Nonpharmacological management of dyspnea
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Introduction
Dyspnea is a subjective sensation defined as an uncomfortable awareness or sensation of breathing. The term is used interchangeably in the medical literature with shortness of breath and breathlessness. It is a very common symptom described by patients with life-limiting illnesses [1] even if the disease process at hand does not directly involve the lungs [2]. The pathophysiology of dyspnea is complex and incompletely understood. The cerebral cortex integrates the various sensory (chemo-receptors, mechanoreceptors, and vagal afferents) and motor inputs along with cognitive and emotional factors. The symptom of dyspnea results when the integration of these factors equals the inability to meet the perceived demand.

The differential diagnosis is extensive, and underlying causes should be addressed whenever possible and consistent with the patient’s goals of care. There are many nonpharmacological interventions that can potentially change physiologic factors, emotional and cognitive factors, or both to ameliorate the symptom of dyspnea (Table 1). Additionally, case management (i.e. hospice or home health) and pulmonary rehabilitation programs may integrate many of these therapies.

Pulmonary rehabilitation
The goals of pulmonary rehabilitation are not only to improve pulmonary function but also to decrease pulmonary symptom burden (including dyspnea) and improve quality of life. Generally, these goals are achieved using a multidisciplinary team to educate the patient and family, provide appropriate exercise training techniques, and give psychosocial support. This type of program has the potential to address physiologic and emotional or cognitive factors. A 2006 Cochrane review concluded that pulmonary rehabilitation for patients with chronic obstructive pulmonary disease (COPD) relieves dyspnea and fatigue, improves emotional function, and enhances patients’ sense of control over their condition [3]. Pulmonary rehabilitation in the palliative care setting is reviewed in more depth in another article in this issue.

Case management
Although case management in and of itself is nonpharmacological, the goal is education and oversight of the total care plan, which often includes medical symptom management. An outpatient palliative care case management program was able to show less dyspnea interfering with activities of daily living after 12 months in the...
intervention group that included patients with heart failure, cancer, and COPD [4].

### Physiologic factors

There are many therapies that may influence physiologic factors and subsequently decrease the symptom of dyspnea. Historically, studies have focused on how these therapies change pulmonary function measurements. Studies are emerging which focus on how these therapies modify the patient’s experience by decreasing the symptom burden and increasing the quality of life.

Strengthening exercises are often the cornerstone of rehabilitation programs. In any type of lung disease, peripheral muscle weakness can be a component of exercise limitation. Low-intensity arm and leg exercises can eventually lead to decreased ventilatory demands and improve endurance. These effects are maintained only as long as the exercise is continued. This focus does not alter the lung disease but can decrease dyspnea and improve other outcome measures. A systematic review [5] of strengthening exercises after an acute exacerbation of COPD did not evaluate dyspnea directly but did show improved health-related quality of life. One study [6] showed that longer durations of strengthening exercises for COPD patients did improve dyspnea scores as well as health-related quality of life significantly more than shorter programs.

Neuromuscular electrical stimulation of the large muscles in the legs has been shown to improve dyspnea scores in patients with COPD who underwent the therapy for 4 weeks [7]. Clinicians may recognize the device as a transcutaneous electrical nerve stimulation unit that is often used to decrease the perception of pain. A similar unit can be used to stimulate muscle contraction. This therapy could be considered for patients too weak to do traditional strengthening exercises; however, it does have some practical limitations. Generally, sessions are part of a physical therapy program and provided in an office setting but can be provided at home with close supervision.

Theoretically, strengthening the muscles of respiration would improve airflow, allowing for better gas exchange and potentially better symptom control. Historically, complicated equipment is used to achieve normocapnic hyperpnea and subsequent strengthening of the muscles of respiration. Some studies [8,9] suggest improvement in dyspnea scores using this type of equipment in pulmonary function laboratories, but overall, results have been unclear. One study [10] suggests that breathing through a tube might be a new inexpensive home-based method for respiratory muscle endurance training. This small study of patients with COPD did show improvement in dyspnea scores after ‘tube breathing’ twice daily for 5 weeks.

