, research methods used, notes on theme development, and raw data including extended quotes were provided supporting the transferability of the research.

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Part Two: Manuscript

In order to maintain readability and consistency of format throughout the thesis this manuscript is prepared in partial accordance with the *International Journal of Osteopathic Medicine (IJOM)* (See Appendix N). However, please note that *IJOM* allows authors to submit ‘in their own style’ and that if accepted, required adaptations to their style will be addressed. Therefore, the main adaptation of *IJOM* style is acknowledged:

- For ease of reading, Table 1 and Figure 1 are included in the body of the text (rather than presented in a separate document).

Current Clinical Practices, Experiences, and Perspectives of Healthcare Practitioners Who Attend to Dysfunctional Breathing: A Qualitative Study

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Current Clinical Practices, Experiences, and Perspectives of Healthcare Practitioners Who Attend to Dysfunctional Breathing

ABSTRACT

Background

The under-recognised and often misdiagnosed condition of dysfunctional breathing (DB) requires urgent critical investigation of the practices, experiences, and perspectives that underlie current clinical practice.

Objective

To explore current clinical practices, experiences, and perspectives of healthcare practitioners currently attending to DB.

Design

This qualitative exploratory study employed interpretive description. Referral and snowball sampling recruited six participants.

Methods

Data collection methods involved semi-structured in-depth interviews with three osteopaths and three physiotherapists. Interviews were deconstructed and analysed, and themes were developed.

Results

The complex journey to optimal breathing emerged as the over-arching theme in narratives of the participants' own experiences. Three sub-themes were developed highlighting the complex nature of DB: 1) missed by both patient and practitioner, 2) re-establishing a mind-body connection, and 3) a multifaceted approach is key.

Conclusions

Findings suggest that there is a general lack of awareness surrounding DB by the general population and possibly by many healthcare practitioners. A lack of identification impacts

patient quality of life and can lead to chronic musculoskeletal adaptations. Establishing a mind-body connection allows patients to establish a level of body awareness that allows a change in their breathing pattern back to an efficient and relaxed state that impacts presenting symptoms. A multifaceted approach to treatment is critical to making maximum changes and optimising clinical outcomes.

Keywords

Breathing dysfunction; Breathing pattern disorders; Hyperventilation syndrome; Interpretive descriptive; Manual therapy; Osteopathy; Physiotherapy; Practitioner Perspectives; Qualitative research.

BACKGROUND

The term DB has been introduced by those who have attempted to describe patients who display a divergent breathing pattern and have symptoms that cannot be attributed to a specific medical diagnosis (Barker & Everard, 2015; Courtney, 2009; Niggemann, 2010). DB has been regarded as a respiratory condition characterised by hyperventilation (Barker & Everard, 2015; Bott et al., 2009; Courtney, 2009; Jones et al., 2015; Lum, 1981), abnormal breathing co-ordination, timing, and volume (Courtney, 2009), breath holding, upper chest breathing, and sighing (Gardner, 1996; Han, Stegen, Schepers, Van den Bergh, & Woestijne, 1998; Han et al., 1997). There has previously been no agreement among healthcare practitioners about a definition or a diagnostic test for DB, nor is there consensus that it manifests into identifiable symptoms (Hagman et al., 2007). The complex nature of DB may contribute to an ambiguity around a clear definition and a lack of consensus among healthcare practitioners on multiple fronts regarding the phenomenon (Barker & Everard, 2015; Gilbert, 1998; Niggemann, 2010;). Establishing a clear definition for the phenomenon and becoming educated about the nature of DB is important to countering the related burden of morbidity claimed to coexist (Barker & Everard, 2015). Barker and Everard (2015), propose DB may be defined as “an alteration in the normal biomechanical patterns of breathing that result in intermittent or chronic symptoms which may be respiratory and/or non-respiratory”.

DB has been described in numerous papers from anecdotal reports to randomised control trials and may be more prevalent than currently recognised (Cliffton-Smith & Rowley, 2011; Henderson, 2007; Jones et al., 2015; Magarian, Middaugh, & Linz, 1983;

Perri & Halford, 2003; Ringsberg, Wetterqvist, Lowhagen, & Sivik, 1997; Thomas et al., 2003). For example, in asthma patients, prevalence of DB has been shown to range from 29–59% (Agache, Ciobanu, Paul, & Rogozea, 2012; Stanton, Vaughn, Carter, & Bucknall; Thomas et al., 2003; Thomas et al., 2001). In addition, it was found that DB may affect up to one in ten of the general population as demonstrated via the NQ (Thomas et al., 2005). In an earlier study up to 75% of a cohort of 94, displayed dysfunctional breathing with a normal breathing pattern being the exception (Perri & Halford, 2003). Furthermore, patients with DB have been shown to be more impaired than patients with well-controlled asthma (Hagman et al., 2007). The possibility that DB could be more prevalent than currently thought and the negative impact it may have on quality of life demonstrates a need for improved recognition and appropriate management that might be sought via further investigating to build a clearer understanding of the phenomenon (Jones et al., 2015).

There is a growing interest in the area of DB with some practitioners beginning to recognise DB as an entity of its own (Cliffon-Smith & Rowley, 2011; Courtney, 2009). This was further supported at the 2012 Olympic Games at which physiotherapists were assigned to specifically treat athletes who presented with DB (Clews, 2012). There is an increasing number of research studies investigating DB and its management (Jones et al., 2015; De Groot, 2011; De Groot, Duiverman, & Brand, 2013; Lum, 1975; Ringsberg et al., 1997; Weinberger & Abu-Hasan, 2007) and therefore more research in support of the phenomenon, however there has been little or no qualitative research exploring what is actually done clinically. Some writers suggest that a lack of recognition, under-diagnosis, and misdiagnosis of DB may be contributing to the lack of consideration being given to the phenomenon within a clinical setting despite a growing interest in the area (Barker & Everard, 2015; Henderson, 2007; Keeley & Osman, 2001; Magarian et al., 1983). Investigating people's attitudes and perspectives of DB and exploring their own experiences may be necessary to build awareness around the phenomenon (Chaitow, 2004; Hagman et al., 2007;). The aim of this research was to explore and capture current clinical perceptions, experiences, and practices, from the perspective of healthcare practitioners who are currently addressing DB.

METHODS

Using an interpretive descriptive approach, a qualitative research study was conducted. Qualitative research is useful when there lacks a robust body of literature surrounding the topic (Thorne, 2008). Therefore, a qualitative study was selected as a deeper exploration of the phenomenon was desired as there is currently little documented about current clinical practice when a patient presents with DB. Ethical approval was obtained prior to the study's commencement (Unitec Research Ethics Committee 2014-1063). Participants were recruited through referral and snowball sampling and contacted via email. In total, 10 participants were contacted with six agreeing to participate in the research, fulfilling the desired sample size of six. The data set included three practising osteopaths and three physiotherapists. The participants were required to be New Zealand registered in their profession and hold a current annual practicing certificate. Additionally, the participants must have had a minimum of five years' clinical experience in their respective healthcare profession. This time period was expected to provide a satisfactory level of clinical experience from which an adequate depth of knowledge and experiences could be explored. Furthermore, it was required that participants must have an interest and/or experience in working with patients with DB. The participants were also required to understand the research process and consent to all aspects of the study. With informed consent from the participants obtained, semi-structured, in-depth, open-ended interviews were conducted in order to explore the participants' experiences and perspectives about the phenomenon. Interviews were conducted between April and June 2015 in the clinical setting of each participant.

Data from the interviews were transcribed verbatim by an outsourced transcriber and sent to the participants for them to check the accuracy of the information and to give them an opportunity to amend the data they had provided if necessary. No changes were made to the transcriptions by the participants. Each interview was summarised as the participant's key experiences and categorised under topic headings for developing theme identification. In addition, emerging themes were discussed and developed further with the researcher's supervisors. Reflexivity was practised with the researcher identifying personal values, beliefs, interests, and disciplinary background that might influence the interpretation of data. Remaining true to the participants' experiences and the data, was achieved by reflexivity and making a conscious effort to minimise bias. Finally, a coherent narrative about the

phenomenon was constructed by the researcher to provide rigour to the research following Houghton, Casey, Shaw, and Murphy (2013).

RESULTS

Three osteopaths and three physiotherapists participated in interviews that ranged from 45 minutes to 93 minutes (Table 1). Three participants were males and three were female with clinical experience in their respective fields ranging from 9 to 37 years.

Table 1

Participant characteristics

Practitioner	Gender	Clinical profession	Years of clinical experience	Approximate number of patients seen per week
1	M	Osteopath	9	12
2	F	Physiotherapist	23	30
3	F	Respiratory Physiotherapist	23	26
4	M	Osteopath	11	35
5	F	Cardio Respiratory Physiotherapist	37	12
6	M	Osteopath	8	45

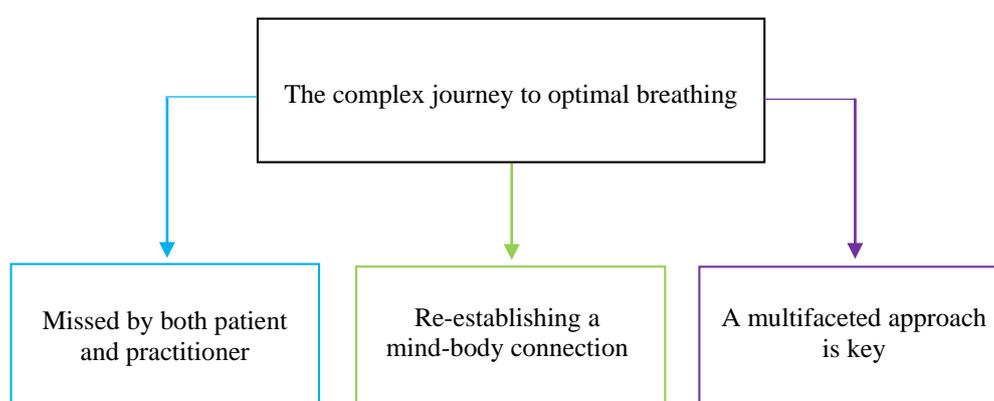
The interviews aimed to discover what was most significant within the participants' own experiences when treating patients with DB in their own practice. Drawing from the information shared by the participants, the study uncovered the complex nature of DB and the challenges that may arise when addressing the phenomenon. The over-arching theme 'The complex journey to optimal breathing' was developed in response to participant narrative of their own experiences that highlighted the complex multidimensionality of DB and that the reality for them that the road to functional breathing was in fact a journey rather than a 'quick fix'. During the interviews many issues were discussed that identified a general lack of awareness surrounding DB ranging from identifying the issue to managing it. The following three themes represent the strongest and most commonly present perspectives as shared by

the participants that relate to three clinically relevant phases including identification/diagnosis, treatment, and management. The sub-themes identified are:

- 1) Missed by both patient and practitioner
- 2) Re-establishing a mind-body connection
- 3) A multifaceted approach is key

Figure 1

Over-arching theme and sub-themes



It is important to note that the participants all have an interest and a general awareness of DB in their own clinical practice. Through in-depth interviews, however, it became apparent that the awareness and knowledge of DB that the participants held may be limited to only some health practitioners, who are the exception. The participants' perception was that the general population and many healthcare practitioners do not fully recognise the effects DB can have on quality of life. 'The complex journey to optimal breathing' was discussed by the participants as being first evident when patients present to a healthcare practitioner often unaware that breathing could/might play a role in their complaint. It was the opinion of the participants that many healthcare practitioners also were not identifying DB as a possible cause of patients' symptoms in the first instance. This led to the first sub-theme, 'missed by both patient and practitioner'. The next phase of the participants' experiences was the treatment of DB, and it was here that the second sub-theme was formed, 're-establishing a mind-body connection'. Once DB was identified as being present in a patient, all the participants expressed the importance of the patient building a better self-awareness of not only their breath but of all aspects of their life as being key to successful

treatment. Thus, due to the patient having to identify and re-establish a mind-body connection that is dependent on a holistic approach, the third sub-theme became clear, being that ‘a multifaceted approach is key’ often requires different avenues of treatment for optimal clinical outcomes. These themes are discussed more fully in the following sections.

