

Relationships Among Pain, Fatigue, Insomnia, and Gender in Persons With Lung Cancer

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Purpose/Objectives: To examine the relationships among pain, fatigue, insomnia, and gender while controlling for age, comorbidities, and stage of cancer in patients newly diagnosed with lung cancer within 56 days of receiving chemotherapy.

Design: Secondary data analysis.

Setting: Accrual from four sites: two clinical community oncology programs and two comprehensive cancer centers.

Sample: 80 patients newly diagnosed with lung cancer.

Methods: Analysis from baseline observation of a randomized clinical intervention trial. Multinomial log-linear modeling was performed to explain the relationships among pain, fatigue, insomnia, and gender.

Main Research Variables: Pain, fatigue, insomnia, and gender.

Findings: For all people with lung cancer, fatigue (97%) and pain (69%) were the most frequently occurring symptoms; insomnia occurred 51% of the time. A model containing all main effects (two-way interactions of pain and fatigue, pain and insomnia, and insomnia and gender; and the three-way interaction of pain, fatigue, and insomnia, along with three covariates [age, comorbidities, and stage of cancer]) was a good fit to the data. Parameter estimates indicated that a statistically significant effect from the model was the three-way interaction of pain, fatigue, and insomnia. Gender did not make a difference. Age, comorbidities, and stage of cancer were not significant covariates.

Conclusions: For people newly diagnosed with lung cancer undergoing chemotherapy, multiple symptoms occur simultaneously rather than in isolation; a symptom cluster exists, consisting of pain, fatigue, and insomnia; and no relationship was found among gender, pain, fatigue, and insomnia.

Implications for Nursing: By understanding this symptom cluster, healthcare providers can target specific troublesome symptoms to optimize symptom management and achieve the delivery of high-quality cancer care.

Key Points . . .

- ▶ People newly diagnosed with lung cancer and undergoing chemotherapy suffer from concurrent, severe symptoms.
- ▶ The presence of several symptoms occurring together, known as a symptom cluster, is a cause for concern because concurrent symptoms are likely to increase the overall level of symptom severity.
- ▶ Multiple concurrent symptoms such as pain, fatigue, and insomnia may be best targeted using an anticipatory approach. The report of one symptom should be considered a risk factor for a cluster of symptoms.
- ▶ The symptom management process needs to be altered to account for multiple concurrent symptoms that should be anticipated, assessed, and treated as a whole.

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Lung cancer is the most commonly diagnosed and lethal cancer, irrespective of gender, in the world (Parkin, Bray, Ferlay, & Pisani, 2005). As a result, lung cancer and its corresponding symptoms have had a tremendous effect on the lives of those who suffer with the disease. However, little is known about the role that gender plays in the symptom experience of people with lung cancer. According to Cooley, Short, and Moriarty (2002), targeting research toward gender

differences would help to identify gender-based symptom assessment and intervention to improve therapy, control disease progression, and manage symptoms. The current study examined the symptom experience of people with lung cancer by gender to see whether differences exist so that tailored interventions can be implemented as appropriate.

People with lung cancer suffer from concurrent, severe symptoms (Chen & Tseng, 2006; Cooley et al., 2003; Gift, Stommel, Jablonski, & Given, 2003). The presence of several symptoms occurring together, known as a symptom cluster, is concerning because concurrent symptoms are likely to influence each other by increasing the overall level of symptom severity (Cleeland & Reyes-Gibby, 2002). Because three of the most common and severe symptoms affecting people with lung cancer are pain, fatigue, and insomnia, the purpose of the current study was to examine the associations and interactions of pain, fatigue, insomnia, and gender while controlling for age, comorbidities, and stage of cancer. The researchers hoped that the analysis would elucidate relationships among the symptoms of pain, fatigue, and insomnia and validate whether gender differences exist. If gender differences were found, further research would be needed to understand the underlying factors for the differences and what symptom interventions would be most effective.

