Assessing referral and practice patterns of patients with chronic cough referred for behavioral cough suppression therapy

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Abstract
The purpose of this exploratory research was to describe current referral and practice patterns for behavioral cough suppression therapy (BCST) throughout the United States, and to assess the need for improving the efficiency of BCST referral patterns. In study I, 126 speech-language pathologists, who treat patients with refractory chronic cough (RCC) in the United States, completed a survey about referral patterns, cough duration, and patient frustration level. In study II, 36 adults with RCC referred for BCST completed a four-part survey about cough symptoms and treatment. The survey included the Leicester Cough Questionnaire (LCQ) before and after BCST. Study I revealed significant patient frustration about the treatment process and the wait-time for BCST. Participants in study II reported average cough duration of over 2 years before BCST. Twenty-seven of 31 participants in study II improved by at least 1.3 on the LCQ, indicating a clinically significant improvement in 87% of patients. This study suggests that the current management model for CC may be unduly time-consuming, and expensive for patients with CC who are successfully treated with BCST. Practitioners are encouraged to consider BCST earlier in the treatment process.

Keywords
Chronic cough, refractory chronic cough, behavioral cough suppression therapy (BCST), Leicester Cough Questionnaire, cough hypersensitivity syndrome (CHS), speech-language pathology

Introduction
Chronic cough (CC) is estimated to effect approximately 12% of the population and is one of the most common complaints for which patients seek medical care.¹⁻⁶ It accounts for over 20 million physician visits per year³ and has a significant impact on quality of life.⁷,⁸ After ruling out the most overt causes of cough (i.e. smoking, angiotensin-converting-enzyme (ACE) inhibitor medications, chronic obstructive pulmonary disease (COPD)/chronic bronchitis, and pulmonary lesion), management typically begins with empiric pharmacologic treatment for the most common causes of CC—upper airway cough syndrome (also known as postnasal drip (PND)), cough-variant asthma, eosinophilic bronchitis, and/or gastroesophageal reflux (GERD).⁹⁻¹² Patients who do not respond to one or a combination of these treatments often face extensive medical testing including pulmonary
function tests, chest and/or sinus computed tomography, laryngoscopy, bronchoscopy, allergy testing, and 24-h pH monitoring. Despite extensive testing, approximately 20% of patients have a cough that is refractory to medical treatment.1,16–19 Behavioral treatment has been shown to be effective in up to 85% of patients with refractory CC (RCC).20–24 This therapy, which we term behavioral cough suppression therapy (BCST), is typically provided by speech-language-pathologists (SLPs) in the United States, and has been shown to reduce cough severity and frequency,20,23,25 to improve quality of life20,21,26, and to reduce cough sensitivity.21,22,27 BCST involves four components: (1) education (e.g. physiology of cough and the larynx, lack of benefit and negative side effects of nonproductive coughing, cough (or laryngeal) hypersensitivity as a potential cause of the cough, and safety and rationale for cough suppression); (2) instruction in vocal hygiene including avoidance of laryngeal irritants and known cough triggers; (3) instruction in cough suppression strategies; and (4) psychoeducational counseling (e.g. that control is possible, treatment is hard work).20,22,25 Patients typically experience significant relief of cough symptoms within 1 to 2 weeks.22,28–30 Despite established efficacy, and the noninvasive, efficient, and inexpensive nature of BCST, it is rarely considered as an early treatment option.28,31

The goal of this qualitative exploratory research was to describe current referral and practice patterns of BCST throughout the United States, and to assess patients’ perceptions of these patterns and the need for improving the efficiency of BCST referral patterns. The research commenced in two studies. Study I consisted of a survey of SLPs in the United States who treat patients with RCC, and Study II consisted of a survey of patients with RCC referred for BCST.

Methods

Study design

A web-based survey methodology was used for both studies. The University of Montana Institutional Review Board approved each study. Study I data were collected anonymously via Survey Monkey Internet application in the fall of 2014. Study II data were collected via Qualtrics Internet application from July 2015 to January 2016.

