Journal of Natural Sciences Research
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.2, No.8, 2012

Unidimentional and Multidimensional Breathlessness Specific Instruments for Adult Population: Literature Review

Dr. Suhair Al-Ghabeesh[1*] Prof. Muayyad Ahmad[2]

1. Faculty of Nursing, Al-Zaytoonah University, PO box 910525, zip code 11191, Amman
2. Faculty of Nursing, University of Jordan, Tel: 00962-799313745 E-mail: mma4@yahoo.com

*E-mail of the corresponding author: **suhair_alghabeesh@yahoo.com**

Abstract

The aim of this review was to identify the psychometric properties and the appropriateness of the most frequently used measures of breathlessness to help the clinical health professionals and researchers to select the appropriate one in treating patients.

A literature search was performed using EBSCO host, Ovid, Science Direct, and Springer Link databases. Eighteen measures of breathlessness were identified, five of them were unidimentional and thirteen were multidimensional breathlessness-specific measures. None of the measures were comprehensive or responsive enough to be recommended for use alone to measure breathlessness. It seems wise to integrate and validate the present measures rather than developing new ones.

Keywords: breathlessness measures; health; nursing; psychometrics.

1. Introduction

The aim of this review was to identify the psychometric properties and the appropriateness of the most frequently used measures of breathlessness to help the clinical health professionals and researchers to select the appropriate one in treating patients. The breathlessness measures have been used in conditions such as chronic obstructive pulmonary disease (COPD), cancer, heart failure (HF), cystic fibrosis, motor neuron disease (MND), and end stage renal disease (ESRD). The findings of this paper shed light on the characteristics of these instruments which will help researchers in selecting the most appropriate one for their studies and clinical nurses in selecting the most appropriate one for assessing and treating their patients.

Reviewing literature showed no consensus on one definition of breathlessness by researchers. Breathlessness is defined as "a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity.[1] The experience is derived from interaction among multiple physiological, psychological, social and environmental factors and may induce secondary physiological and behavioral responses" (p: 322). However, experts agree that beathlessness has three main parts: physiological, functional, and psychological.[2]

Breathlessness is affected by many factors such as past experiences, gender, tolerance to discomfort, cultural norms, and unique breathlessness Breathlessness is still difficult to measure, despite its wide prevalence in population. triggers.

In the past few decades, the most of the instruments focused on the assessment of breathlessness only among hospitalized patients with chronic pulmonary diseases.[3] Recently, the focus is more on the management of breathlessness than its assessment; thus, this requires valid, reliable, and sensitive assessment tools to measure this uncomfortable condition.

2. Search method

Nursing and health care journals published between 1960 and 2011 were reviewed using the keywords and synonyms in various combinations (Table 1). The online databases: EBSCOhost, Ovid, Science Direct, and Springer Link were searched. The selection criteria were research studies published in English and focusing on the development and validation of breathlessness instruments used with adult patients, and research studies used breathlessness instruments.

The search process results with five unidimentional scales, which measures the severity of "dyspnea" or "breathlessness" (both terms can be used interchangeably) and thirteen multidimensional breathlessness-specific tools were identified.

3. Results

3.1 Unidimentional tools

The unidimentional tools are those that measure breathlessness on exercise or in general and often used to describe the severity of breathlessness. All of the unidimensional tools (Table 2) are self-administered and quick to complete, which include:

3.1.1Visual analogue scale-dyspnea (VAS-D)

The Visual analogue scales are one of the most popular measurement devices in nursing research and practice. Visual analogue scales are relatively easy to construct, administer, score and acceptance by respondents, even in the critical care environment. [8] Visual analogue scales tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot simply be measured directly such as breathlessness, pain, appetite. [8] The data are usually treated as being interval or ratio level.

Visual analogue scale has several limitations. [9] First, photocopying the scale can cause small, systematic alterations in the length of the line; therefore, printing is preferable. Second, that is the participant's tendency to place the marks at a similar position when scoring multiple VASs simultaneously. Third, it measures only one dimension of a phenomenon at a time and ignores other factors contributing to breathlessness. Forth, it is not suitable for comparing breathlessness in different patients because the sensation of breathlessness can differ between measures.[3] Finally; there are no standardized criteria for use by different researchers.

Visual analogue scale has moderate to strong reliability as assessed by test/retest method. [9] The validity of the VAS has been established in numerous studies as a measure of breathlessness and or other symptoms. A study on six male subjects with COPD rated both the sense of effort required to breathe and the degree of discomfort associated with breathing on a vertical VAS during exercise on a braked cycle. [10] The researchers tested the convergent validity of this scale and found that the VAS ratings of the sense of respiratory effort and discomfort were highly correlated in each subject ($r = 0.99 \pm 0.006$).[10]

3.1.2 Oxygen cost diagram (OCD)

The oxygen cost diagram is a variation of the VAS. However, few researchers reported some difficulties with patients' lack of understanding of how to use it.[11] In addition, OCD has limited use in patients who are breathless at rest because it relies profoundly on ambulatory activities. Significant correlation was found with distance walked in 12 minutes but not with one-second forced expiratory volume (FEV1); and moderate correlation between anxiety and depression ($r = 0.68$) and physical activities ($r = -0.9$).[12] No sufficient information is available about the reliability of this scale.