Literature Review

Studies have examined the influence of gender on people with lung cancer and have found gender differences in survival rate and susceptibility (Fu, Kau, Severson, & Kalemkerian, 2005; International Early Lung Cancer Action Program Investigators, Henschke, Yip, & Miettinen, 2006; Stabile & Siegfried, 2003). The studies indicate that the risk of lung cancer is different for men and women. However, few studies have targeted gender differences in the symptom experiences of people with lung cancer, and they have produced mixed results.

Studies that examined symptom experiences and reported no differences include one completed by Kurtz, Kurtz, Stommel, Given, and Given (2000), who found no significant gender differences in symptom severity scores in 129 older adult patients with lung cancer. Likewise, Cooley et al. (2003) reported no relationship between gender and symptom distress over time in 117 people receiving treatment for lung cancer. Gift et al. (2003) found in 112 newly diagnosed people that gender did not predict the number of symptom clusters; Gift, Jablonski, Stommel, and Given (2004) found no differences between men and women in the number of symptoms and symptom severity and limitation for 220 people with lung cancer. Conversely, three studies found differences in symptom experiences by gender in people with lung cancer. In 1995, two studies found gender differences among recently diagnosed people with lung cancer. Degner and Sloan (1995) found that women had higher symptom distress scores than men ($N = 82$), and Hopwood and Stephens (1995) reported that women had much higher levels of psychological symptoms than men ($N = 650$).

In summary, studies analyzing gender differences in the symptom experiences of people with lung cancer have been minimal and have focused on the cumulative effects of symptoms (i.e., levels of symptom severity, limitation, distress, and cluster) rather than on specific symptoms, and the studies

have provided inconsistent results. Because most people with lung cancer suffer from multiple symptoms, and because the symptoms may cluster together, the current study focused on three of the most common and severe symptoms associated with the disease: pain, fatigue, and insomnia.

Cooley et al. (2003) noted that pain and fatigue were the most common and distressing symptoms over time among 117 newly diagnosed people receiving treatments for lung cancer. The presence of pain and fatigue may affect the number of symptoms that people with cancer experience. Given, Given, Azzouz, Kozachik, and Stommel (2001) reported in a study of 841 people with newly diagnosed cancer that when pain and fatigue were present, patients suffered from three times as many symptoms as those who reported neither pain nor fatigue. Insomnia was another severe symptom identified in Cooley et al.'s (2003) study, with more than one-third of the people diagnosed with lung cancer reporting insomnia. Other studies have validated that pain, fatigue, and insomnia are the most common and severe symptoms (Fox & Lyon, 2006; Gift et al., 2004; Hoekstra, Vernooij-Dassen, de Vos, & Bindels, 2006; Miaskowski et al., 2006; Walsh & Rybicki, 2006). Furthermore, to date, four research teams have highlighted the effects of the concurrence of pain, fatigue, and insomnia in people with cancer. In 69 women with advanced lung cancer, Sarna (1993b) measured symptom distress related to the concurrence of pain, fatigue, and insomnia and found significant disruption in quality of life and functional status. Dodd, Miaskowski, and Paul (2001) studied fatigue, pain, and sleep insufficiency in 93 people with varied cancer diagnoses who were undergoing chemotherapy and found low intercorrelations among the three symptoms ($r = 0.06-0.22$). However, researchers found in 826 recently diagnosed people with varied types of cancer, including lung cancer, that having symptoms of pain, fatigue, and insomnia predicted loss of functioning (Given, Given, Azzouz, & Stommel, 2001). Lastly, Beck, Dudley, and Barsevick (2005) found patterns of relationships among pain, sleep disturbance, and fatigue in people undergoing treatment for varied cancer diagnoses. Consequently, the current, gender-based study acknowledged the importance of directing research according to a realistic clinical picture of people with lung cancer and focusing on the most common and severe symptoms of pain, fatigue, and insomnia. If pain, fatigue, and insomnia cluster together and are found to interact differently according to gender, then strategies may be developed and implemented to ameliorate the synergistic effects of the symptoms.