Missed by both patient and practitioner

It is not difficult to recognise DB that produces an acute episode such (e.g., hyperventilation). However, chronic and recurrent cases are often missed (Barker & Everard, 2015; Magarian et al., 1983). Participants reported that patients with chronic cases of DB will commonly present with some form of pain, usually chronic pain or functional impairment, but are often unaware of any breathing dysfunction or breathing difficulties themselves.

On average, I'd say the majority of people that I see have had symptoms that they can then retrospectively identify in at least the last two years, if not much more. And often, on reflection they come back and say. 'The symptoms have existed even further back'. So they're actually long-standing. (P 3)

Most participants explained that DB can impact someone’s quality of life to the point they seek medical advice but often to no avail. Some participants expressed that patients can feel helpless as they are left misdiagnosed or undiagnosed despite seeing numerous healthcare practitioners who have not considered DB and the impact it can have on someone’s life.

I think that they haven't seen a therapist that could identify it, or considered that it's an integral issue to their health.... Health practitioners in the biomedical sphere, I think they.... Or, they think they are able to recognize it, but they probably don't recognize that there's some way of the person changing it. So, there's some way of impacting and making a difference. (P 5)

Participants felt the link between the patient’s symptoms and breathing is often missed due to the healthcare practitioner not thoroughly investigating the patient’s breathing pattern. In addition, the participants believed that patient breathing patterns could be

repeatedly overlooked by other healthcare practitioners as a result of being overshadowed by a multitude of other symptoms indicating more serious pathology.

And you know, the crossover of all the symptoms like poor sleep and tiredness, I mean that can be thyroid and there's all these other things that GPs have to pick up that could be more sinister, I think it just gets really missed. (P 2)

It was expressed that diagnosing a patient with some form of DB may become fairly subjective as it was felt amongst all participants that there is currently no reliable clinical test available. However, although diagnosis may be subjective, several participants stated that if knowing what to look for, it should be very obvious that DB is present.

No, there's not one reliable test.... So, it's a combination of.... Yeah, it's a combination of things that brings you to.... It brings you to a picture.... It is actually quite obvious within the first five to 10 minutes.... Yeah, so it's really there. It's not something that you suddenly go, "I think it might be." If you do an assessment, and you look at them and they do have disordered breathing you'll find it straight away. (P 5)

Drawing from the participants' own experiences, it was expressed that it can be difficult to assess someone's breathing when they become aware that you are doing so. Although an automatic function and often done so with little consciousness, it was mentioned that breathing is an intimate experience and patients can begin to alter their breathing due to feeling nervous and self-conscious when being assessed. In addition, the participants have observed that if a patient has had previous breathing re-training to some extent they will also change from their 'normal' breathing which may still be dysfunctional, to how they think they should be breathing, further disguising their DB. A practitioner with advanced expertise and education in the area of DB, however, is able to assess a patient's breathing without revealing what they are doing, as discussed by a number of the participants.

Trying to make sure the patient doesn't know what you're doing. I feel that's the biggest one. And it's fine for the first time you see them but from that point onwards you're screwed because they know what you're doing.... So the way I've gotten

around that is now I don't assess breathing at the same point in the appointment for those patients where I think it's really important to see where they're at. (P1)

Re-establishing a mind-body connection

It was identified by all the participants that patients are often not conscious of their breathing and they have very little awareness and connection to their own body in general, which was felt to play a part in a delayed diagnosis initially and can lead to difficulties in treatment.

Body awareness is a pretty big one. So it's really hard to teach someone how to breathe when they have absolutely no idea which part of their body to use or how to use it. (P 1)

One of the most difficult aspects of managing a patient with DB was identified as trying to get the patient to understand how their breathing may be contributing to some or all of their symptoms.

(P 6) "The next biggest thing is trying to convey how important it is, or how easy it can be to make a big difference. And that's probably the hardest thing".

Education on the 'why' and the 'how' was said to be the first steps to building a mind-body connection that will allow patients to start engaging with their bodies, and in turn their breathing. In addition, the manner in which this is taught must resonate with the patients personally to be relevant.

Some of that is also responding to the learning style of the person. So, when I've had people who've been very linear learners, they want to know exactly how it's all linked together, and they physically can't move on, or rather psychologically can't move on until they found peace with the understanding. Other people are a lot more visual and need to have a visual picture of what's happening. (P 3)

After educating the patient on the importance of their breathing and how it may be relevant to their symptoms, the participants explained how introducing a mind-body

connection was a process that started with self-observation and progressed towards a mindful approach to breathing retraining.

I might say "Oh what did your breath do?" And they'll go "Oh, I don't know". I'm doing that to get them aware that they don't know what their breath is doing.... Just dropping in a bit of awareness. And then, I'll likely say.... what did your breathing do, "Oh I held it".... "And then I might get them to do a twist.... If they turn and go "Oh yeah that hurt". I'm like "Okay, just breathe. I want you to breathe out as you do that movement again and just see what happens". And they go "Oh it didn't hurt" Or they'll go "Oh, I got further".... I want them to have an idea that breathing is intimately linked with them having better movement, better function and it could be quite connected with their chronic pain sometimes. (P 2)

Participants described a process of slowly introducing newly learned breathing patterns into different static and dynamic positions once the patient has established a mind-body connection and is now able to be mindful in their tasks.

Then slowly bringing in all the other factors so it becomes a multi-tasked situation.... So for me it's about bringing the subconscious into the conscious. And becoming aware of it, and noticing it and then training it.... So increasing the amount of time that somebody can comfortably do something and push them through a threshold of being slightly uncomfortable until they become comfortable.... So when I'm talking about support, I mean physical support but also verbal support and manual support. (P 5)

Furthermore, it was argued that once a patient has learned how to consciously reconnect and engage with their breathing they are much more able to manage their breathing in future when they notice themselves reverting to DB.

I think they're more likely to know what to do. I think most patients that have at least techniques for things like calming down and for when they feel short of breath.... They say it in the conversation, "Oh I was going to come and see you about my neck, but I did those breathing exercises and it was all good." Education is

a big part of osteopathy I think. So, they'll really adopt those things they find that work. (P 6)

A multifaceted approach is key

Although participants were all trained in manual therapy modalities, each emphasised the need for a multifaceted approach to treatment and management of a patient with DB. Treatment discussed included manual therapy, counselling, relaxation techniques, mind-body techniques, and breathing retraining/exercises.

I think there's a general approach of which there's.... I suppose there's multiple tools in the tool kit, and then it depends on which one is needed at the time. For some people, at different points in time of their management, they might need relaxation techniques. They might need that before we do the breathing techniques, and they might not need it. (P 3)

It was acknowledged that breathing is a complex function inherently interwoven into almost if not all aspects of one's physical and mental being and as a result needs an intervention that can address multiple facets and is specific to individual needs. Psychological factors such as stress, anxiety, fear, and everyday life were discussed as playing a role in someone's breathing pattern.

I think more so now in the last five years, our experience and now emotions are intimately connected with how we feel and how we breathe.... So, I think that it can certainly come from any experience that's deemed stressful, fear, anxiety, changing schools. So anything that's change.... Anything that's deemed stressful to a person. (P 2)

All participants felt as though it would be difficult for a patient to attempt to resolve their DB unassisted by some form of trained healthcare practitioner. It was expressed that the most important aspect of a patient practitioner interaction at this point was to provide the patient with hands-on feedback and very specific cueing, further establishing a mind-body connection.

I think it would be quite hard to do it on your own. You could certainly give it a go, but I don't think that would be optimum. I think with breathing just having someone objectively cueing you about what you're doing is really useful. Cause the cueing side of things is really important because so often people don't know what's moving and what isn't. (P 6)

Participants stated that changing someone's breathing pattern is not instant but rather it requires high patient compliance involving self-discipline and sometimes stepping outside one's comfort zone. Additionally, guidance from a qualified health practitioner who has experience treating DB is essential.

Usually, if you do the physical treatment without the retraining, your effects are going to be limited. If you do the retraining without the physical treatment, then you're usually going to achieve excellent results, but it might take longer, because the body has to cope with the breathing, and then try and revert the changes. So as long as there isn't anything else that's causing those changes to be there, if breathing is the only predisposing maintaining factor, then they'll eventually get there, but the keyword there is "eventually." So one doesn't do as much, but does it quickly, the other one does usually all of it, but slowly. So the best results is when you do both. (P 1)

The inability for patients and many healthcare practitioners to identify DB as a possible cause for patients' symptoms may further contribute to quality of life being impacted as a result of a misdiagnoses. This is an important finding in the data. In addition, building a mind-body connection in combination with a multifaceted approach to treatment has been stated as being essential to treatment and therefore requires further attention from researchers and practitioners.

DISCUSSION

This study captures the clinical experiences of healthcare practitioners when managing patients with DB. An in-depth understanding of the phenomenon from the perspective of healthcare practitioners has been provided and highlights some key areas that assist and impede clinical management. The results of this research reinforce that the experience of DB for both the patient and the healthcare practitioner is complex,

multidimensional, and still largely unrecognised by both patients and by healthcare practitioners. Magarian et al. (1983) discussed the obvious nature of an acute hyperventilation episode, but in contrast the often overlooked chronic or recurrent hyperventilation can be more difficult to identify. Some of the difficulties identifying chronic DB were described in this research as: 1) patients often being unaware of their breathing, 2) healthcare practitioners lacking adequate knowledge in this area, 3) the patients breathing pattern is often disguised by other more obvious symptoms, 4) a reliable clinical test is lacking, and 5) it can become difficult to get a true picture of someone's breathing when they become aware of what you are assessing.

A lack of coverage on the topic in training colleges and medical textbooks further contributes to the poor recognition of DB (Magarian et al., 1983). This was confirmed by most participants who stated that they had not learned much about the phenomenon during their respective training, but rather came across it during their years of clinical practice. Nicholls, Walton, and Price (2009) state that assessing and treating for DB is still considered to be slightly unorthodox in some physiotherapy circles, which may also influence poor recognition. A consequence of this lack of awareness is that patients are often left misdiagnosed or undiagnosed and are passed around healthcare practitioners with no real answers or relief from their symptoms, which may lead to chronic musculoskeletal adaptations and feelings of frustration and helplessness impacting quality of life as described by the participants. This misdiagnosis or under-diagnosis is further highlighted in a cross sectional survey incorporating the NQ. Thomas et al. (2003) recruited 219 participants with a current diagnosis of asthma from a semirural general practice. Of these participants, 29% ($n = 63$) were identified as having hyperventilation syndrome according to the NQ. The study may have lacked generalisability as it was confined to only one general practice and they did not assess via objective measures whether the participants did have asthma. In addition, the NQ alone may not be enough to confidently diagnose DB but in the absence of a standardised clinical test the questionnaire identified substantial characteristic patterns suggestive of DB thus giving reason to investigate the condition further.