Participants

One hundred twenty six American Speech Hearing Association (ASHA) certified SLPs in 36 different states across the United States, who treat patients with RCC, participated in study I. Thirty-six adult participants with RCC referred for BCST at two separate SLP clinics in the northwestern United States, without a history of smoking, diagnosis of COPD, lung cancer, chronic bronchitis, or emphysema, and not currently on an ACE-inhibitor medication, participated in study II.

Study I (SLP survey) procedures

Study I participants were recruited via ASHA Special Interest Groups, 13 (Swallowing Disorders) and 3 (Voice Disorders) listserves. These listserves consist of approximately 10,000 and 2200 ASHA certified SLPs, with special interest in swallowing and/or voice disorders, respectively. The listserve postings simply asked SLPs, who regularly treat patients for RCC, to complete a short survey, which was accessible via a hyperlink. The purpose of the survey was not mentioned in the post, to reduce the chance of responder bias. Participating SLPs answered nine questions pertaining to referral and practice patterns, patient frustration, symptoms, and treatment success. The questions were developed by the first author for the purpose of the current study. All questions were multiple-choice with one allowable answer, except questions #2 (typical physician type to refer for BCST) and #9 (common symptoms in patients who respond to BCST), which were “choose all that apply.” Questions and the multiple-choice options are shown in Table 1.

Study II (patient survey) procedures

Study II consisted of a four-part survey that was given to patients before and after BCST. The patient survey had four sections. Only data from sections 1 and 3, and two questions from section 4 (i.e. effectiveness of BCST and overall satisfaction with current cough status) were included in the current analysis. Specific questions included in sections 1 and 4 are shown in Appendix A.

Section 1: Demographic questions including name, date of birth, gender, and contact information, as well as one question about cough duration prior to BCST referral.

Section 2: Thirty eight questions designed by an expert panel for a potential future BCST screening tool.
Table 1. Questions and results of SLP survey.a

| Question                                                                 | Multiple choice options and results |
|-------------------------------------------------------------------------|-------------------------------------|
| 1. Approximately how many patients with CC do you treat each month?    | >8 16% 6-8 10% 3-5 31% 0-2 43%       |
| 2. What type of physician typically refers patients with CC to you? (pick all that apply) | ENT 80% Allergist 36% Pulmonologist 56% Primary care 21% |
| 3. How many physicians have your patients with CC typically seen before they are referred to you? | >4 12% 3-4 23% 2-3 22% 1-2 43% |
| 4. Are your patients frustrated about how many physicians and/or medical tests they have had and how long it took before they came to see you? | Very frust. 28% Mod. frust. 44% Mildly frust. 24% Not frust. 4% |
| 5. How many months, on average, have your patients been suffering from CC? | >9 46% 6-9 25% 3-6 25% 0-3 4% |
| 6. How many of your patients would you estimate respond well to your treatment? | <20% 4% 20-50% 25% 50-80% 29% >80% 42% |
| 7. How many sessions do you typically need to see patients with CC? | >6 13% 5-6 24% 3-4 43% 1-2 20% |
| 8. How long does it typically take before patients with CC experience significant relief of their symptoms following onset of treatment? | >4 wks 12% 3-4 wks 18% 2-3 wks 25% 1-2 wks 34% <1 wks 11% |
| 9. Which of the following symptoms are common in your patients with CC that respond well to treatment? (pick all that apply) | Other 6% Dysphonia 61% Throat lump 49% Throat tickle 79% |
|                                                                         | Dry cough 14% Productive cough 14% Urge to cough 14% |
|                                                                         | Exposure to air 14% Throat tightness 14% Chest tightness 14% |
|                                                                         | Diff. breathing out 8% Diff. breathing in 8% Diff. breathing 8% |
|                                                                         | Diff. mucous 8% Throat muccous 8% Asthma dx 8% |
|                                                                         | PND 8% GERD 8% GERD 8% |

SLP: speech-language-pathologists; Diff: difficulty; dx: diagnosis; Exposure to air . . . : exposure to air pollution; frust: frustrated; GERD: gastroesophageal reflux disease; PND: postnasal drip; CC: chronic cough.

*aMultiple-choice options on the x-axis.*
Section 3: Leicester Cough Questionnaire (LCQ; validated survey for assessing cough-related quality of life)

Section 4: Questions pertaining to prior treatment (e.g. medications), compliance to medical and BCST recommendations, effectiveness of treatment, and overall satisfaction with current cough status.

