DEVELOPMENT OF A DYSPNEA MANAGEMENT BEHAVIOR SCALE FOR THAI CHRONIC OBSTRUCTIVE PULMONARY DISEASE PATIENTS

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ABSTRACT:

Background: Dyspnea is the most common and severe symptom in patients with chronic obstructive pulmonary disease (COPD) associated with progressively decreased lung function. Assessment of dyspnea management behavior in COPD patients is therefore of great importance in clinical practice. However, no valid and reliable measure presently exists to assess such behavior in Thai COPD patients. The purpose of this study was to develop a dyspnea management behavior scale (DMBS) for use in the Thai COPD patient population.

Methods: This study was guided by scale development procedures. Development of the DMBS involved four steps: first, generating an item pool; second, performing a content validity procedure; third, performing an item analysis procedure; and fourth, performing a construct validity procedure using exploratory factor analysis (EFA). A convenience sample of 100 COPD patients was recruited for scale validation.

Results: The DMBS was produced as a self-reporting questionnaire, comprising 17 items and a five-point Likert scale. The scale was divided into two components: (1) management of dyspnea exacerbation and (2) prevention of induced dyspnea. Psychometric testing confirmed the content and construct validity, as well as the internal consistency of the instrument when used by Thai COPD patients, with a Cronbach's alpha coefficient of 0.93. The results of EFA showed that the two components accounted for 48.95% of the variation, with Eigenvalues of 8.81 and 1.61.

Conclusions: The findings of this study support the development of the DMBS for assessing the dyspnea management behavior of Thai COPD patients. Further research is needed to field-test the psychometric properties of the DMBS.

Keywords: Scale development; Dyspnea management behavior; Chronic obstructive pulmonary disease; Thai COPD patients

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INTRODUCTION

Dyspnea is the most common and severe symptom in patients with chronic obstructive pulmonary disease (COPD) associated with progressively decreased lung function [1, 2]. Dyspnea manifests as a complex, subjective sensation of perceived and/or experienced difficult or labored breathing, and may also produce secondary physiological, emotional, cognitive, and behavioral responses [3-6]. Consequently, dyspnea management behavior is an important approach to decreasing and preventing dyspnea symptoms in COPD patients. Identifying recommended dyspnea management behaviors would allow for outcomes evaluation when designing nursing interventions for COPD patients. Thus, a valid and reliable measure to assess dyspnea management behavior is needed.

The concept of dyspnea management is typically described by a comprehensive literature

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Table 1 Participant's demographic characteristics (n = 100)

Demographic characteristics	Number	Percent
Gender		
Male	78	78.0
Female	22	22.0
Age ($\bar{x}$= 66.12, S.D.=11.85)		
40-50	9	9.0
51-55	13	13.0
56-60	13	13.0
61-65	13	13.0
66-70	17	17.0
> 70	35	35.0
Educational attainment		
Uneducated	1	1.0
Elementary school	58	58.0
Secondary school	29	29.0
Diploma	6	6.0
Graduate	6	6.0
Severity of COPD		
Stage 2	43	43.0
Stage 3	57	57.0
Underlying disease		
No underlying disease	38	38.0
Having underlying disease	62	62.0
- Hypertension	17	27.4
- Asthma	17	27.4
- Diabetes	3	4.8
- Cardiovascular disease	14	22.6
- Dyslipidemia	1	1.6
- Comorbidity	10	16.2
Smoking status		
Ex-smoker	57	57.0
Current smoker	43	43.0
- < 5	18	41.9
- 5-10	22	51.1
- 11-20	3	7.0

review and the Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD) guideline of 2014 [7]. Dyspnea management is a type of symptom management that patients with COPD use to lessen or control their dyspnea symptoms in their daily lives, with the goal of averting or delaying negative outcomes [8, 9]. Likewise, dyspnea management behaviour is defined as behaviour performed by COPD patients to maintain, attain, or regain an alleviated state of dyspnea and to prevent induced dyspnea occurrence. Dyspnea management is employed whenever a COPD patient has a persistent airflow limitation, reduced airflow in the lungs, and increasingly decreased lung function [10-12].