In a similar study (Agache et al., 2012) 91 adults with diagnosed asthma were recruited and screened for DB via the NQ. The aim of the study was to identify phenotypes related to DB. This study recruited participants from six asthma clinics providing greater generalisability. Furthermore, objective measures such as lung function tests were

incorporated to diagnose asthma establishing a more robust study than the study by Thomas et al. (2003). In addition, DB was confirmed by progressive exercise testing. Agache et al. (2012) found 27 (30 %) participants were indicated via the NQ to have characteristics suggestive of DB, similar to the previous study of Thomas et al. (2003). Of the 27 participants, 16 (59%) of these were confirmed by progressive exercise testing to have DB. Phenotypes identified as having a link to DB were psychopathology, frequent severe asthma exacerbations, and uncontrolled asthma. Stanton et al. (2008) produced similar findings with 59% ($n = 10$) of their participants from a single asthma clinic diagnosed with asthma being confirmed as having DB after positive NQ scores and progressive exercise testing. Sixty-five participants (64%) had originally been identified as having DB via the NQ but were not all able to complete the progressive exercise test for varying reasons and therefore may have provided stronger findings with larger numbers had they been included. The results of the preceding studies offer a different perspective and explanation to asthma-like symptoms that are not related to asthma and instead may identify the presence of DB. Furthermore, accurate diagnosis of DB, in particular if asthma is the alternative diagnosis, may be important in reducing the unnecessary use of medications such as corticosteroids which is the current standard treatment for asthma (Saxena & Saxena, 2009). Thus focusing on treatment methods more suited to addressing DB (Agache et al., 2012).

Lack of a reliable clinical test for DB was raised by all the participants. This lack leads to subjective diagnosis, which may prevent healthcare practitioners who are not experienced in dealing with DB from performing appropriate investigations and constructing an accurate diagnosis. Agache et al. (2012) also mention that there is yet to be a clinical test that assists in diagnosing DB: however, Stanton et al. (2008) suggest diagnostic specificity may be increased when using the NQ in combination with a progressive stationary bicycle exercise test. The bicycle test provides data on circulatory abnormalities and fitness levels, which if normal may provide more support in a diagnosis of DB (Ringsberg et al., 2007). Ringsberg et al. (2007) also support the use of a bicycle test in combination with lung function tests to assist in diagnosing patients who display asthma-like signs but have negative asthma tests. Agache et al. (2012) however state that a limitation to the bicycle test is that it lacks a set of standardised diagnostic parameters to define inappropriate ventilation. Although there has been some progression in the approach to diagnosis, the biggest issue that remains is the validation of an objective diagnostic measure to provide a conclusive diagnosis of DB.

Participants reported that patients are often unaware of their breathing and educating patients is the first step to management. It was stated that teaching patients the importance of breathing in a way that is efficient to their body's demands and how to do this, allows patients to understand the relevance and the impact their breathing can have on the symptoms they are manifesting and their overall quality of life. Engaging the patient in their own recovery was said to be essential and therefore the manner in which this is done is important so that it becomes relatable to the patient. The patient must resonate with what the healthcare practitioner is telling them and this was described as being achieved by using different methods of teaching such as descriptions or visual aids. The participants' view of patient education is supported by a systematic review of research (Stewart, 1995) that investigated the effects of various styles of practitioner-patient communication and the resulting patient outcomes. Stewart (1995), reviewed 21 randomised control trials and analytic studies that focused on practitioner-patient communication and related patient outcomes. Sixteen studies reported patient outcomes were influenced by the quality of communication in both history taking and management plans. Good practitioner-patient communication was said to improved emotional health, symptom resolution, pain control, and functional and physiologic status of the patient. Active participation of the patient was also mentioned as being significant to patient outcomes (Stewart, 1995).

Following on from education, establishing a mind-body connection was discussed. A mind-body connection was described as bringing about a deeper level of body awareness allowing a change in breathing pattern to an efficient and relaxed state that has a positive impact on many if not all of the patients related symptoms. As the patient begins to establish a mind-body connection and is able to be mindful in their tasks, participants stated that slowly introducing their newly-learned breathing pattern into different static and dynamic positions should begin. This process continues until the patient is able to complete everyday tasks with ease as their subconscious breathing pattern is now functioning optimally. At a mind-body medicine training centre, a study was conducted by Fernros, Furhoff, and Wändell (2008), reported quality of life and sense of coherence to show clinically significant improvements in 83 participants compared to a control group ($n = 69$) after completing a one-week course in mind-body medicine. The control group had previously attended the mind-body course and therefore had the potential to affect between-group differences due to the possibility of drawing on knowledge of the same therapies that the study group was now

undertaking. However, the study group showed significant improvements from their baseline data and thus demonstrated the importance of a mind-body connection.

Participants agreed that after a course of treatment, patients have learned ways in which they can manage their breathing, such as through breathing retraining exercises, relaxation techniques, and identifying and adapting to the influences that trigger their DB. A stronger mind-body connection was identified as allowing a more organic process of recognition and adaptation for the patient and, as a result, it was said patients were less likely to re-see help. Furthermore, the findings suggest that a multifaceted approach to treatment is essential as breathing in itself is a multifaceted function that has an outreached effect on the body. The participants commented that treatment outcomes may be limited or the time in which changes are seen and experienced may take longer when not applying a multifaceted approach. Balkissoon and Kenn (2012), reinforce the importance of a multifaceted treatment approach such as speech therapy and biofeedback to override DB habits in addition to psychological support that should provide a favourable prognosis. Additionally, all the participants felt as though it would be difficult for a patient to attempt to resolve their DB unassisted by some form of trained healthcare practitioner. Agache et al. (2012), also states that for successful breathing retraining an appropriate instructor is required. The importance of finding a healthcare practitioner who is able to assist in the resolution of the patients DB is therefore paramount. It was identified that a multifaceted patient-focused approach that is specific to the individual must be applied alongside strong patient compliance, self-discipline, and sometimes stepping outside comfort zones for optimal clinical outcomes.

The studies aim to investigate current clinical practices, experiences, and perspectives of healthcare practitioners who attend to DB has been achieved with findings that provide new and informative insight into the DB phenomenon. The results of this study were strongly conclusive with minimal conflicting data between participants. This cohesiveness between data indicates that osteopaths and physiotherapists have a similar approach to patient management of DB (regardless of their previous training) which has been learned primarily in their clinical experience. These commonalities within the participants' accounts may confirm the phenomenon to be true and highlight the potential for a cohesive treatment protocol for DB in the future. However, it is important to acknowledge a small sample set and purposive sampling may have influenced the similarities in the reported experiences between data sets. There is a need for the general population, and more importantly,

healthcare practitioners in multiple modalities to be more aware of DB, how it manifests, the symptoms it produces, and how to manage DB patients. Initiating conversations about the phenomenon may be key in building this awareness, encouraging healthcare practitioners to investigate breathing patterns and addressing the problem so to allow patients to regain some control over their quality of life. Thus, further research and education on the phenomenon is essential for effective practice and patient care in the future.

CONCLUSIONS

In this study a subjective, interpretive, and explanatory approach was applied and captured an understanding of the DB phenomenon from the perspective of healthcare practitioners. This understanding contributes insights that have the potential to enhance current clinical practice. A variety of factors, including recognition, mind-body awareness, and a multifaceted personalised approach were identified as playing important and interrelated roles in the management of patients with DB. A limitation of the study is that only osteopaths and physiotherapists were interviewed, which left mainstream healthcare (e.g., general practitioners) unexplored. In addition, interviewing patients who currently experience or have previously experienced DB, would have provided a wider picture of the DB phenomenon. This limitation identifies a large area open for future research. Furthermore, it is important that DB is not being overlooked as a result of the phenomenon not having a robust standing amongst healthcare practitioners. Therefore, continued research exploring DB from healthcare practitioners' perspective is crucial.

WHAT THIS PAPER ADDS

Implications for theories

- This study adds to what currently appears to be a relatively limited body of literature investigating DB and its implications. Therefore, the study helps build a stronger body of literature in support of DB by bringing attention to the phenomenon.
- As there is an apparent lack of qualitative research investigating themes such as current clinical practices, experiences, and perspectives of healthcare practitioners who attend to DB, this study has provided insights into the phenomenon from the perspective of a healthcare practitioner. The more that can be discovered and understood about DB the easier it becomes to address the phenomenon in a clinical setting, thus promoting more successful patient outcomes.

Implications for practice

- DB is a complex and multi-faceted phenomenon. Key findings identified are: DB is often missed by both patient and practitioner; re-establishing a mind-body connection is essential to optimal patient outcomes; a multifaceted approach to treatment is required.
- Osteopaths and physiotherapists have a similar approach to managing patients with DB in a clinical setting, despite being trained in different fields. This highlights the potential for a cohesive treatment protocol over different modalities for DB in the future.

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Part Three: Appendices

Appendix A: Acknowledgements

I would like to say thank you to the [specific details of institution removed to preserve anonymity as detailed in “manuscript layout”, *IJOM* submission guidelines] for their support of this thesis. I am particularly grateful to my two supervisors, [specific details removed to preserve anonymity as detailed in “manuscript layout”, *IJOM* submission guidelines] whose contribution of time, their wealth of knowledge, and guidance has been essential to the completion of this research.

I would also like to acknowledge the participants [specific details removed to preserve anonymity as detailed in “manuscript layout”, *IJOM* submission guidelines] that took part in this research project and show my appreciation for generously offering their time, and sharing their knowledge, experiences, and insights. Without the participation of all the mentioned parties, this research would not have taken place and therefore my appreciation and gratitude is extended to all involved.

Appendix B: Ethics Approval

Jade Shaw
2A Caughey Place
Mt Albert
Auckland 1025



24.7.14

Dear Jade,

Your file number for this application: **2014-1063** Title: **What is current clinical practice when the presence of dysfunctional breathing may exist in a patient? A qualitative interpretive descriptive study.**

Your application for ethics approval has been reviewed by the Unitec Research Ethics Committee (UREC) and has been approved for the following period:

Start date: 24.7.14

Finish date: 24.7.15

Please note that:

1. The above dates must be referred to on the information AND consent forms given to all participants.
2. You must inform UREC, in advance, of any ethically-relevant deviation in the project. This may require additional approval.
3. Organisational consent/s must be cited and approved by your primary reader prior to any organisations or corporations participating in your research. You may only conduct research with organisations for which you have consent.

You may now commence your research according to the protocols approved by UREC. We wish you every success with your project.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'G. Whalley'.

Gillian Whalley
Deputy Chair, UREC

cc: Catherine Bacon
Cynthia Almeida

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Appendix C: Amended Ethics Approval

Jade Shaw
2A Caughey Place
Mt Albert
Auckland 1025



18.3.15

Dear Jade,

Your file number for this application: **2014-1063**

Title: **What is current clinical practice when the presence of dysfunctional breathing may exist in a patient?**

A qualitative interpretive descriptive study.

Your application for an amendment to the above ethics application has been reviewed by the Unitec Research Ethics Committee (UREC) and has been approved for the following period:

Start date: 25.2.15

Finish date: 24.7.15

Please note that:

1. The above dates must be referred to on the information AND consent forms given to all participants.
2. You must inform UREC, in advance, of any ethically-relevant deviation in the project. This may require additional approval.
3. Organisational consent/s must be cited and approved by your primary reader prior to any organisations or corporations participating in your research. You may only conduct research with organisations for which you have consent.

You may now commence your research according to the protocols approved by UREC. We wish you every success with your project.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'PP. Donaghey', enclosed in a thin black rectangular box.