3.1.3 Numerical rating scale (NRS)

Numerical rating scale is similar to VAS in the description and its limitations but it is easier and more frequently used than VAS.[13] Unlike the VAS; both NRS and MBS can be used over the phone.[14]

Numerical rating scale was used to measure both sensory and affective dimensions of breathlessness. No information available about the reliability of NRS. The validity for the Dyspnea-NRS was established with high correlation with VAS-D (r: 82).[15]

3.1.4 Modified Borg scale (MBS)

Patients who used the Modified Borg scale and emergency department triage nurses and primary care nurses rated the MBS as highly satisfactory with its quick and easy to use and adequately expressed breathlessness. However, this scale has been criticized for its confusing words and instructions.[16] Modified Borg scale is available in English, French, German, Japanese, Hebrew, and Russian languages.

The MBS correlated well with other clinical parameters and could be useful when monitoring outcomes in patients with acute bronchospasm.[17] The convergent validity of VAS and MBS scales was demonstrated with high correlation ($r = 0.92$, $p = 0.001$).[18]

3.1.5 Verbal rating scale or SOB rating scale

Verbal rating scale is simple and quick to use in a variety of clinical settings, it is the most widely used scale for the measurement of pain, requires no equipment and have consistently lower failure rates than the VAS.[19] The use of verbal rating scale and its validation in the setting of breathlessness for the first time was supported in literature.[15] The Verbal rating scale was validated in emergency department patients.[20] The detection of between-subject variability provides information on a patient's level of physiological distress and also helps quantify additional subjective psychosocial influences causative to perceived breathlessness severity. In this study the verbal dyspnea scores (VDS) at triage correlated significantly with RR ($r = 0.77$, $p < 0.001$), cutaneous oxygen saturation measurement (SaO2) ($r = -0.43$, $p < 0.001$), HR ($r = 0.35$, $p < 0.001$) and SBP ($r = 0.19$, $p < 0.05$). The correlations remained significant after thirty minutes for RR ($r = 0.74$, $p < 0.001$), SaO2 ($r = -0.39$, $p < 0.001$) and HR ($r = 0.40$, $p < 0.001$).[35]

All of the five mentioned tools are simple, easy to administer and score. However, no one of them is free from limitations. The only two tools which are valid and reliable and can rely on in acute conditions are VAS and MBS. Verbal rating scale may be better than VAS and the MBS because it can be administered to critically ill patients without burden, also it is easily used by illiterate patients but it needs further validation. Numerical rating scale and oxygen cost diagram have no information about their reliability.

3.2 Multidimensional tools

The multidimensional breathlessness measures assess the impact of breathlessness on more than one dimension such as emotional and mental functioning. Thirteen multidimensional breathlessness-specific tools (Table 3) were identified. All of the multidimensional tools are used in research, and most of them were used in clinical settings, which include:

3.2.1 Medical Research Council (MRC) dyspnea scale

Medical Research Council dyspnea scale measures the effect of breathlessness on activities of daily living. MRC dyspnea scale is simple, can be self-administered or interviewer administered, takes 30 seconds for completion, and available in English language only. MRC dyspnea scale is not sensitive enough to detect small significant symptomatic changes following an intervention. [20, 32]

The convergent validity for MRC was established by the significantly correlated scores ($r = 0.48$- 0.70, $p < 0.001$) between MRC, OCD, and BDI.[11] There is no data related to the reliability of MRC and modified MRC.

The sensitivity and responsiveness of the MRC scale to the existence and treatment of laryngotracheal stenosis, and its correlation with objective measures of respiratory physiology was tested on 40 tracheostomy-free patients (16 males and 24 females).[33] Medical Research Council dyspnea scale was administered to all patients with laryngotracheal stenosis preoperatively and at the first visit to outpatient clinic after 4-6 weeks of operation. The higher the degree of airway obstruction before treatment, the higher scores of dyspnea ($r = 0.75$, $p < .0001$).[33] This finding proves the discriminant validity of MRC dyspnea scale and its high sensitivity to the presence of varying degrees of laryngotracheal stenosis.

3.2.2 Baseline Dyspnea Index (BDI) / Transition Dyspnea Index (TDI)

Baseline Dyspnea Index /Transition Dyspnea Index has been widely used in clinical trials; it is translated into more than 25 languages.[34] The BDI/TDI is easily administered, it takes approximately three minutes to complete. Interview video tapes and written instructions are available about the BDI /TDI as guidance for the interviewer.[34]

The BDI/TDI measure the severity of breathlessness by observer interviewer in three categories: functional impairment, magnitude of task, and magnitude of effort. Applying the two indexes, one at the baseline state and the second applied after intervention to measure the degrees of improvement or deterioration in breathing, this approach is better than applying a single-state scale repetitively for determining interval changes in breathlessness.[34]

The BDI and TDI have been used extensively in populations with pulmonary diseases, and in clinical trials, and have been shown to correlate better with physiologic measures than other breathlessness scales.[11] Recently; this index was used in patients with neuromuscular disease. The correlation coefficients were 0.98 for each category of the BDI and TDI, signifying nearly perfect reproducibility within patients.[35] In a retrospective study on 88 male patients with COPD, it was found moderate to strong relationship between modified MRC, BDI, and OCD, and strong correlation between both BDI and OCD scores and arterial blood gases (ABGs) abnormalities.[36]