Chest-wall vibration has been tested in patients with COPD [11,12] and progressive neurologic disorders [13]. There are practical limitations to consider as most of the studies for COPD were performed in a laboratory with therapists attaching vibrators to specific intercostal spaces with the goal of changing respiratory sensation. Vibrating vests have been used in the home setting and studied for progressive neurologic disorders with the goal of clearing secretions and subsequent relief of dyspnea. For both patient populations, chest-wall vibration decreased dyspnea scores significantly and could be integrated into a pulmonary rehabilitation program. However, in these studies, dyspnea was created by exercise. Bloch-Salisbury et al. [14] sought to determine whether chest-wall vibration is effective with increased chemoreceptor drive in the absence of increased respiratory drive by using a breath-hold technique in healthy individuals. Although this study was very small, it does support the theory that chest-wall vibration alters mechanoreceptor input, reducing the discomfort from increased mechanical load such as exercise rather than other physiologic changes.

Independent of the underlying illness, patients will often report that their breathing is more comfortable sitting upright rather than lying flat. This position allows the rib cage to form a barrel shape providing better efficiency of the diaphragm and permitting the lungs to expand more. Additionally, this shape is proposed to decrease the use of

### Table 1 Nonpharmacologic therapies for dyspnea

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accessory muscles [15]. Patients with advanced obstructive disease develop this body habitus over time. Reduction in dyspnea may be achieved by sitting at the edge of the bed leaning forward against a pillow on the bedside table [16]. Studies of patients with COPD have shown that walking aids reduce dyspnea [17,18]. The mechanism of this is likely two-fold, energy conservation as well as implementation of the lean forward position.

Breathing training has two potential components, pursed-lip breathing and diaphragmatic breathing. Both have been studied in patients with COPD. Pursed-lip breathing on expiration often happens spontaneously for patients with advanced COPD. This breathing technique can also be taught and has been shown to improve functional residual capacity, tidal volume, alveolar ventilation, effective coughing, blood gas exchange, and strengthen accessory muscles of respiration [19,20]. Using this technique to decrease the symptom of dyspnea is somewhat controversial, as some studies have shown decreased breathlessness, whereas others have shown no change or worsening breathlessness [21].

Diaphragmatic breathing uses the abdominal muscles to move the diaphragm downward, allowing for good lung expansion with reduction of upper rib cage motion. Although this technique reduces the use of accessory muscles, it does not change the overall work of breathing. Gosselink et al. [22] were unable to report a change in dyspnea scores after teaching this technique to patients with COPD.

Patients will often report that keeping their room cool with moving air via open window or fan is helpful in reducing the feeling of dyspnea. It is postulated that nasal cold receptors in the nose arising from the V2 distribution of the trigeminal nerve give sensory input to affect respiration and decrease breathlessness. Moving cold air across the face has been shown to be effective in small studies [23,24]. Another study [25] showed compressed air via nasal cannula to be just as effective as oxygen. As hypoxia alone is a relatively weak stimulus for dyspnea, using a fan and cooling the room are practical therapies to recommend.

In spite of the significant challenge in studying acupuncture and acupressure in placebo-controlled trials, these therapies show promise, and some would argue that these treatments are grossly underutilized [26]. These therapies combined with other complementary and alternative treatments are used less than 5% of the time in palliative care settings [27]. Some studies with longer regimens of 3–6 weeks have shown significant improvement in patients with asthma and COPD, whereas the shorter regimens were not effective [28]. Acupressure may offer a nice self-administered alternative to invasive acupuncture that requires a trained therapist for each administration. Maa et al. [29] have shown that acupressure may be effective at lessening dyspnea and, upon comparing the two techniques, found little difference between the two in decreasing dyspnea [30].