The entire survey was piloted with two unfamiliar, healthy individuals to ensure clarity of the instructions, the questions, and the flow of the survey itself. Minor modifications were made to the survey per the recommendations of these individuals.

Patients enrolled via an iPad or computer at two participating SLP clinics on the first day of BCST. Following enrollment in the study, participants’ care proceeded as determined by the treating SLP. Both SLPs provided the four components of BCST (as described above) in a similar manner and with similar terminology. Treating SLPs encouraged participants to comply with current physician recommendations. When appropriate, treating SLPs also provided education on strategies to reduce PND (e.g. nasal saline rinse) and dietary and behavioral strategies to reduce GERD.

Following discharge from BCST, patients were contacted by phone, text, and/or e-mail to collect posttreatment data. Posttreatment data included sections 3 and 4 of the enrollment survey. Only section 3 (i.e. LCQ data), and two questions from section 4 (i.e. Rate the effectiveness of your behavioral cough strategies during the past week (1 = not at all effective; 7 = completely effective); and, Are you satisfied with your current status regarding your cough? (yes/no) were used for the current analysis. LCQ-change scores were calculated for each participant by subtracting the pre-BCST LCQ total score from the post-BCST LCQ total score. LCQ-change scores were used to determine success of BCST, with a minimum change of 1.3 considered as a clinically significant improvement, as described by Raj et al.

Data analysis

Statistical analyses were performed using Statistical Package for the Social Sciences software version 23. Study I data were analyzed using descriptive statistics. Study II data were primarily analyzed with descriptive statistics. The Mann Whitney U test was used to analyze differences in age and cough duration between gender groups.

Results

Study I: SLP survey

About 26% of respondents to the SLP survey reported treating six or more patients with RCC per month; 31% reported treating 3 to 5 per month. The remaining 43% reported treating 0 to 2 patients per month. SLPs reported receiving referrals commonly from otolaryngologists (80.3%) and pulmonologists (55.7%). About 42% of SLPs reported their patients see, on average, 2 to 3 physicians before receiving an SLP referral; 35% reported their patients see three or more physicians, prior to SLP referral. About 46% of SLPs reported that the majority of their patients wait over 9 months before receiving a referral for BCST; 25% reported an average delay of 6 to 9 months. Approximately 70% reported their patients are moderately or very frustrated about the number of physicians and/or medical tests completed before a referral to the SLP is made. Furthermore, the majority (63%) of SLPs reported typically seeing patients with RCC for no more than four sessions, and 87% reported their patients that respond to BCST are significantly improved within 4 weeks of starting BCST. Over 60% of SLPs reported that the following patient-reported symptoms are common in patients who respond well to BCST: heartburn/reflux, PND, throat mucous, feeling of eminent coughing spell, dry cough, tickle in the throat, and dysphonia. The full results of the SLP survey can be seen in Table 1.

Study II: Patient survey

Thirty females and six males with RCC enrolled in study II. The average age of each gender group was 55 years and 42 years, respectively—a statistically significant difference ($U = 39.00$, $z = -2.10$, and $p = 0.035$). The calculated average cough duration was 28.9 and 37.2 months per gender group, respectively—an insignificant difference ($U = 61.5$, $z = -0.922$, and $p = 0.357$). The actual average cough duration of the sample was likely higher, given that eight participants were unable to recall the exact duration of their cough, and, rather, reported something like, “for years,” or “at least 5 years.” These patients were given a cough duration score of 60 months. All demographic data are shown in Table 2.

Of the 36 participants with RCC who enrolled in the study II, 31 provided post-BCST data. Of those who provided post-BCST data, 27 improved by at least 1.3 on the LCQ total score, indicating a clinically
significant improvement in cough-related quality of life in 87.1% of participants following BCST. The mean change in LCQ total score was 4.94 in the patients with clinically significant improvement, and −0.75 in the four participants without clinically significant improvement. Patients who improved overall also improved on each of the LCQ domain scores, evidenced by mean change scores of 1.27, 1.83, and 1.83, in the physical, psychological, and social domains, respectively. In contrast, mean LCQ domain change scores for the participants who did not improve were −0.06, −0.25, and −0.44, respectively. Of those with a clinically significant improvement, 19(70%) reported they were fully satisfied with their cough status following BCST. The remaining eight participants reported they had improved (evidenced by a score of 5 or 6 on the effectiveness question (i.e. section 4: question #7) but were not fully satisfied. LCQ domain and total change scores are presented in Table 3 and Figure 1.

