

# Assessing Coughing and Wheezing in Lung Cancer: A Pilot Study

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**Purpose/Objectives:** To establish reliability and validity of two self-report questionnaires, the Lung Cancer Cough Questionnaire and the Lung Cancer Wheezing Questionnaire.

**Design:** Prospective, exploratory pilot study.

**Setting:** Clinical oncology settings in the southern United States.

**Sample:** 31 adult women with lung cancer.

**Methods:** Content validity of both questionnaires was assessed through a comprehensive literature review and an expert judge panel. Concurrent validity was established by Spearman rank correlation coefficients and Wilcoxon Rank Sum tests with items from other valid tools. Test-retest reliability was assessed by percent agreement, kappa, paired t tests, and correlations. Internal consistency was determined by Cronbach's alpha.

**Main Research Variables:** Cough, wheeze.

**Findings:** Cronbach's alpha showed excellent internal consistency and percent agreement, and kappa showed similarity of item responses across test-retest administrations. Nonsignificant paired t tests indicated similar mean scores, and significant test-retest correlations supported test-retest reliability.

**Conclusions:** Preliminary testing indicates good reliability and validity for both questionnaires. Both instruments can identify people with problems of coughing and wheezing and have the potential for monitoring these symptoms over time and determining effectiveness of interventions.

**Implications for Nursing:** Assessment of coughing and wheezing is an important component of monitoring respiratory symptoms of lung cancer. Both of these symptoms can be amenable to interventions. Further research is needed to confirm psychometrics and sensitivity of these tools.

## Key Points . . .

- Coughing and wheezing are common symptoms associated with lung cancer and the presenting symptoms in more than 50% of patients.
- Consistent assessments of these symptoms are important for symptom management.
- Further study is needed to confirm the performance of these instruments in clinical settings.

course of these symptoms has limited symptom management in this area.

The purpose of this study was to develop two tools to assess the presence and severity of the lung cancer-related symptoms cough and wheezing. Valid and reliable instruments can aid in the early assessment of and intervention for these symptoms as well as detect changes resulting from symptom management.

## Relevant Literature

Nearly 95% of patients with lung cancer are symptomatic at initial diagnosis (Beckles et al., 2003), with respiratory symptoms being common (Cooley, 2000). The ranges for initial respiratory symptoms are 8%–75% for cough, 3%–60% for dyspnea, 6%–35% for hemoptysis, and 2%–31% for wheezing (Beckles et al.; Sarna et al., 2002). Dyspnea (Mercandante, Casuccio, & Fulfar, 2000; Thomas & Von Gunten, 2002), coughing (O'Driscoll et al., 1999; Selim et al., 1997), production of phlegm (Epstein, Faling, Daly, & Celli, 1993; Selim et al.), hemoptysis (Herth, Ernst, & Becker, 2001; Kuo, Chen, Chao, Tsai, & Perng, 2000), and wheezing (Martins & Pereira, 1999; Selim et al.) have been reported. In addition, fatigue has been reported as a consequence of respiratory distress that compounds symptomatology (Chang, Curtis, Patrick, &

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Lung cancer is the second most common type of cancer in the United States, responsible for 30% of all cancer deaths (Jemal et al., 2004). Respiratory symptoms are common during the course of the disease and include cough, shortness of breath, and wheezing (Beckles, Spiro, Colice, & Rudd, 2003). These symptoms can affect performance of day-to-day activities and diminish quality of life (QOL). Respiratory symptoms associated with lung cancer can be compounded by a history of or continued smoking (Tyczynski, Bray, & Parkin, 2003). The majority of research on management of respiratory symptoms has focused on the needs of those with dyspnea. Coughing and wheezing are presenting symptoms in 23%–80% of patients with lung cancer (Hollen, Gralla, Kris, Eberly, & Cox, 1999; Landis, Murray, Bolden, & Wingo, 1998; O'Driscoll, Corner, & Bailey, 1999). Little data exist on the management of these troublesome symptoms. Although these symptoms are included in some measures of QOL (Fayers, Bottomley, EORTC QOL Group, & QOL Unit, 2002; Gridelli, Perrone, Nelli, Ramponi, & De Marinis, 2001; Hollen et al.), they often are single items included as part of a global score and rarely are reported as individual items. The lack of available instruments to assess the character, dimensions, and clinical

Raghu, 1999; Hollen et al., 1999). A great deal of information is known about the symptom of dyspnea, primarily from the literature on chronic obstructive pulmonary disease (COPD). Several tools are available that measure this phenomenon and its relationship to activities of daily living, exercise, and overall QOL (Gift & Narsavage, 1998; Hajiro et al., 1998).