To understand what patient factors are associated with pain, fatigue, insomnia, and gender, the study controlled for age, comorbidities, and stage of cancer. Dodd et al. (2001) found that (along with pain, fatigue, and sleep insufficiency) age predicted functional status over time in people with varied cancer diagnoses. Degner and Sloan (1995) found that older people with newly diagnosed lung cancer had less symptom distress than younger people. However, Given, Given, Azzouz, Kozachik, et al. (2001) found no relationship between advancing age and reports of pain or fatigue in people with varied cancer diagnoses. In an exploration of correlates of symptom distress in women with lung cancer, Sarna (1993a) reported that comorbidities were associated with high levels of symptom distress. Similarly, Given, Given, Azzouz, Kozachik, et al. found that people with lung cancer and three or more comorbidities were more likely to experience pain, fatigue, or

both than those reporting neither symptom. Greater symptom distress has been reported in people with lung cancer who have more advanced disease (Degner & Sloan). Lastly, Gift et al. (2003) found that people with late-stage lung cancer reported over time one more symptom than people with early-stage lung cancer.

Theoretical Framework

The Theory of Unpleasant Symptoms (TOUS) guided the study (Lenz, Pugh, Milligan, Gift, & Suppe, 1997). The TOUS theorizes that concurrent symptoms (pain, fatigue, and insomnia) may interact and catalyze each other, worsening the overall level of symptom severity experienced by people with lung cancer (see Figure 1). The TOUS also highlights four dimensions that characterize the symptom experience: timing (frequency of occurrence and duration), intensity (severity), quality (description of qualifiers), and distress (bother). The study focused on two dimensions of patients' symptom experiences: frequency and severity. Although symptoms comprise a chief component of the TOUS, the theoretical framework has two other components: the antecedent patient factors influencing the symptom experience and the consequences of the symptom experience. Patient factors that influence symptoms include physiologic, psychological, and situational factors. A key patient factor to be explored in the study was whether gender influences the symptom experience of pain, fatigue, and insomnia. Also, age, comorbidities, and stage of cancer are patient factors to be explored to investigate whether they influence pain, fatigue, and insomnia. The last component of the TOUS is the consequences of the symptom experience, includ-

ing performance outcomes such as symptom status. The study did not explore the consequences of the symptom experience. Finally, the three components of the TOUS are reciprocal, and each component influences every other component.

Research Questions

For people within 56 days of starting chemotherapy for a new diagnosis of lung cancer

- What are the most frequently occurring symptoms in people with lung cancer, and do they differ between men and women?
- What are the mean severity scores for pain, fatigue, and insomnia, and do they differ between men and women?
- Do relationships exist among the occurrence of pain, fatigue, insomnia, and gender?
- If a relationship exists among pain, fatigue, insomnia, and gender, do the differences remain statistically significant after controlling for age, comorbidities, and stage of cancer?

Methods

Secondary analysis of a single-blinded, randomized clinical intervention trial of people with cancer was performed through data sponsored by the National Cancer Institute and the National Institute for Nursing Research (Given & Given, 1997–2002). Study participants were at least 40 years old and receiving chemotherapy within 56 days of a new diagnosis of breast, colon, or lung cancer or non-Hodgkin lymphoma. People had to have no evidence of substance abuse, be cognitively intact, be able to speak and read English, have a willing caregiver to take part in the study, and be willing to participate in a 10-session nursing intervention that spanned 20 weeks. For the present analysis, the researchers selected only people with lung cancer and used the information from the first interview at the time of entry into the trial.