Sara Donaghey
Deputy Chair, UREC

cc: Catherine Bacon
Cynthia Almeida

Appendix D: Participant Information Sheet



Information for Participants

What I am doing

My name is Jade Shaw and I am currently enrolled in the Master of Osteopathy degree in the School of Education at Unitec New Zealand and I seek your help in meeting the requirements of research for a Thesis course which forms a substantial part of this degree.

Research Project Title

What is current clinical practice when the presence of dysfunctional breathing may exist in a patient? A qualitative interpretive descriptive study

Synopsis of project

To interview manual therapists and interpret current clinical practice in the assessment, diagnosis, treatment, and management of patients displaying possible signs and symptoms of dysfunctional breathing.

What it will mean for you

I require participants that have a minimum of five years' experience in a healthcare setting with experience and an interest in treating dysfunctional breathing patterns observed in patients. Your role in the research project will include the researcher (myself) interviewing you with a focus on your current approach to assessment, diagnosis, treatment, and management of symptoms that coexist with dysfunctional breathing patterns that cannot be attributed to a specific medical diagnosis.

If you agree to participate, you will be asked to sign a consent form. This does not stop you from changing your mind if you wish to withdraw from the project. However, because of my schedule, any requests to withdrawal your data must be done within two weeks after your participation in the research project.

Your name and information that may identify you will be kept completely confidential unless prior written consent to use this information is obtained. All information collected from you will be stored on a password protected file and only you, the researcher (myself), and my supervisors will have access to this information.

Please contact us if you need more information about the project. At any time if you have any concerns about the research project you can contact my supervisor:

My supervisor is Dr Catherine Bacon, phone 09 815 6794 or email cbacon@unitec.ac.nz

UREC REGISTRATION NUMBER: 2014-1063

This study has been approved by the UNITEC Research Ethics Committee from 25.02.15 to 24.07.15. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 8551. Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Appendix E: Participant Consent Form



Participant Consent Form

Research Project Title: What is current clinical practice when the presence of dysfunctional breathing may exist in a patient? A qualitative interpretive descriptive study

I have had the research project explained to me and I have read and understand the information sheet given to me.

I understand that once I have participated in the research project, I have the right to request withdrawal of my data up until two weeks following data collection (the time at which I participated in the research project).

I understand that everything I say is confidential and none of the information I give will identify me unless I have given written consent prior and that the only persons who will know what I have said will be the researchers and their supervisor. I also understand that all the information that I give will be stored securely on a computer at Unitec for a period of 5 years.

I understand that the researcher will interview me and that the interview will be reviewed only by myself, the researcher, and the researcher's supervisors.

I understand that my discussion with the researcher will be taped and transcribed.

I understand that I can see the finished research document.

I have had time to consider everything and I give my consent to be a part of this project.

Participant Name:

Participant Signature: *Date:*

Project Researcher: *Date:*

UREC REGISTRATION NUMBER: 2014-1063

This study has been approved by the UNITEC Research Ethics Committee from 25.02.15 to 24.07.15. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 8551). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Appendix F: Participant Confidentiality Form



Confidentiality Agreement - Participant

Research Title: What is current clinical practice when the presence of dysfunctional breathing may exist in a patient? A qualitative interpretive descriptive study

Name:

Address:

Phone number:

Email:

I _____ (*full name - please print*)

Agree to treat in absolute confidence, all information that I become aware of during the course of participation in the above research project. I agree to respect the privacy of those involved and will not divulge in any form, information with regard to any participating person or institution and agree to not retain or copy any information involving the above project.

I am aware that I can be held legally liable for any breach of this confidentiality agreement and for any harm incurred by individuals or organisations involved, should information be disclosed.

Signature:.....Date:.....

UREC REGISTRATION NUMBER: 2014-1063

This study has been approved by the UNITEC Research Ethics Committee from 25.02.15 to 24.07.15. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 8551). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Appendix G: Transcription Confidentiality Form



Transcriber Confidentiality Agreement

Research Title:

Researcher/s Name:

Address:

Phone number:

Email:

I _____ (full name - please print)

Agree to treat in absolute confidence all information that I become aware of in the course of transcribing the interviews or other material connected with the above research topic. I agree to respect the privacy of the individuals mentioned in the interviews that I am transcribing. I will not pass on in any form information regarding those interviews to any person or institution. On completion of transcription I will not retain or copy any information involving the above project.

I am aware that I can be held legally liable for any breach of this confidentiality agreement, and for any harm incurred by individuals if we disclose identifiable information contained in the audiotapes and/or files to which we will have access.

Signature:.....Date:.....

UREC REGISTRATION NUMBER: 2014-1063

This study has been approved by the UNITEC Research Ethics Committee from (24/07/2014) to (24/07/2015). If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 8551). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Appendix H: Interview Schedule

Name:

Profession:

Practice name and location:

How long have you been practicing in your current profession?

Approximate number of patients you would see per week?

General questions

1. Can you explain to me your current understanding of dysfunctional breathing?
2. Are there different patterns of dysfunctional breathing? What are they? Do they produce different signs/symptoms?
3. Could you give a rough percentage of how many patients you would see each week that may present with dysfunctional breathing patterns, whether this is their presenting complaint or not?
4. Do you diagnosis dysfunctional breathing as an entity of its own? Or would you just note it as a finding?
5. Can you tell me what you believe could cause a dysfunctional breathing pattern and how/why the symptoms that result manifest?
6. Have you noticed whether dysfunctional breathing patterns often correlate with a certain type of demographic (e.g., personality, age group, gender, socioeconomic standing)?
7. Are there certain types of people that you believe are more at risk of developing a dysfunctional breathing pattern?

8. Are there acute and chronic sufferers and how do they differ in signs/symptoms
9. In your opinion, what do you believe is the correct way to breath?
10. Is mouth breathing necessarily non-diaphragmatic breathing? Is it possible to learn to breathe diaphragmatically via the mouth?
 - a. Is breathing through the mouth with the diaphragm better than breathing through the nose not using the diaphragm?
 - b. Why is it important to breathe diaphragmatically and through the nose?
11. Should we use different ways of breathing for different activities (e.g., at rest, or when exercising)?
12. Are there different types of breath or ways of breathing that may be consciously used to stimulate certain responses within us, such as a breath to relax us, or a breath to be more alert or energised or stimulate us?

Assessment:

13. Do you always assess patient's breathing?
14. Patients that present with a dysfunctional breathing pattern, are they normally aware that their breathing may be an issue or that they breathe in a certain way?
15. If the patient is unaware of their breathing, what would normally be their presenting complaint that would most likely have a connection to their breathing?
16. What would you have observed in a patient that would lead you to think of their breathing functioning and the possibility of dysfunctional breathing pattern that may be causing their symptoms?
17. Could you describe how you would assess/examine a patient that is displaying signs and symptoms of dysfunctional breathing?

18. Do you feel there is a reliable/repeatable clinical test that can be used to assess someone's breathing functioning?
19. What are the challenges that prevent a clinical test from being effective as a diagnostic tool?

Diagnosis:

20. If a patient had a dysfunctional breathing pattern would this normally be evident during the first appointment/treatment or could it take a few sessions before it came to light, especially if breathing difficulties had not been mentioned by the patient?
21. Have you noticed whether dysfunctional breathing patterns often correlate with a previous or current diagnosis of asthma or any other respiratory conditions? What are they?

Treatment:

22. How do you structure a treatment plan if you suspect dysfunctional breathing? And what is your clinical reasoning for structuring it that way?
23. Do different dysfunctional breathing patterns require different treatment (e.g., do different approaches work better for different presentations)?
24. What are some specific techniques you may use to treat a patient with dysfunctional breathing?
25. How many treatments would you expect it to take to make improvements to someone's breathing to which their related symptoms start to improve?
26. Is it hard to change someone's breathing pattern if this has been their habitual breathing pattern for years?
 - a. And will the changes hold?
 - b. Are these people more susceptible to fall back into bad breathing habits again?

27. Do you use/teach your patients breathing retraining techniques? What are some of the techniques you would use?

Management:

28. Would your treatment and management be different for acute and chronic dysfunctional breathing and how would it differ?

29. What is the most common reason for peoples breathing to have not been identified as problematic earlier if they are chronic dysfunctional breathers?

30. Do you think that health practitioners generally do not have a good understanding of dysfunctional breathing and for this reason it goes undiagnosed or is misdiagnosed?

31. How do you think practitioners could become more aware of dysfunctional breathing?

32. Did you learn about dysfunctional breathing when you trained? How did you develop your understanding of dysfunctional breathing?

33. Do you believe it's important to have a multi-faceted approach to improving someone's breathing pattern or do you feel manual therapy alone, or breathing re-training alone could be enough?

34. What are your thoughts of a psychosocial aspect playing a role in a dysfunctional breathing pattern and would it be necessary to address to also to provide better outcomes for the patient?

35. Can dysfunctional breathing be self-managed by the patient? If so, what kind of things would you advise the patient to do?

36. What are some challenges/problems that can arise when managing a patient with a dysfunctional breathing pattern?

37. How does dysfunctional breathing complicate other medical conditions? For example, can it exaggerate symptoms of other conditions such as asthma, anxiety, headaches? Or can it lead to more serious health issues such as heart disease, hypertension?
38. Are there any aspects of your clinical reasoning that you feel are distinct or unique to your profession? If yes, why?

Appendix I: Researcher's Characteristics, Beliefs, and Assumptions

Researcher's Characteristics, Beliefs, and Assumptions:

- I am an osteopathy student with a deep knowledge of the body and how it functions.
- I have a dysfunctional breathing pattern and had asthma as a child.
- I have been hospitalised due to an asthma attack as a child.
- I have seen patients with dysfunctional breathing patterns.
- I know a lot more about osteopathy than physiotherapy.
- I completed a literature review prior to commencing the research project and therefore had a relatively good understanding of the phenomenon.
- I believe dysfunctional breathing patterns can produce identifiable symptoms and can affect most if not all of the body in some form.
- I believe people are not aware of their breathing.
- I am passionate about this subject.
- I assumed the data would be quite different between osteopaths and physiotherapists.

Appendix J: Extended Findings Section

This included appendix is not the entire findings section for this study. The following is an example of the theme development for the over-arching theme ‘the complex journey to optimal breathing’.

Provisional Themes Explored

- Dysfunctional breathing patterns: Missed by the patient and practitioner due to a lack of awareness.
 - Underdiagnosed and misdiagnosed
 - Hard to diagnose
 - Lack of reliable clinical test
 - Quality of life is often impacted with an often longstanding history of treatment to no avail due to a lack of focus on breathing.

- Re-establishing a mind-body connection is the key to treatment
 - How to?
 - Addressing emotional/psychological issues
 - Hands on manual treatment in addition to breathing re-training

- Multifaceted approach to treatment
 - Psychological component – Counselling
 - Manual therapy
 - Breathing retraining

- Once it’s right, it’s right – Once a correct way of breathing has been established can it revert back to a dysfunctional pattern?
- Strong stress/psychosocial relationship
- Assessment is generally subjective/lack of reliable clinical test
- Difference between osteopaths and physiotherapists approaches
- How should we breathe? What is the correct way to breathe?

Extended Quotes Section

Missed by both patient and practitioner

It is not difficult to recognise DB that produces an acute episode such (e.g., hyperventilation). However, chronic and recurrent cases are often missed (Barker & Everard, 2015; Magarian et al., 1983). Participants reported that patients with chronic cases of DB will commonly present with some form of pain, usually chronic pain or functional impairment, but are often unaware of any breathing dysfunction or breathing difficulties themselves.