The presence of respiratory symptoms can affect QOL negatively (French, Irwin, Curley, & Krikorian, 1998; Roszkowski et al., 2000; Scieszka, Zielinski, Machalski, & Herman, 2000). Respiratory symptoms may be associated with treatment-related mortality (Larson, Svendsen, Milman, Brenoe, & Peterson, 1997; Mehdi et al., 1998); however, they also can be relieved by cancer treatment. They can continue throughout the trajectory of lung cancer (Chernecky & Sarna, 2000; Martins & Pereira, 1999; O'Driscoll et al., 1999; Sarna, 1993, 1994, 1998; Sarna, Lindsey, Dean, Brecht, & McCorkle, 1993; White et al., 2000), and unrelieved respiratory symptoms are the main reasons that people with lung cancer visit the emergency room (ER). Research has supported that 60% of ER visits by patients with lung cancer were for respiratory distress, and 31% who presented with dyspnea died in the first two weeks after presentation (Escalante et al., 1996). Also, an ER visit predicted a four-week mean survival. The symptoms of productive cough and wheezing are known to increase the incidence of postoperative complications (Epstein et al., 1993).

The two troublesome symptoms, coughing and wheezing, affect QOL and activities of daily living. Similar to other symptoms, they are multidimensional. Perception of symptoms may include physical, emotional, social, and spiritual components (Drings, 1999). Physiologic measurements alone, such as pulmonary function tests (Ferguson, Enright, Buist, & Higgins, 2000), do not accurately assess patients' perceptions of symptom distress. For example, pulmonary function tests are correlated poorly with patients' perception of dyspnea (Guyatt, Townsend, Berman, & Pugsley, 1987; Mahler et al., 1992). Some investigators have reported a relationship between QOL and ventilatory capacity (Chang et al., 1999; Lubbe, Krischke, Dimeo, Forkel, & Petermann, 2001; Sarna et al., 2002).

Some dimensions of coughing and wheezing are measured as single items in other tools such as the Sickness Impact Profile (Bergner, Bobbitt, Pollard, Martin, & Gilson, 1976), Short Form 36 (Ware & Sherbourne, 1992), Nottingham Health Profile (Hunt, McEwen, & McKenna, 1986), St. George Respiratory Questionnaire (Jones, Quirk, Baveystock, & Littlejohns, 1992), Chronic Respiratory Questionnaire (Guyatt et al., 1987; Wijkstra et al., 1994), Lung Cancer Symptom Scale (LCSS) (Hollen et al., 1999), European Organization for Research and Treatment of Cancer (Sprangers et al., 1998), and Functional Assessment of Cancer Therapy–Lung (Cella et al., 2002). All of these tools measure QOL, but none specifically measures prevalence and severity of coughing or wheezing.

## Coughing

Cough is the forceful expiration of air with a partially closed glottis that produces a noise. A cough is present in as many as 80% of patients with lung cancer (Hollen et al., 1999; O'Driscoll et al., 1999) and is the most frequent symptom in very young and very old patients with non-small cell lung cancer (NSCLC) (Kuo et al., 2000) and the presenting symptom in bronchioloalveolar (Lee et al., 1997) and giant cell carcinomas of the lung (Laforga, 1999). It can be managed in many cases with thoracic radiotherapy (Langendijk

et al., 2000) and in 31% of cases with chemotherapy (White et al., 2000). Persistent cough is a common symptom with squamous cell carcinoma because the lesions are central to the bronchus (Scully, Mark, McNeely, Ebeling, & Philips, 1997). Irritative neoplastic cough is a complaint in 27% of patients in early disease stages (Moroni, Porta, Gualtieri, Nastasi, & Tinelli, 1996; Vaaler et al., 1997) and in 86%–90% in later stages (Hollen et al.; Vyas et al., 1998) and the chief complaint of younger females with adenocarcinoma (Kuo et al.). Associated with cough is sputum production that occurs in 49% of people with lung cancer; 35% produce more than several teaspoons of sputum per day (Selim et al., 1997). Also, body position has been known to affect respiratory symptoms (Hatipoglu, Laghi, Cattapan, & Chandrasekhar, 2002).