3.2.3 Breathlessness, Cough and Sputum Scale (BCSS)

The Breathlessness, Cough and Sputum Scale is a brief, three-items, patient-reported outcome measure in which each of the three symptoms assessed by the measure is represented by a single item.[22] In BCSS subjects are asked to assess and record the severity of three symptoms of COPD: breathlessness, cough, and sputum. The diary format of the BCSS enables investigators and clinicians to assess symptom changeability, including the variance associated with acute exacerbations, and to evaluate the pathway of symptom severity over time in this patient population. The symptoms of breathlessness, cough, and sputum have been identified as key symptoms of COPD in various statements, and are those most likely to be affected by pharmacotherapy designed to improve and control respiratory symptoms in this population.[22]

The items of BCSS and total scale scores were found to be internally consistent (Cronbach's alpha = 0.70 daily; 0.95 to 0.99 over time) and reproducible under stable conditions.[38] Intra-class correlation coefficients for item and total scores ranged from 0.74 to 0.78. Values for both indicators of reliability exceeded the guideline of 0.70 for group-level analyses. The breathlessness has small to moderate correlation with FEV1, peak expiratory flow (PEF), moderate correlation with Borg scale; total BCSS had low to moderate correlation with short form-36 (SF-36).[22]

3.2.4 Chronic lung disease (CLD) severity index

The development of this index started by a comprehensive list of symptom items derived from the MRC questionnaire, the American Thoracic Society questionnaire, and others. The six CLD severity index items correlated significantly with all eight scales of the SF-36 (range of r from 0.19 to 0.37; $p < 0.01$). CLD severity index had significant correlations with the episodes of acute bronchitis (r = 0.28; $p < 0.001$), the number of inhalers (r = 0.16; $p < 0.01$), the use of oxygen (r = 0.15; $p < 0.01$), and the number of outpatient visits (r = 0.16; $p < 0.01$).[23] Thus, the CLD severity index is a reliable measure and is suitable for making group comparisons. The CLD validity is supported by its significant relationship with health-related quality of life (HRQoL), number of inhalers, use of oxygen, episodes of acute bronchitis, and number of outpatient visits. Compared with PEFR, the CLD index explained more of the variability in HRQoL as measured by SF-36.[23] However; this index limits the ability to distinguish asthma from chronic bronchitis and/or emphysema as suggested by the American Thoracic Society.[23]

3.2.5 University of California San Diego (UCSD) Shortness of Breath Questionnaire (SOBQ)

The existing UCSD SOBQ founded after numerous modifications of a previous questionnaire described in 1987 by Archibald and Guidotti which measured shortness of breath during activities of daily living (ADL) in individuals with COPD.[39] The psychometric properties of the UCSD SOBQ was assessed in 28 COPD patients, 9 with cystic fibrosis, and 17 post lung transplant patients, their age ranged from 12 to 82 years. All the participants were included in pulmonary rehabilitation program.[24] The reliability was tested, the Cronbach's α was 0.96, demonstrating excellent internal consistency, and item-total correlations ranged from 0.49 - 0.87. Additionally, patients completed both old and new versions of the UCSD SOBQ. The correlation between both versions was 0.96, representing good agreement.

The validity was also tested within the same patients by comparing UCSD SOBQ scores with other measures.[24] Scores were negatively correlated with diffusion capacity (-0.67), predicted forced vital capacity (-0.36) and FEV in one second (-0.50), HRQoL (Quality of Well Being questionnaire -0.41), maximal inspiratory pressure (-0.60), and the 6-minute walk test (-0.68). Cronbach's alpha for the SOBQ was 0.91 both at baseline and after-intervention.[24] The UCSD SOBQ was used in a number of pulmonary rehabilitation studies, all of them publicized that it is reliable and valid when used among COPD and post lung transplant.[40]

3.2.6 University of Cincinnati Dyspnoea Questionnaire (UCDQ)

University of Cincinnati Dyspnoea Questionnaire had two formats; self-administered and experimenter-administered. Both format contained the same questions and take 5 to 10 minutes for completion. For the purpose of developing this questionnaire, it was administered to 203 subjects, their age ranged from 23 to 87 years; all of them had pulmonary diseases of various types (asthma, sarcoidosis, emphysema, fibrosis, or COPD).[25] The internal consistency of the individual items in each of the three sections of the questionnaire (physical, speech, and a combination of the two) was assessed by using Cronbach's alpha coefficient; the results were 0.92, 0.95, and 0.91 for the physical, speech, and

combination of the two variables, respectively.[25]
Correlation coefficients between UCDQ and spirometric parameters (FEV1, VC, FEV1/ VC %) were negative, weak to moderate, and significant only for physical and combined sections of the questionnaire. The Cronbach's alpha coefficients were 0.79, 0.96 and 0.82 for the physical, speech and combined variables, respectively. Correlation coefficients with blood gases (PaO2, PaCO2, and Sat of O2 %) and diffusion capacity (TL, CO, TL, CO/VA) parameters were statistically insignificant.[41]
Construct validity has been verified between different sections of UCDQ and symptoms score (physical activity r = 0.60, $p < 0.001$; speech activity r = 0.35, $p = 0.014$;
combined r = 0.63, $p = 0.001$), this means that patients who are clinically more affected will have poorer UCDQ scores. UCDQ correlates strongly with the classic dyspneic scales,
BDI and MRC, these verify the concurrent validity of this complex questionnaire.[41]

