

CONTINUING EDUCATION

Symptom Clusters in Elderly Patients With Lung Cancer

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Purpose/Objectives: To identify the number, type, and combination (cluster) of symptoms experienced by patients with lung cancer.

Design: A secondary analysis of data collected as part of a larger study.

Setting: 24 sites that included community hospitals, medical clinics, oncology clinics, and radiation-oncology clinics.

Sample: 220 patients newly diagnosed with lung cancer, ranging in age from 65–89 years (\bar{X} = 72 years, SD = 5.02), 38% with early-stage and 62% with late-stage lung cancer.

Methods: Subject self-report.

Findings: Factor analysis found that the symptoms of fatigue, nausea, weakness, appetite loss, weight loss, altered taste, and vomiting form a cluster. Initial staging of cancer, the number of comorbid conditions, and being treated with chemotherapy emerged as significant predictors of the symptoms reported. Few differences were noted between men and women. Correlation was found among the numbers of symptoms reported, symptom severity, and limitations attributed to symptoms.

Conclusions: Patients with lung cancer report multiple distressing symptoms related to symptom severity and limitations.

Implications for Nursing: Assessment of multiple symptoms is recommended in patients with lung cancer.

Key Points . . .

- Patients with lung cancer experience multiple symptoms.
- Fatigue, nausea, weakness, appetite loss, weight loss, altered taste, and vomiting form a cluster of common symptoms in patients with lung cancer at the time of diagnosis.
- Patients with more advanced lung cancer and more comorbidities at the time of diagnosis who are treated with chemotherapy are most likely to have multiple symptoms.
- The more symptoms a patient has, the more severe and limiting the symptoms are perceived to be.

Goal for CE Enrollees:

To further enhance nurses' knowledge regarding the number, type, and combination (cluster) of symptoms experienced by patients with lung cancer.

Objectives for CE Enrollees:

On completion of this CE, the participant will be able to

1. Identify the number, type, and combination (cluster) of symptoms experienced by patients with lung cancer.
2. Describe the relationships among symptoms reported, demographic variables, disease characteristics, and perceived level of functioning.

Patients with cancer suffer from a variety of symptoms, many which go unrelieved (Cooley, 2000). Research has focused on only one symptom at a time, rather than the combination of symptoms that can occur simultaneously. A clearer understanding is needed of the combination of symptoms that occurs in patients, factors that affect this symptom experience, and the effects of a combination of symptoms on patients' functioning. This understanding will lay the foundation for better patient assessment and the development and testing of therapies for better symptom relief.

Lung cancer is the number one cause of cancer mortality in men and women, accounting for 25% of all cancer deaths, with rates among women still rising (American Cancer Society [ACS], 2004). Most patients with lung cancer present with advanced disease and have more symptoms than other patients who are newly diagnosed (Hopwood & Stephens, 1995). This disproportionate symptom experience continues until death, with patients with lung cancer having more severe symptom distress than patients with other cancers (Cooley, 2000; Degner & Sloan, 1995; Sarna & Brecht, 1997). The

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most common symptoms include fatigue, dyspnea, insomnia, and pain (Degner & Sloan; Sarna & Brecht).

Although fatigue is a distressing symptom experienced by all patients with cancer, dyspnea has been shown to be more prevalent in patients with lung cancer than in those with other cancers (Vainio & Auvinen, 1996). During the course of lung cancer, dyspnea has been shown to follow a pattern of gradual increase, plateau (during which patients also experience fatigue), and a subsiding after rest (Brown, Carrieri, Janson-Bjerklie, & Dodd, 1986). Pain also is highly prevalent among patients with lung cancer. Studies have reported prevalence rates of 28%–51% (Claessens et al., 2000) and demonstrated that patients are dying in severe pain (McCarthy, Phillips, Zhong, Drews, & Lynn, 2000).