Treatment strategies for cough vary. Irritative neoplastic cough has been treated with albuterol (Irwin & Madison, 2000; Linder & Stafford, 2001) and cough suppressants; if accompanied by dyspnea, cough is treated with bronchodilators, corticosteroids, opioids, oxygen therapy, physiotherapy, inhalation therapy, bronchial stents, or psychoactive medications (Ripamonti, 1999). No definitive treatment is recommended for cough associated with lung cancer.

Despite the clinical relevance of cough, a literature review using the MEDLINE® and CINAHL® databases for the past 10 years revealed fewer than a dozen journal articles in which cough was identified as a major outcome (Evans, Kocha, Gagliardi, Eady, & Newman, 1999; Hollen et al., 1999; Kuo et al., 2000; Lee et al., 1997; Liedekerken, Hoogendam, Buntinx, van der Weyden, & de Vet, 1997; Mehdi et al., 1998; Scully et al., 1997; Sibley, Jamieson, Marks, Anscher, & Prosnitz, 1998; Stephens, Hopwood, & Girling, 1999; Vyas et al., 1998). These studies reveal that cough is a symptom found in all stages and types of lung cancer and may respond to chemotherapy, radiation therapy, and palliative care measures. Cough also has been identified with rhinitis, asthma, gastroesophageal reflux disease (Carney et al., 1997), COPD, hemoptysis, and tobacco use. The incidence and severity of cough also can be attributed to other factors in people with lung cancer. These include treatment-related factors associated with surgery, radiation, and chemotherapy (Ripamonti & Bruera, 1997), tobacco use (onset and pack years), medications such as angiotensin-converting enzyme inhibitors (Irwin et al., 1998), activity (Selim et al., 1997), and comorbid conditions (e.g., COPD, HIV, neutropenia). Cough also can lead to several complications, including sleep disturbances, social disruptions, urinary incontinence, headache, syncope, rib fracture, and back pain (Carney et al.).

## Wheezing

Wheezing is a high-pitched whistling or musical sound from the lungs that can occur with inspiration (breathing in) or expiration (breathing out). Important factors associated with wheezing are body position, activity, and time frame of response to treatment. Wheezing is a common symptom in people with adenocarcinoma because lesions are located peripherally (Scully et al., 1997). Wheezing also is known to increase with activity (Selim et al., 1997) in people with COPD. To date, no cancer-related clinical studies have been conducted in oncology settings specific to the symptom of wheezing, although several tools include the symptom, such as the modified medical research council questionnaire (Mahler & Jones, 1997), St. George Respiratory Questionnaire (Jones

et al., 1992), Chronic Lung Disease tool (Mahler, Weinberg, Wells, & Feinstein, 1984), and the Cancer Dyspnea Scale (Tanaka, Akechi, Okuyama, Nishiwaki, & Uchitomi, 2000).

## Methods

The purpose of this project was to develop valid and reliable measures to assess coughing and wheezing so that both instruments could be used to evaluate these two symptoms in patients with lung cancer. A literature review on coughing and wheezing, based on journal articles from MEDLINE and CINAHL searches in the past 10 years, and assessment of tools associated with dyspnea and COPD led to the identification of symptom dimensions and the initial development of items for both tools. An expert judge panel, consisting of two doctorally prepared oncology nurse specialists and one pulmonary nurse specialist, assessed the instruments for comprehensiveness, accuracy of content, and format. An additional doctorally prepared nurse researcher and two statisticians assessed the instrument for format only. To minimize symptom burden, both self-report tools were designed to be short and easy to use. The final versions of the questionnaires were returned to the same panel for review. This resulted in a few editorial changes for both questionnaires.