**Table 2.** Study II participant characteristics.

|                       | Females (N = 30) |                      | Males (N = 6) |                      |
|-----------------------|------------------|----------------------|---------------|----------------------|
|                       | Min  | Max   | Mean (SD) | Min  | Max   | Mean (SD) | p-Value |
| Age (years)           | 22   | 78    | 55.5 (13.0) | 25   | 65    | 42.0 (14.2) | 0.035   |
| Cough duration (months)| 3.0  | 108   | 28.9 (26.9) | 9.0  | 60    | 37.2 (25.4) | 0.357   |

SD: standard deviation.

**Table 3.** Change scores for total LCQ score and physical, psychological, and social LCQ domain scores for participants with clinically significant improvement (i.e. BCST-success) and participants without clinically significant improvement (i.e. BCST-non-success).

| Group                    | LCQ domain | Min  | Max   | Mean (SD) | SD          |
|--------------------------|------------|------|-------|-----------|-------------|
| BCST-success (N = 27)    | Total      | 1.32 | 11.36 | 4.94      | 2.92        |
|                          | Physical   | −0.500 | 4.5 | 1.27      | 0.98        |
|                          | Psychological | −0.43 | 4.57 | 1.83      | 1.15        |
|                          | Social     | 0.00 | 4.5 | 1.83      | 1.27        |
| BCST-non-success (N = 4) | Total      | −1.86 | 0.32 | −0.75     | 1.10        |
|                          | Physical   | −0.625 | 0.25 | −0.06     | 0.41        |
|                          | Psychological | −0.86 | 0.57 | −0.25     | 0.62        |
|                          | Social     | −1.25 | 1.25 | −0.44     | 1.18        |

LCQ: Leicester Cough Questionnaire; BCST: behavioral cough suppression therapy; SD: standard deviation.

**Discussion**

This work challenges current management models for CC that recommend extensive medical assessment and treatment before considering behavioral therapy.\(^9,11,14,15\) Our survey of SLPs across the United States, who treat patients with CC, as well as the patient survey (and several other studies that confirm high levels of success of BCST), suggest that the current management model is unduly time-consuming, frustrating, and expensive for patients with RCC who are successfully treated with BCST. These patients typically wait months to years before ultimately finding relief from a simple, efficient, and inexpensive behavioral treatment. With CC estimated to effect 12% of the population,\(^6\) and, conservatively,
10–20% of those patients having RCC, a we are talking about 3 to 7 million patients in the United States per year with RCC. Given the high levels of efficacy of BCST for patients with RCC, and the non-invasive, efficient, and inexpensive nature of BCST, we purport BCST should be considered earlier in the treatment process.

At this point, the most appropriate time to consider BCST in the management algorithm of CC is unclear. Given the potential serious medical conditions that can contribute to CC, and that the majority of patients are successfully treated medically, a minimum level of medical assessment and treatment is clearly essential. Further research is needed to determine the risk-benefit ratio of inserting a trial of BCST at different points in the management algorithm. Additionally, a valid screening tool is likely necessary to assist physicians in determining patients who are appropriate candidates for BCST.