On average, I'd say the majority of people that I see have had symptoms that they can then retrospectively identify in at least the last two years, if not much more. And often, on reflection they come back and say, 'The symptoms have existed even further back.' So they're actually long-standing. (P 3)

They haven't got a clue.... Usually by the third positive question then they start tweaking, the fact that, 'Oh yeah, definitely, yeah.' But very rarely do they have any idea when they come in. Apart from.... Again, there're always exceptions, but the ones that have had issues with their breathing in the past, they've had treatment for it, they've moved place, they come in and they go, 'I've got this, it's because of my breathing.' Okay, great, have a look at that. But usually no, they don't have a clue. (P1)

Yeah, I'd say definitely the large majority would be unaware of it. I think most people would only be aware of it if say for instance they had some other form of treatment or they'd had someone talk about it or assessment beforehand. Or else they had a chronic issue like asthma or some allergic condition or chronic respiratory problem, or maybe a history of bronchitis or something, but otherwise, I don't think most people are aware of it. Because so often you get people, you'll treat them and they'll go, 'I can breathe.' And they haven't been aware of it until they find it's much easier to actually inhale, or feel like they're actually getting oxygen. (P 6)

Most participants explained that DB can impact someone's quality of life to the point they seek medical advice but often to no avail. Some participants expressed that patients can feel helpless as they are left misdiagnosed or undiagnosed despite seeing numerous

healthcare practitioners who have not considered DB and the impact it can have on someone's life.

They keep going back to their GP, cause they keep getting those feelings. They'll often say, 'I present and I can see my GP looking at me as if I'm a fraud,' or that 'I'm in the too hard basket. I've got all these very genuine feelings of not being quite right, but they can't find anything.' And that's a typical scenario. (P 3)

I think that they haven't seen a therapist that could identify it, or considered that it's an integral issue to their health.... I think, often GPs will see their clients and some GPs really look and see, and some GPs don't, or it depends who they present to as to whether it's been picked up or not. Health practitioners in the biomedical sphere, I think they.... Or, they think they are able to recognize it, but they probably don't recognize that there's some way of the person changing it. So, there's some way of impacting and making a difference. (P 5)

I don't know in other modalities that people are sort of quite focused about what they're trying to address and they don't necessarily see the breathing as being part of the pattern.... I certainly don't get any referrals for dysfunctional breathing from a GP. It'd be for lots of other things but not that. (P 6)

In general, by various therapists, probably because they don't have an awareness of holism to be fair.... If you treat symptomatically and there are a number of professions that just treat symptoms, they wait to be told what's wrong by their patients. (P 4)

Participants felt the link between the patient's symptoms and breathing is often missed due to the healthcare practitioner not thoroughly investigating the patient's breathing pattern. In addition, the participants believed that patient breathing patterns could be repeatedly overlooked by other healthcare practitioners as a result of being overshadowed by a multitude of other symptoms indicating more serious pathology.

And you know, the crossover of all the symptoms like poor sleep and tiredness, I mean that can be thyroid and there's all these other things that GPs have to pick up that could be more sinister, I think it just gets really missed. (P 2)

It can have chronic adaptation, which can result in long-standing symptoms which then impact on quality of life. The symptoms can be wide ranging, not just those on the Nijmegen Questionnaire, but actually, ones that extend beyond that, and then they impact on people's quality of life. There can also be people who presented to a hospital with chest pain, or people who've presented to multiple health agencies with different symptoms collectively around a particular organ, so maybe the digestive system. They will be fully investigated and then referred on, because all their investigations are essentially non-conclusive or normal.... Often, they'll have acute and chronic adaptation. So that's one group. The other group are specifically people who have a disordered breathing pattern which stems from asthma, and they're quite different to other people who maybe have stress and/or worry or mood-related dysfunctional breathing, and that stems from an altered breathing pattern which is as a result of their asthma. And they have been referred generally through different health services and been investigated, and been found to have non-conclusive investigations. (P 3)

It's starting to change, but in primary healthcare overall, I think it's just completely overlooked. If it's not pathological, it's fine. And so there's that. Within that 'it's fine' bracket, there are a huge range of perfectly functional or completely dysfunctional, they just haven't been diagnosed with the pathology yet. That makes it really hard to pick up so people aren't necessarily looking for it. Not aware that, that it can be something that leads to a large number of issues. (P 1)

It was expressed that diagnosing a patient with some form of DB may become fairly subjective as it was felt amongst all participants that there is currently no reliable clinical test available. However, although diagnosis may be subjective, several participants stated that if knowing what to look for, it should be very obvious that DB is present.

No, there's not one reliable test.... So, it's a combination of.... Yeah, it's a combination of things that brings you to.... It brings you to a picture.... It is actually quite obvious within the first five to 10 minutes.... Yeah, so it's really there. It's not something that you suddenly go, 'I think it might be.' If you do an assessment, and you look at them and they do have disordered breathing you'll find it straight away. (P 5)

The vast majority of patients where if breathing is involved you usually.... I think I pick it up fairly quickly. (P1)

Absolutely. I've never, since I moved to New Zealand, I've never known a population where I can see it so readily. And I've worked in hyperventilation back in the UK. And again, over here, I find it's a lot more symptomatic and I see people from the age of seven upwards.... But essentially, when you start seeing young people who have issues coping, and in these particular scenarios, there were issues of stress. But to be symptomatic at age seven, it doesn't bode well. (P 3)

And I think some people have very much underscored in the Nijmegen Questionnaire, and there was a recent review of the validity of the Nijmegen Questionnaire.... There's flaws when it's always self-reported and some people don't have all of those symptoms, some people have underscored. (P 3)

Drawing from the participants' own experiences, it was expressed that it can be difficult to assess someone's breathing when they become aware that you are doing so. Although an automatic function and often done so with little consciousness, it was mentioned that breathing is an intimate experience and patients can begin to alter their breathing due to feeling nervous and self-conscious when being assessed. In addition, the participants have observed that if a patient has had previous breathing re-training to some extent they will also change from their 'normal' breathing which may still be dysfunctional, to how they think they should be breathing, further disguising their DB. A practitioner with advanced expertise and education in the area of DB, however, is able to assess a patient's breathing without revealing what they are doing, as discussed by a number of the participants.

Trying to make sure the patient doesn't know what you're doing. I feel that's the biggest one. And it's fine for the first time you see them but from that point onwards you're screwed because they know what you're doing.... So the way I've gotten around that is now I don't assess breathing at the same point in the appointment for those patients where I think it's really important to see where they're at. And so whether I do it whilst I'm taking the case history, just looking at them breathing whilst I'm examining, whilst I'm treating them, I might just vary it around, and that seems to get over that mostly. (P1)

It's like I feel that if we have too many things where you can objectively measure, I just think that sometimes that means that people get stuck into am I doing it right or wrong and I think that makes them more anxious. (P 2)

If a client has been before to a physiotherapist and had some breathing work.... They often can change. It's very, very subtle, so their breathing has come into their conscious mind. So, as soon as you start assessing it, they will.... They will be able to change what they do. So then, it might be harder to define what they are doing in their everyday life and what they're doing when they're right in front of you. (P 5)

Well, what I think is that it's always rating someone against normal. So, the problem with that.... Assessing someone's breathing is quite an intimate experience for them and for you. And a lot of what goes on with people, with breathing is that they begin to judge themselves, so if you are assessing someone against what is normal breathing, that they know that there's dysfunction and disorders.... So one of the challenges is it brings with it quite a judgemental sort of attitude about themselves, that they're always measuring themselves up against normal. So, to me.... I'm not probably a classical physio in that way. So I don't particularly like measuring people against a normal. (P 5)

Getting people to relax, getting them to breathe. Trying to assist them breathing like they normally would breathe. I'm a patient in the osteopathic clinic and I've gotta be perfect and brilliant that type of thing. That's the problem cause as soon as you talk about it, everyone's conscious of it. (P 6)

Re-establishing a mind-body connection

It was identified by all the participants that patients are often not conscious of their breathing and they have very little awareness and connection to their own body in general, which was felt to play a part in a delayed diagnosis initially and can lead to difficulties in treatment.

Body awareness is a pretty big one. So it's really hard to teach someone how to breathe when they have absolutely no idea which part of their body to use or how to use it. (P 1)

So, to get someone to be very focused on their breathing when they've really never even thought about their breathing, brings with it the challenges, and some of it is reconnecting that. (P 3)

One of the most difficult aspects of managing a patient with DB was identified as trying to get the patient to understand how their breathing may be contributing to some or all of their symptoms.

Breathing is automatic and unconscious so patients are like, how can breathing.... How can changing my breathing.... Why would I need to? (P2)

Essentially it's the fact that people don't necessarily accept the fact that you need to assess their breathing. And that branches into the more rare, "What are you doing looking at my breathing? I'm coming in for headaches. Just look at my head. (P 1)

The next biggest thing is trying to convey how important it is, or how easy it can be to make a big difference. And that's probably the hardest thing. (P 6)

If someone comes in and they've had, let's say chronic pain for five years, and they've seen two or three other therapists and had lots of hands on and when I assess them, I think, right, I hear all that and think, okay, nothing lasts and I can see that their breathing pattern is driving in a sympathetic stage, you're wound up. And all their pelvis and thoracic stability is being altered because of their breathing pattern and their diaphragm. Then the difficulty is trying to help the patient understand that actually they need to be more aware of themselves in noticing and that this will have an effect on their whole system. (P 2)

Education on the 'why' and the 'how' was said to be the first steps to building a mind-body connection that will allow patients to start engaging with their bodies and, in turn, their breathing. In addition, the manner in which this is taught must resonate with the patients personally to be relevant.

Everyone takes breathing for granted and almost everybody has some issue going on with it and it is really, really productive to educate them about what's going on with their breathing. (P 6)

Some of that is also responding to the learning style of the person. So, when I've had people who've been very linear learners, they want to know exactly how it's all linked together, and they physically can't move on, or rather psychologically can't move on until they found peace with the understanding. Other people are a lot more visual and need to have a visual picture of what's happening. (P 3)

And if they are of a personality where they like quick fix and it's what they've been doing, then it's hard to sell it to them. And because they have to notice their body. And quite often, people don't like their body. You don't want to notice something and become aware of something you don't like. So with all of that, you have to have a healthy love and respect for your body even when it's hooting, or a bit overweight, don't you? To be able to kind of tune in to it and care for it.... And so, breathing makes you very aware of your feelings and often things like that. And so that's the difficulty is I think when people don't want to be that aware of actually what's really going on for them, they will really resist. (P 2)

But often I start in just a simple manner initially and I think basically, trying to make people mindful of what they're doing so that they understand the purpose of why they're doing it and then it's more likely to stick. (P 4)

After educating the patient on the importance of their breathing and how it may be relevant to their symptoms, the participants explained how introducing a mind-body connection was a process that started with self-observation and progressed towards a mindful approach to breathing retraining.

I might say "Oh what did your breath do?" And they'll go "Oh, I don't know." Then I'm doing that to get them aware that they don't know what their breath is doing.... Just dropping in a bit of awareness. And then, I'll likely say something else and say oh what did your breathing do, "Oh I held it". And I'll go 'Good. Good noticing.' And don't say good or bad. Just 'good noticing.' And then I might get them to do a twist or something like that. And just see what they do and again you know, with the stiffness, thoracic spine and I might, if they turn they go "Oh yeah that hurt". So I'm like "Okay, just breathe. I want you to breathe out as you do that movement again and just see what happens". And they go "Oh it didn't hurt. Sometimes it still hurts."