The severity of a patient's dyspnea symptoms is associated with the progression of his or her COPD [13]. To be eligible for participation in this study, patients were required to have COPD of stage 2 or stage 3 severities. Patients with stage 2, or moderate, COPD (50% $\leq$ forced expiratory volume [FEV1] < 80% predicted) have mild dyspnea symptoms, while those with stage 3, or severe, COPD (30% $\leq$ FEV1< 50% predicted) have dyspnea symptoms that interrupt the activities of daily living. Patients with either stage of COPD who are able to manage their dyspnea symptoms may be able to stop or delay the progression of their disease [3, 14].

As efforts intensify to foster successful dyspnea management in COPD patients, health professionals must both assess and better understand the dyspnea management behavior of their patients. Other assessment instruments for use in COPD patients do exist. One example is the Dyspnea Management Questionnaire, which is composed of five domains, as follows: (1) dyspnea intensity, (2) dyspnea

anxiety, (3) activity avoidance, (4) activity self-efficacy, and (5) strategy satisfaction [15]. Another example is the Chronic Obstructive Pulmonary Disease Self-Management Scale, which is composed of five conceptual domains: (1) symptom management, (2) daily life management, (3) emotion management, (4) information management, and (5) self-efficacy [16]. While the available instruments include measures for assessing clinical outcomes and psychosocial and behavioral responses, they lack a measure of COPD patient performance in managing dyspnea. Additionally, the aforementioned instruments have been developed and used predominantly in Western countries, while applications in Thai COPD patients have been limited. The need to develop a new instrument, intended specifically for use in Thai patients with COPD, to measure dyspnea management behavior is thus apparent and prompted us to perform this study.

METHODS

A cross-sectional design was used to develop the dyspnea management behavior scale (DMBS) in a sample of patients with COPD. The study was conducted at the Chest Outpatient Department of the Veterans General Hospital, Bangkok, Thailand from December 2014 to February 2015.

Participants

Patients were considered eligible for this study if they were 40 years of age or older and had both stage 2 and stage 3 COPD as defined by the GOLD guideline [7]. The preferable sample size for factor analysis should be 100 or larger [17]. Total of 100 patients with COPD were recruited into this study. Their mean age was 66.12 ± 11.85 years. The majority of the participants were male (78%), had an elementary school education (58%), and 57% had stage 3 of COPD (versus stage 2 [43%]). Additionally, most participants had hypertension as underlying characteristic of their disease (41%); 57% were ex-smokers and 43% were current smokers. Half of those who were current smokers consumed five to10 cigarettes per day (Table 1).

Ethical considerations

Ethical approval of this study was granted by the Research Ethics Committees of the Institutional Review Board of the Royal Thai Army Medical Department, Thailand (no.Q016h/57). Permission for correction data was obtained from the Veterans General Hospital. Data collection was performed only after written consent was obtained from all study participants.

Procedure for instrument development

This study was guided by the scale development procedures of DeVillis and Nunnally and Bernstein [18, 19]. The development of the DBMS occurred in four phases, as follows:

Step I: Item pool generation

The generation of an initial item pool included a comprehensive literature review related to dyspnea management of COPD patients, the development of operational definitions, a review of existing instruments, and determination of the dimensions of dyspnea management through the GOLD guideline of 2014. Through this process, 18 candidate items were generated to form an initial draft of the DMBS.

The DMBS uses a five-point Likert response scale (using self-reporting) that ranges from 1(never performed) to 5 (always performed). For scoring and interpretation of the DMBS, all questions are summarized to produce raw scores (from 18-90 points), with higher scores demonstrating better performance by patients in managing and controlling their dyspnea.

Step II: Content validity procedure

The content validity of the DMBS was established by a panel of five experts in COPD, dyspnea management research, and instrument development: a physician specializing in COPD and pulmonary rehabilitation, two nurse instructors specializing in instrument development and respiratory care, and two nurse practitioners who work in a respiratory clinic. These experts examined the content validity of the DMBS, and all concluded that the items were relevant and representative of the possible dyspnea management behavior of COPD patients.

The experts were also asked to evaluate the initial items' relevance to their associated concept domains, based on the conceptual definitions provided. The panel assessed each item using a four-point Likert-type scale, where 1=not relevant, 2=somewhat relevant, 3=quite relevant (i.e., relevant but needs minor alterations), and 4=very relevant [20]. If an expert panel member rated any item below 4, the expert was asked to provide suggestions for modifying or eliminating that item.