A number of researchers has examined the symptoms experienced by patients with cancer, often comparing symptoms across cancer diagnoses, but few have examined factors that contribute to the symptom experience (Cooley, 2000). In an attempt to determine the factors contributing to greater symptom severity, Kurtz, Kurtz, Stommel, Given, and Given (2000) studied 129 patients with lung cancer but did not find significant differences in symptom severity scores by stage of disease, treatment categories, or gender. Others have found these factors to be important variables contributing to symptom distress. Sarna (1993), in her study of female patients with lung cancer, observed that type of treatment, specifically chemotherapy, and an increased number of comorbidities were associated with high levels of symptom distress. Degner and Sloan (1995), in their study of patients with lung cancer, found that women, younger patients, and patients with more advanced disease had higher symptom distress. Hopwood and Stephens (1995) separated physical from psychological symptoms and did not find differences between men and women in their report of physical symptoms.

Others have focused on the consequences of symptoms. Kurtz et al. (2000) found patient report of symptom severity to be a significant predictor of patient functioning, as measured by the physical functioning subscale of the Medical Outcomes Study 36-Item Short Form (SF-36). Other researchers studying patients with lung cancer also found a relationship between symptom severity and functioning (Hopwood & Stephens, 1995). However, in such studies, symptom severity usually was represented by an aggregate score that lumped together disparate symptoms such as fatigue, bleeding, and itching.

Instead of focusing on global symptom experience, Sarna and Brecht (1997) looked at symptoms in specific combinations. Focusing on symptom distress, rather than intensity, they used factor analysis on symptoms from 60 patients with lung cancer to separate the symptoms into four distinct congregations of distress, which they labeled as physical and emotional suffering, gastrointestinal distress, respiratory distress and malaise, and dimensions of the symptom experience. Their aim was to use symptoms as indicative of comorbid conditions and to develop a symptom distress scale for use with patients with cancer. However, only women were included in their study.

More recently, Dodd, Miaskowski, and Paul (2001) proposed the notion of studying symptoms in clusters that may or may not share a common etiology or link to comorbid conditions. They studied the symptoms of fatigue, pain, and

sleep insufficiency in 93 adults receiving chemotherapy for cancer at different sites. They found that fatigue and pain affected patients' level of functioning, with fatigue being the largest contributor. No differences were found in functioning for the men versus the women. However, the researchers did not indicate the rationale for their choice of symptoms and, surprisingly, did not find strong intercorrelations among the three symptoms that were supposed to form a cluster. They also did not examine factors contributing to the symptom experience. They suggested that future research focus on symptom clusters rather than one symptom in isolation.

In contrast to that suggestion, most models of symptom management assume that healthcare providers focus on only one symptom rather than a cluster of symptoms. One exception is the Theory of Unpleasant Symptoms (TOUS), in which symptoms are theorized as occurring together rather than in isolation (Lenz, Pugh, Milligan, Gift, & Suppe, 1997). As part of this theory, researchers hypothesized that co-occurring symptoms reinforce each other in a classic interactive pattern rather than being merely additive. For example, an individual may rate pain severity higher when dyspnea and insomnia also are present. As a result, interventions provided for symptom relief should be focused on symptom clusters rather than each symptom in isolation.

Although symptoms are the principal focus of the model, TOUS is comprised of two additional components: the antecedents to the symptom experience and the consequences of the symptom experience (Lenz, Suppe, Gift, Pugh, & Milligan, 1995). Antecedents to the symptom experience include physiologic, psychological, and situational variables. These categories of antecedents interact with each other and with the symptoms to define the overall symptom experience. Physiologic antecedents include disease severity, internal body chemistry, and the like. Examples of psychological factors include mental state, affective reaction to illness, anxiety, and depression. Finally, social support, knowledge level, gender, and lifestyle are aspects of individuals' social situations that affect their symptom experiences. The final component of TOUS is the consequences of the symptom experience in terms of performance and quality of life. Performance includes both physical and cognitive functioning. Individuals with more numerous and severe symptoms likely experience a more significant decline in level of performance. More recently, the antecedents, symptom clusters, and consequences of symptoms were proposed as being interactive and reciprocal rather than linear. For instance, performance is seen not only as a consequence of symptoms but as an influence as well (Lenz et al., 1997).