Or they'll go "Oh, I got further." Sometimes you have to get it out of them but generally they'll realize "Oh when I breathe out or let my breath happen, I move better I move further, the pain is gone." So, if I know they've got a breathing pattern that I'm going to need to work with but they've come in for something else, I want them to have an idea that breathing is intimately linked with them having better movement, better function and it could be quite connected with their chronic pain sometimes. (P 2)

Well, generally, often, the biggest problem with breathing is that many people, when they're trying to go through and do it as an exercise, they're not mindful about it, so they kind of.... They'll just do some panting and rush through something. So it's about actually stopping, taking a minute or two to be involved in the process, do it before and after assessment and just try and establish some perspective. So it could be as simple as breathing in through your nose and out through your mouth, because they just often don't do that. So sometimes, you just start with something simple and then it might progress to other things such as lying down, going through the whole process of letting your arms relax and sort of a relaxation process involving the breathing patterns and bits and pieces as well. (P 4)

So after the assessment, the intervention starts out really slowly, so it's about identifying one thing, possibly that is changeable. So that may be the movement of the diaphragm. It may be the mouth breathing or the nose breathing. It may be the accessory muscle breathing or the hyperinflation of the chest or the backup movement. (P 5)

Participants described a process of slowly introducing newly learned breathing patterns into different static and dynamic positions once the patient has established a mind-body connection and is now able to be mindful in their tasks.

Then slowly bringing in all the other factors so it becomes a multi-tasked situation. So it starts with a simple task, an achievable task. So, something that is achievable for the client in terms of their breathing in a very easy, comfortable position. So, what we're looking for here on my work is to give as much support as needed for the person to breathe well. Emotional support, life support. So as much support as that

person needs to breathe well with you and then to take that breathing outside the clinic and practice in a supportive, comfortable position so they can start to experience what normal breathing is. Even if it's only for moments at a time. So for me it's about bringing the subconscious into the conscious. And becoming aware of it, and noticing it and then training it, and over time, so increasing the amount of time that somebody can comfortably do something and push them through a threshold of being slightly uncomfortable until they become comfortable. So that starts in all positions.... So when I'm talking about support, I mean physical support but also verbal support and manual support. (P 5)

Furthermore, it was argued that once a patient has learned how to consciously reconnect and engage with their breathing they are much more able to manage their breathing in future when they notice themselves reverting to DB.

But generally, once a person is trained, they can recognize. So if they have been progressed.... So they need to get to that point where it starts to really make a difference for them. So if you can progress them that far, then I don't think they have relapses quite the same way. They might have a mild relapse but they could probably manage it themselves. Yeah. They'd not need to see a therapist. (P 5)

The majority of people don't present again. I'd say there's been less than a handful that have re-presented. The majority of people might need a top up.... If they'd managed to sustain, and they've also bought into it, they're engaged, they're motivated, they've perceived and felt, and observed the positive changes, then you'll often find that they're motivated to continue on their pattern. I had somebody the other day, said, "I've started to get a little bit of that chest pain, so I checked my breathing, and I mentally went through the Nijmegen Questionnaire, and I knew it was because I was anxious because of this meeting.... It's not just the symptom, it's the context of the symptom. Then they can look towards how can they manage it, and this person said, "Then I did some of that breathing, and it all went away." So, again, you're giving them survival coping strategies, because a normal response to stress is what they have been doing. It's just, it hasn't gone away, and back to normal. (P 3)

I think they're more likely to know what to do. I think most patients that have at least techniques for things like calming down and for when they feel short of breath or something and they come in, say for something else and they say it in the conversation, "Oh I was gonna come and see you about my neck, but I did those breathing exercises and it was all good." Kind of thing.... Education is a big part of osteopathy I think. So, they'll really adopt those things they find that work. They do. If they find they work, they certainly take them on. (P 6)

So yeah, generally just start with the simple one and then work up to it, if relaxation and stress and anxiety are a component, so you kind of have a little bit more of a whole body approach as well. (P 4)

A multifaceted approach is key

Although participants were all trained in manual therapy modalities, each emphasised the need for a multifaceted approach to treatment and management of a patient with DB. Treatment discussed included manual therapy, counselling, relaxation techniques, mind-body techniques, and breathing retraining/exercises.

I think there's a general approach of which there's.... I suppose there's multiple tools in the tool kit, and then it depends on which one is needed at the time. For some people, at different points in time of their management, they might need relaxation techniques. They might need that before we do the breathing techniques, and they might not need it. (P 3)

So, because there are so many components that can contribute to it. I can't do everything; I don't want to do everything, it's not my obligation to do everything. But I have an obligation to help people find answers if I can't provide them, and if there are more appropriate ones and more appropriate solutions, so multi-pronged, whatever is of relevance and pertinent to what the presentation is. (P 4)

So the first bit of the retraining: The retraining and the physical treatment happening side-by-side. I suppose the next bit of the treatment plan then, because at that point we've hopefully got the symptoms either on their way to decreasing, or mostly under control, is to both look at breathing retraining and removal of any physical

obstacles.... To see if there's anything that needs changing from there. So, let's take that same person with the headaches, the reason they're an upper rib breather is because they smoke, then it's going to affect my treatment as I'm going to take into account the fact that their prognosis is gonna be much bigger. As part of their breathing retraining, I'm gonna try and see if I can get them to quit smoking, it's easier said than done. (P 1)

I think it absolutely needs to be both. Yeah, I mean, I think hands on is very healing. And I... And I love.... I actually, why I love treating the breathing is that such a beautiful adjunct to someone who's come in with headache, chronic pain or shoulder pain because it can be such a driver. (P 2)

It was acknowledged that breathing is a complex function inherently interwoven into almost if not all aspects of one's physical and mental being and as a result needs an intervention that can address multiple facets and is specific to individual needs. Psychological factors such as stress, anxiety, fear, and everyday life were discussed as playing a role in someone's breathing pattern.

I think more so now in the last five years, our experience and now emotions are intimately connected with how we feel and how we breathe.... So, I think that it can certainly come from any experience that's deemed stressful, fear, anxiety, changing schools. So anything that's change.... Anything that's deemed stressful to a person. (P 2)

A poor breathing pattern.... What we call a breathing pattern disorder that's impacting on somebody's life and their well-being, their ability to manage and cope with the tasks, with their life. So that could be due to the stress and anxiety that's provoked around the breathing pattern, or it could be due to lack of physical ability to move or participate. So, it can sort of be like a combination of both or just one or the other. (P 5)

And that's partly why I try to use mindfulness techniques with my breathing retraining as well. So I do a combination of mindfulness and breathing retraining. So that helps and gives the person a way of learning to cope with their stress but also becoming

present to their body and improving their body awareness. So, that combination of therapy actually works very well with the people's breathing disorders. (P 5)

All participants felt as though it would be difficult for a patient to attempt to resolve their DB unassisted by some form of trained healthcare practitioner. It was expressed that the most important aspect of a patient practitioner interaction at this point was to provide the patient with hands-on feedback and very specific cueing, further establishing a mind-body connection.

I've known people to try but I think that's very hard to do on your own. Quite hard to do on your own. And even when you look at a lot of what's going on in yoga and Pilates classes, people are doing breathing in those classes but there's no hands-on or touching or identifying or feedback for the patient, particularly about what they're doing. So because there's no actual feedback from someone else touching the person, they don't really understand what it is that is efficient and effective breathing. (P 5)

I think if it's become habitual and I think once you start getting adaptive muscle shortening, I think as much as they might want to, I don't think they'd be able to and I don't think they could do. Because what they perceive..... A lot of people talk about tummy breathing and say "I've gone online, I've looked it up and I've been tummy breathing" and all they've been doing is shutting out their abdominal muscles and contracting and relaxing, and it's not linked to their breathing. So I think generally, people.... Once you've started getting physiological and mechanical adaptation, I think as much as they might want to, I think it's very difficult to, and I think some of the interpreting.... Some of the interpretations of what's available online for people to look up, even read about, is not necessarily best. (P 3)

And I don't think anything really beats that one-on-one feedback where people can respond, you can check what they're feeling, you can build on an increased awareness of their breathing, and I think with that comes improved practice and then improved long term strategies to cope. (P 3)

My sense is you actually do need a little bit of gentle direction from someone skilled and you need to have an understanding of what the diaphragm feels like when it moves up and down. (P 2)

I guess they could do a certain amount, but I think with breathing just having someone objectively cueing you about what you're doing is really useful. It would be hard, much harder to do. Cause the cueing side of things is really important because so often people don't know what's moving and what isn't. I kinda of just say, "Breathe into the back of your ribs" kind of thing, people go, "What do you mean?" I think it would be quite hard to do it on your own. You could certainly give it a go, but I don't think that would be optimum. (P 6)

Participants stated that changing someone's breathing pattern is not instant but rather it requires high patient compliance involving self-discipline and sometimes stepping outside one's comfort zone. Additionally, guidance from a qualified health practitioner who has experience treating DB is essential.

Usually, if you do the physical treatment without the retraining, your effects are gonna be limited. If you do the retraining without the physical treatment, then you're usually going to achieve excellent results, but it might take longer, because the body has to cope with the breathing, and then try and revert the changes. So as long as there isn't anything else that's causing those changes to be there, if breathing is the only predisposing maintaining factor, then they'll eventually get there, but the keyword there is "eventually." So one doesn't do as much, but does it quickly, the other one does usually all of it, but slowly. So the best results is when you do both. (P 1)

So from my perspective, it's recognising when we might need to involve the health psychologist, and from their perspective, it's a.... If they're not getting the response or if they feel they're not working with the people on their breathing effectively, then again, referring. So we'll have this connectivity to the patient benefits. (P 3)

Symptoms of DB Described by Participants

Watch for	Feel for	Listen to
Mouth breathing, holding their stomach in, laboured breathing, and asymmetry when breathing.	Restricted range of movement in the rib cage, in particular the lower rib cage.	Listen to the patient's story. They may describe always rushing, always being "on the go", and feeling anxious. They may describe chronic pain, in particular neck and back pain. They may describe having had asthma or allergies such as hay fever as a child and/or an adult.
Posture: kyphotic thoracic region, elevated shoulders, the head/jaw held forward, standing very erect, and the shape of the chest (e.g., hyper inflated/barrel chest due to holding the breath). Lifted through the upper chest and sits on the edge of a chair as they are "zipped up".	Hypertonic scalene, sternocleidomastoid, and trapezius muscles with elevated shoulders. There may be widespread muscular hypertonicity often including the rhomboids, diaphragm, and abdominals.	The patient may describe a sense of unease, chest tightness, and/or unusual sensory symptoms (e.g., in the extremities and around the mouth).
Breath holding making exhalation more difficult often resulting in a short exhalation.	Poor circulation (e.g., cold hands and feet).	How a patient talks through their breathing. They may be out of breath when speaking and sigh frequently.
Where there is movement when breathing (e.g., upper or lower ribs) and what the ratio is between inspiratory and expiratory (e.g., short expiratory rate compared to the inspiratory rate).		Patients may describe intense emotions such as feeling anxious, stressed, overwhelmed, and fatigued.
The rhythm and speed of the breath (e.g., regularity, pace of the breathing, the difference between the inspiration and expiration, and		The noise made when breathing (e.g., the smoothness and regularity).

the presence of a pause between breathing phases).		
Dry appearance to the skin and poor circulation (e.g., cyanosis).		
Patients may display intense emotions (e.g., anxious, stressed, overwhelmed, and fatigued).		
Possibly wearing tight clothing.		

