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Running head: VARIABLES ASSOCIATED WITH THE SUCCESS OF BCT

PATIENT-REPORTED VARIABLES ASSOCIATED WITH THE SUCCESS OF BEHAVIORAL
INTERVENTION FOR PATIENTS WITH CHRONIC COUGH

By

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Bachelor of Arts, Montana State University, Bozeman, Montana, 2010

Thesis Paper

presented in partial fulfillment of the requirements for the degree of

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in Speech-Language Pathology

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Abstract

Purpose: To determine if patient-related variables exist that can potentially discriminate patients with refractory chronic cough (RCC) that are reasonable candidates for behavioral cough therapy (BCT). This study was a small sub-set of a larger, ongoing study, which aims to create a screening tool that can identify refer patients who are candidates for BCT.

Methods: In this prospective, exploratory study, 20 adult participants, aged 29-68 years of age, answered questions developed by an expert panel, and the Leicester Cough Questionnaire (LCQ), before and after BCT. Questions pertained to symptoms, personality characteristics, and cough triggers. Data were gathered using Qualtrics survey software. Participants were separated into groups following data collection according to their satisfaction with BCT.

Results: Twelve participants were satisfied with the status of their cough (BCT-S) and eight participants were not satisfied (BCT-NS). Non-parametric statistical analyses revealed significant differences between the groups on the following variables: difficulty breathing in, urge to throat clear, productivity of cough, perceiving reflux/heartburn, blocked-throat feeling, anxiousness, and stress in neck/shoulders. LCQ domain scores were also significantly different.

Conclusion: The current study provides preliminary evidence that suggests there are differences in patient-reported variables associated with success of BCT. These results indicate the potential to create and validate a screening tool that would assist with identification of candidates for BCT.

Key words: chronic cough, behavioral cough therapy, Leicester Cough Questionnaire, laryngeal hypersensitivity, speech-language pathology, cough suppression, nonpharmacological intervention

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List of Abbreviations

BCT	Behavioral Cough Therapy
BCT-NS	Behavioral Cough Therapy-Not Satisfied
BCT-S	Behavioral Cough Therapy-Satisfied
CC	Chronic Cough
GERD	Gastro-Esophageal Reflux Disease
LCQ	Leicester Cough Questionnaire
LPR	Laryngopharyngeal Reflux
MTD	Muscle Tension Dysphonia
PND	Post-Nasal Drip
PPI	Proton Pump Inhibitor
PVFM	Paradoxical Vocal Fold Movement (aka Vocal Cord Dysfunction)
QoL	Quality of Life
RCC	Refractory Chronic Cough
SLP	Speech-Language Pathologist
SPSS	Statistical Package for the Social Sciences
VCD	Vocal Cord Dysfunction (aka Paradoxical Vocal Fold Motion)

Table of terminology

Behavioral cough therapy: cough suppression therapy using behavioral strategies, provided by a speech-language pathologist

Chronic cough: any cough that persists for longer than eight weeks

Leicester Cough Questionnaire: a self-administered survey that measures a cough's impact on quality of life across physical, psychological, and social domains

Refractory chronic cough: any cough that persists despite medical treatment

Upper respiratory infection: infection of the nose, throat, and airways resulting in symptoms like sore throat, stuffy/runny nose, and cough

Vocal hygiene: habits to implement or desist in order to help reduce drying effects on the larynx

Chapter 1: Introduction and Literature Review

Chronic cough (CC) is defined as a cough lasting for more than eight weeks and it is the most common reason for an adult to consult a primary physician for medical treatment (French, Irwin, Curley, & Krikorian, 1998; Iyer & Lim, 2013; Natt, Earis, & Swift, 2012). While the exact prevalence of CC is difficult to estimate, up to 40% of the population report suffering from CC (Chung & Pavord, 2008; Morice et al., 2004; Morice & Kastelik, 2003). CC can have many contributing etiologies, most of which can successfully be treated via medical intervention (Gibson & Vertigan, 2008; Vertigan, Theodoros, Gibson, & Winkworth, 2007a). However, 12-42% of patients who seek medical treatment continue to have what is known as refractory, habit, psychogenic, idiopathic, or unexplained chronic cough (Chamberlain, Birring, & Garrod, 2014; Vertigan, Theodoros, Winkworth, & Gibson, 2007b). For the purpose of this study, we will use the term refractory chronic cough (RCC) in order to encompass the unresolved nature of the cough (Birring, 2001; Gibson & Vertigan, 2009; Morice, 2010; Morice, 2013; Ryan, Vertigan, Bone, & Gibson, 2010; Vertigan, Gibson, Theodoros, & Winkworth, 2008).

RCC is a complex disorder that has significant health, psychological, and financial repercussions. RCC generally presents following an upper respiratory infection (URI) that includes a severe cough. Although the URI resolves, the cough persists (Gibson & Vertigan, 2009). It is most prevalent in middle-aged females (Chamberlain et al., 2013; Iyer & Lim, 2013). The duration of RCC in patients has been documented to last as little as a few months to as long as twenty years (Vertigan et al., 2007). Research documents a relationship between patients with RCC and anxiety, frustration, and/or depression (Iyer & Lim, 2013; Natt et al., 2012).

Patients with RCC also commonly have co-occurring laryngeal problems such as vocal cord dysfunction (VCD) and muscle tension dysphonia (Vertigan et al., 2007a; Vertigan et al., 2008).

The current management model for patients with chronic cough is laborious, expensive, and inefficient for many patients (Morice, 2013; Pavord & Chung, 2008). Traditionally, the recommended management model for RCC has either been to “test all, then treat,” which is expensive and time consuming, or treat any likely contributor to the cough one at a time, which is often unremitting (Iyer & Lim, 2013; Morice et al., 2004). Furthermore, the numerous tests that a patient may undergo can cost thousands of dollars, not to mention the cost of medication and lost wages. However, behavioral cough therapy (BCT) offers an alternative to these treatment approaches and a corpus of research is growing to support its efficacy, efficiency, and cost effectiveness.

BCT is a simple, non-invasive treatment, typically provided by speech-language pathologists (SLPs). Four general components compose BCT therapy: education, cough suppression, vocal hygiene, and counseling (Chamberlain et al, 2013; Gibson & Vertigan, 2009; Vertigan et al., 2007a). Existing studies show that patients who benefit from BCT exhibit alleviation of cough symptoms in as little as two weeks (Chamberlain et al., 2013, Gibson & Vertigan, 2009; Ryan et al., 2010; Vertigan et al., 2007a; Vertigan et al., 2007), which would likely only cost the patient a few hundred dollars. By comparison, the current medical model of treatment often costs up to several thousand dollars (Lin, Poh, & Lim, 2001). Additionally, patients with RCC wait on average 18-60 months before being referred for BCT, and many patients are not referred at all (Chamberlain et al., 2013).

Statement of the Problem

The current recommended algorithm for treating CC is time-consuming and expensive for patients with RCC. Behavioral cough therapy (BCT) is rarely considered as an early option for the treatment of CC, yet it has been shown to be safe, effective, efficient, and inexpensive for many patients (Chamberlain et al., 2013; Ryan et al., 2010; Vertigan, Theodoros, Gibson, & Winkworth, 2006). A validated screening tool is needed to assist primary care providers in identifying patients who are good candidates for BCT immediately after ruling out the most common and most serious causes of cough. The first step for developing a screening tool is to investigate the traits of patients who are satisfied with the effects of BCT.

Purpose

The purpose of this study was to determine if patient-related variables exist that have the potential to discriminate patients with RCC that are reasonable candidates for BCT. Potential variables for analysis included symptoms, onset factors (e.g., cough persisting after an illness with significant coughing), response to prior treatment, co-occurring diagnoses, cough triggers, and personality traits. Determination of variables that discriminate between patients who are or are not satisfied with BCT will assist in the development of a validated screening tool to be used early in the management process.

Research Question and Hypothesis

This study addressed the following primary research question:

1. Is there a difference in patient-reported variables in patients with RCC who are satisfied with BCT and patients with RCC who are not satisfied BCT?

- a. Null hypothesis: There are no patient-reported variables that are different between patients with RCC who are satisfied with BCT and patients with RCC who are not satisfied with BCT.
- b. Alternative hypothesis: There are patient-reported variables that differ between patients with RCC who are satisfied with BCT and those who are not satisfied with BCT.

If the alternative hypothesis for research question #1 is confirmed, the following sub question will be asked:

2. If differences are evident between patients with RCC who are satisfied with BCT and those who are not, what variables are different?
 - a. Alternative hypothesis 1: Patients who are satisfied with BCT are hypothesized to report the following differences from patients who are not satisfied with BCT:
 - More difficulty breathing in than out;
 - A less or non-productive cough;
 - More of a tickling/itching feeling in their throat;
 - Onset of their cough began with an illness that involved significant coughing; and
 - Higher occurrence of the following cough triggers: strong smells, changes in air temperature, exercise, stress/anxiety, and smoke
 - b. Alternative hypothesis 2: Patients who are satisfied with BCT will report more “Type A” personality qualities (e.g., high-achieving, competitive, stressed, need

to be in control, etc.) than those who are not satisfied with BCT (Watson & Minzenmayer, 2006).

Literature Review

Chronic cough is challenging to diagnose and treat and is caused by numerous conditions, including smoking, post-nasal drip, asthma, reflux, and unknown causes (McGarvey & Morice, 2005). While many patients with CC may present with any of these etiologies, the term refractory chronic cough (RCC) is prescribed when all known causes have either been ruled out or treatment has failed (Chamberlain et al., 2013; Vertigan et al., 2007a). McGarvey (2013) reported that inadequate evaluation, patient non-compliance, and side effects/safety concerns contribute to the difficulty of treating RCC. However, the systematic approach to treating patients with RCC, in addition to treatment barriers, is a time-consuming and expensive process. Current practice implements an extensive process of elimination to determine the causes of and treat the cough, which may be costly and time-intensive and may have negative impacts on the patient's quality of life (QoL). Effects on QoL may include symptoms such as depression and lethargy in addition to their cough symptoms (Brignall, Jayarman, & Birring, 2008; Chamberlain, Garrod, & Birring, 2013; Chung, 2011). Further, cough-related symptoms can include sleep deprivation, incontinence, or even vomiting, which can further decrease QoL in this population (Brignall et al., 2008).

Many common symptoms and triggers are evident among patients with RCC. Common symptoms include a persistent tickling feeling in the throat, an irritating sensation, a sensation of choking, and the urge to throat clear or cough (Chung, 2011; Gibson & Vertigan, 2009; Ryan et al., 2010; Vertigan et al., 2007). These symptoms are most commonly triggered by smoke,

dry crumbly foods, strong fumes, perfumes, dramatic change in air temperature or humidity, exercise, stress, or talking (Vertigan & Gibson, 2010; Vertigan et al., 2007; Vertigan, Theodoros, Gibson, & Winkworth, 2007b). Patients frequently describe their cough as dry, barking, and self-propagating (Vertigan et al., 2007b). Many also complain of voice problems (Gibson & Vertigan, 2009; Ryan, Vertigan, & Gibson, 2009).

The most common concomitant voice issues include muscle tension dysphonia (MTD)¹ and paradoxical vocal fold movement (PVFM)²; (Chamberlain et al., 2014; Gibson & Vertigan, 2009; Vertigan et al., 2007b). Symptoms of MTD and PVFM are often exacerbated by stress and anxiety (Dietrich, Abbott, Gartner-Schmidt, & Rosen, 2006; Hui Ng, Lo, Lim, Goh, & Kanagalingam, 2013). Additionally, patients with MTD and/or PVFM frequently exhibit “Type A” personality traits³, anxiety, and stress (Dietrich et al., 2006; Hui Ng et al., 2013). Therefore, because of the relationship between RCC and MTD and PVFM, it is possible that patients with RCC may exhibit more “Type A” personality traits, stress, and anxiety as well.

