HHS Public Access

Author manuscript

J Pain Symptom Manage. Author manuscript; available in PMC 2017 April 01.

Published in final edited form as:

J Pain Symptom Manage. 2016 April ; 51(4): 682–689.e1. doi:10.1016/j.jpainsymman.2015.11.005.

The Trajectory of Dyspnea in Hospitalized Patients

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Abstract

Context—The trajectory of dyspnea for patients hospitalized with acute cardiopulmonary disease, who are not terminally ill, is poorly characterized.

Objectives—To investigate the natural history of dyspnea during hospitalization, and examine the role that admission diagnosis, and patient factors play in altering symptom resolution.

Methods—Prospective cohort study of patients hospitalized for an acute cardiopulmonary condition at a large tertiary care center. Dyspnea levels and change in dyspnea score were the main outcomes of interest and were assessed at admission, 24 and 48 hours and at discharge using the verbal 0 - 10 numeric scale.

Results—Among 295 patients enrolled, the median age was 68 years, and the most common admitting diagnoses were heart failure (32%), chronic obstructive pulmonary disease (COPD) (39%), and pneumonia (13%). The median dyspnea score at admission was 9 (interquartile range [IQR] 7, 10); decreased to 4 (IQR 2, 7) within the first 24 hours; and subsequently plateaued at 48 hours. At discharge, the median score had decreased to 2.75 (IQR 1, 4). Compared to patients with heart failure, patients with COPD had higher median dyspnea score at baseline and admission, and experienced a slower resolution of dyspnea symptoms. After adjusting for patient characteristics, the change in dyspnea score from admission to discharge was not significantly different between patients hospitalized with congestive heart failure, COPD or pneumonia.

Conclusion—Most patients admitted with acute cardiopulmonary conditions have severe dyspnea on presentation, and their symptoms improve rapidly after admission. The trajectory of dyspnea is associated with the underlying disease process. These findings may help set

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Disclosurs

The authors report no conflicts of interest.

expectations for the resolution of dyspnea symptoms in hospitalized patients with acute cardiopulmonary diseases.

Keywords

Dyspnea; chronic obstructive pulmonary disease; heart failure; pneumonia; hospitalization

Introduction

Dyspnea, often defined as the inability to breathe comfortably,[1] is a common complaint of patients with cardiopulmonary disease. A recent study found that 9% of community dwelling adults report experiencing dyspnea.[2] Significant dyspnea is often the reason a person seeks medical attention, and 3.5% of all emergency department (ED) visits are for evaluation and treatment of dyspnea.[3]

The importance of dyspnea evaluation is addressed in the 2012 American Thoracic Society[4] and the 2010 American College of Chest Physicians[5] consensus statements, which recommend that patients with cardiopulmonary diseases should be asked and evaluated for the intensity of their breathlessness, and the patient-reported rating should be documented in the medical record to guide management.[4] This quantitation of dyspnea allows clinical interventions to be monitored for effectiveness, while increasing the patient centeredness of care. Dyspnea resolution has been emphasized over other clinical measures by the U.S. Food and Drug Administration as a key endpoint in efficacy trials of acute heart failure therapies.[6] Multiple scoring systems have been developed to quantify dyspnea severity[7,8] and track treatment response.[9] These dyspnea rating scores have additionally been correlated to physiologic measurements, such as spirometry.[10]

However, while the appropriate management of dyspnea symptoms is receiving increased attention, the natural history of dyspnea for patients admitted to the hospital is still poorly characterized. Studies that have addressed dyspnea within hospitalized patients have investigated specific patient populations with widely varying dyspnea rates, and have not reported on the resolution of dyspnea symptoms.[11,12] We, therefore, aimed to describe the trajectory of dyspnea throughout the inpatient hospitalization for general medical patients with a broad range of acute cardiopulmonary diagnoses. Additionally, we sought to describe the association between patient factors, including admission diagnosis, body mass index (BMI) and comorbidities, with dyspnea severity and resolution.

Methods

Design, Setting and Subjects

This was a prospective cohort study that enrolled consecutive patients admitted to Baystate Medical Center, a 714-bed teaching hospital in Western Massachusetts, between June 2012 and June 2013. Patients 18 years and older were included if they spoke English and had an admission diagnosis consistent with congestive heart failure (CHF), acute exacerbation of chronic obstructive pulmonary disease (COPD), asthma, pneumonia, pulmonary embolism, lung cancer or a generic diagnosis of shortness of breath. Patients who were unable to give

informed consent or assess their dyspnea because of cognitive impairment, and patients admitted to the intensive care unit were excluded.

The study was approved by the Baystate Health Institutional Review Board, Springfield, MA with a waiver for writer informed consent (Project approval number 322731-16).