Procedures

Each participating university and agency approved the study through institutional review boards for the protection of human subjects. Participants were accrued from four sites: two community oncology programs and two comprehensive cancer centers. Trained recruiters enrolled participants, and all participants had the study explained to them and signed informed consent before participating. In the original study, trained interviewers questioned participants via telephone using a structured interview format.

Measures

Symptoms were assessed using the **Cancer Symptom Experience Inventory** (Given & Given, 1997–2002). The inventory is a self-report measure of 15 symptoms related to cancer or its treatment. Patients were asked on how many days in the prior two weeks they experienced the symptoms. Miaskowski, Dodd, and Lee (2004) stated that the timing of assessments for the presence of symptom clusters should begin with cross-sectional evaluations. Thus, in the present analysis, the variable assessing the frequency of pain, fatigue, and insomnia was dichotomized (presence of symptoms for 1–7 days [one week] and presence of symptoms for 8–14 days [two weeks]) to evaluate the duration of the relationships among pain, fatigue, and insomnia in

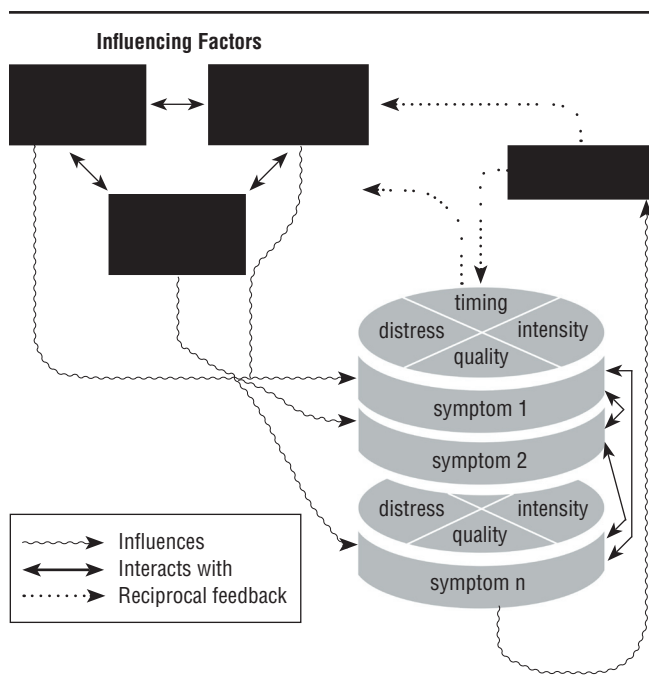


Figure 1. Theory of Unpleasant Symptoms

Note. From "The Middle-Range Theory of Unpleasant Symptoms: An Update," by E.R. Lenz, L.C. Pugh, R.A. Milligan, A. Gift, and F. Suppe, 1997, *Advances in Nursing Science*, 19(3), p. 17. Copyright 1997 by Lippincott Williams and Wilkins. Reprinted with permission.

people with a new diagnosis of lung cancer within 56 days of receiving chemotherapy. Severity of the symptoms was rated on an 11-point scale from 0–10, with 10 indicating greatest severity.

Stage of cancer was classified according to the tumor-node-metastasis staging system of the American Joint Committee on Cancer for non-small cell lung cancer, which stages cancer on a scale of 0–IV. A two-staged system was used for small cell lung cancer: limited or extensive. The study's researchers combined stages 0–II and limited stage into the early stage, and stages III–IV and extensive stage as late stage.

Comorbidities were assessed using a modified version of the **Comorbidity Questionnaire** (Katz, Chang, Sangha, Fossel, & Bates, 1996), which inquired about the presence or absence of 14 various chronic health conditions. A summary score was calculated on the number of yes responses, a higher score indicating a greater number of chronic health conditions. The Comorbidity Questionnaire has established content validity and test-retest reliability.

Data Analysis

An estimation algorithm employing the maximum likelihood factor of covariance was used for missing value analysis (von Eye & Schuster, 1998). A cut-off point determined at 50% or fewer missing cases was used to estimate incomplete data, yielding 100% complete cases on data analyzed.