Anatomy and Physiology of Laryngeal Hypersensitivity and the Cough Reflex. The mechanisms that result in RCC involve a complex neural network that is not fully understood (Mazzone, Cole, Ando, Egan, & Farrell, 2011; Morice, 2013; Spina & Page, 2013). The cough reflex involves cough receptors, afferent (sensory) pathways, central processing, and efferent (motor) pathways (Bucca et al., 2010; McGarvey, 2005). When a cough is triggered, sensory receptors in the upper airway respond to a stimuli and send the information up the vagus nerve

¹ Hui Ng et al., (2013) define MTD as a functional voice disorder meaning it has no organic pathology

² Ryan et al., (2009) define PVFM as the vocal folds paradoxically adducting instead of abducting on inhalation

³ Hui Ng et al., (2013) and Watson & Minzenmayer (2006) describe “Type A” personality traits as being time conscious, aggressive, controlling, ambitious, impatient, and competitive

to the nucleus tractus solitarius in the brainstem (Chung & Pavord, 2008). Once the information is decoded in the brainstem, efferent messages are sent to the respiratory and laryngeal muscles resulting in a cough (Chung & Pavord, 2008).

In patients with RCC, research suggests that the cough's underlying mechanism is a hypersensitization of afferent vagal receptors in the larynx (Chung, 2011; Morice, 2010; Morice, 2013; Spina & Page, 2013). Under normal circumstances, chemical and mechanical irritants (i.e., stimuli) that are potentially harmful to the lungs trigger a response in the vagus nerve receptors that are delivered to the cough center in the brainstem (Mazzone, et al., 2011; Vertigan et al., 2008). In patients with RCC, afferent receptors in the larynx are hypersensitive to non-noxious environmental stimuli such as a change in room temperature, perfumes, or cleaning agents (Morice, 2013). Research also indicates that coughing itself creates a "feed forward system" that perpetuates the cough by further enhancing the sensory mechanisms, which means that constant coughing contributes to the continued lowering of the cough threshold (Chung, 2011). Subsequently, the cough reflex is triggered by a lower level of stimuli (Vertigan et al., 2007a). Based on principles of neuroplasticity, the laryngeal cells themselves then change how they react to incoming stimuli after prolonged exposure to stimuli (McGarvey, 2005; McGarvey & Morice, 2005; Vertigan et al., 2008).

While the cough reflex is housed in the brainstem, and is generally thought to be a reflexive action, emerging evidence suggests that cough may involve a "top down" directive from cortical brain structures (Mazzone et al., 2011; Vertigan et al., 2008). Mazzone and colleagues (2011) supported this hypothesis by measuring blood oxygen level-dependent (BOLD) responses with functional magnetic resonance imaging (fMRI). They found that the

supplementary motor cortex (SMC) was activated during voluntary cough and cough suppression. However, the SMC was inactive in a chemically induced reflexive cough. Similar brain activations are evident during voluntary breath holding, which lends support to the intertwined relationship between respiration and cough suppression, both of which are addressed with BCT.

Cortical influence on cough supports research of medical treatments. Studies assessing peripheral (i.e., laryngeal) hypersensitivity sometimes use antitussive medication as a control because antitussives act on the central nervous system to suppress a cough (McGarvey, 2013; McGarvey & Morice, 2005). However, because antitussives have little effect on reducing laryngeal sensitivity, some element of cortical control of cough is evident (Chamberlain et al. 2013). The potential central mechanisms involved in RCC also explain the abnormal sensations experienced by patients (e.g., tickling sensation), similar to patients with other hypersensitivity conditions, such as chronic pain (Chamberlain et al., 2014). Moreover, partial cortical control of cough explains why medications (e.g., gabapentin) that are effective for processes controlled by the central nervous system have shown some success in abating RCC (Ryan & Gibson, 2014).

Some of the structures and pathways associated with chronic cough overlap with those associated with chronic pain (Chamberlain et al., 2013; Gibson, Simpson, Ryan, & Vertigan, 2014; Mazzone et al., 2011). Chronic cough and chronic pain both protect the human body from noxious stimuli through similar pathways (O'Neill, McMahon, & Udem, 2013). Similarly, the sensory neurons in both conditions can become hypersensitive, resulting in conditions such as hyperalgesia (O'Neill et al., 2013). A behavioral approach, cognitive behavioral therapy (CBT) has been effective for alleviating chronic pain (e.g., back pain or arthritis) and pain-related

depression as well as improving health-related quality of life (Ehde, Dillworth, & Turner, 2014). Understanding the relationship between chronic cough and chronic pain may strengthen the limited research on chronic cough and its underlying laryngeal hypersensitivity by encompassing the plethora of research on chronic pain (O'Neill et al., 2013).

The extent of the underlying laryngeal sensitivity in chronic cough that provides crucial information can be objectively measured in a few different ways. For example, cough frequency may be measured in response to pre-determined amounts of inhaled capsaicin or citric acid (Morice et al., 2004). Capsaicin is the spicy component in hot peppers and has been reliably tested and used to measure cough threshold (Morice et al., 2004). Morice et al. (2001) describe the two main ways a capsaicin challenge is conducted: single dose or dose response. In single dose, the patient inhales one measured dose of capsaicin and the number of coughs is recorded. Dose response involves multiple inhalations of measured doses to find the dose that elicits a certain number of coughs (Morice et al., 2001; Pavord & Chung, 2008).

The capsaicin challenge has been used to demonstrate heightened laryngeal sensitivity in patients with RCC. Ryan et al. (2009) had their participants inhale controlled dosages of increasing concentrations of capsaicin. The subject hit threshold when they either coughed five or more times or tolerated a dose of the most potent concentration. They found that both patients with RCC alone and with RCC in addition to paradoxical vocal fold movement (PVFM) significantly increased their tolerance to capsaicin exposure following BCT. Ryan et al., (2010) also noted that compared with normed scores, patients in their study had heightened sensitivity to capsaicin at baseline that significantly improved with BCT.

Assessment and Treatment of Cough. In the assessment of cough, a methodical, medical approach is typically used to eliminate or identify causes of cough that is based on an “anatomic diagnostic protocol” developed by Irwin and colleagues in 1981 (Irwin, Corrao, & Pratter, 1981; MacGarvey, 2013; Pavord & Chung, 2008; Vertigan et al., 2007). The “anatomic diagnostic protocol” is a systematic way to conduct an evaluation and determine the cause of a persistent cough (Irwin et al., 1981). This protocol emphasizes the importance of how different conditions affect anatomical structures, such as the hypersensitization of the laryngeal sensory receptors (Pavord & Chung, 2008). During the evaluation, a comprehensive history is necessary to exclude personal (e.g., smoking), occupational (e.g., factory workers), or iatrogenic (e.g., angiotensin converting enzyme, or ACE-inhibitors) causes for the cough (Lee & Birring, 2012; Morice et al., 2004; Natt et al., 2012). Further examination includes a chest x-ray and possibly spirometry to rule out underlying respiratory conditions (Lee & Birring, 2012). If these tests are negative, the most common approach is to medically treat without testing for the most common causes of chronic cough (i.e., reflux, asthma, and post-nasal drip) (Lee & Birring, 2012). See Figure 1, developed by Morice and committee members in 2004, for an overview of the typical management algorithm for chronic cough.

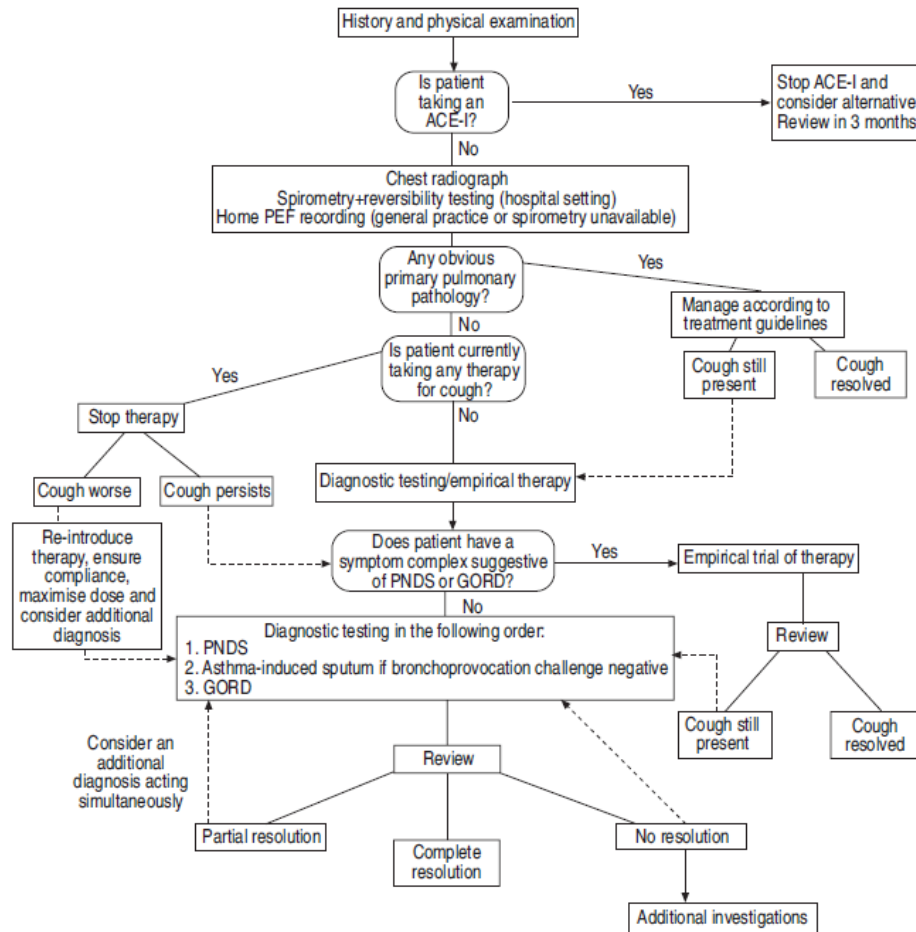


Figure 1 Management of chronic cough: Reprinted from Morice et al., 2004

When respiratory causes, aggravating factors (e.g., reflux, post-nasal drip, asthma), and personal factors are ruled out, various medical tests are conducted (e.g., for congenital anomalies) to exclude other possibilities (Morice et al., 2004). Once all medical options have been exhausted, the cough is considered refractory and more extreme steps are taken. Current treatments to alleviate RCC include medications such as opiates and dextromorphan, the effects of which are controversial and have many side effects such as drowsiness, constipation, or addiction (Spina & Page, 2013). Morice and colleagues (2007) conducted a randomized, double-blind, placebo-controlled trial involving 27 participants with RCC to study the effects of

morphine on RCC. They found significant improvement in Leicester Cough Questionnaire (LCQ)⁴ scores and in cough severity and frequency as reported in a daily cough diary. However, there was no notable reduction in peripheral laryngeal hypersensitivity (tested via the citric acid cough challenge). This result may support the hypothesis that RCC involves cortical control, as morphine can also be used to alleviate central (i.e., cortical) neuropathic pain (Attal et al., 2010).

Emerging research also indicates that gabapentin may alleviate symptoms of cough; however this medication does not have long-standing effects (Ryan & Gibson, 2014). In 2001, Ryan, Birring, and Gibson conducted a randomized, double-blind trial to test the effects of gabapentin against a placebo. In their study, 26 of the 64 participants received the gabapentin treatment. The authors found significant improvements in cough frequency and severity and in overall LCQ scores. However, all aforementioned scores returned to baseline after stopping gabapentin. Gabapentin, therefore, only worked while patients were actively taking the medication. The return to baseline, when off of gabapentin, suggests that gabapentin affects the central control of the cough, but does not affect the peripheral cough reflex sensitivity (Ryan, Birring, & Gibson, 2012).