The researchers used the content validity index (CVI) to quantify the extent of expert agreement. The CVI for an item was calculated as the proportion of experts who rated it as a 3 or 4 in relevance [21]. Problematic items were revised or further clarified,

based on the recommendations of the expert panel. For example, the participants didn't understand "attempt to find someone help you when dyspnea occurred", it was changed to "called for help from others when dyspnea occurred". In addition, "clear your airway" was used instead of "blow your nose and spit phlegm" that was confusing the participants.

Step III: Item analysis procedure

Item analysis was conducted in a subgroup of the eligible study participants within the convenience sample of 100 COPD patients. This approach was used to select the best items with which to construct the DMBS. Both corrected item-total correlation and reliability approaches were utilized. The corrected item-to-total correlations were to exceed 0.50 and a reliability coefficient that assessed the consistency of the entire scale was to be Cronbach's alpha above the standard of 0.70 [17].

Item review was then used to determine the appropriateness and clarity of the wording for each item in the first draft of the DMBS. This draft, which comprised 18 items, was reviewed by 10 COPD patients selected by convenience sampling. As these 10 patients responded to the DMBS, the researchers observed whether they paused or skipped any questions, or asked outright for any answers. These behaviors were recorded as the patient misunderstanding, the item proving difficult to understand, or the patient being reluctant to answer. After this review was completed, two items were modified to enhance their clarity.

Step IV: Construct validity procedure

Exploratory factor analysis (EFA) was used to measure the construct validity of the DMBS and its 18 items and to assess the factor structure. In this study, the principal components analysis (PCA) method was used for factors extraction which is the first phase of EFA. After choosing number of factors, varimax rotation was applied to redefine factors that loadings greater than 0.30 on various factors or tend to be very high (-1 or 1) or very low (0) [22]. This rotation method has been proven as an effective analytical approach [17].

RESULTS

Results of Step 1 (Item pool generation):

The DMBS comprised 18 items and was divided into two components: management of dyspnea exacerbation and prevention of induced dyspnea. Additionally, the DMBS included a five-point Likert scale, using self-reporting, that ranged from 1 (never performed) to 5 (always performed).

Results of Step 2(content validity procedure):

The DMBS was appropriately developed after completion of the content validity process. The scale's content validity index (S-CVI) was 0.98, resulting in an initial draft of 18 items.

Results of Step 3 (item analysis procedure):

Items in the DMBS had corrected item-total correlations ranging from 0.39-0.83, with the exception of one item with a correlation of 0.16. However, the researchers still considered that item ("You have taken medication correctly, as prescribed.") acceptable for inclusion in the scale because its correlation was statistically significant. In addition, the item may be useful as a measure of dyspnea management behavior in COPD patients.

Results of Step 4 (construct validity procedure):

The EFA identified a two-factor structure, and the principal component method (rotated component matric with Varimax rotation) was used to extract specific factors. The assumptions of EFA were tested, including by Kaiser-Meyer-Olkin, which had a value of 0.89, and Bartlett's test of sphericity ($X^2 = 1202.88$, degrees of freedom = 153, $p < .001$); these results suggested that the data set was appropriate for an EFA [23].

The results of EFA included two components (1) management of dyspnea exacerbation and (2) prevention of induced dyspnea. Component 1 (Eigenvalues = 8.81, $\alpha = 0.91$) explained 34.47% of the variance, while Component 2 (Eigenvalues = 1.61, $\alpha = 0.87$) explained 23.40% of the variance.

For the PCA procedure, factor loadings of more than .30 were considered and high loadings on each component were grouped together [17]. Six items are complex in the sense that they had loadings above .30 on both factors. To simplify factors structure and make their interpretation easier and more reliable, the data set was rotated by varimax method. Consequently, one item ("You have taken the medication correctly, as prescribed") in the prevention of induced dyspnea component was deleted because of low factor loading (0.22). Two items which were pooled on component 1 ("You have called for help from others when dyspnea occurred", and "You have engaged in activities to relieve stress, such as meditation, calming, and talking with others") were moved to component 2. The final draft of the DMBS included 17 items: seven for the management for dyspnea exacerbation