3.2.7 Feinstein's Index of Dyspnea (FID)
Feinstein's Index of Dyspnea is simple, easy to apply and takes only few moments for completion. The FID was primarily called Yale scale then modified by Feinstein in 1989.[26] This index of breathlessness and fatigue has been applied to rate the condition of patients with congestive heart failure (CHF). The index helps reflect the quality of life (QoL) in patients with CHF; because breathlessness and fatigue are major symptoms and sources of clinical distress. In double-blind trials of therapy, the post therapeutic changes in the index ratings were significantly higher with lisinopril than with Captopril.[26]

3.2.8 Cancer dyspnoea scale (CDS)
Cancer dyspnoea scale used mainly to measure breathlessness in cancer patients, it is validated in Japanese, English and Swedish population, completed in 2 minutes. The convergent validity with VAS is 0.72, and with Borg scales 0.67.[31] The reliability of this scale was tested by Cronbach's alpha (r = 0.86) and test retest reliability (r = 0.66). The criterion-related validity was demonstrated by significant group differences in CDS scores when patients were stratified by breathlessness intensity, as measured by VAS-D.[42]
Correlations between the total CDS score and other breathlessness scales varied between 0.63 and 0.68. Convergent validity was shown by comparing the CDS-score subscales with conceptually related measures of physical and emotional function and discomfort, and the correlations ranged from 0.34 to 0.57. The CDS-S evaluated the psychological dimension of breathlessness better than did the VAS-D. Cronbach's alpha coefficients were ranging from 0.81 to 0.90 which reveals the internal consistency of the CDS-S. The CDS has two weaknesses; first, it asks patients to rate breathlessness by recalling which could be confusing to them, second, it is not helpful to rate clinical change caused by treatment.[42]

3.2.9 Breathlessness Assessment Guide (BAG)
Breathlessness Assessment Guide was developed for use in the clinical setting rather than as an outcome measure for research; it may be completed by any member of health care team. The content of this guide derived from a review of theoretical literature, and the research and experiential knowledge of a team of nurse researchers working in a nursing breathlessness intervention clinic. Sixty patients with lung cancers, who had finished chemotherapy or radiotherapy and were suffering from breathlessness, were included in the original study. The guide does not have any inbuilt psychometric properties and therefore no attempt was made to test this formally.[28] The guide was planned around the following areas: 1) Patient details and underlying pathology in relation to breathlessness. 2) The MRC current respiratory symptoms questions and breathlessness scale modified to include a category of 'breathlessness at rest'. 3) Timing and incidence of breathlessness. 4) Vertical visual analogue scales to rate breathlessness over the last 24 h: when breathing has been at its best, worst and how much distress breathlessness causes. 5) Information to be recorded on triggers for breathlessness, strategies used to improve breathlessness, limitations forced by breathlessness and feelings engendered by breathlessness. And 6) Breathlessness management plan.[28]

3.2.10 Dyspnea Exertion Scale (DES)
This scale measures the magnitude of task that causes breathlessness. This scale has been validated for patients with cancer.[43] There are few studies used this scale. In addition, there is no available data about the validity and reliability of this scale.

3.2.11 Dyspnea Assessment Questionnaire (DAQ)

This questionnaire asks patients to pick one word from each of the 16 categories that describe their breathlessness over the last 24 hours. This scale has been used with cancer patients only, and there is no sufficient data about the validity and reliability of this scale. [43]

3.2.12 Dyspnea Management Questionnaire (DMQ)

The content of "Dyspnea Management Questionnaire" was drawn from qualitative interview data, literature review, and pilot testing with three adults with COPD. The content validity of the DMQ was supported by a panel of 12 experts.[30] The internal consistency tested by Cronbach's alpha coefficients ranging from .87 to .96 and test-retest reliability over 2.5 weeks (intraclass correlation coefficient ranging from 0.71 to 0.95. Three subscales of DMQ-30; Dyspnea intensity, dyspnea-related anxiety, and fearful activity avoidance subscales of DMQ-30 were moderately to highly correlated with three Seattle Obstructive Lung Disease Questionnaire dimensions (r = 0.44-0.83), Medical Outcomes Study 12-Item Short-Form scales (r = 0.41-0.57), and Hospital Anxiety and Depression Scale-Anxiety (r = 0.59 to 0.65). While the other two subscales; self-efficacy for activity and satisfaction with strategy use were correlated mildly with Seattle Obstructive Lung Disease Questionnaire (r = 0.28 and 0.27, respectively). The DMQ can discriminate adults with COPD requiring supplemental oxygen from those not requiring it. The Dyspnea Management Questionnaire increase the insights into the benefit of psychoeducation, controlled breathing strategies, and cognitive-behavioral approaches in pulmonary rehabilitation for anxious patients with COPD.[30]

3.2.13 Computer Adaptive Test (CAT)

The Computer Adaptive Test tool can measure dyspnea by administering on average 10 questions for each participant; then, the selection of the following question depends on the person's answer to the previous question.[31] The questions are drawn from 44 items in item bank. All the items focusing on dyspnea, the selection of items uses an item response theory-based method for multiple questionnaires and organizes them on a common scale. The respondent continued in answering the questions until a prespecified maximum number of questions have been answered (5 to 15) or a specified standard error is reached (0.3). This method takes less time and has more precision than paper and pencil tests. The internal consistency reliability coefficient as tested by Cronbach's alpha was 0.98. The item-total correlations ranged from 0.43 (eating) to 0.82 (going out socially) with a median of 0.72. The concurrent validity of the dyspnea item bank score was established by examining the correlation with the 6-minute walk distance and the overall shortness of breath question.