When controlling common aggravating factors of cough with medication fails, referrals may be made to a pulmonologist, a gastroenterologist, an allergist (Natt et al., 2012), or a psychologist (Vertigan et al., 2007a). A referral for behavioral cough therapy (BCT) by a SLP often occurs at the very end of the management algorithm for “difficult-to-treat cough” along

⁴ The LCQ is a validated survey with which patients rate how their cough impacts their QoL across physical, psychological, and social domains (Brignall et al., 2008, Pavord & Chung, 2008).

with more extreme medications such as gabapentin (Gibson & Vertigan, 2009; McGarvey, 2013). McGarvey (2013) proposed an algorithm for “difficult-to-treat cough” (see Figure 2). However, his proposed algorithm places speech and language intervention (i.e., BCT) as a consideration for only after everything else has failed. Given that BCT is safe, affordable, and patients respond in just a few weeks, consideration of BCT much earlier in the management process could save many patients considerable time and money.

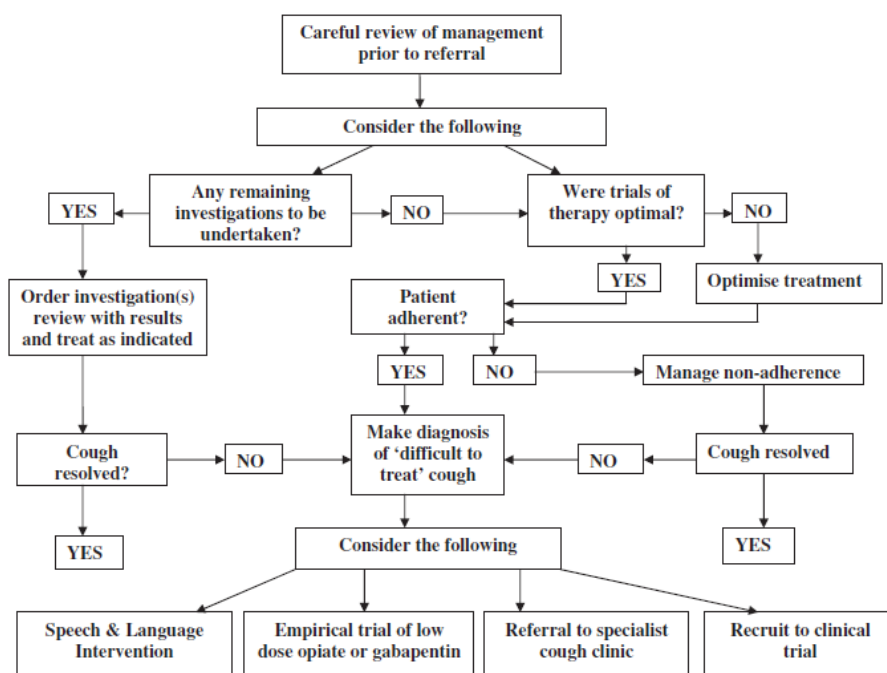


Figure 2 Management algorithm for "difficult to treat" cough. Reprinted from McGarvey, 2013

In addition to saving time and money, there are a variety of reasons why RCC should be treated with BCT provided by SLPs. SLPs have knowledge in the areas of swallowing, voice, and motor speech disorders that equip them to identify irregularities in the larynx or respiratory system (Vertigan et al., 2007). Furthermore, RCC is often mitigated following the treatment of comorbid voice issues, like PVFM, which is commonly treated by SLPs (Gibson & Vertigan,

2009). Finally, because similarities exist between medical conditions (e.g. asthma or reflux), voice concerns (e.g., hoarseness or muscle tension dysphonia), and psychological issues (e.g., depression or anxiety) of RCC and PVFM (Vertigan et al., 2007), their underlying mechanisms are thought to overlap under the umbrella of laryngeal dysfunction (Ryan, Vertigan, & Gibson, 2009). Therefore, SLPs can treat RCC with BCT efficiently and economically by targeting the underlying cause of the cough, not just the symptoms (Vertigan et al., 2007).

Behavioral Cough Therapy. There are four recommended components of a behavioral cough therapy (BCT) program: education, cough suppression, vocal hygiene, and counseling (Vertigan et al., 2006). These four components are described below.

Education. First, the clinician educates the client about the neurology behind cough/laryngeal sensitivity and why cough suppression reduces laryngeal hypersensitivity. The negative consequences of chronic cough, such as laryngeal trauma and perpetuating the cough cycle are discussed. Moreover, the patient is informed that there are no negative consequences for suppressing the cough. The education component also plays an important role for promoting patient compliance in controlling aggravating factors to cough (e.g., reflux) pharmacologically (Vertigan et al., 2007a).

Cough suppression. In the second component, the client learns specific cough suppression techniques. One technique is relaxed throat breathing. During relaxed throat breathing, the patient inhales abdominally while focusing on a relaxed throat. Then the patient exhales while making an “s” sound. The restriction produced by the “s” sound promotes an abducted airway (Gibson & Vertigan, 2009). This technique is also used in the treatment of

paradoxical vocal fold motion (PVFM). Other cough suppression techniques include substitution techniques (e.g., swallowing instead of coughing) or distraction techniques (e.g., chewing gum).

The client also identifies triggers when provided a list of commonly reported triggers.

Frequently reported triggers reported by Vertigan et al. (2007a) include inhaled stimuli (e.g. perfumes, cleaning agents, smoke), temperature changes (e.g., air conditioning), intrinsic causes (e.g., anxiety), or activity (e.g., exercising or talking). Once the patient identifies his/her triggers, he/she can implement cough suppression strategies in their presence.

Vocal hygiene. The third component involves vocal hygiene techniques to improve any habits that have a drying effect on the larynx. The first step is to improve hydration. Research indicates that adequate hydration can reduce the effort needed to phonate, which reduces the possibility of laryngeal injury (Vertigan et al., 2006). Other components of vocal hygiene include avoiding smoking, reducing alcohol and caffeine consumption which dehydrate laryngeal tissues, and encouraging nose breathing to reduce laryngeal sensitivity by humidifying the air before approaching the larynx (Gibson & Vertigan, 2009; Vertigan et al., 2006, Vertigan et al., 2007a).

Counseling. Finally, the fourth component comprises counseling to promote motivation and internalization of controlling the cough. Internalizing the locus of control allows the patient to have power over their cough. However, the clinician must validate the patient's perception that the cough is real (Vertigan et al., 2007a). The process of validation and internalization promotes compliance with controlling the cough. Furthermore, counseling supports setting attainable goals so that BCT is successful (Chamberlain et al, 2013; Gibson & Vertigan, 2009; Vertigan et al., 2007a).

Efficacy of BCT. A review of the literature generally supports the effectiveness of BCT. To date, there is one randomized control trial (Vertigan et al., 2006) and several non-comparative studies to support the use of BCT for RCC (Murry et al., 2010, Patel et al., 2011; Ryan et al., 2010; Ryan et al., 2009). See Table 1 for a summary of BCT studies. Each study measured effects in various areas including cough frequency, cough severity, cough sensitivity, and quality of life (QoL) (Chamberlain et al., 2014). For example, Ryan and colleagues (2010) studied 17 adults before, during, and after BCT. This was the first study to objectively measure BCT's effect on cough severity and frequency. They found that after BCT, patients had reduced cough reflex sensitivity, decreased cough frequency, and improved laryngeal symptoms. Their findings support the previous hypotheses that controlling the underlying mechanism of cough as well as reduced sensitivity of the cough receptors contribute to the success of BCT (Vertigan et al., 2007a). Furthermore, research behind cough suppression indicates that because voluntary cough is initiated in the cortex, it likely can also be suppressed from within the cortex (Vertigan et al., 2008). BCT suppresses the cough by increasing the strength of a patient's volitional control of the cough (Vertigan et al., 2007a).

Table 1

Improvement areas of BCT

Intervention area	Citation(s)
Cough frequency	Vertigan et al., 2006; Patel et al., 2011; Ryan et al., 2010
Cough severity	Vertigan et al., 2006; Murry et al., 2010
Cough sensitivity	Ryan et al., 2010; Ryan et al., 2009
QoL	Vertigan et al., 2006; Patel et al., 2011; Ryan et al., 2010; Ryan et al., 2009

Additionally, the current management approach to managing RCC has detrimental effects on QoL. Patel et al. (2011), Ryan et al. (2009), and Ryan et al. (2010) all used the LCQ pre- and post-treatment to measure QoL. In the research, the minimal important difference for the total score of the LCQ is 1.3 (Patel et al., 2011). That is, if a patient's score changes by at least 1.3 points between pre- and post-treatment, it is considered significant. These three studies found significant improvements in self-reported QoL post-treatment. Furthermore, Patel et al. (2011) reported the improvements in each individual domain (i.e., physical, psychological, and social) of the LCQ, regardless of duration of the cough. Finally, Vertigan et al. (2006) measured QoL in their study by assessing limitations in daily activities. They found significantly reduced limitations in daily life in the treatment group when compared to the placebo treatment.

Finally, BCT is efficient and cost-effective. While medical testing for cough can take months or years to complete, BCT can be effective in as few as two sessions (Chamberlain et al., 2013, Gibson & Vertigan, 2009; Ryan et al., 2010; Vertigan et al., 2007a; Vertigan et al., 2007). For example, Vertigan et al. (2006) conducted a randomized, single-blind, placebo-controlled study on BCT. In only four, 30-minute sessions, 38 out of 43 subjects who received treatment were considered successful. Conversely, 35 out of 44 in the placebo group were considered unsuccessful. Thus, BCT should be considered earlier in the management algorithm to mitigate the limiting effects of the current framework.

Limitations of the current cough management algorithm. The aforementioned studies have shown BCT or cough-suppression therapy to be a non-invasive and effective treatment for RCC and they highlight the limitations in the current “test all, then treat” approach to managing CC/RCC (Iyer & Lim, 2013). For example, in a retrospective study, Murry et al. (2010) found that patients reported that a proton-pump inhibitor (PPI) regimen alone to control reflux resulted in no subjective improvement in cough status. However, the PPI regimen in addition to respiratory retraining showed improvements in the areas of sensation and cough reduction. They measured reflux symptoms using the Reflux Symptom Index, which is a reliable, patient-reported assessment of reflux symptoms. They further assessed the presence of laryngeal sensitivity by applying pulses of air to the back of the throat and measuring the response. All measures improved significantly. Therefore, a simple, quick, and non-invasive respiratory retraining in addition to a reflux control regimen might resolve the cough and bypass the need for extensive testing.

Another major limitation in the research is how many resources the current management algorithm for cough consumes (see Figure 1). As the algorithm demonstrates, the steps to exclude diagnoses is extensive and requires many referrals and testing, which is time-consuming and expensive. Furthermore, time and money spent with referrals in testing is time and money lost because of absenteeism and lost productivity (Iyer & Lim, 2013). Finally, behavioral intervention is only considered alongside or after invasive tests and potent drugs such as morphine (Iyer & Lim, 2013).

In summary, the current management algorithm for CC is time-consuming and expensive for patient with RCC. BCT is an evidence-based treatment option that is non-

invasive, efficient, and inexpensive; yet, BCT is currently only considered after all medical tests and treatment options have failed (Iyer & Lim, 2013). The current study addressed potentially altering the current management algorithm for RCC by aiming to identify differentiating variables of patients that are likely to be successful with BCT versus those are not earlier in the process. As the sub-set of a larger ongoing study, the ultimate goal is to create a screening tool for primary care physicians to use in their referral making process for patients with chronic cough based on their self-reported variables.

Chapter 2: Methodology

Introduction

The University of Montana IRB approved this exploratory, prospective pilot study on March 05, 2015. The study was conducted in collaboration with an allergist and a SLP at the Western Montana Clinic, a pulmonologist at Community Medical Center, and an otolaryngologist at Rocky Mountain Ear, Nose and Throat to investigate patient-reported variables of patients suffering from RCC. The primary goal of this study was to determine if a pattern of patient-reported variables exist to help differentiate patients who will benefit from BCT from those who will not. Data collection commenced from June 2015 to February 2016.