Table 2 Factor analysis of dyspnea management behavior scale

Items	Factor loadings		Communality	Mean	SD	Corrected item-total correlation
	I	II				
Component 1: Management for dyspnea exacerbation						
1) You have observed and assessed the severity of coughing, sputum, and dyspnea-associated wheezing.	.70		.59	3.56	.90	.64
2) You have used inhalation treatment when dyspnea occurred.	.70		.51	4.09	1.0	.50
3) You have improved your respiration with the help of your abdominal and diaphragmatic muscles and pursed lip breathing when dyspnea occurred.	.71		.53	3.06	.93	.50
4) You have used proper positioning, such as sitting on a chair while leaning forward or standing with your back against the wall, when dyspnea occurred.	.71		.50	3.10	.86	.39
5) You have met with your doctor when dyspnea occurred.	.70		.75	3.30	1.09	.80
6) You have changed your level of activity (for example, from strenuous activity to low-intensity activity).	.69		.74	3.21	.87	.79
7) You have changed your type of activity (for example, from quick activity to slow and smooth activity).	.57		.70	3.15	.91	.79
Component 2: Prevention for induced dyspnea						
8) You have avoided dyspnea triggers such as smoke, damp places (too hot or too cool), poor ventilation, and close contact with any person with a respiratory infection.		.57	.46	3.65	1.02	.62
9) You have engaged in appropriate and proper exercise (for example, walking, riding a bicycle, Qigong, or Taijji).		.68	.49	3.12	1.21	.57
10) You have cleared your airway before meals.		.82	.74	3.18	.87	.77
11) You have avoided big meals.		.81	.77	3.19	.87	.81
12) You have avoided food that causes gas and abdominal flatulence (such as sparkling water, cabbage, onion, and peanuts).		.60	.40	3.03	.87	.55
13) You have been drinking at least 6-8 glasses of water/day.		.75	.64	3.52	.92	.72
14) You have had enough sleep (at least 6-8 hours/night).		.67	.48	3.63	.92	.59
15) You use empowering language with yourself and have rewarded yourself when you can manage your dyspnea.		.75	.59	3.01	.88	.63
16) You have called for help from others when dyspnea occurred.	.56	.65	.75	2.98	1.12	.83
17) You have engaged in activities to relieve stress, such as meditation, calming, and talking with others.	.37	.79	.76	2.88	1.05	.81
% variance explained	34.47	23.40				
Eigenvalues	8.81	1.61				
Cumulative%	34.47	57.87				

and ten for prevention of induced dyspnea. For all items on the DMBS scale, Cronbach's alpha coefficient was 0.93. The updated items are shown in Table 2.

DISCUSSION

The purpose of this study was to examine the validity and reliability of the DMBS in measuring dyspnea management behavior among Thai COPD patients. The final version of the DMBS is a self-reporting questionnaire with 17 items and a five-point Likert scale. The scale is divided into two components: (1) management of dyspnea exacerbation and (2) prevention of induced dyspnea. To the best of the researchers' knowledge, this instrument is the first investigative tool of its kind in Thailand to demonstrate validity and reliability. Psychometric testing confirmed the validity of the content and constructs, as well as the internal consistency of the instrument for use in Thai COPD patients, with Cronbach's alpha coefficient of 0.93. The results of the internal consistency procedure also demonstrated high reliability for the DMBS at > 0.70.

Content validity was also established by five experts with respiratory medicine expertise in both the clinical and research settings. Following the experts' review, the scale's content validity index (S-CVI) was found to be 0.98. In order to fulfill the minimum criterion of a S-CVI of 0.80, the DMBS content domain contained 18 items [24].

Finally, EFA (using the principal component method) was conducted to test the construct validity of the DMBS, to identify complex inter-relationships among items, and to group items that collectively formed unified concepts. The results of this analysis indicated that two items were differently grouped as showed in item pool step. Meanwhile one item in the second component was extracted from the DMBS. The finding may be explained by the fact that most Thai COPD patients are older adults who may not adhere to medication instructions [25, 26]. Moreover, as COPD is a chronic respiratory disease, the severity of disease occurs when the patients approach with factor stimuli dyspnea severity [27].

CONCLUSION

This study showed the DMBS to be an appropriate instrument in measuring dyspnea management behavior. Furthermore, this instrument has the potential to be valuable in assessing interventions that may prevent severe dyspnea occurrence in the context of COPD and avoid the exacerbation of progressive COPD, resulting in improved management and control of dyspnea symptoms in both the clinical and community settings.

This study developed a new dyspnea management behavior scale for Thai COPD patients. Its validity and reliability were confirmed through a patient-based field survey. However, concurrent validity and criterion-related validity were not established due to the lack of an existing, acceptable instrument for assessment of COPD patients' dyspnea management behavior. Future studies will use the DMBS to evaluate the effectiveness of educational interventions in the clinical setting for patients with other chronic respiratory diseases.

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