Research geared towards the clinical application of cough hypersensitivity testing may also be helpful. The theoretical mechanistic explanation for BCST is that it works by normalizing cough sensory receptors that were hypersensitized due to a neuropathic process following a cough-inducing illness. Specifically, reduction of laryngeal irritants, avoidance of cough triggers, and suppression of cough over time, result in down-modulation of cough-inducing afferent receptors through a neuroplastic mechanism. Support for this theory is provided by Ryan et al., who found that BCST resulted in an increase in capsaicin-induced cough threshold (i.e. reduced cough sensitivity) in patients with RCC. If, in fact, BCST works by changing cough hypersensitivity, we would expect BCST to only work for patients with cough hypersensitization, or what Morice et al. termed cough hypersensitivity syndrome (CHS). Hence, the clinical application of cough hypersensitivity testing may be helpful in determining candidates for BCST. The Newcastle Laryngeal Hypersensitivity Questionnaire (NCHQ) discriminates patients with several types of laryngeal dysfunction syndromes (including RCC) from healthy controls, and provides further evidence of CHS in patients with RCC. The NCHQ may prove to be helpful in determining candidates for BCST, but it has not yet been tested for such use. Future research is needed to determine if the NCHQ, or a similar tool, can help discriminate candidates for BCST from patients who would be better treated medically.

Until further work is done in this vein, physicians must use their clinical judgment for determining when and who to consider for BCST. However, there is data to guide physicians in the clinical decision-making process. First, RCC often co-occurs with paradoxical vocal fold movement, which has several identifiable symptoms including dyspnea, audible inhalation, inspiratory stridor, tightness in neck muscles, sensation of restriction in the larynx/throat, tendency for more difficulty breathing in than out, and quick or no response to rescue inhalers. Muscle tension dysphonia also often co-occurs with RCC, the symptoms of which include strained voice quality, unpredictable voice pattern (e.g. short or long periods of normal voicing without explanation). Patients who present with any of these symptoms may be good candidates for BCST. Finally, physicians may also want to consider the increasingly long wait times to see specialists in the United States when considering BCST. In many areas, patients may be able to complete a trial of BCST before they are able to see a specialist. In these cases, it may be appropriate to refer patients to a speech-language pathologist trained in BCST and a specialist at the same time. If the patient is successfully treated with BCST prior to the specialist appointment, the specialist consultation may be unnecessary.

Limitations and future directions

The primary limitation to this study is the qualitative and exploratory nature of the design, which limits the inferences that can be made from the results. The biggest limitation of study I is the lack of objective measures. All data were obtained via recall of SLPs who treat patients with CC, which most certainly contributes to a level of error in the data. Any conclusions drawn from the data, therefore, must be taken with caution. There are three main limitations of study II. First, the sample size is relatively small. Second, the lack of a control group negates the ability to determine the impact of a placebo effect. Lastly, we did not gather repeat data from patients who reported they were satisfied with BCST. We, therefore, do not know if improvements following BCST were long-standing. However, prior studies on behavioral cough treatment, which have looked at sustainability of effect from 8 weeks to 18 weeks following treatment, have found no degradation of treatment effect.

The data from study II were used to estimate sample size for a study designed to create a valid screening tool for identifying candidates for BCST, which is currently underway. The project includes patients
treated with BCST as well as patients successfully
treated with medical management alone in order to
determine which screening questions are related to
success of medical versus behavioral treatment.