Setting and Participants

All data were collected via Qualtrics survey software. Participants enrolled in the study at the offices of the Western Montana Clinic, University of Montana (UM) Voice and Swallow Clinic, Community Physician Group, and Rocky Mountain Ear, Nose, and Throat in Missoula, Montana. Subsequent data were collected on the participant's home computer or over the phone with the researcher.

Inclusion criteria included:

- at least 18 years of age,
- complaint of a cough lasting at least 8 weeks

Exclusion criteria included:

- smoking for longer than 12 months duration in the past 10 years,
- diagnosis of COPD, lung cancer, chronic bronchitis, or emphysema, and

- use of an ACE-inhibitor medication within the past two months.

If the participants met the criteria, they were given an iPad and headphones containing written and video information describing the purpose and procedures of the study. If the participant consented, he/she also provided contact information for follow-up.

Procedures

Survey Development. For the development of this survey, an interdisciplinary expert panel consisting of an allergist, a pulmonologist, an ENT, and two speech-language pathologists (SLPs) was assembled. Each panelist was familiar with the research on laryngeal sensitivity/chronic cough and regularly treated patients with RCC. The purpose of this panel was to compile a list of potentially relevant survey items based on the cough/ laryngeal sensitivity literature in addition to professional experience.

Having an interdisciplinary panel also helped incorporate the various aspects of creating a good questionnaire. According to Salkind (2009), there are basic assumptions, question types, and basic formatting concerns that make a quality survey. Basic assumptions include: asking questions that the target population can answer, making the questionnaire engaging, and being direct and honest with the information. The types of questions asked should be answerable, straightforward, and socially appropriate to answer. Finally, in formatting the questionnaire, it should be easy to read, simple, and have guiding instructions. In order to achieve the basic components of a good questionnaire, the survey for patients with RCC was developed in stages.

First, the lead investigator provided survey items to the panel based on the literature and clinical experience. These proposed items included questions about environmental triggers

(e.g., strong perfume), aggravating factors (e.g., reflux or post-nasal drip), and symptoms (e.g., feeling a “tickle” in the throat before coughing). Second, each expert panelist added proposed items based on their knowledge of the research, their clinical experiences, and their specialty area. Proposed survey items were then compiled into a Qualtrics survey and distributed to each expert panelist. Expert panelists then rated the importance of each potential item using a four-point Likert scale, one being *not relevant* and four being *highly relevant*. An average of scores was calculated and questions receiving a score of less than two were removed because they were deemed to be too general or insensitive to the target population.

After finalizing the items for the enrollment questionnaire, all components of the survey were organized into three parts: (1) the expert-panel questions, (2) the Leicester Cough Questionnaire (LCQ), and (3) a treatment and compliance portion (i.e., medical or behavioral), and cough status. Part one of the survey provided detailed written consent and video instructions to inform the participants of the purpose and procedures of the study, followed by the option to agree and continue, or disagree and exit the survey. Participants who agreed to continue provided their contact information and preference of contact method for follow-up. Part one concluded with the questions created and agreed upon by the expert panel. Each question was rated using a 7-point Likert scale in which 1 signified *all of the time* and 7 signified *none of the time*. Some questions also included a *not applicable* option. Additionally, the expert panel included questions allowing for multiple answers (i.e., Q53: self-perceived personality traits Q51: triggers), previous or current interventions (i.e., Q78-Q84), and yes/no questions as indicated (i.e., Q48-Q49). See Appendix C.

Part two of the survey contained the Leicester Cough Questionnaire (LCQ), which is a validated, self-report, 7-point Likert-scale questionnaire used to assess cough and its impact on QoL (Birring et al., 2003; Brignall et al., 2008). The Likert scale used in part one of the survey was identical to the Likert scale used in the LCQ. The LCQ was used to measure progress of cough remediation in each follow-up contact, as explained in survey administration. (See Appendix D for copy of the LCQ.) Finally, part three of the survey contained questions about type(s) of treatment (i.e., medical or behavioral strategies) the patient had tried and their compliance with each treatment. (See Appendix C for a copy of the survey in its entirety.)

Once the items were established, the survey was piloted with two unfamiliar, healthy individuals to review clarity of the written and video instructions, the questions, and the flow of the survey itself. Minor modifications were made to the survey per the recommendations of these individuals. Once the survey was finalized, four iPads were programmed with the survey. One iPad was then delivered to each participating office and the staff was trained on how to use the iPad and to administer, reset, and avoid duplicates of the survey. The researcher assured that the following basic training points were covered at each office: the purpose of the study, inclusion/exclusion criteria, and ultimate goal of the larger, ongoing study. The training also included navigating the Qualtrics survey software application and assurance that Qualtrics is HIPAA compliant in order to protect the sensitive information of the participants.

Survey administration. Staff at each participating office identified appropriate potential participants based on a primary complaint of cough and if they met the inclusion criteria of the survey. If they met the criteria, the staff then provided patients the option to participate in the study. The staff provided the iPad and headphones in addition to any technical support

participants needed (e.g., navigating the iPad or reading questions aloud for participants with visual impairment). Once a participant declined to participate or completed the survey, the staff ensured that the survey had closed and returned the program to the informed consent and instruction page. If the subject declined to participate, they were exited from the survey. However, if the subject chose to participate, they completed parts one, two, and three of the survey (see Appendices C-E). All participants completed the survey before or immediately after their first session of BCT.

Once patients were enrolled in the study, they began BCT, which included: vocal hygiene, education, cough suppression techniques, and counseling. The two SLPs participating in the study had discussed and agreed upon a similar course of treatment before the study began. Both SLPs provided the four components of BCT (education, cough suppression, vocal hygiene, and counseling) in a similar manner and with similar terminology.

Following enrollment, participants were contacted by phone, text, and/or e-mail, depending on their indicated preference, every three to four weeks to monitor success of treatment(s). The follow-up timeline was flexible due to the nature of BCT and medical treatments of cough. These treatments are not duration dependent, they either work or they do not. Therefore, whether a follow-up was conducted at three weeks post-treatment or four weeks post-treatment, the results should not have differed. Parts two (the LCQ) and three (intervention type, compliance, and cough status) of the survey comprised the portion used to collect information at follow-up (see Appendices D and E). Patients indicated which strategies they had attempted, how compliant they had been with the strategies, and whether they were satisfied with the current status of their cough. These data also were gathered through a

Qualtrics survey. Follow-up data continued to be gathered every three to four weeks until the participants indicated they were content with the status of their cough or until they no longer wished to participate in the study.

Data Analysis

Data analysis was performed by exporting the data from Qualtrics and uploading it into the Statistical Package for the Social Sciences (SPSS) software. In SPSS, participants were coded by group for analysis. Participants were grouped into one of three groups based on self-reported cough status: (1) satisfied with BCT (BCT-S), (2) not satisfied with BCT (BCT-NS), or (3) unresolved (participants who had not yet had BCT). Participants coded as unresolved were excluded from analysis. Participants who started but did not complete the survey were also excluded from analysis. Once the groups were divided and coded, histograms, box plots, and line graphs were created to examine the distribution of each variable and to obtain a primary sense of which variables might be significant. The Mann-Whitney U and Fisher's exact tests were used for variables with non-normal distributions. The independent t-test was used for normally distributed variables. Descriptive statistics were also run.

A Mann-Whitney U test was used to determine between-group differences in the Likert scale questions in part one of the survey. A Fisher's exact test was used to look for differences between the groups regarding specific triggers, allergens, and personality traits⁵. Independent t-tests analyzed change in QoL related to cough from pre-BCT and post-BCT results of the LCQ.

The LCQ in turn served as an outcome measure that was associated with the patient's report of

⁵ These questions did not follow the Likert scale format. Rather, they were a "check all that apply" format. Results from these analyses investigated the patterns among patient-reported variables in the study-specific portion of the survey.

being BCT-satisfied (BCT-S) or BCT not-satisfied (BCT-NS). Finally, being that this study was a small subset of a larger study aiming to create a screening tool for patients with chronic cough, this study only looked at the self-reported variables of patients who underwent BCT.

Chapter 3: Results

Descriptive Statistics

Thirty eight participants enrolled in the study. Three participants dropped the study before completion and 15 are ongoing with follow-up surveys as part of a larger ongoing study. Twenty participants completed the study and were included in this analysis. Out of the 20 who completed the survey, twelve reported being satisfied with BCT (i.e., BCT-S group) and eight reported being not satisfied (i.e., BCT-NS group). The participants in the BCT-S group (10 female, 2 male) had a mean age of 53.3 years with an average cough duration of 45 months. The participants in the BCT-NS group (7 females, 1 male) had a mean age of 54.7 years with an average cough duration of 41 months. Cough duration was missing for two of the participants (one in each group) because of a researcher oversight on the original version of the survey. See Table 2 for a summary of the descriptive statistics.

Table 2. *Descriptive statistics of participants*

	BCT-S				BCT-NS			
	Min	Max	Mean	SD	Min	Max	Mean	SD
Age (years)	29	67	53.3	12.72	46	68	57.14	11.05
Cough duration (months)	3.0	180.0	45.27	57.84	3.0	108.0	41.0	43.61

Inferential Statistics

Differences in patient-reported variables. A Mann-Whitney U test was performed to analyze differences between the groups on each Likert scale survey question. As seen in Table 3 and Figure 3, seven variables reached statistical significance (i.e., $p \leq .05$) and four variables

approached significance (i.e., $p = .051 - .08$). The BCT-S group reported more difficulty breathing in than out ($U = 24, z = -1.891, p = .0295, r = 0.423$), less need to clear their throat ($U = 20.5, z = -2.180, p = .0145, r = 0.487$), a less productive cough ($U = 26, z = -1.791, p = .0365, r = .40$), more reflux/heartburn ($U = 11, z = -2.914, p = .002, r = 0.652$), more difficulty breathing in general ($U = 29, z = -1.495, p = .0675, r = 0.334$), and more of a sensation of pushing on their chest ($U = 28, z = -1.622, p = .0525, r = 0.363$) The BCT-NS group reported more of a blocked throat feeling ($U = 27, z = -1.658, p = .0485, r = 0.061$), more anxiety ($U = 24, z = -1.880, p = .03, r = 0.420$), more stress in their neck and shoulders ($U = 15, z = -2.628, p = .0045, r = 0.588$), more temporary alleviation of their cough with sips of water ($U = 28.5, z = -1.529, p = .063, r = 0.342$), and more of a concern about pollutant/chemical exposure ($U = 30, z = -1.426, p = .077, r = 0.319$). Mean scores, Mann-Whitney U scores, Z-scores, p-values, and effect sizes for each variable are summarized in Table 3. Mean scores of significant or nearly significant variables are depicted in Figure 3. Accordance with the Likert scale of 1=all of the time and 7=none of the time, a higher mean is correlated with less severity.