The **Lung Cancer Cough Questionnaire (LCCQ)** is an eight-main-item self-report tool with a range of scores from 0–32. Higher scores indicate more distress with self-reported cough. The questionnaire takes less than five minutes to complete, and the timeframe for assessment is “within the prior week.” If present, details about the coughing experience are assessed to evaluate the impact of cough on the ability to sleep and to carry out normal activities, and the quality (color) and quantity of associated sputum production are noted. The severity of the symptom is assessed by time of day and body position. To calculate an overall score, the number of “yes” answers on the set of 8 main items and 30 subitems (e.g., amount of sputum) are added, with a deduction of one point for each of the six main questions if the subquestions were answered “yes”; hence, the maximum score is  $8 + 30 - 6 = 32$ . Subtraction of points for the main items is done so that the score for the presence of the symptoms is not doubled. A higher score indicates greater symptom distress from coughing.

The **Lung Cancer Wheezing Questionnaire (LCWQ)** is a seven-main-item self-report tool with a range of scores from 0–18. Higher scores indicate more distress with self-reported wheezing. The questionnaire takes less than five minutes to complete. The timeframe for assessment is “within the prior week.” After determining the presence of wheezing, details about the wheezing experience are assessed, including frequency of wheezing (all the time, when you take a breath in, when you breath out, accompanied by dyspnea), the severity of the symptoms by time of day and body position, whether wheezing goes away after cough or taking a deep breath, and impact on ability to sleep and carry out normal activities. Three of the questions have subitems in response to an affirmative answer to the main item. To calculate an overall score, the number of “yes” answers on the set of 7 main items and 14 subitems are added, with a deduction of one point for each of the three main questions that have subquestions; hence, the maximum score is  $7 + 14 - 3 = 18$ . Subtraction of points for the main items is done so that the score for the presence of the symptoms is not doubled. A higher score indicates worse effects from patients’ perspectives concerning the symptom of wheezing.

## Sample

The pilot testing for these instruments was conducted as part of a study focused on QOL of women with lung cancer. The convenience sample for this study included 31 female adults with NSCLC who lived in the southern United States. The women were eligible if they were female, had a histologic diagnosis of NSCLC, had no known brain or central nervous system metastasis, and were able to read English. Patients with any stage disease were eligible for this exploratory study. Other instruments used to assess respiratory distress included the **LCSS**, the **Dyspnea Index**, and a **symptoms management query** created by the investigators to evaluate the presence of symptoms. The study was approved by the Medical College of Georgia’s institutional review board.

## Procedure

Subjects were recruited from offices of local oncologists who practiced in academic healthcare settings and in three community settings. Physicians and nurses gave potential subjects information about the study. Patients who were interested called the investigator’s office to discuss the study and make an appointment for data collection. Both questionnaires were administered on separate clipboards at the participant’s respective location: the subject’s home, the researcher’s office, outpatient oncology department, physicians’ office, or diagnostic waiting room. All subjects completed the coughing questionnaire first, followed by the wheezing questionnaire. To establish test-retest reliability, the two tools were readministered in a 60–90 minute timeframe. This timeframe was chosen for three reasons: (a) at least one activity had occurred between the test

**Table 1. Lung Cancer Cough Questionnaire Mean and Standard Deviation of Differences Between Times 1 and 2**

Variable	$\bar{X}$	SD
Cough in past week	–0.03	0.18
Cough all the time	0.06	0.25
Hurt when you coughed	–0.03	0.18
Cough resulted in sputum	0.00	0.00
Color of sputum		
Bloody	0.06	0.25
Gray	–0.03	0.18
Green	0.00	0.00
Yellow	0.00	0.00
White	0.00	0.00
Clear	–0.06	0.25
Cough interfered with ability to sleep	0.00	0.00
Cough interfered with ability to carry out normal activities	–0.03	0.31
Cough worse at certain time of day	–0.06	0.36
Right after waking up	–0.06	0.25
Right after going to bed	0.00	0.00
Right after exercise or activity	0.06	0.25
Right after eating	0.00	0.25
Generally in the evening	0.00	0.00
Generally in the morning	–0.06	0.25
Generally in the afternoon	0.00	0.00
Cough worse in a certain body position	0.00	0.26
Sitting up	0.00	0.00
Lying flat on back	0.00	0.00
Lying on either right or left side	0.00	0.00
Lying flat on stomach	0.00	0.00
Amount of sputum coughed up at any one point in time	0.00	0.00
Amount of sputum coughed up in last week	0.00	0.26