Example of My Working Diary

What happened	Reflection
<p>21/08/2014</p> <p>I met with one of my supervisors today to discuss my interview process. My second supervisor joined us for part of the meeting. Another tutor who is a practising osteopath also joined the conversation briefly.</p> <p>Outcomes after discussion:</p> <ul style="list-style-type: none"> • Create poster for breathing course being held on Wed 10th Sep advertising my research – use the course to recruit participants • Use the information given at the breathing course to is some part guide my questions I will put together for my interviews • I may have to sit in the participants practice for half a day until a patient presents with thoracic/breathing dysfunction as I need to observe/video the initial consultation between the patient and practitioner so that the practitioners clinical reasoning is taken from the exact time they came to their reasoning. • I need to note my previous assumptions/beliefs on the topic so that I can 	<ul style="list-style-type: none"> • After a discussion with my tutor (osteopath) it was discovered that observing patients with thoracic musculoskeletal dysfunction without dysfunctional breathing, may also be useful to my study – Why do they not present with dysfunctional breathing if they clearly have thoracic dysfunction? • He also mentioned that his practice is located in a business area and therefore sees a lot of patients with neck and back issues. This gave me some insight into where might be appropriate for me to seek participants. • Is dysfunctional breathing an underlying cause for other symptoms or is it a symptom of another underlying cause? Or can it be both?

<p>conduct and interview/analyse/reflect objectively.</p> <ul style="list-style-type: none"> • I need to practice interviewing someone else before my first interview with a participant. • Two possible participants I need to approach are <p>04/09/2014 – Breathing workshop</p> <p>10/09/2014 – Breathing Course at Unitec</p> <p>25/02/2015 – Request to ethics to make amendments to research</p>	<ul style="list-style-type: none"> • Attended a breathing workshop at AUT. The workshop was run by a physiotherapist who has an interest in DB. I was able to discuss my research with the physiotherapist running the workshop and she agreed to be my first participant in my research. • This evening I attended a breathing course at Unitec that a number of speakers presented at. From this I was able to go back to my interview questions I had put together and refine them. It also gave me a few ideas of things to include in my literature review (e.g., psychological relationships to breathing, different treatment approaches, diagnosis). <ol style="list-style-type: none"> 1. Originally there were two phases to this research project, the research will now only include one phase. The first phase involved the researcher (myself) observing and video recording a total of three osteopaths and/or physiotherapists treating three patients that displayed possible signs and symptoms of dysfunctional breathing. This was to be followed by an interview discussing the practitioners clinical reasoning behind the specific treatment they had just given in addition to a wider interview with the focus on their thoughts of dysfunctional breathing as a whole and their approach to assessment,
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	<p>diagnosis, treatment, and management of symptoms that coexist with dysfunctional breathing patterns that cannot be attributed to a specific medical diagnosis. The change I would like to make will now see me explore three different professions, including osteopathy, chiropractic, and physiotherapy with the intention of comparing different or similar approaches that may be used within the three professions. It will still include the same format of interview regarding the practitioners' thoughts on dysfunctional breathing and their clinical approach. It will however no longer involve participation of any patients as they were only peripherally involved in the original study and have been deemed not essential for the intended purpose of this research. The research project will now solely be based on in depth interviews that will involve myself interviewing six therapists in total, two from each respective profession.</p> <p>2. The second phase was to involve a survey that would have required a second ethics proposal that had not been submitted as yet, however, this will no longer be required due to an increase in the proposed number of practitioners being interviewed.</p> <ul style="list-style-type: none"> • Permission to remove patient involvement from the study is being sought as it has proven to be difficult to find patients that were suitable for the study as it may not be apparent that dysfunctional breathing patterns are present until a number of treatment sessions have passed, as this is often not a patients first presenting complaint. Due to this, I thought it best to exclude patient involvement, so not to delay my data collection, as the main focus of the
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<p>18/03/2015</p> <p>March/April 2015</p> <p>18/04/2016</p> <p>13/06/2016</p>	<p>study is the practitioners' thoughts and approach to dysfunctional breathing patterns and therefore it is not necessary to have patient involvement to obtain this data. Furthermore, I believe there is value in comparing different manual therapy professions to gain a broader perspective of dysfunctional breathing patterns and how they may be best managed.</p> <ul style="list-style-type: none"> • Amendments to my proposal have been accepted by the ethics committee. • Over this period, I have sent emails to a number of chiropractic clinics based in the Auckland area and have had no reply. I have also contacted the New Zealand College of Chiropractic to seek interest from tutors/chiropractors and I have also had no response despite following up twice. • Due to no response from a single chiropractor I will focus only on osteopaths and physiotherapists moving forward. • I completed my first interview today and it went really well. I think I have collected some great data and I am confident moving forward that I will be provided with more interesting and informative data. • I completed my last interview today. Without having deconstructed all my data thoroughly yet, I can say from memory that I was surprised at how similar osteopaths and physiotherapists approach DB in their patients. I am not sure what differences I was expecting to find but I thought there may have been some more obvious differences.
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<p>20/08/2015 – Meeting with my secondary supervisor</p> <p>Points from today’s meeting:</p> <p>Writing: Data Analysis; Interpretation of meaning; Discussion (so what)</p> <p>Themes: Two to three themes (I will aim for three) with possible sub themes.</p> <ul style="list-style-type: none"> • Explore theme titles that will catch people’s attention • Have a look at other journal articles to find a structure/layout that works for me. <ul style="list-style-type: none"> ○ Example: I could include a quote and then write about it or vice versa. ○ The structure should be consistent throughout to allow readers to remain engaged and retain the information they are reading with ease. • When writing about the themes I can include my opinion or view of the findings but in a way that shows I am being guided by the data I have collected. <p>Discussion: This will include more referencing so to compare my findings with other research.</p> <p>Post Discussion: Application to practice; Usefulness for education; Further research.</p> <ul style="list-style-type: none"> • Continue with my journal (methods, rigour) • Start putting together pieces of work that demonstrates my brain storming (this may include a number of versions of one piece of work). • I need to show that I have used a formula/method to dissect my information and explore themes (e.g., Tracy). 	<ul style="list-style-type: none"> • This morning I had a meeting with my supervisor to discuss the process of my data analysis and writing up my findings. This was extremely helpful as I now have a clear path identified as to where I need to go from here and it sparked some more enthusiasm to get stuck into writing as I had hit a little bit of a wall. • I have also realised that I have not been keeping enough hard copies of the brainstorming I have been doing. I find that as I start working though everything my brainstorming just happens organically and I change my approach or process as needed without making note. I will endeavour to brainstorm in hardcopy from here on. • I have found that my initial research question (“What is current clinical practice when the presence of dysfunctional breathing may exist in a patient?”) has been answered but in a much different way than I had expected, which in fact has provided me with fuller descriptions. For example, some of the interview questions I had expected to provide fuller descriptions did not. In contrast, questions I did not expect to provide as deeper understanding of the phenomenon became the most relevant and interesting. As a result, I have gone back to my working question and have changed it from “What is current clinical practice when the presence of dysfunctional breathing may exist in a patient? A qualitative interpretive descriptive study” to “What is current clinical practices, experiences, and perspectives of healthcare practitioners who attend to dysfunctional breathing: A qualitative study.”
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Appendix K: Nijmegen Questionnaire

Please tick how often you suffer from the symptoms listed.

	Never 0	Rare 1	Sometimes 2	Often 3	Very often 4
Chest pain					
Feeling tense					
Blurred vision					
Dizzy spells					
Feeling confused					
Faster and deeper breathing					
Short of breath					
Tight feeling in chest					
Bloated feeling in stomach					
Tingling in fingers					
Unable to breathe deeply					
Stiff fingers or arms					
Tight feelings around mouth					
Cold hands or feet					
Palpitations					
Feelings of anxiety					

Scoring the Nijmegen Questionnaire

To score add numerical value of each answer. Cut- off of both 20 and 22 have been used to categorize individuals as having DB (Courtney, Greenwood, & Cohen., 2011; van Dixhoorn and Duivenvoorden, 1985).

Courtney, R., Greenwood, K. M., & Cohen, M. (2011). Relationships between measures of dysfunctional breathing in a population with concerns about their breathing. *Journal of Bodywork and Movement Therapies*, 15(1), 24-34.

Van Dixhoorn, J. & Duivenvoorden, H. J. (1985). Efficacy of the Nijmegen Questionnaire in recognition of the hyperventilation syndrome. *Journal of Psychomatic Research*, 29, 199- 206.

Appendix L: Self Evaluation of Breathing Questionnaire

	0 – Never or not true at all	1 – Occasionally a bit true	2 – Frequently mostly true	3 – Very frequently Very true
I get easily breathless on physical exertion out of proportion to my fitness	0	1	2	3
I get breathless even when resting	0	1	2	3
I get breathless when I am anxious	0	1	2	3
I get short of breath or very tired when reading out loud or talking a lot	0	1	2	3
I feel breathlessness in association with other physical symptoms	0	1	2	3
I feel that the air is stuffy, as if there is not enough air in the room	0	1	2	3
I feel I cannot get a deep or satisfying breath	0	1	2	3
I can't catch my breath	0	1	2	3
My breathing feels stuck, restricted	0	1	2	3
I Feel that my ribcage is tight and can't expand	0	1	2	3
My clothing often feels too tight or uncomfortable around my chest	0	1	2	3
I sigh, yawn or gasp	0	1	2	3
I find myself holding my breath at various times	0	1	2	3
I notice myself breathing shallowly using my upper chest and shoulders	0	1	2	3
I notice myself breathing quickly	0	1	2	3
I notice myself mouth breathing	0	1	2	3
I have trouble co-ordinating my breathing when I am speaking	0	1	2	3
I notice myself breathing irregularly	0	1	2	3

Courtney, R., Greenwood, K. M., & Cohen, M. (2011). Relationships between measures of dysfunctional breathing in a population with concerns about their breathing. *Journal of Bodywork and Movement Therapies*, 15(1), 24-34.

Appendix M: Rowley Breathing Self-Efficacy Scale

This questionnaire considers how controllable your symptoms are. It provides information helpful for focusing your treatment on what would be useful for you. There are no good/bad or right/wrong answers. Circle the number that best describes how confident you feel for each statement.

The guidelines for the number are:	1	2	3	4	5	6	7	8	9
	Not at all				Very				
	Confident				Confident				

How confident are you that you can:	1	2	3	4	5	6	7	8	9
1. Do the tasks you need to without being affected by your symptoms									
2. Talk without being affected by your symptoms									
3. Enjoy recreational activities without being affected by your symptoms									
4. Feel calm and achieve a good breathing pattern when you want to									
5. Identify what triggers your symptoms									
6. Improve your symptoms with what you do									
7. Manage your symptoms (without introducing medication) in the future									
8. Go into situations that might bring on your symptoms, and still control these symptoms									
9. Improvements you make by improving your breathing will be useful and valuable									
10. Persist at improving your breathing pattern, even on bad days when it is difficult									

Mood:									
The guidelines for the number are:	1	2	3	4	5	6	7	8	9
	Very low				Very				
					Positive				

	1	2	3	4	5	6	7	8	9
My mood today									
My mood over the last six months (generally)									

Comments: (optional, if you want to add anything to the information above):

Rowley, J., & Nicholls, D. (2006). Development of the RoBE self-efficacy scale for people with Breathing Pattern Disorders. *NZ Journal of Physiotherapy*, 34(3), 132.

Appendix N: International Journal of Osteopathic Medicine Submission Guidelines

Specific Guidance for Original Research Articles

Please note that *IJOM* allows authors to submit 'in their own style' and that if accepted, required adaptations to their style will be addressed.