The overall shortness of breath question was strongly correlated with the dyspnea item bank score (r = 0.76, $p < .001$). Thus, approximately 58% of the variance in the dyspnea item bank score was explained by the single shortness of breath item. Dyspnea score was a significant predictor of hospitalization at 1 or 3 months in logistic regression models ($p < .05$).[31] The CAT can be administered by different modalities such as a computer, a voice-activated telephone, and a web-based system. The answers scored in real-time and results may be presented immediately.

4. Discussion

This review demonstrated that many instruments are available to measure breathlessness, varies from structured interviews to numeric scales. In addition, breathlessness may be measured in different settings, such as emergency units, doctors' clinics, rehabilitation programs, and pulmonary function and exercise laboratories. In addition, it demonstrated the suitability of these tools to all adult age group.

Considering the complexity of the symptom and the diverse approaches to measurement, the choice of breathlessness measures should be appropriate for the specific purpose of the study. None of the currently available instruments for breathlessness measurement was developed in the context of a theoretical and physiological model of breathlessness except CAT.

The review identified five unidimensional scales and thirteen multidimensional tools. Only two unidimensional scale (VAS, MBS) and three of multidimensional tools (BDI/TDI, UCDQ, and CDS) met the criteria of validity, reliability, responsiveness and appropriateness. Three measures missing psychometric data, in one it had not been tested (Breathlessness assessment guide) and for others the data are not available (Dyspnea exertion scale and Dyspnea assessment questionnaire). For Computer Adaptive Test, the psychometric prosperities tested only one time because it is newly used for dyspneic patients. For Dyspnea Management Questionnaire it is minimally used in research and clinical

settings.

Most of the scales and questionnaires included in this review have been evaluated in chronic respiratory disease, yet breathlessness is also common in advanced cancer, heart failure, and renal failure. None of the identified scales has been validated in renal failure patients and in palliative care setting and five of them used with cancer patients (CDS, Breathlessness assessment guide, Dyspnea exertion scale, Dyspnea assessment questionnaire, VAS) but only two of them are valid and reliable (CDS, VAS). Only four instruments applied with heart failure; two of them have no information related to their reliability (Feinstein's Index of dyspnea, Numerical rating scale, CAT) only two of them valid and reliable (VAS, CAT). Thus, there is a lack of instruments that could apply to a group of breathless patients with different conditions. This makes research into a mixed patient group challenging with regard to the choice of the measurement tool.

Other major findings were the inconsistencies in number of items, content and wording of the multidimensional tools. The variation in wordings of items is likely to affect the results. The number of items ranged from 3 to 44, the content of most tools asks about the magnitude of task that causes breathlessness, functional impairment, psychological aspects such as fear and anxiety, only one instrument reflect on the impact of breathlessness on speech (UCDQ). Unfortunately, the instrument that covers most aspects and dimensions of breathlessness, the Breathlessness Assessment Guide, has not undergone the usual psychometric testing examining the validity and reliability of the tool. Overall, the findings indicate that there is little agreement on how breathlessness should be assessed and what should be included. However, there is a consistency in the time required to complete the tools, the time required ranged from few seconds to few minutes which is acceptable for all patients.

5. Conclusion

Although 18 tools for assessing breathlessness were identified, none were comprehensive or responsive enough to be recommended for use in isolation to measure breathlessness and its impact on the QoL of patients and their families. All individuals having dyspnea related to advance diseases should be assessed appropriately. If the focus is more on QoL, then a multidimensional tool is preferable. It seems wise to spend time on integrating and validating the present scales rather than developing new ones