TOUS originally was developed and tested with patients experiencing fatigue and dyspnea. Subsequent research has supported the model's use with patients who experience fatigue during pregnancy and childbirth, those with chronic obstructive pulmonary disease, and asthma patients who experience dyspnea and to explain the interactive nature of symptoms and their effects on performance in patients with Alzheimer's disease (Hutchinson & Wilson, 1998; Lenz et al., 1997). TOUS was used to guide the current study, which sought to determine whether symptoms co-occur in patients newly diagnosed with lung cancer; whether those symptoms vary according to the antecedents of stage of disease, comorbidities, treatment provided, or gender; and

whether those co-occurring symptoms affect patients' performance, such as their perceptions of their limitations or their self-reported functional status.

Research Questions

1. What are the most frequently occurring symptoms reported by patients newly diagnosed with lung cancer? What is the average number of symptoms, symptom severity, and perceived influence of symptoms on functioning reported by these patients?
2. Can a cluster or clusters of symptoms be identified in newly diagnosed patients?
3. Does a relationship exist between the number of cluster symptoms reported and the mean severity of symptoms?
4. Do differences exist in the number of symptoms in a cluster reported for those with different antecedents such as stage of disease, comorbidities, different treatments, or gender?
5. Do those experiencing more of the cluster symptoms report a lower perceived level of functioning and lower functional status than those reporting fewer of these symptoms?

Methods

The current analysis relied on data from a National Institutes of Health-sponsored panel study of patients with newly diagnosed cancer (Given & Given, 1993–1998). To be eligible for the study, subjects had to be newly diagnosed with one of the four major cancers (i.e., breast, colon, lung, or prostate), be older than 64, have no other cancer diagnosis within the previous two years, be able to speak and read English, and have no cognitive impairments that would affect self-report information.

Subjects were recruited by nurses who were specially trained to implement the protocol. Nurses approached patients, explained the study, and provided a brochure explaining their role in the research. If a patient and a family caregiver agreed to participate, they were asked to sign forms indicating their willingness. Twenty-four sites, including community hospitals, medical clinics, oncology clinics, and radiation-oncology clinics in lower Michigan, plus one site in Indiana, were used to accrue the sample. The Detroit metropolitan area was not used for subject recruitment. For the current analysis, the researchers selected only patients with lung cancer and relied on information from the first interview (four to eight weeks after diagnosis) and the medical record audits.

Procedures

In the original study, nurses and medical students who were employed and trained by the investigators recruited patients using an established protocol. All patients who met the inclusion criteria were approached and provided with a brochure that explained the study. Informed consent then was obtained from those willing to participate. At a mutually agreed upon time, the investigators interviewed the patients via telephone using a structured interview script that required about 45 minutes to complete. Patients spent an additional 15 minutes responding to items presented in a self-administered booklet that was mailed to their homes. The self-administered booklet was returned to the investigators by mail.

Power Calculation

The sample of 220 subjects was large enough so that the probability of discovering a difference of one symptom between the mean symptoms reported by two comparison groups of equal size was 0.9614 (power analysis). This power calculation was based on the observed standard deviation for the symptom count variable in this sample of 1.99, a significance value of $p < 0.05$. The implied standardized effect size for this calculation was $d = 0.5$ ($= 1/1.99$), but differences of less than one symptom in the mean symptom counts were not clinically meaningful. (Power calculations were performed using the "samps" procedure of the STATA® 7.0 software [StataCorp, College Station, TX].)

Measures

Symptom occurrence and severity: Symptoms were assessed using the **Physical Symptom Experience** tool developed by Given et al. (1993). Based on other widely accepted multisymptom tools (McCorkle & Quint-Benoliel, 1983; Portenoy et al., 1994), the instrument is a self-report measure that elicits information on the occurrence and severity of 37 symptoms commonly experienced by patients with cancer. Patients rate the severity of symptoms that occurred during the two weeks prior to the interview using a three-point numeric rating scale. Higher scores denote greater severity. The established alpha for the tool is 0.90 (Wyatt, Friedman, Given, & Beckrow, 1999).