For any patient who complains of dyspnea, large meals may be burdensome as there can be difficulty coordinating breathing and chewing. Therefore, many small-energy dense meals spread throughout the day might decrease difficulty and avoid postprandial dyspnea. Alternatively, for patients with COPD, a high-fat, low-carbohydrate diet or formula such as Pulmocare (Abbott Laboratories, Chicago, Illinois, USA) may improve pulmonary function and reduce carbon dioxide retention while boosting caloric intake [31]. In 2005, a Cochrane meta-analysis showed that nutritional support had no measurable benefit for patients with stable COPD [32]; however, the symptom of dyspnea had not been examined carefully.

Noninvasive positive pressure ventilation (NPPV) has a potential role for select patients in ameliorating dyspnea in COPD, cancer patients, and progressive motor neuron diseases [33–35]. NPPV is an alternative to invasive ventilation for symptom relief and can also act as a bridge to future invasive ventilation if desired. This makes it extremely important to carefully consider the patient’s goals of care when offering or recommending this intervention. The equipment interface is difficult for some patients, and it is not tolerated by everyone.

**Emotional and cognitive factors**

Similar to pain, there is an interrelationship between the experience of dyspnea and how we feel about that experience. Additionally, dyspnea can result from purely emotional stimulation or panic attacks. Figure 1 [36] shows the interrelationship between dyspnea and anxiety.

![Figure 1 Interrelationship between dyspnea and anxiety](image)

Adapted with permission from [36].
Cortical limbic and paralimbic areas as well as frontoparietal attention networks are areas of the brain that are activated during breathlessness and seen on functional MRI [37] and PET [38,39]. It is likely that these areas of the brain are involved in perception as well as modulation of dyspnea. Some of the therapies that focus on changing physiologic factors may actually change the way we feel about the experience of dyspnea. For example, exercise may lessen the fear that the sensation of dyspnea itself is lethal [40]. There are, however, several therapies that focus on modifying the emotional, cognitive experience, or both with the goal of reducing breathlessness.

Counseling and support is often a nursing-led activity though it can involve other members of the healthcare team when needed. Nursing-led counseling and support programs for lung cancer patients have been effective at reducing dyspnea [41]. In addition to psychosocial support, programs will sometimes include case management aspects with a focus on nonpharmacologic therapies such as breathing training, relaxation techniques, and activity pacing [42,43].

Anecdotally, patients will report that an open environment helps reduce feelings of dyspnea. Reducing the number of people in the patient’s room and moving the overbed table away or clearing it off can be helpful. There are no studies examining these simple techniques, but elements of claustrophobia (a type of anxiety) may affect or modulate dyspnea.

Two relaxation techniques are thought to be helpful for dyspnea, although the literature is unclear. Progressive muscle relaxation in patients with heart failure did not significantly change the symptom of breathlessness [44]. Small studies have shown some improvement in patients with COPD [45,46]. Guided imagery in patients with COPD did not significantly change the symptom of breathlessness [47]; however, one study suggests improvement in perceived quality of life for patients with chronic bronchitis and COPD [48].

Music can be used to distract patients from an unpleasant experience. Several studies have attempted to evaluate this technique for patients suffering from dyspnea. Although one study showed that music provided increased comfort during bronchoscopy [49], studies looking directly at the symptom of dyspnea are primarily on patients with COPD with exercise-induced dyspnea and are not very favorable [50–52].

Psychotherapy has the potential to address the emotional and cognitive factors associated with advanced illness and high symptom burden. Two studies have attempted to use this technique to decrease breathlessness, and both failed to show a significant reduction in dyspnea [53,54].

Conclusion
There are many nonpharmacological therapies to consider using when treating dyspnea. The influence of emotional and cognitive factors on physiologic function supports the integration of therapies and a whole-person approach. Even though the evidence base is weak for many of these therapies, the low risk profile and the potential to avoid additional medications makes them attractive options. More research is needed in all patient populations to see the potential value for most of these therapies.

References and recommended reading
Papers of particular interest, published within the annual period of review, have been highlighted as:
• of special interest
•• of outstanding interest
Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 145).
Respiratory problems


18 Crisafulli E, Costi S, De Blasio F, et al. Effects of a walking aid in COPD patients receiving oxygen therapy. Chest 2007; 131:1068–1074. This study provides good support to recommend this very low-cost, practical therapy.