The text of **original research** for a quantitative or qualitative study is typically subdivided into the following sections:

Introduction. Describe the wider context of the topic and its relevance providing selected citations that evidence and underpin the context. Identify key relevant research and briefly describe the strengths and weaknesses of past work and identify the gaps in the literature and key questions that are pertinent to the topic and practice. Build on this descriptive account to establish an argument for the manuscript's focus and end the introductory section with the aims of the research that is being reported and or the research questions.

Materials and methods. Describe your selection of observational or experimental participants (including controls). Identify the methods, apparatus (manufacturer's name and address in parenthesis) and procedures in sufficient detail to allow workers to reproduce the results. Give references and brief descriptions for methods that have been published but are not well known; describe new methods and evaluate limitations.

Indicate whether procedures followed were in accordance with the ethical standards of the institution or regional committee responsible for ethical standards. Do not use patient names or initials. Take care to mask the identity of any participants in illustrative material.

Results. Present results in a logical sequence in the text, tables and illustrations. Do not repeat in the text all the data in the tables or illustrations. Emphasise or summarise only important observations.

Discussion. Emphasise the new and important aspects of the study and the conclusions that follow from them. Do not repeat in detail data or other material given in the introduction or the results section. Include implications of the findings and their limitations, and include implications for future research. Relate the observations to other relevant studies. Link the

conclusion with the goals of the study, but avoid unqualified statements and conclusions not completely supported by your data. Recommendations, when appropriate, may be included.

Conclusion. A summary of the pertinent findings and, relevance of the study and implications of the study for future research.

Appendices. In addition to containing information regarding Acknowledgements, Appendices may also be used to publish supplementary files online, to which a reference should be made in the printed article.

Considerations Specific to Types of Research Designs

Manuscripts are required to adhere to recognized reporting guidelines relevant to the research design used. These identify matters that should be addressed in your paper. These are not quality assessment frameworks and your study need not meet all the criteria implied in the reporting guideline to be worthy of publication in the journal.

To improve the quality of reporting of other categories of research, the *IJOM* supports the initiatives available through the **EQUATOR Network** (Enhancing the Quality and Transparency Of health Research) which houses a database of all reporting guidelines for health research (<http://www.equator-network.org>). All authors of research articles and reviews are required to complete and submit a checklist from the appropriate reporting guideline together with your paper as a guide to the editors and reviewers of your paper. The checklists for each reporting guideline can be found on the EQUATOR website.

Reporting Guidelines Endorsed By The Journal Are Listed Below:

Observational cohort, case control and cross sectional studies - STROBE - Strengthening the Reporting of Observational Studies in Epidemiology <http://www.equator-network.org/index.aspx?o=1032>

Quasi-experimental/non-randomised evaluations - TREND - Transparent Reporting of Evaluations with Non-randomized Designs <http://www.equator-network.org/reporting-guidelines/improving-the-reporting-quality-of-nonrandomized-evaluations-of-behavioral-and-public-health-interventions-the-trend-statement/>

Randomised (and quasi-randomised) controlled trial - CONSORT - Consolidated Standards

of Reporting Trials <http://www.equator-network.org/index.aspx?o=1032>

Study of Diagnostic accuracy/assessment scale - STARD - Standards for the Reporting of Diagnostic Accuracy Studies <http://www.equator-network.org/index.aspx?o=1032>

Quality Appraisal of Reliability Studies - QAREL

Consensus-based Clinical Case Reporting Guideline Development – CARE - <http://www.equator-network.org/reporting-guidelines/care/>

Systematic Review of Controlled Trials - PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses <http://www.equator-network.org/index.aspx?o=1032>

Systematic Review of Observational Studies - MOOSE - Meta-analysis of Observational Studies in Epidemiology <http://www.equator-network.org/index.aspx?o=1032>

Qualitative researchers might wish to consult the guideline listed below:

Qualitative studies - COREQ - Consolidated criteria for reporting qualitative research. Tong, A., Sainsbury, P., Craig, J., 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care* 19 (6), 349-357.

<http://www.emgo.nl/kc/Analysis/statements/COREQ.pdf>

Specific Guidance for Protocols

Organisation of a protocol. The following need to be adequately addressed.

- Title
- Abstract/Summary - this should provide a concise description of the purpose of the Protocol and should not exceed 200 words.
- Background, including rationale and any previous systematic review(s).
- Keywords - provide 4-10 keywords.
- Principal investigator(s); contact details.
- Aim(s).
- Design (randomised, double-blind) - including inclusion and exclusion criteria; intervention(s)/method; primary and secondary endpoint(s); side-effects reporting and

quantification

- Statistical analysis - including sample size and power calculations; type of analysis; statistical testing.
- Ethical issues - including ethics committee approval; informed consent form and information sheet.
- Publication plan.
- Time required - an estimation of the time required to run the protocol should be given per separate step and for the whole protocol, including reporting.
- Funding source(s).
- References.

Language (usage and editing services)

Please write your text in good English (American or British usage is accepted, but not a mixture of these). Authors who feel their English language manuscript may require editing to eliminate possible grammatical or spelling errors and to conform to correct scientific English may wish to use the English Language Editing service available from Elsevier's WebShop (<http://webshop.elsevier.com/languageediting/>) or visit our customer support site (<http://support.elsevier.com>) for more information.

Submitted papers should be relevant to an international audience and authors should not assume knowledge of national practices, policies, law, etc. Authors should consult a recent issue of the journal for style if possible. Since the journal is distributed all over the world, and as English is a second language for many readers, authors are requested to write in plain English and use terminology which is internationally acceptable.

Abbreviations. Avoid the use of abbreviations unless they are likely to be widely recognised. In particular you should avoid abbreviating key concepts in your paper where readers might not already be familiar with the abbreviation. Any abbreviations which the authors intend to use should be written out in full and followed by the letters in brackets the first time they appear, thereafter only the letters without brackets should be used. Statistics - Standard methods of presenting statistical material should be used. Where methods used are not widely recognised explanation and full reference to widely accessible sources must be given.

References. There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the pagination must be present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct.

Formatting requirements. There are no strict formatting requirements but all manuscripts must contain the essential elements needed to convey your manuscript, for example Abstract, Keywords, Introduction, Materials and Methods, Results, Conclusions, Artwork and Tables with Captions and "Contribution of Paper" (where applicable).

If your article includes any Videos and/or other Supplementary material, this should be included in your initial submission for peer review purposes.

Divide the article into clearly defined sections.

Figures and tables embedded in text. Please ensure the figures and the tables included in the single file are placed next to the relevant text in the manuscript, rather than at the bottom or the top of the file. Ensure that figures and tables are referred to in the body of the text and that they are clearly labelled.

All Submissions

The following documents are needed for all submissions.

Title page (with author details). This should include the title, authors' names and affiliations, and a complete address for the corresponding author including telephone and e-mail address.

Blinded manuscript (no author details). The main body of the paper (including the references, figures, tables and any Acknowledgements) should not include any identifying information, such as the authors' names or affiliations.

Covering letter. To the editor in which you detail authorship contributions and other matters

you wish the editors to consider.

What this paper adds. At submission stage, authors of reviews and original research articles are required to provide three to four bullet points outlining what the manuscript adds to the literature. This should succinctly and accurately summarise the key new knowledge resulting from the study along with the implications for clinical, educational or research practice as appropriate for the focus of the manuscript.

Manuscript Layout

The manuscript with a font size of 12 or 10 pt double-spaced with wide margins (2.5 cm at least) and number pages consecutively beginning with the Title Page. Depending on the paper type (see above) this should include the title, abstract, keywords, text, references, tables, figure legends, figures, and appendix. Microsoft Word or similar programme should be used. Please check your typescript carefully before you send it off, both for correct content and typographic errors. It is not possible to change the content of accepted typescripts during production.

To facilitate anonymity, the author's names and any reference to their addresses should only appear on the title page. Please check your typescript carefully before you send it off, both for correct content and typographic errors. It is not possible to change the content of accepted typescripts during production.

Text

The text of observational and experimental articles is usually, but not necessarily, divided into sections with the headings; introduction, methods, results and discussion. In longer articles, headings should be used only to enhance the readability. Three categories of headings should be used:

- major headings should be typed in capital letter in the centre of the page and underlined (i.e. INTRODUCTION)
- secondary ones should be typed in lower case (with an initial capital letter) in the left hand margin and underlined (i.e. Participants).

- minor ones typed in lower case and italicised (i.e. questionnaire).

Do not use 'he', 'his' etc. where the sex of the person is unknown; say 'the patient' etc. Avoid inelegant alternatives such as 'he/she'.

Essential title page information

- **Title.** Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
- **Author names and affiliations.** Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
- **Corresponding author.** Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. **Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.**
- **Present/permanent address.** If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

General Guidance

Abstract. Both qualitative and quantitative research approaches should be accompanied by a structured abstract of no more than 250 words. Commentaries and Essays may continue to use text based abstracts of no more than 150 words. All original articles should include the following headings in the abstract as appropriate: Background, Objective, Design, Setting, Methods, Participants, Results, and Conclusions. As an absolute minimum: Objectives, Methods, Results, and Conclusions must be provided for all original articles. Abstracts for reviews of the literature (in particular systematic reviews and meta-analysis) should include the following headings as appropriate: Objectives, Data Sources, Study Selection, Data Extraction, Data Synthesis, Conclusions. Abstracts for Case Studies should include the following headings as appropriate: Background, Objectives, Clinical Features, Intervention

and Outcomes, Conclusions.

Keywords. Include four to ten keywords in alphabetical order, which accurately identify the paper's subject, purpose, method and focus. These should be indexing terms that may be published with the abstract with the aim of increasing the likely accessibility of your paper to potential readers searching the literature. Therefore, ensure keywords are descriptive of the study. Use the Medical Subject Headings (MeSH®) thesaurus or Cumulative Index to Nursing and Allied Health (CINAHL) headings where possible (see <http://www.nlm.nih.gov/mesh/meshhome.html>).

Abbreviations. Avoid the use of abbreviations unless they are likely to be widely recognised. In particular you should avoid abbreviating key concepts in your paper where readers might not already be familiar with the abbreviation. Any abbreviations which the authors intend to use should be written out in full and followed by the letters in brackets the first time they appear, thereafter only the letters without brackets should be used.

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List: Number the references in the list in the order in which they appear in the text.

Examples:

Reference to a journal publication:

1. Thomson OP, Petty NJ, Moore AP. Reconsidering the patient-centeredness of osteopathy. *Int J Osteopath Med* 2012;**16**:25-32.

Reference to a book:

2. Cohen J. *Statistical power analysis for the behavioural sciences*. 2nd ed. Hillsdale, NJ: Laurence Erlbaum Associates; 1988.

Reference to a chapter in an edited book:

3. Patel VL, Kauffman DR. Clinical reasoning and biomedical knowledge: implications for teaching. In: Higgs J, Jones M, editors. *Clinical reasoning in the health professions*. 2nd ed. Oxford: Butterworth-Heinemann; 2000. P. 33-44.

For journal articles, the abbreviated title of the journal should be used. Authors should refer to the National Library of Medicine database for journal abbreviations (<http://www.ncbi.nlm.nih.gov/nlmcatalog/journals>).

Note shortened form for last page number. (e.g., 51-9), and that for more than 6 authors the first 6 should be listed followed by "et al." For further details you are referred to "Uniform Requirements for Manuscripts submitted to Biomedical Journals" (*J Am Med Assoc* 1997;**277**:927-934) (see also <http://www.nejm.org/general/text/requirements/1.htm>).

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