The level of significance was established at $p < 0.05$ for all statistical procedures. Descriptive statistics were used to characterize the participants. Multinomial log-linear modeling (von Eye & Niedermeier, 1999) was used to examine the interaction patterns among pain, fatigue, insomnia, and gender in people with a new diagnosis of lung cancer within 56 days of receiving chemotherapy.

Results

Sample

The analysis was completed on 80 people. Table 1 depicts demographic characteristics. Participants ranged in age from 41–83 years, with a mean age of 63 years ($SD = 9$ years); 55% were men; most participants were Caucasian (95%) and married (80%). Educationally, 28% of the participants possessed a high school diploma; 49% had an annual household income ranging from \$50,000–\$79,999. The mean number of comorbidities per participant was two, with hypertension, arthritis, and emphysema accounting for the greatest number of comorbidities. Regarding stage of cancer, only 10% of participants were diagnosed with early-stage cancer, whereas 90% were in late-stage lung cancer.

Symptom Frequency and Severity

The participants reported a mean and a median number of six ($SD = 3.01$) symptoms. The most frequently reported symptoms by all people were fatigue (97%), pain (69%), nausea (53%), constipation (53%), insomnia (51%), and poor appetite (50%). However, for men, nausea, cough, and insomnia were the next most common symptoms after fatigue and pain, whereas women reported poor appetite, constipation, and insomnia more frequently after fatigue and pain (see Table 2). As depicted in Table 3, the men and women had similar reports of severity levels for pain and fatigue. However, women de-

Table 1. Participant Demographic and Clinical Characteristics

Characteristic	n	%
Gender		
Male	44	55
Female	36	45
Race		
Caucasian	76	95
Other	4	5
Marital status		
Married	64	80
Not married	16	20
Education completed		
Less than high school	7	9
High school	22	28
Some college or technical training	21	26
College	13	16
Graduate or professional	17	21
Annual household income (\$)		
10,000–24,999	6	7
25,000–49,999	17	21
50,000–79,999	39	49
80,000 and more	18	23
Comorbidities		
Hypertension	28	35
Arthritis	26	33
Emphysema	24	30
Other health problems	21	26
Emotional problems	20	25
Cardiovascular problems	15	19
Incontinence	15	19
Other cancer	9	11
Diabetes	6	8
Stroke	1	1
Stage of cancer		
I	–	–
II	1	1
III	41	51
IV	26	33
Limited	7	9
Extensive	5	6

N = 80

scribed higher levels of severity for insomnia ($\bar{X} = 6.06$, $SD = 1.98$) in comparison to men ($\bar{X} = 4.77$, $SD = 2.18$).

Modeling the Relationships Among Pain, Fatigue, Insomnia, and Gender

The most parsimonious model ($G^2 = 0.875$; 2 df; $p = 0.646$) suggested that none of the main effects and none of the two-way interactions were significant. The only significant effect was the three-way interaction among pain, fatigue, and insomnia. Table 4 shows the frequency distribution of the variables and the expected frequency distribution from the model that was retained. All adjusted residuals were small. Parameter estimates are provided in Table 5. Therefore, people with a new diagnosis of lung cancer within 56 days of receiving chemotherapy reported the symptom cluster of pain, fatigue, and insomnia as being present for one to seven days. The model has good power (0.80) to detect information with medium effects (0.31) (Erdfelder, Faul, & Buchner, 1996). Adding the covariates of age, comorbidities, and stage of cancer did not improve the model.