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References
1. Chung KF and Pavord ID. Prevalence, pathogenesis,
and causes of chronic cough. Lancet 2008; 371:
1364–1374.
2. Ford AC, Forman D, Moayyedi P, et al. Cough in the
community: a cross sectional survey and the relation-
ship to gastrointestinal symptoms. Thorax 2006; 61:
975–979.
3. Irwin RS, Boulet LP, Cloutier MM, et al. Managing
cough as a defense mechanism and as a symptom. A
consensus panel report of the American College of
Chest Physicians. Chest 1998; 114: 133S–181S.
4. Natt RS, Earis JE, and Swift AC. Chronic cough: a
multidisciplinary approach. J Laryngol Otol 2012;
126: 441–444.
5. Polverino M, Polverino F, Fasolino M, et al. Anatomy
and neuro-pathophysiology of the cough reflex arc.
Multidisicp Respir Med 2012; 7: 1–5.
6. Morice A. Chronic cough: epidemiology. Chron
Respir Dis 2008; 5: 43–47.
7. Brignall K, Jayaraman B, and Birring SS. Quality of
life and psychosocial aspects of cough. Lung 2008; 186
Suppl 1: S55–S58.
8. French CL, Irwin RS, Curley FJ, et al. Impact of
chronic cough on quality of life. Arch Intern Med
1998; 158: 1657–1661.
9. Iyer VN and Lim KG. Chronic cough: an update. Mayo
Clin Proc 2013; 88: 1115–1126.
10. Lin L, Poh KL, and Lim TK. Empirical treatment of
chronic cough—a cost-effectiveness analysis. Proc
AMIA Symp 2001; 383–387.
11. Morice AH, Fontana GA, Sovijarvi AR, et al. The
diagnosis and management of chronic cough. Eur
Respir J 2004; 24: 481–492.
12. Pratter MR. Unexplained (idiopathic) cough: ACCP
evidence-based clinical practice guidelines. Chest
2006; 129: 220S–221S.
13. Kastelik JA, Aziz I, Ojoo JC, et al. Investigation and
management of chronic cough using a probability-
based algorithm. Eur Respir J 2005; 25: 235–243.
14. Irwin RS, Baumann MH, Bolser DC, et al. Diagnosis
and management of cough executive summary: ACCP
evidence-based clinical practice guidelines. Chest
2006; 129: 1S–23S.
15. Pratter MR, Brightling CE, Boulet LP, et al. An
empiric integrative approach to the management of
cough: ACCP evidence-based clinical practice guide-
lines. Chest 2006; 129: 222S–231S.
16. Chung KF. Chronic ‘cough hypersensitivity syn-
drome’: a more precise label for chronic cough. Palm
Pharmacol Ther 2011; 24: 267–271.
17. Haque RA, Usmani OS and Barnes PJ. Chronic idiio-
pathic cough a discrete clinical Entity? Chest 2005;
127: 1710–1713.
18. McGarvey LP, Heaney LG, Lawson JT, et al. Evalua-
tion and outcome of patients with chronic non-productive cough using a comprehensive diagnos-
tic protocol. Thorax 1998; 53: 738–743.
19. Poe RH, Harder RV, Israel RH, et al. Chronic persist-
ent cough experience in diagnosis and outcome using
an anatomic diagnostic protocol. Chest 1989; 95:
723–728.
20. Patel AS, Watkin G, Willig B, et al. Improvement in
health status following cough-suppression physiother-
apy for patients with chronic cough. Chron Respir Dis
2011; 8: 253–258.
21. Ryan NM, Vertigan AE, and Gibson PG. Chronic
cough and laryngeal dysfunction improve with specific
treatment of cough and paradoxical vocal fold move-
ment. Cough 2009; 5: 4.
22. Ryan NM, Vertigan AE, Bone S, et al. Cough reflex
sensitivity improves with speech language pathology
management of refractory chronic cough. Cough
2010; 6: 5.
23. Soni R, Ebersole B, and Jamal N. Treatment of chronic
cough: single-institution experience utilizing behavioral
therapy. Otolaryngol Head Neck Surg 2016; 156: 1–6.
24. Vertigan AE, Theodoros DG, Winkworth AL, et al. Perceptual voice characteristics in chronic cough and paradoxical vocal fold movement. *Folia Phoniatr Logop* 2007; 59: 256–267.
25. Vertigan AE, Theodoros DG, Gibson PG, et al. Efficacy of speech pathology management for chronic cough: a randomised placebo controlled trial of treatment efficacy. *Thorax* 2006; 61: 1065–1069.
26. Chamberlain Mitchell SA, Garrod R, Clark L, et al. Physiotherapy, and speech and language therapy intervention for patients with refractory chronic cough: a multicentre randomised control trial. *Thorax* 2017; 72: 129–136.
27. Vertigan A, Kapela SL, Ryan NM, et al. Pregabalin and speech pathology combination therapy for refractory chronic cough: A randomized controlled trial. *Chest* 2016; 149: 639–648.
28. Chamberlain S, Garrod R, and Birring SS. Cough suppression therapy: does it work? *Pulm Pharmacol Ther* 2013; 26: 524–527.
29. Gibson PG and Vertigan AE. Speech pathology for chronic cough: a new approach. *Pulm Pharmacol Ther* 2009; 22: 159–162.
30. Vertigan AE, Theodoros DG, Gibson PG, et al. Review series: chronic cough: behaviour modification therapies for chronic cough. *Chron Respir Dis* 2007; 4: 89–97.
31. Morice AH, Faruqi S, Wright CE, et al. Cough hypersensitivity syndrome: a distinct clinical entity. *Lung* 2011; 189: 73–79.
32. Birring SS, Prudon B, Carr AJ, et al. Development of a symptom specific health status measure for patients with chronic cough: Leicester Cough Questionnaire (LCQ). *Thorax* 2003; 58: 339–343.
33. Raj AA, Pavord DI, and Birring SS. Clinical cough IV: what is the minimal important difference for the Leicester Cough Questionnaire? In: Chung KF and Widdicombe J (eds) Pharmacology and Therapeutics of Cough. *Handb Exp Pharmacol*. Springer, Berlin, Heidelberg, 2009, pp. 311–320.
34. Adcock JJ. TRPV1 receptors in sensitisation of cough and pain reflexes. *Pulm Pharmacol Ther* 2009; 22: 65–70.
35. Groneberg DA, Niimi A, Dinh QT, et al. Increased expression of transient receptor potential vanilloid-1 in airway nerves of chronic cough. *Am J Respir Crit Care Med* 2004; 170: 1276–1280.
36. Lee LY and Gu Q. Role of TRPV1 in inflammation-induced airway hypersensitivity. *Curr Opin Pharmacol* 2009; 9: 243–249.
37. Murry T, Branski RC, Yu K, et al. Laryngeal sensory deficits in patients with chronic cough and paradoxical vocal fold movement disorder. *Laryngoscope* 2010; 120: 1576–1581.
38. Vertigan AE, Bone SL, and Gibson PG. Development and validation of the Newcastle Laryngeal Hypersensitivity Questionnaire. *Cough* 2014; 10: 1.
39. Morice AH. The cough hypersensitivity syndrome: a novel paradigm for understanding cough. *Lung* 2010; 188 Suppl 1: S87–S90.
40. Morice AH. Chronic cough hypersensitivity syndrome. *Cough* 2013; 9: 14.
41. Vertigan AE, Theodoros DG, Gibson PG, et al. Voice and upper airway symptoms in people with chronic cough and paradoxical vocal fold movement. *J Voice* 2007; 21: 361–383.