For the purpose of this study, only 32 of the original 37 symptoms were considered. Two (hot flashes and vaginal dryness) are gender specific, and three (arm swelling, leg swelling, and limitations in arm movement) were added later and had too many missing responses.

Limitations from symptoms: The Physical Symptom Experience instrument also was used to assess limitations associated with the 32 symptoms that were included in the analysis. In addition to occurrence and intensity of symptoms, patients in the original interview were asked to rate the extent to which each symptom interfered with daily activities, using a five-point numeric scale. Higher numbers were indicative of greater limitation.

Physical functioning: During the intake interview, each patient was asked to complete the **Medical Outcomes Study SF-36**. This instrument, which was designed as a general measure of health status and quality of life, has been used extensively in clinical research, general population surveys, and policy evaluation (Ware & Sherbourne, 1992). It is composed of eight multi-item scales that measure physical functioning, role limitations associated with physical health, bodily pain, general health, vitality, social functioning, role limitations associated with emotional problems, and mental health (Ware, Snow, Kosinski, & Gandek, 1993). In the current analysis, with its emphasis on physical functioning relative to symptoms, only the three subscales that contribute the most to the physical dimension were included. These consisted of the 10-item physical functioning subscale, the 4-item role limitations associated with physical health subscale, and the 2-item bodily pain subscale (Ware & Davies, 1995). All scales were standardized in the usual manner to a 0–100 scale. Internal consistency of the physical functioning subscale for this sample was 0.89 (Given, Given, Azzouz, Stommel, & Kozachik, 2000), which is consistent with original reports by Ware and Sherbourne.

Results

Sample

A total of 220 patients newly diagnosed with lung cancer were selected from the original data set for this analysis. Subjects ranged in age from 65–89 years ($\bar{X} = 72$ years, $SD = 5.02$); 59% were men, 61% were married, 32% widowed, 6% divorced, and 1% never married. As for education, 73% reported high school or less than high school education. The majority of the participants were Caucasian (91%), with 8% being African American and 1% other minority. Using the TNM staging system, stage of cancer at diagnosis was determined and obtained from medical record audits. For current purposes, cancer staging was collapsed into two groups: early (stage 0–II; 38%) and late (stage III–IV; 62%).

Data on the patients' comorbid conditions at the time of diagnosis were available from interview information. The patients were asked specifically about 11 comorbidities (see Table 1). Patients were being treated with a variety of therapies (see Table 2).

Symptom Occurrence and Severity

The patients in this sample reported 1–27 symptoms, with a mean and median of 11 symptoms ($SD = 4.95$). The most frequently reported symptoms were fatigue (79% of subjects), followed by “being up at night to urinate” (68%), cough (65%), pain (60%), and difficulty breathing (58%) (see Table 3). Several other symptoms, such as mouth sores (7%) and dehydration (5%), were reported by less than 10% of the patients.

Mean symptom severity scores ranged from 1.31–2.33 on a scale of 1–3, with no systematic tendency for either frequently or infrequently reported symptoms to be accompanied by higher or lower severity ratings ($r = 0.16$, $p > 0.343$). The symptoms reported to be most severe were lack of sexual interest ($\bar{X} = 2.07$, $SD = 0.81$), vomiting ($\bar{X} = 2.00$, $SD = 0.88$), trouble sleeping ($\bar{X} = 1.89$, $SD = 0.77$), fatigue ($\bar{X} = 1.84$, $SD = 0.73$), pain ($\bar{X} = 1.84$, $SD = 0.80$), and difficulty breathing ($\bar{X} = 1.82$, $SD = 0.70$).