Table 3. *Mann-Whitney U scores, mean score, Z-scores, significance levels, and effect sizes of patient-reported variables as determined by Mann-Whitney U test*

Variable	Mean BCT-S	Mean BCT-NS	U	z-score	P-value (1-tailed)	Effect size
Q15_Tickle/itch	3.0	3.0	47	-0.08	0.468	0.018
Q16_Anticipation	2.5	2.35	36.5	-0.927	0.177	0.207
Q17_Sleep	4.083	3.95	39.5	-0.671	0.251	0.150
Q18_Suppression	4.333	4.55	37.5	-0.863	0.194	0.193
Q19_Water alleviates cough**	4.417	3.95	28.5	-1.529	0.063	0.342
Q20_Cough is productive*	5.333	4.7	26	-1.791	0.036	0.400
Q21_No air	5.0	5.0	43	-0.397	0.345	0.089

Q22_ Pass out	5.833	6.1	40.5	-0.656	0.256	0.147
Q23_ Urge to throat clear*	4.167	3.45	20.5	-2.18	0.014	0.487
Q24_ Feeling of a blocked throat*	5.167	4.65	27	-1.658	0.048	0.371
Q25_ Feeling of a tight throat	4.417	4.5	44.5	-0.274	0.392	0.061
Q26_ Pushing sensation in chest**	4.667	5.3	28	-1.622	0.053	0.363
Q27_ Pushing sensation in throat	4.25	4.5	39	-0.705	0.241	0.158
Q28_ Difficulty breathing in general**	4.167	4.8	29	-1.495	0.068	0.334
Q29_ Inhaler relieves breathing difficulty immediately	5.583	5.95	34	-1.126	0.13	0.252
Q30_ Difficulty breathing in*	4.083	4.85	24	-1.891	0.029	0.423
Q31_ Difficulty breathing out	5.5	5.75	35.5	-0.98	0.164	0.219
Q32_ Tight chest w/ symptoms	4.333	4.55	40	-0.629	0.265	0.141
Q33_ Tight throat w/ symptoms	3.417	3.65	33	-1.177	0.119	0.263
Q34_ Squeaky inhalation	5.5	5.7	38.5	-0.754	0.226	0.169
Q35_ Voice Problems	4.0	4.3	35	-1.022	0.154	0.229
Q36_ Voice Unpredictability	3.5	4.1	36	-0.946	0.172	0.212
Q37_ GERD/LPR*	3.25	4.3	11	-2.914	0.002	0.652
Q38_ PND	3.083	3.25	45	-0.238	0.406	0.053
Q39_ Pollutant/ chemical exposure**	5.583	5.1	30	-1.426	0.077	0.319
Q40_ Feeling stressed	3.833	3.45	32.5	-1.217	0.112	0.272
Q41_ Feeling anxious*	4.667	4	24	-1.88	0.03	0.420
Q42_ Having stress/anxiety w/ symptoms	4.667	4.6	46.5	-0.118	0.453	0.026
Q43_ Feeling lump in the throat	4.083	4.2	44	-0.317	0.376	0.071
Q44_ Perfume triggering symptoms	5.0	5.05	46.5	-0.118	0.453	0.026
Q45_ Need for control	3.273	3.263	44	0	0.5	0
Q46_ Anxiety w/o control	4.167	4.2	47.5	-0.039	0.485	0.009
Q47_ Carrying stress in neck/shoulders*	3.167	2	15	-2.628	0.005	0.588

Q48_ Cough started with illness***	1.417	1.4	46	-0.182	0.428	0.041
Q49_ Allergies make symptoms worse***	1.333	1.35	46	-0.187	0.426	0.042

*= significant (p ≤ .05)

***Yes/no questions: 1= Yes; 2= No

**= approached significance (p= .051-.080)

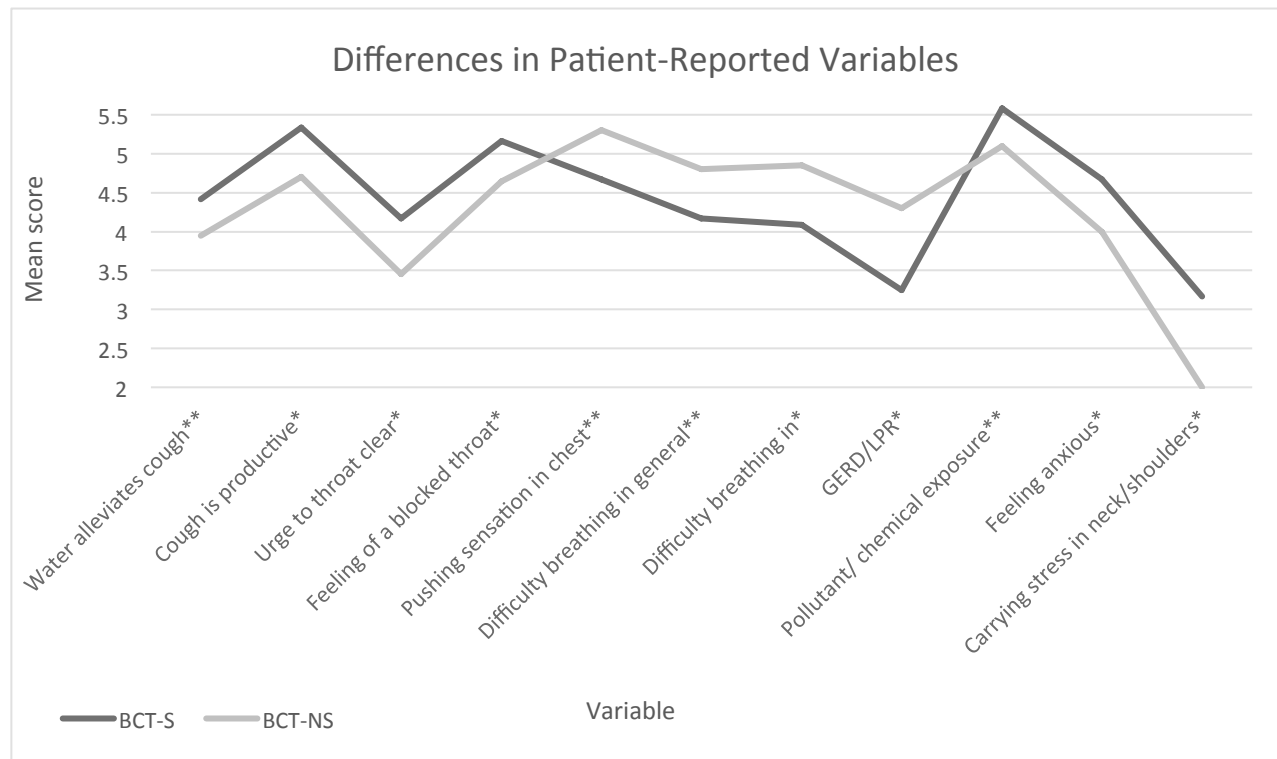


Figure 3. Means of significant/nearly significant differences in variables as determined by the Mann-Whitney U test

*Significant at alpha level = .05

**Approached significance at alpha level=.051-.080

Note: Means based on Likert scale 1=all of the time and 7=none of the time

The LCQ was used as a pre- and post-test measure of cough’s impact on quality of life. There were some significant or nearly significant differences in pre- and post-treatment scores in patients who reported satisfaction with BCT and no significant differences in patients who were not satisfied. Recall an increase in scores indicates improvement in QoL. The BCT-S

patients showed improvements in all of the domains as well as total score while BCT-NS patients showed improvements only in the physical domain (see Figures 4a, 4b).

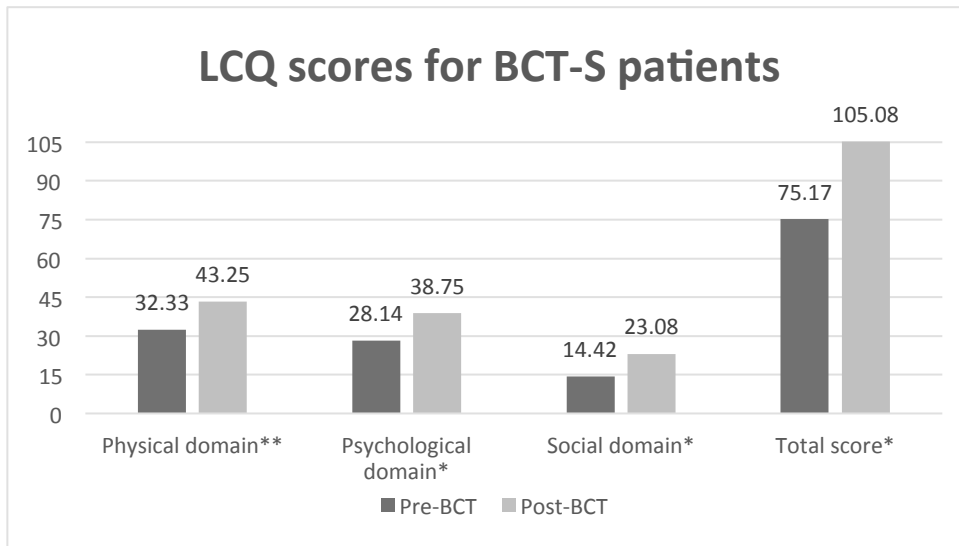


Figure 4a. Pre- and post-treatment LCQ scores for BCT-S patients

*=significant $p \leq .05$

**=approached significance $p = .051-.080$

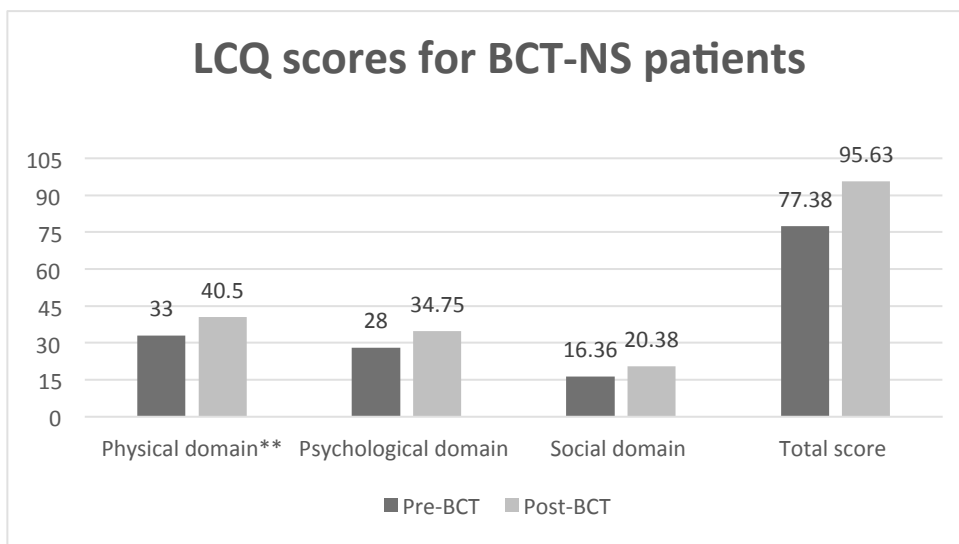


Figure 4b. Pre- and post-treatment LCQ scores for BCT unsatisfied patients

*=significant $p \leq .05$

**=approached significance $p = .051-.080$

Fisher's exact test was used to analyze between-group differences for each cough trigger, allergen, and personality trait. No significant between-group differences were found for triggers, allergens, or personality traits. Tables 4a, 4b, and 4c summarize these results.

Table 4a. Reported cough triggers and their significance between BCT-S and BCT-NS groups as determined by the Fisher's Exact test.

Trigger	BCT-S (n=12)		BCT-NS (n=8)		p-value (1-tailed)
	No	Yes	No	Yes	
Strong smells	6	6	4	4	.675
Smoke	8	4	4	4	.388
Change in air temperature	9	3	7	1	.465
Laughing	10	2	5	3	.296
Talking	12	0	6	2	.147
Stress/anxiety	10	2	6	2	.535
Exercise	5	7	6	2	.157

Table 4b. Reported allergens and their significance between BCT-S and BCT-NS groups as determined by the Fisher's Exact test.

Allergen	BCT-S (n=12)		BCT-NS (n=8)		p-value (2-tailed)
	No	Yes	No	Yes	
Pollens	2	10	3	5	.592
Animals	9	3	5	3	.91
Molds	8	4	7	1	.614
Foods	11	1	6	2	.688

Table 4c. Reported personality traits and their significance between BCT-S and BCT-NS groups as determined by the Fisher's Exact test.