Table 2. Symptoms Reported by Gender

Symptom	Total Sample (N = 80)		Men (N = 44)	Women (N = 36)
	n	%	%	%
Fatigue	77	97	98	94
Pain	55	69	73	69
Nausea	42	53	59	44
Constipation	42	53	50	56
Insomnia	41	51	52	50
Poor appetite	40	50	43	58
Cough	39	49	55	42
Dry mouth	35	44	43	44
Difficulty breathing	35	44	43	44
Diarrhea	24	30	32	28
Difficulty concentrating	21	26	20	33
Coordination problems	19	24	32	14
Vomiting	18	23	16	31
Fever	9	11	14	8
Mouth sores	6	8	14	—

Discussion

Limitations

Although the secondary data analysis highlighted important results concerning a symptom cluster in people newly diagnosed with lung cancer within 56 days of receiving chemotherapy, some limitations should be recognized. First, the ability to generalize the findings of the study to the larger lung cancer population is hampered by under-representation of minorities. Second, whether the symptoms addressed in the study were the result of cancer, treatment, or comorbidity is unknown. Although a strength of the study was evaluation for multiple symptom relationships among pain, fatigue, and insomnia by gender in people with lung cancer at one point in time, the science of symptom cluster research should be extended to test for stability of a cluster over time. However, given the short survival of people with lung cancer and the great morbidity associated with the disease, longitudinal studies may be challenging. Lastly, to obtain goodness-of-fit values that approximate the chi-squared distribution, one cell had to be declared a structural zero. Without that step, the expected cell frequency for the cell would have been too small. A replication study is recommended because the cell sizes of the expected frequencies in the study were small.

The findings parallel the guiding principles of the TOUS in that newly diagnosed people with lung cancer undergoing chemotherapy experience multiple symptoms simultaneously rather than symptoms in isolation. Fatigue, pain, nausea, constipation, insomnia, and poor appetite were the most frequently reported symptoms experienced by at least 50% of the sample. The top five symptoms for men were, from most frequent to less frequent, fatigue, pain, nausea, cough, and insomnia; for women, fatigue, pain, poor appetite, constipation, and insomnia. For men and women, the severity levels for fatigue and pain were similar, whereas women reported a greater severity of insomnia than men.

The study did not find a relationship among gender, fatigue, pain, and insomnia in newly diagnosed people with lung cancer undergoing chemotherapy. It did find a relationship among pain, fatigue, and insomnia, a symptom cluster, in men

and women newly diagnosed with lung cancer undergoing chemotherapy. The TOUS asserts that concurrent symptoms may interact and catalyze each other. Cancer-related symptom clusters have been reported to share a common cytokine-based neuroimmunologic mechanism where symptoms occur because of the activation of the neuroendocrine immune system in response to a tumor and treatments (Cleeland et al., 2003; Lee et al., 2004; Wood, Nail, Gilster, Winters, & Elsea, 2006). Dodd et al. (2001) noted the importance of delineating the time dimension of symptom clusters, particularly specifying the duration of the presence of symptoms which form a cluster. The current study reports the symptom cluster to be present for a shorter duration (1–7 days) as compared to a longer duration (8–14 days). Additionally, the TOUS outlines the influence of patient factors on the symptom experience; in this study, age, stage of cancer, and number of comorbidities did not make a difference in the symptom experience of pain, fatigue, and insomnia.

Implications for Practice

Most patients with lung cancer are diagnosed with advanced disease that has no cure. Moreover, most people with lung cancer report a high frequency of treatable symptoms. Symptom management philosophy for people with cancer needs to change relative to the disproportionate focus given to treating cancer versus treating its symptoms (Patrick et al., 2004). Symptoms and cancer go hand in hand, and both require active treatment. Treatment of symptoms must be given equal priority because inadequate symptom control produces suffering and can have a deleterious effect on patient outcomes (Cleeland, 2001). Symptoms are the perceived life-saving warnings of health threats and serve an important purpose in protecting patients when health is presented with acute risk. Unmanaged symptoms may trigger stress reactions that worsen the condition of people with cancer (Chapman & Gavrin, 1999). Consequently, symptoms lose their protective purpose when they are not treated appropriately. Thus, symptom relief and management are key nursing-sensitive outcomes. Optimizing management of multiple symptoms to achieve the delivery of high-quality cancer care requires focus in two philosophical areas.