**Appendix A: Patient Survey**

**Section 1: Demographic Questions**

1. Please enter your first name.
2. Please enter your last name.
3. Please choose your gender.
   a. Male
   b. Female
   c. Other
4. Please enter your date of birth.
5. Please enter your phone number including area code.
6. 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.
7. Which form of communication do you prefer?
   a. Phone
   b. Text message
c. Email
d. Any of these forms are fine
8. Do you have access to the internet? (If you do not, we will plan to gather data with you over the phone.)
a. Yes
b. No
9. Please enter how long ago your cough started.
10. Please enter the professional that referred you to this survey.

Section 2: Potential Screening Items (not included in this analysis)

Section 3: Leicester Cough Questionnaire

Section 4: Prior Treatment, Compliance, and Effectiveness of Treatment

1. 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)?
a. Yes
b. No
2. 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) | <1 week | 1-2 weeks | 3-4 weeks | >4 weeks |
| Medication for reflux (2) | <1 week | 1-2 weeks | 3-4 weeks | >4 weeks |
| Medication for asthma (3) | <1 week | 1-2 weeks | 3-4 weeks | >4 weeks |
| Sinus rinse (4) | <1 week | 1-2 weeks | 3-4 weeks | >4 weeks |
| Other medication for cough (please explain): (5) | <1 week | 1-2 weeks | 3-4 weeks | >4 weeks |

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

| Not very compliant (50-70% of the time) | Somewhat compliant (70-90% of the time) | Fairly compliant (>90% of the time) |
| Choose one (1) | o | o | o |

4. 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) | 2 | 3 | 4 | 5 | 6 | 7 (completely effective) |
| Please rate your answer (1) | o | o | o | o | o | o |

5. Are you now, or have you within the last 2 weeks, used behavioral strategies recommended by a speech-language pathologist to manage your cough?
a. Yes
b. No
6. How compliant have you been with following the behavioral strategies as prescribed by your speech-language pathologist?

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

8. Are you satisfied with your current status in regards to your cough?
   a. Yes
   b. No