**Table 2. Lung Cancer Cough Questionnaire Amount of Sputum at Time 1 and Time 2**

Variable at Time 1	Variable at Time 2					
	None (n)	1 tsp. (n)	1 tbsp. (n)	1/4 cup (n)	1/2 cup (n)	≥ 1 cup (n)
<b>Amount of sputum coughed up at any one point in time</b>						
None	26	—	—	—	—	—
1 tsp.	—	4	—	—	—	—
1 tbsp.	—	—	1	—	—	—
1/4 cup	—	—	—	—	—	—
1/2 cup	—	—	—	—	—	—
1 cup or more	—	—	—	—	—	—
<b>Total amount of sputum coughed up in last week</b>						
None	26	—	—	—	—	—
1 tsp.	—	—	—	—	—	—
1 tbsp.	—	—	3	—	—	—
1/4 cup	—	—	—	—	—	—
1/2 cup	—	—	—	1	—	1
1 cup or more	—	—	—	—	—	—

and retest time periods, allowing enough time for subjects to forget their previous answers, (b) these symptoms can change quickly, so too much time could influence the retest results, and (c) convenience. The activities that occurred between the test and retest time periods included having a physician office visit, diagnostic test, or lung cancer treatment with chemotherapy or radiation therapy.

## Analysis

To evaluate reliability, test-retest reliability (paired t tests), percent agreement, and kappa on each item were performed. Item agreement and Cohen's kappa between times 1 and 2 were assessed for the coughing and wheezing questionnaires. Internal consistency was evaluated by performing an item analysis to determine Cronbach's alpha coefficients for each of the questionnaires. Additionally, the relationship of coughing and wheezing was explored with Pearson correlations for the coughing and wheezing total scores between times 1 and 2 as well as a paired t test for the difference between the time 1 and 2 scores. To explore concurrent validity, Spearman rank correlation coefficients were calculated between the overall LCCQ score and data from the LCSS item pertaining to coughing and dyspnea and the Dyspnea Index score for a subsample of five subjects. The results from these tools were readily available from an ongoing study of patients with lung cancer. Additionally, Wilcoxon Rank Sum tests were analyzed to examine whether differences in the mean rank of the LCCQ existed between subjects' responses to the presence of cough or dyspnea in relation to their responses on the Symptom Management Query. All statistical significance was computed using an alpha level of 0.05.

## Results

Twelve of 31 women with lung cancer (39%) reported cough as a current symptom, and three (10%) experienced wheezing in the past week. Mean scores on the LCCQ were 2.42 (SD = 4.83) and 2.29 (SD = 4.24). Mean scores for the LCWQ were 0.45 (SD = 1.41) and 0.61 (SD = 2.01).

Mean and standard deviation of the differences between times 1 and 2, percent agreement, and kappa between times 1 and 2 on the coughing questionnaire are given in Tables 1, 2, and 3 and for the wheezing questionnaire items in Tables 4 and 5. For most items, percent agreement was excellent or good, and the kappa reflected this as well. In some instances,

**Table 3. Lung Cancer Cough Questionnaire Percent Item Agreement and Kappa**

Variable	Percent Agreement (95% Confidence Interval)	Kappa (95% Confidence Interval)
<b>Cough in past week</b>	96.8 (83.3–99.9)	0.9310 (0.80–1.00)
<b>Cough all the time</b>	93.6 (78.6–99.2)	0.6353 (0.18–1.00)
<b>Hurt when you coughed</b>	96.8 (83.3–99.9)	0.8394 (0.53–1.00)
<b>Cough resulted in sputum</b>	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
<b>Color of sputum</b>		
Bloody	—	—
Gray	—	—
Green	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Yellow	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
White	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Clear	93.6 (78.6–99.2)	0.6353 (0.18–1.00)
<b>Cough interfered with ability to sleep</b>	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
<b>Cough interfered with ability to carry out normal activities</b>	90.3 (74.2–97.9)	–0.0449 (–0.11 to 0.02)
<b>Cough worse at certain time of day</b>	87.0 (70.2–96.4)	0.4312 (–0.02 to 0.89)
Right after waking up	—	—
Right after going to bed	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Right after exercise or activity	93.6 (78.6–99.2)	–0.0333 (–0.08 to 0.01)
Right after eating	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Generally in the evening	93.6 (78.6–99.2)	0.7130 (0.34–1.00)
Generally in the morning	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Generally in the afternoon	93.6 (78.6–99.2)	0.7130 (0.34–1.00)
<b>Cough worse in a certain body position</b>	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Sitting up	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Lying flat on back	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Lying on either right or left side	—	—
Lying flat on stomach	—	—
<b>Amount of sputum coughed up at any one point in time</b>	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
<b>Amount of sputum coughed up in last week</b>	96.3 (78.6–99.2)	0.7754 (0.53–1.00)