First, multiple concurrent symptoms such as pain, fatigue, and insomnia may be best targeted using an anticipatory approach. The report of one symptom should be considered a risk factor for the cluster of symptoms. Establishing pre-emptive planning to equip patients with the ability to prevent and address symptoms at the earliest time is essential. Pre-emptive planning begins with initial assessment of the symptom experience, with healthcare providers evaluating for the presence of multiple symptoms rather than symptoms in isolation.

Table 3. Severity Levels of Pain, Fatigue, and Insomnia

Symptom	Total Sample		Men		Women	
	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
Fatigue	5.12	2.50	5.12	2.48	5.12	2.56
Pain	4.63	2.36	4.83	2.56	4.37	2.08
Insomnia	5.33	2.17	4.77	2.18	6.06	1.98

Table 4. Observed and Expected Frequency Distribution and Adjusted Residuals of Pain, Fatigue, Insomnia, and Gender

Pain	Fatigue	Insomnia	Gender	Observed Frequency	Expected Frequency	Adjusted Residual
1 W	1 W	1 W	Men	22	20.641	0.864
-	-	2 W	Men	1	1.000	-
-	-	1 W	Women	17	18.359	-0.864
-	-	2 W	Women	1	1.000	-
-	2 W	1 W	Men	6	7.034	-0.838
-	-	2 W	Men	5	4.952	0.233
-	-	1 W	Women	6	4.966	0.838
-	-	2 W	Women	1	1.048	-0.233
2 W	1 W	1 W	Men	-	0.082	-0.568
-	-	2 W	Men	2	1.758	0.412
-	-	1 W	Women	2	1.918	0.568
-	-	2 W	Women	2	2.242	-0.412
-	2 W	1 W	Men	6	6.243	-0.796
-	-	2 W	Men	2	2.290	-0.363
-	-	1 W	Women	4	3.757	0.796
-	-	2 W	Women	3	2.710	0.363

W—week(s)

Note. One week indicates presence of symptoms for 1–7 days; two weeks indicate presence of symptoms for 8–14 days.

People living with cancer have voiced the expectation of being partners in the management of their cancer. However, healthcare providers must note that people living with cancer and receiving treatment are faced with a new set of challenges, which they may not have knowledge and skill to handle. Complicating matters is a lack of awareness by healthcare providers of people's symptoms (Patrick et al., 2004). In addition, many patients do not independently report their symptoms because they believe that symptoms are an inevitable part of cancer, that nothing can be done, or that reporting symptoms will distract healthcare providers from cancer treatment (Patrick et al.). Therefore, the primary responsibility for the assessment of multiple occurring symptoms must rest with healthcare providers.

Next, although the trend in the practice environment is to empower people to take on increasing responsibility to manage their cancer, its treatment, and associated symptoms, preemptive planning also includes healthcare providers ensuring that people with cancer are fully informed to maximize their self-efficacy to manage their symptoms. Effective education

is important to achieve optimal symptom management, yet patients report that they are receiving inadequate information to manage their symptoms (Patrick et al., 2004; Skalla, Bakittas, Furstenberg, Ahles, & Henderson, 2004). At a minimum, patients must receive anticipatory education about what symptoms are, the multiple symptoms that can occur and when they may occur, the strategies available to help, and when and how to access healthcare providers for help. Because patients often report that they are overwhelmed by information (Skalla et al.), healthcare providers should follow up on anticipatory symptom management education by asking patients to summarize key points of symptom management plans to validate understanding. Given the results of the current study that the symptom cluster of pain, fatigue, and insomnia was reported in newly diagnosed people with lung cancer within 56 days of chemotherapy, the cluster should be anticipated at initial contacts with healthcare providers. Moreover, the symptom cluster was found to be prevalent over a shorter duration (1–7 days) as compared to a longer duration (8–14 days). That presentation of the symptom cluster indicates that temporal variability of the symptoms may be acute in people undergoing chemotherapy or other treatment, especially when symptoms become multiplicative in nature. The experience of pain, fatigue, and insomnia may change on a frequent basis, requiring focused assessments of the occurrence, severity, and effects of multiple symptoms on patient outcomes, and whether patients achieve satisfactory levels of symptom relief. Incorporating assessment of multiple symptoms into everyday practice will necessitate striking a balance between gaining key information to optimize symptom management and requiring additional respondent burden. Prevention rather than intervention after symptoms appear is ideal in promoting positive patient outcomes.

