Efficacy of speech pathology management for chronic cough: a randomised placebo controlled trial of treatment efficacy

A E Vertigan, D G Theodoros, P G Gibson, A L Winkworth

Background: Chronic cough that persists despite medical treatment may respond to speech pathology intervention, but the efficacy of such treatment has not been investigated in prospective randomised trials. The aim of this study was to determine the efficacy of a speech pathology intervention programme for chronic cough.

Methods: A single blind, randomised, placebo controlled trial was conducted in 87 patients with chronic cough that persisted despite medical treatment. Patients were randomly allocated to receive either a specifically designed speech pathology intervention or a placebo intervention. Participants in both groups attended four intervention sessions with a qualified speech pathologist.

Results: Participants in the treatment group had a significant reduction in cough (8.9 to 4.6, \(p<0.001\)), breathing (7.9 to 4.7, \(p=0.001\)), voice (7.3 to 4.6, \(p=0.001\)) upper airway (8.9 to 5.9, \(p=0.001\)) symptom scores and limitation (2.3 to 1.6, \(p=0.001\)) ratings following intervention. There was also a significant reduction in breathing (6.8 to 5.6, \(p=0.047\)), cough (7.6 to 6.3, \(p=0.014\)), and limitation (2.3 to 2.0, \(p=0.038\)) scores in the placebo group, but the degree of improvement was significantly less than in the treatment group (\(p<0.01\)). Clinical judgement of outcome indicated successful ratings in 88% of participants in the treatment group compared with 14% in the placebo group (\(p<0.001\)).

Conclusion: Speech pathology is an effective management intervention for chronic cough which may be a viable alternative for patients who do not respond to medical treatment.
approved by the Hunter Area Research Ethics Committee and the University of Queensland Medical Research Ethics Committee. All participants provided informed and written consent for this study.

Participants
One hundred and twenty persons with chronic cough that had persisted despite medical treatment according to the anatomical diagnostic protocol referred to the speech pathology department at John Hunter Hospital, New South Wales, Australia between April 2003 and October 2004 for behavioural management of their cough were assessed for eligibility in the study. Chronic cough was defined as the presence of chronic coughing that persisted for 2 months following medical treatment based on the approach recommended by Irwin et al.1,13 including treatment for asthma, postnasal drip syndrome (PNDS), gastro-oesophageal reflux (GER), and withdrawal of angiotensin converting enzyme (ACE) inhibitors (if used). The severity of the cough was sufficient for participants to seek medical attention from both general practitioner and respiratory physician. Participants had undergone respiratory case history, hypertonic saline challenge, and induced sputum analysis before inclusion in the study. Significant symptoms identified during the case history were subsequently investigated and treated. Exclusion criteria included recent upper respiratory tract infection, untreated allergy, PNDS, asthma, GER, eosinophilic bronchitis, lung pathology, abnormality on the chest radiograph, chronic obstructive pulmonary disease, and neurological voice disorder. Inclusion criteria included a minimum age of 18 years and ability to travel to John Hunter neurological voice disorder. Inclusion criteria included a radiograph, chronic obstructive pulmonary disease, and bronchitis, lung pathology, abnormality on the chest Exclusion criteria included recent upper respiratory tract history were subsequently investigated and treated. Significant symptoms identified during the case had undergone respiratory case history, hypertonic saline (range 23–84); 64 were women and 23 were men. The demographic data and history of co-morbid medical conditions of study participants that had been treated before inclusion in the study.

Mean (SD) age (years) 59.4 (13.6) Sex (M/F) 64/23 Asthma* 18 (20.7%) Reflux 41 (47%) ACE inhibitors 10 (11.5%) Allergies 52 (59.8%) PNDS1 44 (50.6%) Smoking 2 (2.3%) Mean (SD) FEV1 (% predicted) 95 (20) Mean (SD) FVC (% predicted) 100 (21) Mean (SD) FEV1/FVC 78 (8) AHR1 8 (9%)

ACE, angiotensin converting enzyme; PNDS, postnasal drip syndrome; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; AHR, airway hyperresponsiveness. *Previous asthma treatment included inhaled corticosteroid and long acting bronchodilator. †Previous reflux treatment was proton pump inhibitors. ‡Previous PNDS treatment included topical nasal steroids and ingested antihistamines. §Airway hyperresponsiveness to hypertonic (4.5%) saline.