References

1. American Thoracic Society. Dyspnea: mechanisms, assessment, and management: a consensus statement. *AJRCCM* 1999; 159: 321-340.
2. Eakin E, Sassi-Dambron D, Ries A, Kaplan R. Reliability and validity of dyspnea measures in patients with obstructive lung disease. *INT J BEHAV MED* 1995; 2:118-34.
3. Bausewein C, Farquhar M, Booth S, Gysels M, Higginson I. Measurement of breathlessness in advanced disease: A systematic review. *Respir Med J* 2007; 101: 399-410.
4. Aitken RC. Measurement of feelings using visual analogue scales. *J R Soc Med* 1969; 62(10):989-93.
5. Wewers M, Lowe N. A critical review of visual analogue scales in the measurement of clinical phenomena. *Research in Nursing & Health* 1990; 13: 227-236.
6. Gift AG, Narsavage GR. Validity of the numeric rating scale as a measure of dyspnea. *AM J RESP CRIT CARE* 1998; 7:200-4.
7. Borg GA. Psychophysical bases of perceived exertion. *Med Sci Sports Exerc* 1982;14(5):377-381.
8. McGavin CR, Artvinli M, Naoe H, McHardy GJ. Dyspnea, disability, and distance walked: comparison of estimates of exercise performance in respiratory disease. *BMJ* 1978; 2 (6132):241-243.
9. Waltz C, Strickland O, Lenz E. *Measurement in Nursing and Health Research*, 3rd ed. 2005; New York: Springer Publishing Company.
10. Mador M, Kufel T. Reproducibility of visual analog scale measurements of dyspnea in patients with chronic obstructive pulmonary disease. *Am. Rev Respir Dis*. 1992; 146: 82–87.
11. Mahler D, Wells C. Evaluation of clinical methods for rating dyspnea. *Chest*. 1988; 93: 580-586.
12. Williams S, Bury M. Impairment, disability and handicap in chronic respiratory illness. *Soc Sci Med* 1989; 29: 609-616.
13. Caraceni A. Evaluation and assessment of cancer pain and cancer pain treatment.

Acta Anaesthesiol. Scand 2001; 45:1067–1075.
14. Wilcock A, Crosby V, Clarke D, Tattersfield A. Repeatability of breathlessness measurements in cancer patients. *Thorax* 1999; 54: 375.
15. Gift A, Narsavage G. Validity of the numeric rating scale as a measure of dyspnea. *Am J Resp Crit Care Med* 1998; 7: 200-204.
16. van der Molen B. Dyspnea: a study of measurement instruments for the assessment of dyspnea and their application for patients with advanced cancer. *J Adv Nurs* 1995; 22: 948-956.
17. Carrieri-Kohlman V, Dudgeon D. Multidimensional assessment of dyspnea. In: Booth S, Dudgeon D, editors. *In*: *Dyspnea in advanced disease*. 2006; Oxford University Press, 19-37.
18. Lush M, Janson-Bjerklie S, Carrieri V, Lovejoy N. Dyspnea in the ventilator-assisted patient. *Heart and Lung* 1988; 17: 528–535.
19. Saracino A, Weiland T, Dent A, Jolly B. Validation of a Verbal Rating Scale for Breathlessness Amongst Patients Referred for Cardiac Stress Tests. *Heart Lung* Circ 2007; 17: 305–312.
20. Saracino A, Weiland T, Dent A, Jolly B. Validation of a verbal dyspnea rating scale in the emergency department. *Emerg Med Australas* 2008; 20: 475-481.
21. Mahler DA, Weinberg DH, Wells CK, & Feinstein AR. The measurement of dyspnea: Contents, interobserver agreement, and physiologic correlates of two new clinical indexes. *Chest* 1984; 85(6):751-758.
22. Leidy NK, Schmier JK, Jones MK, Lloyd J, Rocchiccioli K. Evaluating symptoms in chronic obstructive pulmonary disease: validation of the Breathlessness, Cough and Sputum Scale. *Respire Med* 2003; 97:S59-70.
23. Selim A, Ren X, Fincke G, et al. Symptom-based measure of the severity of chronic lung disease: results from the Veterans Health Study. *Ches*t 1997; 111: 1607-1614.
24. Eakin E, Resnikoff P, Prewitt L, Ries A, Kaplan R. Validation of a new dyspnea measure: The UCSD Shortness of Breath Questionnaire. University of California, San Diego. *Chest* 1998; 113: 619–624.
25. Lee L, Friesen M, Lambert I, Loudon R. Evaluation of dyspnea during physical and speech activities in patients with pulmonary diseases. *Chest* 1998; 113: 625-632.
26. Feinstein A, Fisher M, Pigeon J. Changes in dyspnea-fatigue ratings as indicators of quality of life in the treatment of congestive heart failure. *Am J Cardiol* 1989; 64: 50-55.
27. Tanaka K, Akechi T, Okuyama T, Nishiwaki Y, Uchitomi Y. Development and validation of the Cancer Dyspnea Scale: a multidimensional, brief, self-rating scale. *Br. J. Cancer* 2000; 82: 800-805.
28. Corner J, O'Driscoll M. Development of a breathlessness assessment guide for use in palliative care. *JPM* 1999; 13: 375-84.

29. Zeppetella G. Nebulized morphine in the palliation of dyspnea. *PMJ* 1997; 11:267-275.
30. Norweg A, Whiteson J, Demetis S, Rey M. A new functional status outcome measure of dyspnea and anxiety for adults with lung disease: the dyspnea management questionnaire. *J Cardiopulm Rehabil* 2006; 26: 395-404.
31. Ruo B, Choi S, Baker D, Grady K, Cella D. Development and Validation of a Computer Adaptive Test for Measuring Dyspnea in Heart Failure. *J CARD FAIL* 2010; 1-10.
32. Mahler D. Mechanisms and measurement of dyspnea in chronic obstructive pulmonary disease. *PATS* 2006; 3: 234-238.
33. Nouraei S, Nouraei SM, Randhawa P, et al. Sensitivity and responsiveness of the medical research council dyspnea scale to the presence and treatment of adult laryngotracheal stenosis. *Clin. otolaryngol* 2008; 33: 575–580.