Personality trait	BCT-S (n=12)		BCT-NS (n=8)		p-value (2-tailed)
	No	Yes	No	Yes	
High-achieving	7	5	2	6	.314
Self-critical	5	7	2	6	.784
Anxious	10	2	4	4	.274
Stressed	5	7	1	7	.374
Worrier	8	4	3	5	.41
Easygoing	7	5	8	0	.102
High-strung	10	2	7	1	1.312
Cooperative	4	8	4	4	.776
Pessimistic	11	1	6	2	.688
Optimistic	4	8	3	5	1.216
Self-motivated	3	9	2	6	1.386
Perfectionist	6	6	3	5	.93
Competitive	7	5	4	4	1.07
Team-oriented	6	6	3	5	.93
Procrastinator	7	5	6	2	.784
Type A	11	1	5	3	.306

Chapter 4: Discussion

The purpose of this study was to determine if there are differences in patient-reported symptoms and other variables in individuals with chronic cough who are successfully treated with BCT versus those who are not successfully treated with BCT. To answer our research questions, participants took a survey assembled to determine different patient reported variables, assess the cough's impact on QoL, and rate compliance with attempted strategies. Participants then completed BCT with a SLP. Following enrollment, participants were contacted every three to four weeks to monitor success of treatment. Participants completed the study when they had indicated that they either were satisfied with their cough status or continued to be unsatisfied after attempting BCT strategies for three to four weeks. Participants were then filtered into either the BCT-S or BCT-NS group. Data was analyzed using non-parametric tests and descriptive statistics to determine patterns among patient-reported variables.

Research Question 1: Is there a difference in patient-reported variables in patients with RCC who are satisfied with BCT and patients with RCC who are not satisfied with BCT?

Significant differences were found in patient-reported variables in patients in the BCT-S group and the BCT-NS group. Out of the 34 variables on the study-specific survey, 11 were found to be significantly different. Based on these results, we can reject the null hypothesis and retain the alternative hypothesis.

Research Question 2: If differences are evident between patients with RCC who are satisfied with BCT and those who are not, what variables will be different?

The following variables were hypothesized to be significantly different between the two groups.

The BCT-S group will report more difficulty breathing in than out. Patients in the BCT-S group reported having significantly more difficulty breathing in than out. This result confirms the hypothesis and is consistent with the literature as patients with RCC often have co-occurring PVFM, which results in more difficulty breathing in than out. Conversely, patients whose CC is caused by asthma tend to report more difficulty breathing out than in.

The BCT-S group will report a less or non-productive cough. Patients in the BCT-S group reported having a less or non-productive cough. This result confirms the hypothesis and is consistent with the literature as a refractory cough is often described as being a dry cough. Conversely, patients suffering from a lung pathology (e.g., pneumonia) would be more likely to report a productive cough.

The BCT-S group will report more of a tickling/itching feeling in their throat. There were no significant differences between groups in the report of having a tickling/itching feeling in the throat. Generally, the research on RCC reports a tickle or itch that suggests a hypersensitization of the laryngeal cells. However, the current study did not support this common symptom.

The BCT-S group will report the onset of their cough began with an illness that involved significant coughing. There were no significant differences between groups regarding onset of cough. It is possible that CC and RCC in general can be caused and/or exacerbated by a cold. Significant coughing has been thought to cause the hypersensitization of the laryngeal cells based on the principle of neuroplasticity “repetition matters” (Kleim & Jones, 2008). The lack of

significant difference in this study may have been due to the small sample size. It may be worthwhile to explore onset of cough more in future studies.

The BCT-S group will report a higher occurrence of the following triggers: strong smells, changes in air temperature, exercise, stress/anxiety, and smoke. There were no significant differences between groups regarding triggers. However, one trigger, exercise, yielded the largest difference between groups as seven in the BCT-S group reported exercise as a trigger but only two in the BCT-NS group identified it as a trigger. This difference is interesting because PVFM commonly co-occurs with RCC and is often triggered by competitive sports (Giminez & Zafra, 2011).

Based on clinical experience and the literature, the lack of significant differences regarding triggers was surprising. There are several potential reasons for this finding, the most obvious being the small sample size. Additionally, the binary yes/no question format may not have been sensitive enough to detect differences. Using a similar Likert scale as was used on the other questions may have been more sensitive, as it would have captured severity of triggers. One other possibility is that the question regarding triggers was omitted from the original survey for the first 24 participants as an accidental oversight. The data gathered regarding triggers for these patients was collected retrospectively from the initial cough evaluation performed by the treating SLP. As the triggers for these patients were recorded from interviewing the patients and not from a visual list of options, it is possible that some triggers went unreported. Additionally, it is possible that patients did not initially report all of their triggers, due to lack of awareness. In the author's clinical experience, some patients only identify triggers after in-depth interviewing or after being asked to journal their triggers and

thus possibly did not identify all triggers on the survey. Finally, another possibility for the lack of differences is that that patients with any form of chronic cough (e.g., CC controlled by medicine) might experience the same cough triggers.

The BCT-S group will report more “Type A” personality qualities (e.g., high-achieving, competitive, stressed, need to be in control, etc.). There were no significant findings between groups regarding self-reported personality traits. A review of the literature suggested that the BCT-S population might be more anxious, but the results of this study did not support that hypothesis. It is possible that self-perception of personality traits is not reliable and self-report may not be the most informative source of this data. For example, some participants may not consider themselves to be anxious or competitive even if others would describe them as such, and thereby may not indicate those personality traits on the survey. Gosling, John, Craik, and Robins (1998), found that the perception of personality traits in oneself were distorted to be more positive than when rated by observers. Therefore, if patients perceived being anxious or needing to be in control as negative, they may not have selected it as a personality trait. As such, in future studies it may be interesting to have friends and/or family rate personality traits of to determine if there is a difference in participants’ perception and the perception of others. Furthermore, similar to the trigger question, personality questions were also binary (e.g., yes/no), which may not have been sufficiently sensitive to capture differences between the groups. In hindsight, it would have been better to ask participants to rate personality traits in a Likert scale format, to capture gradations in personality characteristics. .

The following patient-reported variables were not accounted for in the hypotheses, yet yielded significant differences between the BCT-S and BCT-NS groups. Several of the findings were opposite in direction that anticipated given clinical experience and the literature.

The BCT-S group reported more difficulty breathing in general. Similar to the BCT-S group reporting more difficulty breathing in, they also reported more difficulty breathing in general. It is likely that participants who reported difficulty breathing in also reported more difficulty breathing in general, which makes this finding not surprising.

The BCT-S group reported a lower urge to throat clear. Throat clearing is a frequently reported symptom in patients with RCC, which was not supported by our findings. It is possible that wording the question as having an “urge” to throat clear was less sensitive than if the question had been worded as “I clear my throat frequently throughout the day.” Additionally, clinical observation suggests that patients do not always realize that they clear their throat frequently. It is also possible that the BCT-NS group produced more phlegm, consistent with having a more productive cough than the BCT-S group, which could have resulted in the urge to throat clear more often.

The BCT-S group reported more perceived reflux/heartburn. The question of having perceived reflux/heartburn might be worth exploring more in depth. It is likely that patients who were referred to BCT had already been put on medication to control for the possibility of acid reflux, but more frequently reported BCT satisfaction. Further investigation of this finding is warranted.

The BCT-S group reported more sensation of something pushing on their chest. Given that patients with asthma commonly report symptoms in the chest (which is typically controlled with medicine) while patients with PVFM (which commonly co-occurs with RCC) more commonly report symptoms in the throat, this was a very surprising finding. It is possible that the chest sensation could be related to increased perception of heartburn/reflux. Further investigation of this finding is warranted.

The BCT-NS group reported more of a blocked throat feeling. This result is not consistent with the RCC literature. Although we had not hypothesized that the RCC group would have more of a blocked throat feeling, people with RCC often report paresthesia, or abnormal feelings, in their throat. Therefore, the BCT-NS group reporting a significant difference in the blocked throat feeling was unexpected. Further investigation of this finding is warranted

The BCT-NS group reported being more anxious. This result was the opposite of what we had expected because patients anxiety has been associated with some common voice disorders, such as PVFM or MTD (Gimenez & Zafra, 2011; Vertigan et al., 2008). Furthermore, anxiety is common cough trigger throughout the RCC literature. It may be that patients in the BCT-NS group had a more severe cough, which contributed to worse anxiety. .

The BCT-NS group reported having more stress in their neck/shoulders. This finding was also opposite of what we would have expected. Because muscle tension dysphonia (MTD) commonly co-occurs with RCC, and patients with MTD tend to carry stress in their

neck/shoulders, we anticipated that the BCT-S group would be more inclined to carry stress in their neck/shoulders..

The BCT-NS group reported more cough alleviation with drinking water. The BCT-NS group also reported more tickling/itching in their throat, as well as more phlegm production. It is possible that water was more likely to alleviate these sensations, which would also help alleviate cough. .

The BCT-NS group reported more concern of chemical/pollutant exposure. The expert panel included this question based on clinical experience that many patients with PVFM, which commonly co-occurs with RCC, worry about past chemical/pollutant exposure. It was, therefore, surprising that the BCT-NS group reported a greater concern in this regard. The finding could be related to severity of cough. If the BCT-NS group had a more severe cough, they may have had a greater concern about pollutant/chemical exposure.

Leicester Cough Questionnaire: Pre- and Post-BCT

Consistent with our expectations, there were significant differences in pre- and post-treatment LCQ scores in the BCT-S group. Three of the four domain scores were at or approached significance. While the physical domain did not meet the level of significance, it is likely that it would have reached significance in a larger sample size. It is interesting that the BCT-S group had more significant QoL improvements in the social and psychological domains, while the BCT-NS group had more significant QoL improvements in the physical domain (although not statistically significant). These results suggest that the success of BCT alleviated the social (e.g., interfering with daily tasks or enjoyment of life) and psychological (e.g., feeling

frustrated, worried, or anxious) components of cough more so than the physical components of cough. To see all of the questions that fall under which domain, see the color-coded version of the LCQ in Appendix D, Part IIb.

Limitations

There are several limitations of this study. First, the number of participants that completed all of the criteria was only 20. Furthermore, there was an uneven number between the groups, twelve in the satisfied group and eight in the unsatisfied group. This uneven number was likely partially based on the binary response of being satisfied or not satisfied that did not capture cough severity. Additionally, the study lacked an objective cough severity measure, such as a capsaicin challenge. It depended wholly on subjective patient report which may have resulted in inaccurate results. For example patients in the BCT-NS group reported improvements, but may have not improved enough to feel satisfied. An objective measure could have captured the physiological improvement of cough.

Another limitation of this study was the manner in which some of the questions were asked. First, some of the questions were redundant and/or unclear. For example, there was one question of “I have difficulty breathing” and then two other questions of “When I have difficulty breathing, it is hardest to breathe in.” and “When I have difficulty breathing, it is hardest to breathe out.” This creates an overlap of questioning and may inflate the significance of the answers as two questions account for the same symptom. Second, there were questions that might have been more sensitive if written in a different format. For example, we did not use the Likert scale for triggers, allergens, and personality traits. Rather, participants were given a binary “yes” or “no” choice for each trigger/allergen/personality characteristic. Asking the

participants to rate the severity level of each item, including a “not applicable” option, likely would have been more sensitive.

Patient recruitment and subsequent participant demographics posed another limitation. It would have been interesting to recruit participants earlier in the treatment process for CC in order to include data from participants whose cough resolved with medicine alone. This was the original intent of the study; however, recruitment from the physicians’ offices was minimal, so the focus of analysis was narrowed only to include patients who were referred for BCT. Recruitment from physicians’ offices likely could have been better if the instructions and purpose of the study had been made clearer during their initial training. Two of the participating physicians express that they thought we were only looking for patients who would also participate in BCT and thus it was assumed the SLP receiving the referral could enroll the participant in the study.

Finally, there was a limitation regarding patient compliance. It is likely that patients with poor compliance also had low “buy in” to perform the behavioral strategies of BCT. If a patient does not believe that an intervention will work, it is doubtful that the patient will maintain compliance. Patient’s compliance may also have been negatively impacted because of minimal external motivation to maintain their performance of the BCT strategies, as the two SLPs often saw each participant only twice: the initial evaluation and one follow-up. Furthermore, some of the patients declined to schedule a follow-up appointment. It might have been interesting to analyze the participants who did and did not schedule a follow-up appointment against their self-reported level of compliance. Furthermore, investigating why certain people did not

schedule a follow-up appointment may have revealed areas for improvement within BCT, such as providing more thorough education on how CC and laryngeal hypersensitivity work.