<table>
<thead>
<tr>
<th>Component</th>
<th>Example</th>
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<tbody>
<tr>
<td>Education</td>
<td>No physiological benefit from cough; capacity for voluntary cough control</td>
</tr>
<tr>
<td>Strategies to reduce cough</td>
<td>Identify warning signs for cough and replace with modified swallow technique, pursed lip breathing</td>
</tr>
<tr>
<td>Reduce laryngeal irritation</td>
<td>Increase hydration, decrease exposure to irritating stimuli</td>
</tr>
<tr>
<td>Psycho-educational counselling</td>
<td>Internalising locus of control; acceptance that treatment is hard work; setting realistic goals</td>
</tr>
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Procedure
Participants completed a symptom frequency and severity rating before and after the intervention.14 Twenty three different cough, respiratory, voice, and upper airway symptoms were rated on a 5-point scale from 1 (never present or absent) to 5 (present all the time or most severe discomfort ever) based on symptoms over the preceding week. Five composite scores were calculated from the symptom rating data and included a total symptom score, breathing score, cough score, voice score and upper airway score.14 The limitation of symptoms on everyday activity was also rated on a 5-point scale ranging from 1 (not limited, have done all the activities that I want to) to 5 (severely limited).

Participants were then randomised by random number generation to receive either a treatment or placebo intervention. Once the participant consented to the study, a random number between 0.000 and 0.999 was computer generated and given to the treating speech pathologist. Participants with numbers between 0.000 and 0.499 received the placebo programme while those with numbers between 0.500 and 0.999 received the treatment programme. The treating speech pathologist was not involved in the randomisation process; however, once the treatment group was allocated, the speech pathologist knew the participant’s group allocation. Group allocation was concealed from participants until the post-intervention symptom rating and clinical judgement of outcome had been recorded.

The intervention for both treatment and placebo groups was provided by qualified speech pathologists with experience in treating voice disorders. Participants in each group attended four individual 30 minute intervention sessions scheduled over a 2 month period. Following the post-intervention rating, the treating speech pathologist made a clinical judgement of each participant’s outcome as successful, unsuccessful, or partially successful. Clinical judgements were made with reference to participant’s informal reports of the effectiveness of the intervention and the speech pathologist’s judgement of the individual’s capacity to understand and implement the strategies.

Participants allocated to the treatment programme were offered the SPEICH-C in accordance with the standard clinical procedure at John Hunter Hospital.7 The SPEICH-C comprises four components including education about the nature of chronic cough, strategies to control the cough, psycho-educational counselling, and vocal hygiene education to reduce laryngeal irritation. Examples of these strategies are

Table 1 Demographic data and co-morbid medical conditions of study participants that had been treated before inclusion in the study.

Table 2 Examples of strategies in the treatment programme.
also recommended.

The programme was tailored for each participant according to their case history. Home practice of these components was addressed at least once during the course of the treatment and was revised during subsequent therapy sessions according to the needs of individual participants. Treatment was considered complete when participants perceived a reduction in symptoms and their perception that their cough was no longer perceived as a threat. There was an equivalent distribution of participants into the treatment and placebo groups according to sex and age (eight men and 35 women in the treatment group, and 15 men and 29 women in the placebo group). The mean (SD) age of participants in the treatment group was 57.5 (13.8) years compared with 61.3 (13.2) years in the placebo group. There was no significant difference in age distribution between treatment and placebo groups using a Mann-Whitney U test. The Wilcoxon signed ranks test was then used to compare scores before and after the intervention in both the treatment and placebo groups. The degree of change in symptom scores following intervention was compared between the treatment and placebo groups using a Mann-Whitney U test. Symptom scores were analysed by intention to treat with the pre-intervention data carried forward for post-intervention analysis. The measure of clinical judgement of treatment outcome was compared between treatment and placebo groups using the $\chi^2$ test.

### RESULTS

There was an equivalent distribution of participants into the treatment and placebo groups according to sex and age (eight men and 35 women in the treatment group, and 15 men and 29 women in the placebo group). The mean (SD) age of participants in the treatment group was 57.5 (13.8) years compared with 61.3 (13.2) years in the placebo group. There was no significant difference in age distribution between treatment and placebo groups using a Mann-Whitney U test.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Comparison of mean (SD) pre-intervention symptom scores for participants in the treatment and placebo groups (Mann-Whitney U test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>Treatment (N = 43)</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Total symptom</td>
<td>32.9 (16.0)</td>
</tr>
<tr>
<td>Breathing</td>
<td>7.5 (4.1)</td>
</tr>
<tr>
<td>Cough</td>
<td>8.6 (3.0)</td>
</tr>
<tr>
<td>Voice</td>
<td>7.0 (5.8)</td>
</tr>
<tr>
<td>Upper airway</td>
<td>8.5 (6.4)</td>
</tr>
<tr>
<td>Limitation</td>
<td>2.3 (1.1)</td>
</tr>
</tbody>
</table>