Management of multiple symptoms requires an ongoing process of regular assessment, intervention, and evaluation. Although the current research identifies the presence of the symptom cluster of pain, fatigue, and insomnia in newly diagnosed people with lung cancer within 56 days of chemotherapy, appropriate implementation of prevention and intervention strategies should evade the chronicity of the cluster. Knowing that pain, fatigue, and insomnia are prevalent symptoms, healthcare providers can tailor prevention and intervention strategies to target the symptoms to optimize symptom management. Because the symptoms are linked together, a single strategy may culminate in the ultimate relief of all three symptoms. Research groups have warned about the adverse effect that symptom clusters may have on patient

Table 5. Parameter Estimates of the Parsimonious Multinomial Log-Linear Model

Parameter	λ Estimate	Standard Error	Z	95% Confidence Interval	
				Lower	Upper
Age	0.149	0.101	1.481	-0.048	0.346
Comorbidities	-0.455	0.587	-0.776	-1.605	0.695
Stage of cancer	-2.676	2.416	-1.108	-7.410	2.058
Two-way interaction of pain and fatigue	-0.461	1.607	-0.287	-3.612	2.689
Two-way interaction of pain and insomnia	1.660	1.660	1.000	-1.593	4.913
Two-way interaction of insomnia and gender	0.824	0.886	0.930	-0.913	2.561
Three-way interaction of pain, fatigue, and insomnia	2.841	1.350	2.105	0.196	5.486

outcomes (Dodd et al., 2001; Given et al., 2001). Most people with lung cancer already face a lethal health condition, and the addition of any other unremitting situations, such as the presence of symptom clusters, should be circumvented.

Implications for Research

The science of symptom cluster research is important because most people with cancer report multiple occurring symptoms. The following recommendations, based on the limitations of the current study, may serve as a platform to extend the science of symptom cluster research. Future studies should incorporate longitudinal designs to discern whether the symptoms in the cluster of pain, fatigue, and insomnia change and under what conditions. Similar to the current, gender-based study, knowledge of other patient factors that influence the development of symptom clusters is critical to target effective strategies to prevent or eliminate their occurrence. As previously discussed, a specific cluster of symptoms may share a biologic basis that differs from other clusters. Such a hypothesis begets further research to identify whether one symptom in a cluster is a driver of the other symptoms. Consequently, if a symptom is identified as a driver of all of the other symptoms, streamlined symptom management strategies could be devised to prevent cluster development or eliminate a cluster should it occur. Additionally, symptoms in varying rank order were reported by men and women in the current

study, leading to a recommendation to explore the existence of other symptom cluster combinations, which, if found, would lead to interventions to optimize symptom control. Moreover, extending the investigation of symptom cluster research from one cancer population to others with varied cancer and non-cancer diagnoses may provide more answers to the underlying influences of symptom clusters.

Conclusion

Symptom clusters play an important role in the overall symptom severity of people with lung cancer. Further investigation is needed to define what symptom clusters exist, their effects on people with lung cancer, and the modifications that need to be made to existing symptom management strategies to address the phenomenon. Likewise, the symptom management process needs to be altered to account for multiple concurrent symptoms that need to be anticipated, assessed, and treated as a whole.

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