The symptoms that were reported as most severe were not necessarily those reported by most patients. The number of subjects reporting the most severe symptoms ranged from 2%–60% of the sample. Fatigue, the most commonly reported symptom, had a mean severity score of 1.84 ($SD =$

Table 1. Comorbidities

Comorbidity	n	%
High blood pressure	101	46
Heart problems	79	36
Chronic lung disease	70	32
Arthritis	46	21
Cataracts	42	19
Urinary problems	33	15
Eyesight problems	26	12
Hearing problems	26	12
Stroke	24	11
Diabetes	24	11
Emotional problems	13	6

N = 220

Table 2. Therapies Reported by Patients in the Sample

Therapy	n	%
Total therapy use		
Radiation	139	63
Chemotherapy	95	43
Surgery	92	42
Therapy combinations		
Only radiation	30	14
Only chemotherapy	16	7
Only surgery	26	12
Radiation and chemotherapy	40	18
Radiation and surgery	21	9
Surgery and chemotherapy	5	2
All three therapies	16	7
No therapy reported	66	30

N = 220

0.73). The mean severity scores of the remaining symptoms ranged from 1.31–1.82. The researchers also compared the number of symptoms reported by patients with lung cancer to the mean severity rating for those reported symptoms. The observed correlation of $r = 0.43$ ($p < 0.01$) indicates a clear tendency for patients to report more severe symptom experiences when the number of symptoms increases.

Symptom Clusters

Although researchers usually construct symptom scales as simple counts or summated rating scales across many reported symptoms, one drawback of this procedure is the possibility of combining symptoms into scales even though they do not correlate at all. A high Cronbach's alpha does not protect against

Table 3. Most Frequent, Most Intense, and Most Limiting Symptoms

Symptom	n	%	\bar{X} Severity (SD)	\bar{X} Limitation (SD)
Fatigue	174	79	1.84 (0.73)	2.82 (1.21)
Up at night to urinate	149	68	1.39 (0.61)	1.40 (0.91)
Cough	143	65	1.54 (0.72)	1.59 (1.09)
Pain	133	60	1.84 (0.80)	2.45 (1.42)
Difficulty breathing	128	58	1.82 (0.70)	2.75 (1.25)
Weakness	125	57	1.69 (0.72)	2.69 (1.28)
Appetite loss	110	50	1.74 (0.82)	1.88 (1.25)
Dry mouth	108	49	1.56 (0.74)	1.44 (0.96)
Trouble sleeping	107	49	1.89 (0.77)	2.17 (1.39)
Weight loss	100	45	1.67 (0.79)	1.49 (1.13)
Altered taste	76	35	1.76 (0.75)	1.71 (1.15)
Nausea	75	34	1.56 (0.76)	2.15 (1.20)
Lack of sexual interest	69	31	2.07 (0.81)	1.61 (1.07)
Difficulty swallowing	65	30	1.82 (0.75)	1.89 (1.32)
Dizziness	51	23	1.43 (0.64)	2.00 (0.96)
Difficulty concentrating	43	20	1.44 (0.63)	2.12 (1.05)
Problems with coordination	36	16	1.61 (0.73)	2.47 (1.36)
Vomiting	32	15	2.00 (0.88)	2.47 (1.48)
Hot flashes	16	7	1.94 (0.77)	1.88 (1.15)
Arms swelling	6	2	2.33 (1.03)	2.00 (0.89)

N = 220

this occurrence when many symptoms are involved. For instance, the alpha value for the symptom severity scores reported above 0.90 implies a mean interitem correlation of only 0.195 (Nunnally & Bernstein, 1994). That reported symptoms often do not correlate well reflects both clinical reality and statistical artifacts. Given the different constellations of comorbid conditions and different cancer stagings at diagnosis, as well as variations in treatment, patient age, and other factors relevant to symptom experience, researchers should not be surprised to find that patient reports of their symptoms exhibit a lot of variation. In addition, the very fact that the proportions of patients who reported individual symptoms varied in this sample from a low of 3% to a high of 79% ensures that they cannot all correlate well because they do not all occur together in the same patient. Nonetheless, value exists in exploring to what extent certain symptom constellations form clusters with a tendency to occur together. If such symptom clusters exist, they provide a better gauge of a patient's symptom experience than aggregates of unrelated symptoms whose combinations change from one patient to the next.