*Note.* Actual frequencies and cross classifications used to calculate percent agreement and kappa between times 1 and 2 are available by contacting the author.

**Table 4. Lung Cancer Wheezing Questionnaire Item Mean and Standard Deviation of Differences Between Time 1 and 2**

Variable	$\bar{X}$	SD
Wheeze in past week	0.00	0.00
Wheeze all the time	0.00	0.00
Wheeze when you breathe in	0.00	0.00
Wheeze when you breathe out	0.03	0.18
Short of breath	0.00	0.00
Wheezing interfered with ability to sleep	0.00	0.00
Wheezing interferes with ability to perform activities	-0.06	0.25
Wheezing worse at certain time of day	0.03	0.18
Right after waking up	0.00	0.00
Right after going to bed	0.00	0.00
Right after exercise or activity	0.00	0.00
Right after eating	0.00	0.00
Generally in the evening	0.00	0.00
Generally in the morning	0.00	0.00
Generally in the afternoon	-0.03	0.18
Wheezing worse in a certain body position	0.00	0.26
Sitting up	-0.03	0.18
Lying flat on back	0.00	0.26
Lying on either right or left side	0.00	0.00
Lying flat on stomach	-0.03	0.18
Wheezing goes away after coughing or taking a deep breath	-0.03	0.18

kappa could not be calculated because of zero row or column marginal totals. Percent agreements for the LCCQ items (see Tables 3) ranged from 87.0–100.0, and the kappas ranged from -0.04 to 1.00. The percent agreement for the LCWQ (see Table 5) ranged from 93.6–100.0, and the kappas ranged from 0.47–1.00. These indicate good to excellent reliability (Burns & Groves, 1999).

Table 6 gives the means and standard deviations for the coughing and wheezing scores at times 1 and 2, as well as Cronbach's alpha at each time point. Cronbach's alpha demonstrated acceptable internal consistency (Burns & Groves, 1999). Additionally, the correlation between time 1 and 2 scores is given as well as a paired t test for the difference between the scores. Cronbach's alpha was very good for the coughing and wheezing scales at times 1 and 2, and removing any items from the scales resulted in decreased alphas. Likewise, the correlation between time 1 and 2 coughing scores was high ( $r=0.98$ ). The correlation also was very high between time 1 and 2 wheezing scores ( $r=0.97$ ). The paired t tests for both scores were nonsignificant. The correlation and paired t test results indicate good test-retest reliability.

The alpha coefficients ( $N=31$ ) for time 1 were LCCQ = 0.90 and LCWQ = 0.85 and for time 2 were LCCQ = 0.90 and LCWQ = 0.90. This reflects that the items hang together well and helps establish repeatability. Paired t tests (see Table 6) demonstrated no significant difference in scoring between times 1 and 2. Test-retest correlations also were high (LCCQ  $r=0.98$ ,  $p<0.001$ ; LCWQ  $r=0.97$ ,  $p<0.001$ ).

Concurrent validity testing of the LCCQ with the LCSS item "How much coughing do you have?" was high ( $r_s=0.80$ ,  $p=0.10$ ) although nonsignificant as a result of the small sample size. Sample size does have an effect on validity testing. When the sample size is small, the occurrence of

any particular symptom is low, resulting in low frequencies in an already small sample size. Hence, testing based on small frequencies is not generalizable. The mean rank test of the LCCQ was not statistically different for those who answered "yes" on the Symptom Management Tool item 6 identifying cough as a symptom versus those who answered no ( $p=0.56$ ).