Future directions

There are several proposed considerations for future research on this topic. First, the results indicate it may be possible to create a screening tool based on patient-reported variables to differentiate patients who may benefit from an early referral to BCT. In order to create such a tool, future studies will need a larger number of participants. Specifically, future studies should recruit more participants who are either not successful with BCT, or do not need BCT because they are successfully treated with medicine. Future studies should include recruitment of participants from physicians who regularly and successfully treat patients with CC in order to compare patients whose cough resolves with medicine to those whose cough resolves following BCT. Data from that comparison will further differentiate patient-reported variables that predict success with BCT. It may also be beneficial to base group assignment on an objective measure of cough status, such response to known cough stimulants such as capsaicin or citric-acid. Additionally, a larger number of participants will allow for the use of parametric statistical measures such as linear regression, discriminant analysis, or factor analysis to determine which items are predictive of BCT success. The data from this preliminary pilot study will contribute to estimating the necessary sample size for the ongoing larger study that is already in process with these goals in mind.

Future studies may also want to consider creating domains for measurement, similar to the LCQ, by grouping questions based on theory or analyzing features of the patient-reported variables. For example, there could be a “throat sensations” domain that would include: feeling

a tickle/itch in their throat (Q15), frequently clearing the throat (Q23), having a blocked feeling in the throat (Q24), having a tight feeling in the throat (Q25), having a pushing sensation on the throat (Q27), having a tight throat when experiencing cough symptoms (Q33), and feeling like there is a lump in the throat (Q43). One possibility for determining how to cluster questions is to continue to cross-examine this survey's items with the LCQ, but also with the Newcastle Laryngeal Hypersensitivity Questionnaire⁶, which formatted its questions to align with the LCQ (Vertigan, Bone, & Gibson, 2014). (See Appendix F for a copy of this questionnaire.)

Future studies should also consider patient motivation and compliance with BCT as an important focus. On one hand, it may be worth investigating dosage of BCT sessions and patient compliance. As the SLPs in this study often only conducted an initial and one follow-up session, future studies may want to research the effects of two or three follow-up sessions. On the other hand, it may be worth incentivizing participants treated at the current dosage level to be compliant and forthcoming with their level of compliance to improve the likelihood of obtaining accurate data. A facilitating option may be an increased emphasis on the locus of control that participants have regarding BCT strategies and their cough. An important component of BCT is that the person takes control of their cough through implementation of cough suppression strategies. It is possible that some people do not make a strong connection between suppression strategies and cough mitigation, but rather they conclude that their cough is out of their control and that there is no point in attempting BCT. Therefore, promoting patient "buy in" for the strategies could influence their locus of control and subsequently their compliance

⁶ Vertigan et al., (2014) created the Newcastle Laryngeal Hypersensitivity Questionnaire to measure the level of laryngeal dysfunction across all hypersensitivity syndromes (RCC, PVFM, MTD, and globus pharyngeus, or the sensation of something being stuck in the throat).

with strategies. Obtaining “buy in” with future patients may be positively impacted by an early referral to BCT, before the participant is frustrated from exhausting options, and/or by the clinician providing a thorough education regarding the cause and treatment of their cough. Future clinicians may also increase “buy in” and compliance by conducting an extensive initial interview in order to determine the patient’s principle concerns and desired target areas to then create patient-centered goals woven together with BCT strategies. Review of these goals upon follow-up may be beneficial to reinforce compliance.

Clinical Implications

It is currently not common practice to refer patients with CC to an SLP for BCT until the cough is considered refractory and medical options have been exhausted (Gibson & Vertigan, 2009; McGarvey, 2013). This study provides pilot evidence that it may be possible to create a screening tool that can differentiate patients who are likely to have success with BCT from those who likely will not. Creation of a validated screening tool could help patients be referred for BCT early and appropriately. An early referral could avoid the expensive and time-consuming process of exhausting medical options to alleviate their cough. It also could reduce the cough duration that a patient suffers prior to a BCT referral, which can take as long as 18-60 months (Chamberlain et al., 2013). This study also contributed further evidence for the efficacy of BCT, as participants in both the BCT-S and BCT-NS groups demonstrated improvements on all scores of the LCQ post-BCT, indicating that BCT did help reduce cough severity in all patients.

Conclusion

The current study provides preliminary evidence that suggests that there are differences in patient-reported variables associated with success of BCT. These findings further suggest that

there is potential to create a chronic cough screening tool based on self-reported variables of patients suffering from CC (see Appendix G for a prototype). This study provides additional evidence for the efficacy of BCT. It is unique in that it researches the idea that patient-reported variables could discriminate who would likely benefit from BCT. While the data from this study are based on a small sample size, there are emerging significant differences that will likely be strengthened with future, larger studies. As this study is a small sub-set of a larger, ongoing study, these results can help guide future revisions to the questionnaire and surveying process. Eventually, the hope is that primary care physicians can use such a tool to refer patients early and appropriately for medical or behavioral intervention. Ultimately, further research will lend support to the efficacy of BCT and the appropriate population to implement behavioral strategies.

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Appendix A

Informed Consent

Q1 Please click on the arrow in the middle of the video screen to watch the following video:

Q2 You are invited to participate in a research project about treatment for chronic cough. Please start by answering the following questions.

Are you at least 18 years old?

Have you had a cough for at least 8 weeks?

If you answered NO to questions 1 or 2, you do NOT qualify for the study. Please STOP and return this ipad. If you answered YES to questions 1 and 2, please continue.

Do you have a history of smoking (beyond just trying it or smoking less than 12 months over 10 years ago)?

Have you been diagnosed with any of the following: COPD, lung cancer, chronic bronchitis, emphysema?

Have you taken an ACE-inhibitor medication within the past two months (e.g., lisinopril/Prinivil/Zestril, captopril/Capoten, enalapril/Epaned/Asotec, ramipril/Altace, benazepril/Lotensin, fosinopril/Monopril, moexipril/Univasc, perindopril/Aceon, quinapril/Accupril, trandolapril/Mavik)?

If you answered YES to questions 3, 4, or 5, you do NOT qualify for the study. Please STOP and return the ipad. If you answered NO to questions 3, 4, and 5, you do qualify to participate in the study. Please continue reading.

If you agree to take part in this study, you will answer a brief online survey today and every three weeks until you are satisfied with the treatment for your cough. Today's survey should take approximately 10 minutes to complete. All surveys after today should take no more than 5 minutes. Participation is voluntary, and responses will be kept confidential. Qualtrics survey software is used to administer the survey and is encrypted and compliant with the Health Information Portability and Protection Act (HIPPA). Only designated researchers will have password protected access to your data.

If you choose to enroll in this study, the Principle Investigator, Professor Laurie Slovarp (or a research assistant), will contact you via phone or email every three weeks. They will provide you with a link to the Qualtrics website to fill out a short survey, which should take no more than 5 minutes. If you do not have access to the internet, we will fill out the survey for you by asking you the questions over the phone, or we can mail the survey to you via the US Postal

Service. We will continue to collect data from you every three weeks until you are satisfied with your cough treatment. You may also withdraw from the study at any time.

Risks/Discomforts

There is no risk or discomfort associated with your involvement in this study. Participation or non-participation will not impact your relationship with The University of Montana or your physician/clinician. Entrance and submission of the survey will be interpreted as your informed consent to participate and that you affirm that you are at least 18 years of age.

Benefits

By participating in this study, your cough status will be monitored on a regular basis. If you do not respond to treatment, your physician will be notified and other treatment options may be explored. Your participation in this research also may contribute to the knowledge base on how best to treat patients with chronic cough.

If you have any questions about this research, please contact the Principal Investigator, Laurie Slovarp, via email at laurie.slovarp@umontana.edu or phone at (406)243-2107. If you have any questions regarding your rights as a research subject, contact the UM Institutional Review Board (IRB) at (406) 243-6672.

Payment

There will be no cost to you for participating in this study and you will not receive payment for participating.

Confidentiality

Your identity and the information that is obtained about you during this study will remain confidential to the extent provided by law. However, National Institute of Health, The US Food and Drug Administration (FDA), study staff, study sponsor, and the University of Montana Investigational Review Board may review your records to verify study-related information. If the study results are published or presented, you will not be identified by your name.

Compensation for Injury

Although there are no foreseen risks in taking part in this study, the following liability statement is required in all University of Montana consent forms: "In the event that you are injured as a result of this research you should individually seek appropriate medical treatment. If the injury is caused by the negligence of The University or any of its employees, you may be entitled to reimbursement or compensation pursuant to the Comprehensive State Insurance Plan established by the Department of Administration under the authority of M.C.A., Title 2, Ch 9. In the event of a claim for such injury, further information may be obtained from The University's Claims representative or University Legal Counsel." (Reviewed by University Legal Counsel, July 6, 1993)

It is not the regular policy of The University of Montana, the sponsor of this research study, to provide compensation for injury beyond what is stated in the above paragraph. You still have all of your legal rights to seek other compensation.

Voluntary Participation/Withdrawal

Your decision to take part in this research study is voluntary. You may refuse to take part in or you may withdraw from the study at any time without penalty or loss of benefits to which you are normally entitled.

Questions

This research study has been reviewed by the University of Montana Investigational Review Board (UMIRB) for the purpose of protecting your safety and rights. The UMIRB was instituted under Federal and State law to review studies such as this one in order to protect research participants from: unnecessary risks, risks that outweigh the benefits, procedures that are scientifically unnecessary.

If you have any questions regarding your rights as a research study participant, you may call the UMIRB Coordinator at (406) 243-6672.

If you have any questions about the research procedures now or during the study contact: Laurie Slovarp, The University of Montana, Department of Communicative Sciences and Disorders (CSD 031), (406)243-2107.

Q3 * I have read the above information. I attest that I am at least 18 years of age. I agree to participate in this research project. Would you like to participate in this research?

- Yes (1)
- No (2)

Appendix B

Demographics

Q4 Please enter your first name. (If you are using an ipad, touch the box with your finger first. If you are using a computer, click on the box with the mouse first.)

Q5 Please enter your last name. (If you are using an ipad, touch the box with your finger first. If you are using a computer, click on the box with the mouse first.)

Q6 Please choose your gender.

- Male (4)
- Female (5)
- Other (6)

Q7 Please enter your date of birth.

Q8 Please enter your phone number including area code. You may add more than one number. If you do, please indicate which number you prefer.

Q9 Please enter your email address. We promise we will not send you anything other than information specific to this study. We will not give anyone your email address. If you do not have an email address, leave blank.

Q10 Which form of communication do you prefer?

- Phone (1)
- Text message (2)
- Email (3)
- Any of these forms are fine (4)

Q11 Do you have access to the internet? (If you do not, we will plan to gather data with you over the phone.)

- Yes (1)
- No (2)

Q12 Please enter how long ago your cough started.

Q13 Please enter the professional that referred you to this survey.

Appendix C

Part I: Study Specific Survey

Q14 For each of the following questions, click the circle that best applies to your symptoms within the past week.

Q15 I feel a "tickle" or "itch" in my throat before I start coughing.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q16 I can tell when I'm about to cough.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q17 I cough during sleep.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18 I am able to suppress my cough for short periods of time.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 Sipping water helps my cough for short periods of time.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q20 My cough is productive (i.e., phlegm or mucous comes up when I cough).