The 32 symptoms were subjected to an exploratory maximum likelihood factor analysis. The first factor model was constrained to the extraction of a single factor, with subsequent models increasing the extracted factors by one at each step. Using the chi-square test as a criterion, the researchers determined that four factors were sufficient to produce a model variance/covariance matrix that is consistent with the observed variance/covariance matrix ($p > 0.05$). The four common factors accounted for a modest 31% of the item variance, with communalities generally in a range of 0.2–0.3. Only eight variables displayed communality magnitudes larger than 0.3, indicating the general difficulty of reducing symptoms to a few scalable dimensions. The first factor produced item loadings higher than 0.4 for seven of the symptoms: nausea, fatigue, weakness, appetite loss, weight loss, altered taste, and vomiting. Subsequent reliability analysis revealed these symptoms to be consistently correlated (Cronbach's $\alpha = 0.73$, mean interitem correlation = 0.28, with a range of 0.15–0.52). None of the other common factors extracted revealed a group of symptoms occurring together sufficiently often enough to form an internally consistent scalable symptom dimension.

Of the 220 patients in the sample, 196 reported symptoms in the cluster: 24 patients did not report experiencing any of the symptoms, 24 patients reported experiencing one of the symptoms, 42 patients reported experiencing two cluster symptoms, 42 reported having three of the symptoms, 29 reported four symptoms, 23 reported five symptoms, 25 reported six of the symptoms in the cluster, and 11 reported having all seven of the symptoms.

Relationship of Symptom Cluster to Antecedent Variables

For the symptom cluster that exhibits a consistent pattern of common occurrence, information on the antecedents of stage at diagnosis, presence of comorbid conditions, and treatments prescribed were used to predict variations in symptom counts and severity within that cluster. Table 4 shows the results based on a factorial analysis of variance (ANOVA), with the number of symptoms in the cluster as the outcome variable. As the ANOVA table shows, three F-

Table 4. Analysis of Variance Results for Count of Symptoms Within Cluster

	Sum of Squares	Df	F	p
Model sum of squares	175.18	19	2.71	0.000
Surgery before intake interview				
Yes = 1; No = 0	0.23	2	0.03	0.966
Chemotherapy before intake interview				
Yes = 1; No = 0	22.05	2	3.24	0.041
Radiation before intake interview				
Yes = 1; No = 0	1.09	2	0.16	0.853
Stage of cancer at diagnosis				
I–IV	41.35	4	3.04	0.019
Count of comorbid conditions (0–9)	86.80	9	2.84	0.004
Error	625.99	184		
Total sum of squares	801.8	203		

Note. $\text{Eta}^2 = 0.219$

tests associated with predictor variables were statistically significant ($p < 0.05$): those involving tumor stage at diagnosis, the number of comorbid conditions, and being treated with chemotherapy prior to the interview. In particular, the mean numbers of reported symptoms associated with the significant F-tests and adjusted for all other variables in the model (see Table 5) were consistently higher among patients classified as having more advanced forms of cancer, rising from $\bar{X} = 2.30$ symptoms for stage I to $\bar{X} = 3.67$ symptoms

Table 5. Descriptive Statistics for Significant Predictors: (Adjusted) Mean Number of Symptoms

	\bar{X}	n	95% Confidence Interval	
			Lower Boundary	Upper Boundary
Chemotherapy before intake interview				
Yes	3.44	87	2.72	4.15
No	2.79	85	2.08	3.50
No information	2.47	32	1.59	3.35
Stage of cancer at diagnosis				
I	2.30	56	1.57	3.03
II	2.87	20	1.87	3.88
III	3.24	84	2.50	3.98
IV	3.67	47	2.83	4.50
Unstaged	2.42	13	1.26	3.58
Count of comorbid conditions (1–9)				
No information	3.49	11	2.27	4.72
1	1.71	29	0.89	2.54
2	2.80	42	2.07	3.53
3	2.60	41	1.87	3.32
4	2.84	40	2.08	3.59
5	3.75	24	2.85	4.64
6	3.57	9	2.30	4.83
7	4.37	3	2.14	6.60
8	0.07	2	–2.59	2.72
9	3.80	3	1.57	6.03