For the LCWQ, the correlations with the LCSS item "How much shortness of breath do you have?" ( $r_s=0.0$ ,  $p=1.00$ ) and the Dyspnea Index ( $r_s=0.58$ ,  $p=0.30$ ) were low to moderate in strength and not statistically significant. The mean ranks of the LCWQ were not statistically different for those who answered "yes" on the Symptom Management Tool versus those who answered "no" ( $p=0.07$ ).

## Discussion

Despite the prevalence and severity of the symptoms of coughing and wheezing in lung cancer (Dudgeon & Rosenthal, 1996; Muers & Round, 1993), little attention has been given to these symptoms in the research or clinical literature. This pilot study presents initial evidence for the reliability and

**Table 5. Lung Cancer Wheezing Questionnaire Item Percent Agreement and Kappa**

Variable	Percent Agreement (95% Confidence Interval)	Kappa (95% Confidence Interval)
Wheeze in past week	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Wheeze all the time	–	–
Wheeze when you breathe in	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Wheeze when you breathe out	96.8 (83.3–99.9)	0.7832 (0.38–1.00)
Short of breath	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Wheezing interfered with ability to sleep	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Wheezing interfered with ability to perform activities	–	–
Wheezing worse at certain time of day	96.8 (83.3–99.9)	0.7832 (0.38–1.00)
Right after waking up	–	–
Right after going to bed	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Right after exercise or activity	100.0 (88.8–100.0)	1.0000 (1.00–1.00)
Right after eating	–	–
Generally in the evening	–	–
Generally in the morning	–	–
Generally in the afternoon	–	–
Wheezing worse in a certain body position	93.6 (78.6–99.2)	0.4655 (-0.16 to 1.00)
Sitting up	–	–
Lying flat on back	93.6 (78.6–99.2)	0.4655 (-0.16 to 1.00)
Lying on either right or left side	–	–
Lying flat on stomach	–	–
Wheezing goes away after coughing or taking a deep breath	96.8 (83.3–99.9)	0.6517 (0.02–1.00)

*Note.* Actual frequencies and cross classifications used to calculate percent agreement and kappa between times 1 and 2 are available by contacting the author.

**Table 6. Coughing and Wheezing Scores at Times 1 and 2**

Score	$\bar{X}$	SD	Alpha	Correlation	p
<b>Coughing</b>					
Time 1	2.42	4.83	0.9036		
Time 2	2.29	4.24	0.8989		
Difference of time 1–time 2	0.13	1.024		0.9827	0.0001 0.4885
<b>Wheezing</b>					
Time 1	0.45	1.41	0.8462		
Time 2	0.61	2.01	0.9000		
Difference of time 1–time 2	–0.16	0.73		0.9685	0.0001 0.2311

validity of instruments to assess these symptoms. All results indicate very good reliability and validity of the coughing and wheezing scales. However, several factors can influence alpha coefficients, including number of subjects, variance of test results, incomplete tests, and score distribution (Waltz, Strickland, & Lenz, 1991). In this study, the score distributions had similar means and standard deviations although the sample size of 31 was small.

Future research is needed to evaluate the validity, reliability, and clinical utility of these instruments. The development of these two tools initiates the possibility that nurses can assess these two symptoms while monitoring interventions focused on respiratory distress.

## Limitations

A small sample size of 31 is good for pilot data, but the low frequency of the occurrence of symptoms, 46% for cough and 9.7% for wheezing, did not allow for adequate testing of these instruments, including the lack of sensitivity and specificity for construct validity. Future research with a much larger sample size that includes men and women with lung cancer, all stages of lung cancer, and all types of lung cancer is needed. Demographic and clinical details that may be correlated with symptom presence and severity were not assessed in this pilot study but are critical for future investigations.

## Future Direction

Both tools need further development and validity testing. These include consideration of the addition of items associated with impact of respiratory symptom in other studies such as QOL, coping with symptoms, and respiratory-related fatigue and anxiety (Guyatt et al., 1987; Hajiro et al., 1998; Mahler & Jones, 1997; “Nurses Develop Treatment for Breathlessness,” 1999). Although both instruments are in the early stage of development, with further testing they may be used in the assessment of the symptoms of coughing and wheezing and become established outcome measures for evaluating the efficacy of therapeutic interventions in people with lung cancer.

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