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q21 I cough so hard that I can't get air into my lungs.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q22 I cough so hard that I nearly pass out.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q23 I find myself clearing my throat frequently.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q24 My throat feels blocked.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q25 My throat feels tight.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q26 I have a sensation of something pushing on my chest.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q27 I have a sensation of something pushing on my throat.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q28 I have difficulty breathing.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q29 When I use a rescue inhaler, it works immediately.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)	Not applicable (8)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q30 When I have difficulty breathing, it is hardest to breathe in.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)	Not applicable (8)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q31 When I have difficulty breathing, it is hardest to breathe out.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)	Not applicable (8)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q32 When I am having my symptoms, I feel tightness in my chest.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q33 When I am having my symptoms, I feel tightness in my throat.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q34 When I am having trouble breathing, I make a squeaky sound when inhaling.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)	Not applicable (8)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q35 I have a problem with my voice.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q36 My voice is unpredictable. Sometimes it is fine and other times it sounds bad, but it doesn't follow a predictable pattern.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)	Not applicable (8)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q37 I think I have reflux/heartburn.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q38 I think I have post-nasal drip.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q39 I am concerned about past exposures to environmental pollutants/chemicals.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q40 I feel stressed.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q41 I feel anxious.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q42 When I am stressed or anxious, my symptoms are worse.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q43 I feel a lump in my throat.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q44 My breathing shuts down when there is someone in the room with strong perfume and I have to leave.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q45 I feel the need to be in control.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q46 I feel anxious when I am not in control.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q47 I carry a lot of stress in my neck/shoulders.

	All of the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q48 My cough started with an illness that involved significant coughing (e.g., cold, bronchitis, whooping cough, etc.)

- Yes (1)
- No (2)

Q49 Do you think environmental allergies make your symptoms worse?

- Yes (1)
- No (2)

Q50 What environmental allergies trigger your cough/breathing difficulty?

- seasonal pollens (1)
- animals (2)
- molds (3)
- foods (4)
- not applicable, I don't have environmental allergies (5)

Q51 Do any of the following trigger coughing or difficulty breathing? (pick all that apply.)

- Strong smells (e.g., perfumes, cooking, chemicals) (1)
- Smoke (2)
- Change in air temperature (3)
- Laughing (4)
- Talking (5)
- Stress/anxiety (6)
- Exercise (7)
- None (8)
- Other (9)

Q52 If other, please enter trigger(s) here:

Q53 Check each of the following personality characteristics that describe you.

- high-achieving (1)
- self-critical (2)
- anxious (3)
- stressed (4)
- worrier (5)
- laid-back/easy going (6)
- high strung (7)
- cooperative (8)
- pessimistic (9)
- optimistic (10)
- self-motivated (11)
- perfectionist (12)
- competitive (13)
- team oriented (14)
- procrastinator (15)
- Type A (16)

Q54 Please click "Next" to continue. You are more than half way done. Thank you!!!!

Appendix D

Part IIa: Leicester Cough Questionnaire (LCQ)

Q55 Remember to answer the following questions according to how they apply to you during the past week.

Q56 Check the item that matches how serious you feel your cough problem is OVERALL.

- No problem (1)
- Mild problem (2)
- Moderate problem (3)
- Severe (4)

Q57 Check the item that matches how serious you feel your cough problem is TODAY.

- No problem (1)
- Mild problem (2)
- Moderate problem (3)
- Severe (4)

Q58 Have you had chest or stomach pains as a results of your cough?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q59 Have you been bothered by phlegm production when you cough?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q60 Have you been tired because of your cough?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q61 Have you felt in control of your cough?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q62 Have you felt embarrassed by your coughing?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q63 My cough has made me feel anxious.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q64 My cough has interfered with my job, or other daily tasks.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q65 My cough has interfered with the overall enjoyment of my life.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q66 Exposures to paints or fumes has made me cough.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q67 Has your cough disturbed your sleep?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q68 How often per day have you had coughing bouts? (in the past week)

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q69 My cough has made me feel frustrated.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q70 My cough has made me feel fed up.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q71 Have you suffered from a hoarse voice as a result of your cough?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q72 Have you had a lot of energy?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q73 Have you worried that your cough may indicate serious illness?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q74 Have you been concerned that other people think something is wrong with you, because of your cough?

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q75 My cough has interrupted conversations or telephone calls.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q76 I feel that my cough has annoyed my partner, family or friends.

	All the time (1)	Most of the time (2)	A good bit of the time (3)	Some of the time (4)	A little of the time (5)	Hardly any of the time (6)	None of the time (7)
Choose relevance: (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Part IIb: LCQ with Color-Coded Domains

		All the time	Most of the time	A good bit of time	Some of the time	A little of the time	Hardly any of the time	None of the time
1	Have you had chest or stomach pains as a result of your cough?	1	2	3	4	5	6	7
2	Have you been bothered by phlegm production when you cough?	1	2	3	4	5	6	7
3	Have you been tired because of your cough?	1	2	3	4	5	6	7
4	Have you felt in control of your cough?	7	6	5	4	3	2	1
5	Have you felt embarrassed by your coughing?	1	2	3	4	5	6	7
6	My cough has made me feel anxious.	1	2	3	4	5	6	7
7	My cough has interfered with my job, or other daily tasks.	1	2	3	4	5	6	7
8	I felt that my cough interfered with the overall enjoyment of my life.	1	2	3	4	5	6	7
9	Exposure to paints or fumes has made me	1	2	3	4	5	6	7
10	Has your cough disturbed your sleep?	1	2	3	4	5	6	7
11	How many times a day have you had coughing bouts?	1	2	3	4	5	6	7
12	My cough has made me feel frustrated.	1	2	3	4	5	6	7
13	My cough has made me feel fed up.	1	2	3	4	5	6	7
14	Have you suffered from a hoarse voice as a result of your cough?	1	2	3	4	5	6	7
15	Have you had a lot of energy?	7	6	5	4	3	2	1
16	Have you worried that your cough may indicate serious illness?	1	2	3	4	5	6	7
17	Have you been concerned that other people think something is wrong with you, because of your cough?	1	2	3	4	5	6	7
18	My cough has interrupted conversations or telephone calls.	1	2	3	4	5	6	7
19	I feel that my cough has annoyed my partner, family or friends.	1	2	3	4	5	6	7

For clinician use only:
 (a) = Physical: 1,2,3,9,10,11,14,15 (b) = Psychological: 4,5,6,12,13,16,17 (c) = Social: 7,8,18,19 Domain scores: total score from items in domain/number of items in domain (range 1-7). Total scores: addition of domain scores (range 3-21).

Leicester Cough Questionnaire. © 2001

Physical Domain Score: _____/8

Psychological Domain Score: _____/7

Social Domain Score: _____/4

Total: _____



Appendix E

Part III: Intervention type, Compliance, and Cough Status

Q78 Are you now or have you within that last 2 weeks taken a prescribed medication for your cough (including medication for post-nasal drip, reflux, sinus problems)?

- NO (1)
 YES (2)

Q79 Which of the following medications have you taken in the past 2 weeks and how long have you been taking each? (leave blank if not applicable)

Medication for post-nasal drip (1)	<input type="checkbox"/> <1 week (1)	<input type="checkbox"/> 1-2 weeks (2)	<input type="checkbox"/> 3-4 weeks (3)	<input type="checkbox"/> >4 weeks (4)
Medication for reflux (2)	<input type="checkbox"/> <1 week (1)	<input type="checkbox"/> 1-2 weeks (2)	<input type="checkbox"/> 3-4 weeks (3)	<input type="checkbox"/> >4 weeks (4)
Medication for asthma (3)	<input type="checkbox"/> <1 week (1)	<input type="checkbox"/> 1-2 weeks (2)	<input type="checkbox"/> 3-4 weeks (3)	<input type="checkbox"/> >4 weeks (4)
Sinus rinse (4)	<input type="checkbox"/> <1 week (1)	<input type="checkbox"/> 1-2 weeks (2)	<input type="checkbox"/> 3-4 weeks (3)	<input type="checkbox"/> >4 weeks (4)
Other medication for cough (please explain): (5)	<input type="checkbox"/> <1 week (1)	<input type="checkbox"/> 1-2 weeks (2)	<input type="checkbox"/> 3-4 weeks (3)	<input type="checkbox"/> > 4 weeks (4)

Q80 How compliant have you been with taking your medication as prescribed?

	Not very compliant (Somewhat compliant (50-70% of the time) (2)	Fairly compliant (70-90% of the time) (3)	Very compliant (>90% of the time) (4)
Choose one (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q81 On a scale from 1-7, please rate the effectiveness of the medication in the past week in regards to your cough.

	1 (not at all effective) (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (completely effective) (7)
Please rate your answer (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q82 Are you now, or have you within the last 2 weeks, used behavioral strategies recommended by a speech-language pathologist to manage your cough?

- NO (1)
 YES (2)

Q83 How compliant have you been with following the behavioral strategies as prescribed by your speech-language pathologist?

	Not very compliant (Somewhat compliant (50-70% of the time) (2)	Fairly compliant (70-90% of the time) (3)	Very compliant (>90% of the time) (4)
Choose one (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q84 On a scale from 1-7, please rate the effectiveness of behavioral cough strategies during the past week.

	1 (not at all effective) (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (completely effective) (7)
Please rate your answer (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q85 Are you satisfied with your current status in regards to your cough?

- NO (1)
- YES (2)

Q86 Do you feel you need any additional treatment for your cough?

- NO (1)
- YES (2)
- I'M NOT SURE (3)

Appendix F**Newcastle Laryngeal Hypersensitivity Questionnaire**

(1=all of the time; 2=most of the time; 3=a good bit of the time; 4=some of the time; 5=a little of the time; 6=hardly any of the time; 7=none of the time)

1. There is an abnormal sensation in my throat.
2. I feel phlegm and mucous in my throat.
3. I have pain in my throat.
4. I have a sensation of something stuck in my throat.
5. My throat is blocked.
6. My throat feels tight.
7. There is an irritation in my throat.
8. I have a sensation of something pushing on my chest.
9. I have a sensation of something pressing on my throat.
10. There is a feeling of constriction as though needing to inhale a large amount of air.
11. Food catches when I eat or drink.
12. There is a tickle in my throat.
13. There is an itch in my throat.
14. I have a hot or burning sensation in my throat.

Appendix G

Prototype of Refractory Chronic Cough Questionnaire

		All the time	Most of the time	A good bit of time	Some of the time	A little of the time	Hardly any of the time	None of the time
1	My cough is productive (i.e., phlegm or mucous comes up when I cough).	1	2	3	4	5	6	7
2	I find myself clearing my throat frequently.	1	2	3	4	5	6	7
3	Sipping water helps my cough for short periods of time.	1	2	3	4	5	6	7
4	My throat feels blocked.	1	2	3	4	5	6	7
5	I have a sensation of something pushing on my chest.	1	2	3	4	5	6	7
6	When I have difficulty breathing, it is hardest to breathe in.	1	2	3	4	5	6	7
7	When I have difficulty breathing, it is hardest to breathe out.	1	2	3	4	5	6	7
8	I think I have reflux/heartburn,	1	2	3	4	5	6	7
9	I think I have post-nasal drip.	1	2	3	4	5	6	7
10	I think I have asthma.	1	2	3	4	5	6	7
11	I am concerned about past exposures to environmental pollutants/chemicals.	1	2	3	4	5	6	7
12	I feel anxious.	1	2	3	4	5	6	7
13	I carry a lot of stress in my neck/shoulders.	1	2	3	4	5	6	7
14	Strong smells (e.g., perfumes, cleaning products) make my symptoms worse and/or trigger my urge to cough.	1	2	3	4	5	6	7
15	Smoke makes my symptoms worse and/or triggers my urge to cough.	1	2	3	4	5	6	7
16	Changes in air temperature (e.g., walking into an air conditioned room) make my symptoms worse and/or trigger my	1	2	3	4	5	6	7

	urge to cough.							
17	Laughing makes my symptoms worse and/or triggers my urge to cough.	1	2	3	4	5	6	7
18	Talking makes my symptoms worse and/or triggers my urge to cough.	1	2	3	4	5	6	7
19	Stress and/or anxiety make my symptoms worse and/or trigger my urge to cough	1	2	3	4	5	6	7
20	Exercise makes my symptoms worse and/or triggers my urge to cough.	1	2	3	4	5	6	7
DOMAINS:	Symptoms	Parasthesias	Breathing	Comorbidities	Stress/anxiety			Triggers