N = 220

for stage IV ($p < 0.019$). The adjusted means also show that patients with lung cancer with more comorbid conditions tended to report more symptoms ($p < 0.004$), changing from a low of 1.7 symptoms for those with one comorbid condition to more than 3.5 reported symptoms for those with five or more comorbid conditions. Thus, the cumulative effect of comorbidities rather than any specific individual comorbidity affects the symptoms in the symptom cluster. Lastly, patients who were on chemotherapy at the time of the interview or just finished a cycle ($n = 87$) tended to report more symptoms ($\bar{X} = 3.44$) than those who had no chemotherapy experience ($\bar{X} = 2.79$) or those for whom no information was available about chemotherapy treatment ($\bar{X} = 2.47$) in the data set.

Students' t tests found no differences between men and women in the number of symptoms, severity of symptoms, or limitations reported to occur as a result of symptoms. Also, no differences were found between men and women on the physical functioning subscale, the impact on role from physical health subscale, or the bodily pain subscale of the SF-36.

Relationship of Symptoms to Performance

Mean perceived limitations in daily activities associated with the 32 symptoms ranged from 1.00–2.82 on a 1–5 scale. The symptoms reported to be the most limiting on average were fatigue, difficulty breathing, weakness, problems with coordination, vomiting, and pain. The number of subjects reporting these symptoms ranged from 15%–79%. The researchers found a correlation between the numbers of symptoms reported and mean limitations attributed to them ($r = 0.35$, $p < 0.01$). A tendency existed among patients to rate individual symptoms as more limiting if they reported having more symptoms. A relationship also was noted between perceived limitations and symptom severity scores ($r = 0.43$, $p < 0.01$). Thus, the more severe the symptoms, the more likely they were to be perceived as limiting.

The number of symptoms reported in the cluster was significantly related to the physical functioning subscale of the SF-36 ($r = -0.38$, $p < 0.01$), the role limitations associated with physical health subscale ($r = 0.46$, $p < 0.01$), and the bodily pain subscale ($r = 0.27$, $p < 0.01$). In a like manner, symptom severity was related to physical functioning ($r = -0.46$, $p < 0.01$), role limitations associated with physical health ($r = 0.43$, $p < 0.01$), and bodily pain ($r = 0.44$, $p < 0.01$).

Discussion

Limitations of the Study

Ability to generalize the findings of this study to the larger lung cancer population is limited by sample demographics. Comprised primarily of Caucasians, the sample does not reflect the diversity among patients with lung cancer. Only 8% of the participants were African American, a group in which lung cancer rates are the highest and escalating (ACS, 2004). Also underrepresented in the sample were members of other minority groups, who also develop lung cancer, although at somewhat lower rates (ACS). Whether the symptom experience in other racial and ethnic minorities is similar to that of Caucasians cannot be determined from this study.

In addition, only newly diagnosed patients older than 65 were eligible to participate in the study. The mean age of the study sample was 72 years, but the average age at the time of diagnosis in the general lung cancer population is 60 years (ACS, 2004). A significant difference may exist in symptom experience of older versus younger patients. Earlier research with patients with lung cancer indicated that age may be related to the type of symptoms experienced and the level of distress associated with them. Degner and Sloan (1995) noted that older patients reported less symptom distress than younger patients, and DeMaria and Cohen (1987) found that patients older than 70 reported more dyspnea and less chest pain than younger patients. Unclear from this study is whether the symptom experience and the degree to which it limits functioning are similar for the general lung cancer population.

Finally, the effect of age on functional limitations was not controlled for in this study. Increasing age typically is associated with greater numbers of comorbidities and declining functional status. To what extent functional limitations resulted as a natural consequence of aging as opposed to the symptom experience is unclear.