34. Mahler D, Witek T. The MCID of the Transition Dyspnea Index is a Total Score of One Unit. *Int J Chron Obstruct Pulmon Dis* 2005; 2: 99–103.
35. Lechtzin N, Lange D, Davey C, Becker B, Mitsumoto H. Measures of dyspnea in patients with amyotrophic lateral sclerosis. *Muscle Nerve* 2007; 35: 98–102.
36. Chhabra S, Gupta A, Khuma M. Evaluation of three scales of dyspnea in chronic obstructive pulmonary disease. *Ann. Thorac. Med* 2009; 4: 128-132.
37. Leidy N, Rennard S, Schmier J, Jones M, Goldman M. The breathlessness, cough, and sputum scale: the development of empirically based guidelines for interpretation. *Chest* 2003; 124: 2182-2191.
38. Nunnally J, Bernstein I. *Psychometric theory*. 3rd Ed. 1994; New York, NY: McGraw-Hill.
39. Archibald C, Guidotti T. Degree of objectivity measured impairment and perceived shortness of breathing with activities of daily living in patients with chronic obstructive pulmonary disease. *Can J Rehabil* 1987; 1: 45-54.
40. Heppner P, Morgan C, Kaplan R, Ries A. Regular walking and long-term maintenance of outcomes after pulmonary rehabilitation. *J Cardiopulm Rehabil* 2006; 26: 44-53.
41. Hodgev V, Kostianev S, Marinov B. University of Cincinnati Dyspnea Questionnaire for Evaluation of Dyspnea during physical and speech activities in patients with chronic obstructive pulmonary disease: a validation analysis. *CLIN PHYSIOL FUNCT I. Journal* 2003; 23: 269-274.
42. Henoch I, Bergman B, Gaston-Johansson F. Validation of a Swedish Version of the Cancer Dyspnea Scale. *J. Pain Symptom Manage* 2006; 31: 353-361.
43. Heyse-Moore L. As cited in Bausewein C, Farquhar M, Booth S, Gysels M, Higginson I. Measurement of breathlessness in advanced disease: A systematic review. *Respir Med J* 2006; 101: 399-410.

Table 1. Keywords and synonyms used in database search

Breathlessness synonyms	Major diseases and breathlessness	Measures synonyms
Breathlessness	Chronic obstructive pulmonary disease	Measure
Dyspnea	Heart failure	Instrument
Shortness of breathing	Motor neuron disease	Rating scales
	End stage renal disease	Assessment tool
	cystic fibrosis	
	cancer	
	Asthma	

Table 2. Unidimensional breathlessness-specific instruments

No	Name of the scale	Author/ Year	Domains covered	Population	Format
1-	Visual analogue scale (VAS)	Aitken in 1969	Dyspnea	COPD, CHF, cancer	VAS is usually a horizontal line, but it may be drawn also vertically, 100 mm in length, anchored by word descriptors (extreme states) at each end (Wewers & Lowe, 1990).
2-	Numerical rating scale (NRS)	Gift & Narsavage in 1998	Dyspnea	COPD, CHF	Written form (tested) or verbal (needs to be validated); Anchor of 0 means no dyspnea intensity and dyspnea distress and anchor 10 means the worst possible breathlessness intensity and breathlessness distress.
3-	Modified Borg Scale (MBS)	Borg in 1982	Dyspnea on exercise	Pulmonary disease	Categorical scale with ratio properties, 11 points on a vertical scale with words describing increasing degrees of breathlessness anchored to numbers between '0' ('nothing at all') and '10' ('maximal')
4-	Oxygen Cost Diagram (OCD)	McGavin and co-workers in 1978	Dyspnea on exercise	Pulmonary disease	Retrospective measure. 100 mm vertical line with descriptive phrases of 13 everyday activities placed at various points along the line. Patients indicate the point above which they think their breathlessness would not let them go; usually further explanation necessary to understand the relationship between the vertical line and the listed activities. The phrases correspond with the oxygen requirements needed by each activity
5-	Verbal rating scale also called SOB rating scale	Gift and Narsavage in 1998	Dyspnea	COPD	The line drawn with numbers or calibrations from 1 to 10 can be placed at equal intervals below it. Usually treated as being at least interval level.

Table 3. Multidimensional breathlessness-specific instruments for adult population

No	Name of the scale	Author/ Year	Domains covered	No. of items	Population	Format
1-	Medical Research Council (MRC) dyspnea scale	Fletcher and co-workers in 1959	magnitude of task that causes breathlessness	5	COPD	It is a categorical scale, 5 point (1 = I only get breathless with strenuous exercise to 5 = I am too breathless to leave the house) with yes/no answers. It can be self-report or interview guide scoring the effect of breathlessness on daily activities; The modified MRC consists of six questions about perceived breathlessness: category 0 (no breathlessness), category 1 (slight degree of breathlessness), category 2 (moderate degree of breathlessness), category 3 (moderately severe degree of breathlessness), category 4 (severe degree of breathlessness), category 5 (very severe degree of breathlessness)
2-	Baseline Dyspnea Index (BDI)/ Transition Dyspnea Index (TDI)	Mahler and co-workers in 1984	magnitude of task, magnitude of effort and functional impairment	3	respiratory disease (predominantly COPD), amyotrophic lateral sclerosis (ALS)	The BDI is used at baseline to assess breathlessness, it is interviewer administered; five grades for each category of breathlessness ranging from severe to unimpaired, BDI focal score is obtained by adding the scores from 0 (severe) to 4 (not impaired) for each of the three categories, the total score ranged from 0 to