Table 4 | Comparison of mean (SD) pre- and post-intervention symptom scores and degree of change for participants in the treatment and placebo groups |
<table>
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<tr>
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<tbody>
<tr>
<td>Score</td>
<td>Group</td>
<td>Pre</td>
<td>Post</td>
<td>Difference</td>
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<tr>
<td>---------</td>
<td>-------</td>
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<td>-----------</td>
</tr>
<tr>
<td>Total symptom</td>
<td>Treatment†</td>
<td>35.4 (16.0)</td>
<td>22.7 (18.0)</td>
<td>12.7 (12.7)</td>
</tr>
<tr>
<td></td>
<td>Placebo†</td>
<td>29.9 (13.5)</td>
<td>28.8 (16.5)</td>
<td>2.9 (12.5)</td>
</tr>
<tr>
<td></td>
<td>Difference‡</td>
<td>2.2 (3.7)</td>
<td>0.4 to 3.2</td>
<td>0.001*</td>
</tr>
<tr>
<td>Breathing</td>
<td>Treatment†</td>
<td>7.9 (4.1)</td>
<td>5.0 (4.2)</td>
<td>2.9 (3.6)</td>
</tr>
<tr>
<td></td>
<td>Placebo†</td>
<td>6.6 (4.7)</td>
<td>5.5 (3.5)</td>
<td>1.1 (3.4)</td>
</tr>
<tr>
<td></td>
<td>Difference‡</td>
<td>0.5 (1.0)</td>
<td>0.0 to 0.8</td>
<td>0.011</td>
</tr>
</tbody>
</table>

*Calculated using Wilcoxon signed rank test.  
†Calculated using Mann-Whitney U test.

The placebo programme consisted of four components of healthy lifestyle education including relaxation, stress management, exercise, and diet. These components were provided during four individual sessions with the treating speech pathologist in which participants received information and home practice exercises relating to each of the components. Each component was covered at least once during the course of the placebo programme.

### Data analysis

Breathing, cough, voice, upper airway, limitation, and total symptom scores before the intervention were compared between treatment and placebo groups using a Mann-Whitney U test. The Wilcoxon signed ranks test was then used to compare scores before and after the intervention in both the treatment and placebo groups. The degree of change in symptom scores following intervention was compared between the treatment and placebo groups using a Mann-Whitney U test. Symptom scores were analysed by intention to treat with the pre-intervention data carried forward for post-intervention analysis. The measure of clinical judgement of treatment outcome was compared between treatment and placebo groups using the $\chi^2$ test.
groups in terms of age (p = 0.187), sex (p = 0.102), reflux (p = 0.911), ACE inhibitor use (p = 0.526), allergies (p = 0.837), asthma (p = 0.187), PNDS (p = 0.914), or smoking (p = 0.148).

Symptom scores
There was no significant difference in any pre-intervention symptom score between the treatment and placebo groups (table 3). The magnitude of improvement was significantly greater in the treatment group than in the placebo group for all symptom scores analysed by intention to treat (table 4). Participants in the treatment group had a significant reduction in all symptom scores after the intervention (table 4). In the placebo group there was a significant difference between pre and post-intervention breathing and cough scores but no significant improvement in total symptom, voice, or upper airway scores. Although there was a significant improvement in limitation scores after the intervention in both the treatment and placebo groups, the degree of improvement was significantly greater in the treatment group. Outcomes for treatment and placebo group are summarised in table 5.

Clinical outcome
The clinical outcome for each participant was rated as successful, unsuccessful, or partially successful (table 6). Most of the participants in the treatment group were rated as having a successful outcome, while most in the placebo group were rated as having an unsuccessful outcome. The treatment group had a significantly higher incidence of participants with a successful outcome than the placebo group. Three participants in each group made positive progress but were considered to require additional speech pathology treatment at the conclusion of the programme to achieve satisfactory resolution of symptoms. Comparison of outcomes based on intention to treat was also statistically significant (p<0.001).

DISCUSSION
This study is the first randomised controlled trial of speech pathology intervention for chronic cough and is the largest investigation of speech pathology management for chronic cough reported in the literature.

The symptom data suggested that speech pathology was effective in reducing symptoms in chronic cough and that the treatment was more effective than a placebo intervention. The lack of a significant difference in pre-intervention symptom scores between the treatment and placebo groups indicated that improvements observed in the treatment group were due to the intervention rather than inherent pre-intervention differences between groups. Both the treatment and placebo groups showed a significant reduction in limitation scores following the respective interventions, but the degree of improvement was significantly greater in the treatment group. It might be supposed that the reduction in limitation scores was affected by both the improvement in symptoms and the positive attention provided during the treatment programme. The placebo effect could be relevant in both treatment and placebo groups; however, the degree of attention received during the intervention programme was consistent between the two groups.

The results of the clinical judgement were consistent with the symptom ratings and indicated that most of the participants in the treatment group had a successful outcome. The use of clinical judgement as an outcome measure is similar to the judgements made in everyday clinical practice and those described in previous reports. However, for research purposes, unblinded clinical judgements from the participant’s treating speech pathologist are likely to be affected by bias and are therefore less robust than formal symptom ratings. The interpretation of the outcome of clinical judgements in this study should therefore be made with reference to the methodological shortcoming of this procedure.

Because of the single blinded design of this study and the nature of the intervention programmes, it was not possible to blind the treating speech pathologist to the type of intervention. The possibility that unconscious bias could have been conveyed to the participants during the course of intervention cannot therefore be discounted. Double blinding is not possible in studies of behavioural intervention. Despite this limitation, the participants remained blinded until after completion of the post-intervention symptom ratings.

The activities used in the placebo programme were unrelated to the cough. The lifestyle education programme was chosen for its similarity to the direct SPEICH-C whereby behaviour change was targeted over a number of sessions through education and specific activities. The placebo programme also comprised real life education rather than nonsensical or foil activities. Although the placebo programme was not specific for chronic cough, it is possible that the placebo activities such as stress management and progressive relaxation had a more direct influence on voice and cough symptoms than was previously anticipated. Comparison of treatment and placebo responses with a non-intervention control group might provide further information on the impact of the activities used in the placebo programme.

The 2 month duration of follow up chosen in the current study reflected current practice, but long term follow up as recommended by McGarvey was lacking in the current protocol. Long term follow up is lacking in many studies of

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Summary of outcomes for the treatment and placebo groups</th>
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<tbody>
<tr>
<td>Score</td>
<td>Treatment</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Breathing</td>
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<tr>
<td>Cough</td>
<td></td>
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<tr>
<td>Voice</td>
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<tr>
<td>Upper airway</td>
<td></td>
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<tr>
<td>Limitation</td>
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</table>

(•, significant improvement from pre- to post-intervention; ×, no significant improvement from pre- to post-intervention; N, improvement significantly greater in treatment group than in placebo group.)

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Comparison of clinical judgement of outcome of the intervention between treatment and placebo groups (χ² test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Treatment (N = 43)</td>
</tr>
<tr>
<td>Successful</td>
<td>38</td>
</tr>
<tr>
<td>Unsuccessful</td>
<td>2</td>
</tr>
<tr>
<td>Partially successful</td>
<td>3</td>
</tr>
</tbody>
</table>
the medical management of chronic cough. For example, a systematic review of randomised trials of omeprazole in the treatment of chronic cough found limited follow up beyond the study period in the majority of studies.21 Further studies of speech pathology interventions in chronic cough are needed to investigate the duration of the beneficial effect. This study provides preliminary support for the effectiveness of speech pathology management for chronic cough that persists despite medical treatment. Speech pathology intervention for chronic cough is multifactorial. This study demonstrates the effectiveness of the SPEICH-C, but further studies are needed to determine which specific components are the most beneficial. It is possible that protocols for the management of chronic cough according to the anatomical diagnostic protocol could be expanded to include treatment with speech pathology. Behavioural control of chronic cough is a management option with the potential to provide many savings in terms of healthcare resources including expensive medications and diagnostic investigations that may continue in a potentially fruitless search for an organic cause.24

Although speech pathology treatment appears to be successful in improving symptoms in persons with chronic cough, the mechanism behind the symptom improvement is yet to be determined. The education and reassurance given in the treatment programme may have resulted in a more rapid subjective improvement. Nevertheless, it is possible that processes such as muscle tension and cough reflex sensitivity could play an important role in chronic cough.25–27 Smith et al. compared cough sensitivity and ratings of the urge to cough among healthy volunteers assigned to a psychological exercise group, a cough suppression group who were advised to try not to cough, or a no intervention control group.28 The cough threshold was significantly reduced in the psychological exercise and cough suppression groups, but there was no significant difference in ratings of the urge to cough between the groups. The authors concluded that psychological factors could influence cough reflex sensitivity and that reducing concern and active suppression of the cough could raise the cough threshold. Extrapolating these results to the current study, it is possible that a speech pathology intervention directed at cough suppression could increase the threshold for cough and reduce cough sensitivity in persons with chronic cough. However, further studies of cough sensitivity are needed to confirm this proposition.

Several studies have found a beneficial effect on the larynx of adequate hydration including attenuating or delaying an increase in the phonation threshold pressure, which is the minimum amount of pressure needed to set the vocal folds into vibration and reduced risk of laryngeal injury.29–30

Increasing hydration in the treatment group may have reduced the phonation threshold pressure and subsequent stimulation of the cough receptors.

In conclusion, clinical judgement and symptom ratings support the hypothesis that speech pathology treatment is an effective behavioural intervention for chronic cough which could be considered a valid alternative for individuals whose cough persists despite medical intervention. Further investigations are required to understand the pathophysiologic bases of the outcome of speech pathology intervention for chronic cough.

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REFERENCES
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