Research Questions

Multiple distressing symptoms were reported, with a mean of 11 symptoms reported per patient. The most frequently reported symptoms, however, were not the most severe symptoms reported. Most symptoms reported to be severe were reported by few subjects. The notion of symptoms co-occurring was demonstrated in this study with fatigue, nausea, weakness, appetite loss, weight loss, altered taste, and vomiting being the symptoms that clustered together. One of the reasons that these symptoms form a common cluster among patients with lung cancer is that they are relatively common among these patients. On average, these seven symptoms were reported by 45% of the patients, ranging from 15% reporting vomiting to 79% reporting fatigue. Many other symptoms (e.g., mouth sores, bleeding, leaking urine) not only occurred relatively rarely (i.e., $< 12\%$ of patients) but also did not seem to follow a predictable pattern. The symptoms found in this study to form a cluster differed from those chosen by Dodd et al. (2001). They chose pain, fatigue, and sleep insufficiency to form a cluster of symptoms but did not give a rationale for their choice. However, they focused on patients with a wide variety of cancers, not just lung cancer.

The study answered the third research question by demonstrating a strong positive relationship between the number of cluster symptoms reported and the mean severity of symptoms. In answer to the fourth research question, a variety of antecedents was found to be related to symptom co-occurrence. Having an advanced stage of lung cancer, having an increased number of comorbidities (not specific comorbidities), and being treated with chemotherapy were the antecedents that related to an increased number of cluster symptoms being reported.

Similar to the findings of Dodd et al. (2001), as well as findings by other researchers, the researchers of the current study found a relationship between symptoms and functioning. The number of symptoms in the cluster that were reported was found to be related to the perception of limitations in functioning and self-reported functioning. Of the 32 symptoms, those that were reported to be the most limiting

and those that were experienced by more than half of the subjects were fatigue, difficulty breathing, weakness, and pain. Difficulty breathing and pain, however, were not included in the cluster of symptoms, indicating that they did not follow a consistent pattern. The number of symptoms reported was associated with perceived symptom severity and perceived limitation from symptoms. Symptom severity scores had the strongest relationship to the perception of limitations.

Implications for Nursing Practice

Thorough assessment is the first step in effective symptom management. As reported in this study, patients with lung cancer experience high numbers of co-occurring symptoms that limit their ability to engage in everyday activities. This situation requires systematic appraisal of multiple symptoms and their interaction, rather than assessment of isolated symptoms, as is typical of current clinical practice (Sarna, 1998).

Evaluation of the full constellation of symptoms is essential, according to TOUS, which states that the experience of an isolated symptom changes in the presence of additional symptoms (Lenz et al., 1997). In the current study, the researchers also found that the presence of multiple symptoms influenced patients' perceptions of their functional limitations.

Furthermore, strategies to manage symptoms must be chosen in light of the interplay among symptoms. A program of interventions that will alleviate symptoms but not exacerbate others is needed when multiple symptoms coexist. However, practical tools to assess the interaction of coexisting symptoms have yet to be investigated. Experimental research also

is needed to determine effective combinations of interventions to manage symptoms that are experienced simultaneously.

The findings of this study also indicate that particular symptoms have a tendency to occur together. The constellation of symptoms that clustered together in this study were fatigue, nausea, weakness, appetite loss, weight loss, altered taste, and vomiting. These symptoms are of a general nature and common to many types of cancer (Vainio & Auvinen, 1996). Nurses should assess for this cluster of symptoms in all of their patients with cancer but also should be aware that their patients may experience additional symptoms specific to particular cancers. Although patients with lung cancer commonly experience dyspnea, cough, and pain, these symptoms did not emerge as part of the cluster. However, these symptoms often are reported as serious by patients and should not be overlooked by healthcare professionals focusing only on the cluster.

Future Research

Future research should focus on testing the symptom cluster as an assessment tool for patients with lung cancer. Whether the same cluster of symptoms would be found in all ethnic groups is not known. Also needed is the testing of interventions to relieve this cluster of symptoms. Once strategies are found to decrease the symptom burden, researchers can determine whether relief of symptoms enhances functioning in these patients.

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