						12.TDI used to measure changes from a baseline condition after intervention through ratings obtained on a 7-point scale (-3 = major deterioration to +3).
3-	Breathlessness, Cough and Sputum Scale (BCSS)	Leidy and co-workers in 2003	Symptoms (breathlessness, cough, sputum)	3	COPD (FEV1 predicted 20-70%)	It is a 5-point-Likert scale (0 to 4), higher scores demonstrating a more severe manifestation of the symptom. A daily total score is expressed as the sum of three item scores as stated in daily diary, with a range of 0 to 12.
4-	Chronic lung disease (CLD) severity index	Selim and co-workers 1997	dyspnea, wheezing, and productive cough	6	Severe chronic lung disease, bronchitis, emphysema, asthma), only men	It is an interview instrument. It scored in two steps, first, sum the raw scores of the items included in the three subscales, then transform the raw scores of the items to a normal range from 0 (least severe) to100 (most severe) (Selim et al, 1997).
5-	University of California St.Diego (UCSD) Shortness of Breath Questionnaire	Eakin and co-workers 1998	ADL, fear of overexertion, shortness of breath	24	COPD, cystic fibrosis, post transplant	It measures the severity of breathlessness over a variety of daily activities. It's scored as 0= not at all to 5= maximal or unable to do because of breathlessness; sum of scores ranged from 0 to 120, the higher scores representing more severe breathlessness.
6-	University of Cincinnati Dyspnoea Questionnaire	Lee and co-workers in 1997	breathlessness during physical activity, during speaking activity,	30	COPD, emphysema, fibrosis, sarcoidosis,	Breathlessness is rating on 5-point-scale (1= no shortness of breath, 5= activities always causing

			when speaking during physical activity		asthma	shortness of breath). It may be self-administered or experimenter administered with same questions.
7-	Feinstein's Index of Dyspnea	Mahler and co-workers in 1984 modified by Feinstein in 1989.	magnitude of task evoking dyspnea and fatigue, magnitude of pace (effort), associated functional impairment	3	congestive heart failure	Its content derived from BDI/TID, it consists from 3 components, each rated on a scale from 0 (worst condition) to 4 (no breathlessness) completed by health professionals. Total score ranged from 0 to 12.
8-	Cancer dyspnoea scale (CDS)	Tanaka and co-workers in 2000	sense of effort, sense of anxiety, sense of discomfort	12	cancer	This questionnaire consists of three factors; the physical factor called sense of effort (five items), a psychological factor called sense of anxiety (four items), and a factor reflecting the uncomfortable feeling at rest called sense of discomfort (three items).The maximum total score is 48, a higher score reflects more severe breathlessness (Tanaka et al, 2000).
9-	Breathlessness Assessment Guide	Corner & O'Driscoll in 1999	underlying pathology, symptoms, adapted MRC dyspnea scale, breathlessness frequency, timing, triggers, coping strategies, limitations, feelings, 3 breathlessness VAS over last 24 h	9	lung cancer	It consists from 2 questions adapted from MRC respiratory symptoms questionnaire and dyspnea scale, and VAS. It is interviewer administered.

			(best, worst, distress)			
10-	Dyspnea Exertion Scale		magnitude of task that causes breathlessness	5	cancer	-
11-	Dyspnea Assessment Questionnaire	Zeppet and co-workers in 1997	intensity, temporal, constrictive pressure, pain, sound quantity, dry sound, wet sound, energy, air quantity, respiratory effort, loss of power, fear, depression, dread, suffocation, illness	16	cancer	This questionnaire masures the intensity, temporal, constrictive pressure, pain, sound quantity, dry sound, wet sound, energy, air quantity, respiratory effort, loss of power, fear, depression, dread, suffocation, and illness
12-	Dyspnea Management Questionnaire	Norweg and co-workers in 2006	Dyspnea intensity, dyspnea-related anxiety, fearful activity avoidance, self-efficacy for activity, satisfaction with strategy use.	30	COPD	It has a 7-point Likert-type scale from 0 (cannot do because of shortness of breath) to 6 (not at all short of breath). The higher the score reflecting the better functional status of the client. Each item was assigned a numerical value from 0 to 6. In each subscale all values are summed then divided by the number of items in the subscale to obtain the mean score.
13-	Computer Adaptive Test	Ruo and co-workers in 2010	breathlessness during physical activity	10 questions	Heart Failure	The patients answer round 10 questions of 44 items included in item bank. The dyspnea item bank scores range from approximately 25 to 90 with higher scores representing dyspnea with less physical exertion.

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage: http://www.iiste.org

CALL FOR PAPERS

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. There's no deadline for submission. **Prospective authors of IISTE journals can find the submission instruction on the following page:** http://www.iiste.org/Journals/

The IISTE editorial team promises to the review and publish all the qualified submissions in a **fast** manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar