VALIDATION OF THE CANCER DYSPNEA SCALE IN VIETNAMESE PERSONS WITH LUNG CANCER

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ABSTRACT:

Background: Dyspnea in Vietnamese persons with lung cancer is highly problematic. The accurate measurement of dyspnea is essential for effective research, diagnosis, and management of this symptom. Nevertheless, no standardized measurement of dyspnea is available in Vietnam. This study aimed to validate the Cancer Dyspnea Scale in Vietnamese lung cancer patients.

Methods: This cross-sectional study was conducted in 6 oncology centers in Vietnam. A convenience sample of 246 lung cancer patients answered to the Cancer Dyspnea Scale Vietnamese version (CDS-V). Five content validity experts were consulted, Exploratory Factor Analysis was employed to examine construct validity, and Cronbach's alpha coefficient was used to assess the internal consistency of the CDS-V.

Results: The age of participants ranged from 47 to 79 years, with the mean age of 60.79 + 6.59 years. The majority of the participants was male (72.8%) and the mean duration from diagnosis with a lung tumor was 5.44 ±3.97 years. The CVI of CDS-V was acceptable (1.0). Twelve items of CDS-V formed three factors (accounting for 59.29% of the variance of dyspnea), which were similar to factors found in the original CDS (Sense of Anxiety, Sense of Effort, and Sense of Discomfort). The Cronbach's alpha of the total scale was 0.86. Corresponding coefficients for Sense of Effort (item 1, 2, 3), Sense of Anxiety (item 5, 7, 9, and 11), and Sense of Discomfort (item 4, 6, 8, 10, and 12) subscales were 0.86, 0.70, and 0.73, respectively. Corrected Item-to-Total Correlation coefficients of items ranged from 0.39 to 0.64.

Conclusions: CDS-V is a reliable and valid instrument in the study group. The application of this scale would facilitate practices of researchers and clinicians. Further studies of other psychometric properties, such as predictive validity, discriminant validity or test-retest reliability of the CDS-V are recommended, as is further assessment of the generalizability of these results.

Keywords: Cancer Dyspnea Scale, Dyspnea, Lung cancer, Scale validation

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INTRODUCTION

Among malignant diseases, lung cancer has been remaining as the most popular and lethal one for several decades [1]. In Vietnam, there are 20,000 new cases and 17,000 deaths due to this disease annually [2]. A national survey ranked lung cancer as the fourth and the seventh cause of death in male and female, respectively [3].

Lung cancer is the disease of symptoms [4]. In average, each patient suffers from more than ten symptoms, and most of them are at moderate level of severity [5]. Among symptoms, dyspnea is highly problematic. Since the tumor involves directly to the respiratory system, dyspnea is very prevalent, especially in those who are at the late stage [4]. The average prevalence of dyspnea reported by studies on lung cancer was 70.5%, with a range of 50%–87% [6]. A study of Phạm [7] found that nearly one of every five Vietnamese patients had dyspnea at the time of diagnosis with lung cancer.

Dyspnea is described as "a subjective experience of breathing discomfort" [8]. The term dyspnea is used interchangeably with breathlessness, shortness of breath, breathing difficulty, and labored breathing in the literature [9]. Patho-physiologists explain that dyspnea is caused by a discrepancy between the effort of the respiratory muscles necessary to get air into the lungs and the actual amount of air that was inhaled [10].

In lung cancer, being dispneic is frightening to both patients and caregivers, making them anticipate

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about death [11]. Patients are severely suffering from dyspnea [12], highlighting the urgent need for efficient management of this symptom. Obviously, the accurate measurement is a priori condition for an efficient management of dyspnea. Nevertheless, up to our knowledge, no standardized dyspnea measurements in Vietnamese are currently available. Therefore, the translation and validation of an existing measurement in this population is necessary and important.

The review of dyspnea measurements by Oncology Nursing Society [13] identifies eleven scales, such as Visual Analog Scale, Cancer Dyspnea Scale, Shortness of Breath Questionnaire, or Modified Borg Scale. In general, existing instruments have acceptable psychometric quality [13]. However, since most instruments are initially developed to measure dyspnea in non-cancer populations (e.g., asthma, COPD), such scales assess dyspnea in its relation to daily activities [13]. Consequently, the application of those scales to inpatient cancer groups, whose daily living patterns have been significantly altered during hospitalization, appears not to be suitable. More importantly, lung cancer is a unique cancer, whose tumors directly involve to the lungs. Dyspnea, consequently, occurs frequently and constantly in this population [12]. Therefore, inpatient lung cancer group needs a sensitive and activity-independent measurement of this symptom.

Among existing instruments, Cancer Dyspnea Scale (CDS) appears to be a suitable measurement of dyspnea in lung cancer. The scale is originally developed in Japan to capture multi-facets of dyspnea, which are not related to daily activities [13, 14]. Its psychometric properties in lung cancer population, including construct validity, convergent validity, internal consistency, and stability, have been reported. Validation studies in Japan, America, and Sweden find that CDS is a qualified instrument to measure dyspnea in lung cancer patients [14-16]. It is also brief (12 items) and requires short time to complete (2 minutes). These characteristics make it very practically applicable in clinical setting and research [15]. Therefore, the CDS was chosen to validate in Vietnamese individuals with lung cancer.

METHODS

Study design and participant

This paper was a part of a main research entitled "Causal model for fatigue in Vietnamese persons with lung cancer receiving chemotherapy" [17]. It was a cross-sectional descriptive study, which was granted the ethical approval (decision No. 282/2014/YTCC-HD3) by the Institutional Review Board of Hanoi School of Public Health, Vietnam (IORG0003239). In the main study, requests for data collection were sent to all ten current oncology centers throughout the north and the centre of Vietnam. Six of them (Bach Mai Hospital, 103 Military Hospital, 108 Military Centre Hospital, National Lung Hospital, Thai Nguyen Centre Hospital, and Nghe An Oncology Hospital) granted permission, and data was then collected from these six institutions. These were main organizations, which offer comprehensive treatments for cancer patients throughout nearly half of the country.

Vietnamese patients who were diagnosed with lung cancer, have been receiving chemotherapy or concurrent radio-chemotherapy for at least one cycles, without prior lung resection surgery, were subjects of this study. A convenience sampling method was employed to recruited participants. All patients, who met the selection criteria during the data collection period, were invited. With regard to sample size, to examine construct validity of a certain scale by factor analysis, at least 10 subjects were needed for each item [18]. Since CDS-V consisted of 12 items, the participant should include at least 120 respondents. The final participants of this study consisted of 246 lung cancer patients, assuring the conduct of factor analysis.

Instrument

The original version of Cancer Dyspnea Scale (CDS) [14] consisted of 12 items. Such items ask about patients' experience with dyspnea in the past few days, such as "Can you inhale easily?", "Do you feel as if you are panting?", or "Do you feel your breathing may stop?". Respondents were asked to rate on five-point Likert scales, from 1 (not at all) to 5 (very much). EFA found that 12 items formed three subscales, namely, Sense of Effort (SE) (item 4, 6, 8, 10, and 12), Sense of Anxiety (SA) (item 5, 7, 9, and 11), and Sense of Discomfort (SD) (item 1, 2, and 3). The mean value of inter-subscale correlation coefficients was 0.48. Cronbach's alpha of total scale was 0.86 and of subscales were 0.83 (SE), 0.81 (SA), and 0.94 (SD). Test–retest coefficients (7-day interval) between SE, SA, and SD and the total score were 0.71, 0.69, and 0.58, respectively [14].

Uronis, Shelby [15] validated the CDS in a heterogeneous group of Australian, American, and British patients with lung cancer. The Cronbach's alpha of SE, SA, and SD subscales were 0.84, 0.80, and 0.84, respectively. The total reliability coefficient was 0.71. CDS score also significantly related to VAS (r = 0.82), Borg's scale (r = 0.87),

HADS (r = 0.57), physical status (r = 0.44), SpO2 (r = 0.29). Henoch, Bergman [16] also translated the CDS into Swedish and validated the scale. The internal consistency coefficients of SE, SA, and SD were 0.81, 0.84, and 0.88, consecutively. The reliability coefficient of total scale was found to be 0.90. Factor analysis found three factors similar to studies of Uronis, Shelby [15] and Tanaka, Akechi [14]. Criterion validity of CDS was also affirmed by its significant associations with other measurements of dyspnea, such as dyspnea frequency ($r = 0.36$, $p < 0.05$), EORTC QLQ-C30 Dyspnea ($r = 0.68$, $p < 0.05$). CDS score was also found to be correlated with scores of anxiety and depression (measured by the Hospital Anxiety and Depression Scale), with the coefficients of 0.36 and 0.27, respectively.

According to Tanaka, Akechi [14], score for SE subscale is calculated by the formula (items 4 + 6 + 8 + 10 + 12) – 5, producing the possible range from 0 to 20. Score for SA is obtained by formula (items 5 + 7 + 9 + 11) – 4, producing the possible range from 0 to 16. And the formula for SD subscale is 15 – (items 1 + 2 + 3), producing the possible range from 0 to 12. The total dyspnea score is the sum of three subscales' scores, ranging from 0 to 48. The higher score indicates the higher level of dyspnea.

Translation of the CDS to the CDS-V and content validity checking

The CDS was translated from English to Vietnamese by back-translation technique [19]. Firstly, two Vietnamese bilingual persons (one was a nurse and the other was an English teacher) translated instruments from English to Vietnamese. In the second step, two other Vietnamese bilingual persons (two English teachers) translated the instruments back to English. A British was then consulted about the semantic equivalence between the original and the back-translated instruments. Comments were sent back to translators for modification. The process was run until the semantic equivalence between back-translated and original scales was assured.

To check the content validity of CDS-V, five experts were invited. The purpose of this step was to examine the relevancy of items to the measuring concept [20]. The group of experts composed of two physicians and three nurses. Among nurses, two have master degree and one has PhD in nursing. Both two physicians are PhD prepared and associate professors. All of them have at least five-year clinical experience with cancer patients. The acceptable value of the Content Validity Index (CVI) was 0.80.

Procedures of data collection

Data was collected from December 2014 to March 2015. Before the data collection took place, under the permission of hospital authorities, name lists of all patients who met the selection criteria were retrieved from hospital databases. Eligible participants were approached at their units and were invited to participate in the study. Consent forms were obtained if the patients agreed to involve in the study. Participants were then provided with self-administered questionnaires, including the CDS-V and a demographic questionnaire (about their age, gender, education level, etc.). Other information related to patients' diseases was obtained from their medical records.

Data analysis

Data was analyzed by computerized statistical program. Descriptive analysis was used to summarize the characteristics of the participants.

Exploratory Factor Analysis (EFA) was used to examine construct validity of the CDS-V. To determine the appropriateness of factor analysis, the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used. For a reliable analysis, the KMO of 0.8 or 0.9, and a significant Bartlett's test were desirable. Principal component analysis with orthogonal varimax rotation was employed to create factors. To be considered as statistically significant, the factor loadings should not be less than .50. The cutoff criterion of eigenvalue > 1.0 was used to select the number of factors [21].

Cronbach's alpha coefficients were used to examine internal consistency of CDS-V. According to DeVellis [18], the Cronbach's alpha more than 0.7 is acceptable for the new instrument. Moreover, items of the instrument should sufficiently contribute to its reliability. The criterion for such contribution is the Corrected Item-Total Correlation coefficient (CITC). Nunnally [22] recommended that such coefficient should be higher than 0.3 to be accepted. Therefore, in the current study, the reliability coefficient of at least 0.7 and the CITC of at least 0.3 were considered to be acceptable.

RESULTS

The participants of this study consisted of 246 lung cancer patients. As showed in the Table 1, the participant was aged at older adult (mean age = 60.79 ± 6.59). The majority (72.80%) of the participants were male. Approximately one-third of them finished their college/bachelor (26.80%) and postgraduate studies (6.50%). Participants with high

Table 1 Characteristics of participants (n=246)

	n	%
Age (years)		
≤ 55	44	17.90
56 – 60	81	32.90
61 – 65	69	28.10
66 – 70	30	12.20
≥ 71	22	8.90
Mean (SD)	*60.79 + 6.59 years*	
Gender		
Female	67	27.20
Male	179	72.80
Education level		
Primary	40	16.30
Secondary	39	15.90
High school	85	34.50
College/Bachelor	66	26.80
Postgraduate	16	6.50
Working condition		
Working	110	44.70
Not working	136	55.30
Months since diagnosis of lung cancer		
Mean (SD)	*5.44 + 3.97 years*	
Stage of disease (NSCLC*)		
I	21	8.50
II	46	18.70
III	93	37.80
IV	86	35.00

**NSCLC: Non-small cell lung cancer*

Table 2 Factor loading pattern for exploratory factor analysis (n =246)

Descriptors	Factor loadings			
	Sense of anxiety	**Sense of discomfort**	**Sense of effort**	**Extraction communalities**
1. Inhale easily	.14	.86	.20	.80
2. Exhale easily	.25	.84	.09	.78
3. Breath slowly	.24	.81	.21	.76
4. Short of breath	-.13	.21	.80	.70
6. Panting	.25	.22	.60	.47
8. Shallow	.40	.27	.51	.49
10. Narrower	.48	.10	.56	.55
12. Stuck in the airway	.36	-.01	.62	.52
5. Accompanied by palpitations and sweating	.59	.21	.28	.47
7. Breathing difficulties that one does not know what to do	.69	.19	.16	.54
9. Breathing may stop	.78	.12	.03	.62
11. As if drowning	.59	.21	.20	.43
Variance explained	20.90%	20.12%	18.27%	
Total variance explained	**59.29%**			

school degree accounted for the biggest prevalence (34.50%). The mean duration from diagnosis with lung cancer was 5.44 months (SD = 3.97). Notably, most patients were at stage III (37.80%) and IV (35%).

Content validity

Content validity of the CDS was evaluated by five experts. The total CVI was 1.0. Experts agreed that items of CDS represented the symptom of dyspnea.

Construct validity

The Kaiser-Mayer-Olkin measurement of sampling adequacy was 0.88, and the Bartlett's Test of Sphericity was significant, reflecting that the use

Table 3 Item description and reliability

Items	Mean ± SD	CITC for scale	CITC for subscale
Sense of discomfort subscale (α = 0.86)			
1. Can you inhale easily?	2.19 ± 1.04	.59	.75
2. Can you exhale easily?	2.14 ± 1.02	.59	.73
3. Can you breathe slowly?	2.24 ± 1.03	.64	.72
Sense of effort subscale (α = 0.73)			
4. Do you feel short of breath?	2.17 ± 0.96	.39	.45
6. Do you feel as if you are panting?	1.87 ± 0.99	.51	.50
8. Do you feel your breath is shallow?	2.09 ± 0.87	.59	.53
10. Do you feel your airway has become narrower?	1.99 ± 0.78	.56	.53
12. Do you feel as if something is stucking your airway?	1.89 ± 0.85	.47	.48
Sense of anxiety subscale (α = 0.70)			
5. Do you feel breathing difficulty accompanied by palpitations and sweating?	1.96 ± 0.912	.54	.47
7. Do you feel such breathing difficulty that you don't know what to do about it?	1.74 ± 0.95	.52	.53
9. Do you feel your breathing may stop?	1.71 ± 0.85	.47	.53
11. Do you feel as if you are drowning?	1.98 ± 0.85	.50	.42

**CITC: Corrected Item-Total Correlation*

of factor analysis was appropriate [21].

Exploratory Factor Analysis was conducted to examine the construct of the CDS-V. Three factors, which appeared to be similar to those reported by Tanaka, et al [14], were found. The first factor (Sense of Anxiety) accounted for 20.90% variance of dyspnea, with the loading score of items ranged from 0.59 to 0.78. The second factor (Sense of Discomfort) accounted for 20.12% variance of dyspnea, with the loading score of items ranged from 0.81 to 0.86. The last factor (Sense of Effort) accounted for 18.27% variance of dyspnea, with the loading score of items ranged from 0.51 to 0.80. Totally, three factors explained 59.29% variance of dyspnea (Table 2).

Reliability

The Cronbach's alpha coefficient of the total scale was found to be 0.86. Such coefficients of SE subscale, SA subscale, and SD subscale were 0.86, 0.70, and 0.73, respectively. CITC coefficients of item to total CDS-V scale ranged from 0.39 to 0.59. With regard to subscales, the association coefficients between item and its relevant subscale varied from 0.42 to 0.75 (Table 3).

DISCUSSION

The measurement of dyspnea is always challenging but highly useful. An accurate assessment of dyspnea would help clinicians making clear diagnosis about causes and impacts, and establishing appropriate management plans to control this symptom [23]. The standardized measurement of dyspnea would also facilitate qualified and reliable research studies focused on this symptom. Up to our knowledge, this is the first study validating a dyspnea instrument in Vietnamese lung cancer patients. It is believed that the availability of this standardized questionnaire would enable researchers and clinicians developing their works in this population.

In EFA, pattern of factors found in this study was similar to the original study of Tanaka and colleagues [14]. Twelve items of CDS-V formed three subscales, namely sense of discomfort, sense of anxiety, and sense of effort. However, in the current study, some items appeared to have cross-loadings between factors. In particular, although item 8 (shallower) and 10 (narrower) highly loaded to Sense of Effort subscale, they were also slightly closed to Sense of Anxiety subscale. In their validation studies, Henoch, Bergman [16] and Uronis, Shelby [15] also found some items having cross-loadings between factors. For example, Henoch, Bergman [16] examined CDS in a Swedish participant and found that the item 4 (painting) loaded very closely to the Sense of Anxiety rather than Sense of Effort factor. It is important to note that the CDS was originally constructed by interviewing cancer patients and medical experts. Since its items were empirically rather than theoretically derived, the loadings of CDS items appear to depend on the cultural or linguistic diversions among population being tested [16]. Hence, future research, especially qualitative study, is suggested to explore, compare and contrast the concept of dyspnea in different cultures. Such findings would provide valuable understanding to

further validation of dyspnea measurements.

In this study, the consultation with content experts showed that items of CDS-V appropriately represent the concept of dyspnea in Vietnamese lung cancer population. More importantly, the factor loading scores of items to their relevant subscales found in this study akin to those in studies of Tanaka, Akechi [14] and Uronis, Shelby [15]. Particularly, results from all three studies found that items of CDS subscales had good factor loading scores, ranging from moderate (0.50s) to high (0.80s) levels. These findings suggest the cross-cultural validity of this instrument among various populations.

It was found that internal consistency coefficient of the CDS-V was acceptable ($\alpha = 0.86$). Nevertheless, such coefficients of its subscales were mildly lower, which were 0.86 (SD), 0.73 (SE), and 0.70 (SA). It should be noted that the CDS-V was firstly translated and validated in Vietnamese in this study. According to Nunnally [22], the internal consistency coefficient of a new instrument should not be less than 0.70. Therefore, the internal consistency coefficients of CDS-V, as well as its subscales, were considered to be acceptable. Interestingly, the similar magnitude of reliability was also found in previous CDS validation studies, which found the Cronbach's alpha coefficients of this scale was 0.71 [15] and 0.86 [14]. Seemingly, the small number of items could be one of the causes that make the Cronbach's alpha of CDS was only marginally acceptable [18].

The current study focused on construct validity, content validity, and internal consistency of the CDS-V. There are various aspects of a scale that need to be examined, such as predictive, discriminant validity or test-retest reliability. It is very important to look at these psychometric properties of a new instrument. Therefore, the subsequent studies are recommended to explore these issues in the future.

CONCLUSIONS

The Vietnamese version of the Cancer Dyspnea Scale is a reliable and valid scale to measure dyspnea in lung cancer population. The instrument captures multi-aspects of dyspnea. Thus, it may provide systematic and comprehensive understanding about patients' experience of this symptom. Researchers and clinicians are recommended to employ this scale in their practices.

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REFERENCES

1. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. Int J Cancer. 2010 Dec; 127(12): 2893-917. doi: 10.1002/ijc.25516
2. Phương TC. Lung cancer in Vietnam. [S.l.]: Lung cancer, National Hospital for Lung Diseases; 2013.
3. Nguyen TTN, Tran KL, Bui NL, Vos T, Ngo ĐA, Nguyen TH. The burden of diseases and injuries in Vietnam in 2008 (in Vietnamese). Ha Noi: Medical Press; 2011.
4. Soni MK, Cella D, Masters GA, Burch SP, Heyes A, Silberman C. The validity and clinical utility of symptom monitoring in advanced lung cancer: a literature review. Clin Lung Cancer. 2002 Nov; 4(3): 153-60.
5. Liao YC, Liao WY, Shun SC, Yu CJ, Yang PC, Lai YH. Symptoms, psychological distress, and supportive care needs in lung cancer patients. Support Care Cancer. 2011 Nov; 19(11): 1743-51.
6. Kathiresan G, Clement, Sankaranarayanan. Dyspnea in lung cancer patients: a systematic review. Lung Cancer: Targets and Therapy. 2010; 1: 140-151. doi: 10.2147/lctt.s14426
7. Phạm VL. The application of Gama knife in operation for lung cancer patients in Hue University of Medicince and Pharmacy's hospital. Hue University Journal of Science. 2010; 63: 107-20.
8. Huhmann M, Camporeale J. Supportive care in lung cancer: clinical update. Semin Oncol Nurs. 2012 May; 28(2): e1-10. doi: 10.1016/j.soncn.2012.03.009
9. Simon ST, Higginson IJ, Booth S, Harding R, Bausewein C. Benzodiazepines for the relief of breathlessness in advanced malignant and non-malignant diseases in adults. Cochrane Database Syst Rev. 2010; (1): CD007354. doi: 10.1002/14651858.CD007354.pub2
10. De Peuter S, Van Diest I, Lemaigre V, Verleden G, Demedts M, Van den Bergh O. Dyspnea: the role of psychological processes. Clin Psychol Rev. 2004 Sep; 24(5): 557-81.
11. Williams AC, Grant M, Tiep B, Kim JY, Hayter J. Dyspnea Management in Early Stage Lung Cancer: A Palliative Perspective. J Hosp Palliat Nurs. 2012 Jul; 14(5): 341-2.
12. Henoch I, Bergman B, Gustafsson M, Gaston-Johansson F, Danielson E. Dyspnea experience in patients with lung cancer in palliative care. Eur J Oncol Nurs. 2008 Apr; 12(2): 86-96.
13. Joyce M, Beck SL. Measurement summary: Dyspnea: Oncology Nursing Society; 2005 [Cited 2013 Nov 10]. Available from: http://www.ons.org/Research/PEP/media/ons/docs/research/measurement/dyspnea.pdf.
14. Tanaka K, Akechi T, Okuyama T, Nishiwaki Y, Uchitomi Y. Development and validation of the Cancer Dyspnoea Scale: a multidimensional, brief, self-rating

scale. Br J Cancer. 2000 Feb; 82(4): 800-5.

15. Uronis HE, Shelby RA, Currow DC, Ahmedzai SH, Bosworth HB, Coan A, et al. Assessment of the psychometric properties of an English version of the cancer dyspnea scale in people with advanced lung cancer. J Pain Symptom Manage. 2012 Nov; 44(5): 741-9.
16. Henoch I, Bergman B, Gaston-Johansson F. Validation of a Swedish version of the Cancer Dyspnea Scale. J Pain Symptom Manage. 2006 Apr; 31(4): 353-61.
17. Long, N.H., Thanasilp, S, Thato, R. A causal model for fatigue in lung cancer patients receiving chemotherapy. European Journal of Oncology Nursing. 2016 Apr; 21: 242-247.
18. DeVellis RF. Scale development: Theory and applications. 3rd ed. California: Sage; 2012.
19. Maneesriwongul W, Dixon JK. Instrument translation process: a methods review. J Adv Nurs. 2004 Oct; 48(2): 175-86.
20. Waltz C, Strickland OL, Lenz E. Measurement in nursing and health research. 4th ed. New York: Springer; 2010.
21. Munro BH. Statistical methods for health care research. 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2005.
22. Nunnally JC. Psychometric theory. New York: McGraw-Hill; 1978.
23. Bausewein C, Booth S, Higginson IJ. Measurement of dyspnoea in the clinical rather than the research setting. Curr Opin Support Palliat Care. 2008 Jun; 2(2): 95-9.