Assessment of Dyspnea

All patients were interviewed to assess their severity of dyspnea using the verbal numeric scale (VNS),[13] a 0-10 scale that has been validated for the measurement of breathlessness in the acute care setting.[14,15] Patients were asked, “On a scale from 0 to 10, how bad is your shortness of breath, with zero being no shortness of breath and 10 the worst shortness of breath you could ever imagine?” A trained research assistant asked the patients to rate dyspnea severity at admission, at 24 hours, 48 hours, and on the day of discharge. Usual or baseline dyspnea levels were assessed by asking “Using the same 0 to 10 scale, how would you rate your shortness of breath on a usual day before you became sick and came into the hospital?” At each assessment, the patients were not reminded of their prior score. The research assistant did all the evaluations, which were performed either in the general medical ward or in the ED. The research assistant enrolled patients during the weekdays, from 8 AM to 5 PM.

Patient Information

In addition to demographic information such as age, gender, and race, we collected the following information from a claims-based registry: number of admissions in the prior year, source of admission (e.g., ED or nursing home), discharge disposition and length of stay. Comorbidities were classified using the Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project Comorbidity Software, v. 3.7.[16] We also calculated a single numeric comorbidity score using the method described by Gagne, et al.[17] and grouped the score in tertiles, for analysis. Manual review of medical records was used to ascertain clinical data relevant to the study, including smoking history, chronic steroid use, BMI, respiratory rate (RR), admission oxygen saturation index, the partial pressure of carbon dioxide and oxygen in arterial blood gas, N-terminal-pro-brain natriuretic peptide (BNP), and transfer to an intensive care unit.

Statistical Analysis

Descriptive statistics for the full cohort and by diagnosis group are presented as frequencies and proportions for categorical variables, and medians and interquartile ranges (IQR) for continuous variables. Associations between patient characteristics and diagnosis groups were computed via Fisher's exact test and Chi-square test for categorical variables and by Kruskal-Wallis test for continuous variables.

Change in VNS dyspnea score, which was the main measure of interest, was defined as the difference between the scores at admission and at 24 and 48 hours, and between admission and discharge and, finally, between discharge and baseline. Kruskal-Wallis test was used to assess differences in dyspnea levels and changes across diagnosis groups and BMI categories. We also developed a model for within-subject change in dyspnea scores from

admission to discharge, including diagnosis groups, comorbidity tertiles and other patient characteristics via analysis of variance (ANOVA) models. We applied Tukey-Kramer multiple comparison corrections.

Dyspnea severity was grouped into four categories: none (score = 0), mild (1 -3), moderate (4 -7), and severe (8 -10). We compared RR and O2 saturation index (calculated as the ratio between oxygen saturation and fraction of inspired oxygen, SpO2/FiO2) at admission and discharge for the four dyspnea categories using Kruskal-Wallis tests. The study was approved by the Institutional Review Board at Baystate Medical Center, and informed consent was obtained for all study participants. All analyses were performed using SAS v. 9.3 (SAS institute, Inc., Cary, NC) and figures were produced using STATA software 2013 (StataCorp LP, College Station, TX).

Results

Patient Characteristics

Of the 677 patients who were screened, 136 declined participation or could not be interviewed in time, 67 were not English speakers, 61 had cognitive impairment, 36 were judged to be too ill to participate, and 28 did not have dyspnea. Other reasons for non-participation are detailed in Fig. 1. A total of 295 patients were enrolled into the study. The median age was 68 years (IQR 55, 79), 161 (54.6%) were female, and 224 (75.9%) were Caucasian. The most common admitting diagnoses were CHF (31.9%), COPD (39.3%), and pneumonia (13.2%); and the most frequently documented comorbidities were hypertension, obesity, diabetes, and renal failure. Fifty-three percent of patients had a comorbidity score ≥3. The median BMI was 28.4 kg/m^2 (IQR 23.5, 34.9) and 41.7% of patients had a BMI ≥ 30. (Table 1) Sixty-two percent of the patients had been admitted more than once in the prior 12 months. Of the patients included in the study, 83 (28.1%) were current smokers, 209 (70.9%) were past smokers, and 66 (22.4%) were on home oxygen. (Table 1) At the time of admission, the median RR was 20 breaths/minute (IQR 18, 24) and median SpO2/FiO2 ratio was 342.9 (IQR 284.4, 460.0). N-terminal BNP was measured in 184 patients at admission, with a median value of 2166 pg/mL (IQR 653.5, 5371.5). Median hospital length of stay was four days (IQR 2, 6)

Dyspnea Severity

The median dyspnea score at the time of admission was 9, and three of four patients had a score of 7 or higher. There was a large decrease in patient-reported dyspnea levels within the first 24 hours after hospital admission, with median dyspnea score decreasing to 4 (IQR 2, 7) (Fig. 2). At 24 hours, approximately 42% of patients had a dyspnea score of less than 4. Subsequent improvement proved to be more modest and median dyspnea score remained essentially unchanged at 48 hours. At 48 hours, 91% of all patients reported improvement in dyspnea (Fig. 3). At the time of discharge, dyspnea score decreased to a median of 2.75 and one in four patients were discharged from the hospital with a score of ≥4. The median change in dyspnea score from admission to discharge was a decrease of 6 (IQR 4, 8). By hospital discharge, half of the patients reported that their dyspnea had returned to baseline

levels, with the remaining patients split equally between those who reported better than baseline or worse than baseline levels.

When we stratified patients by primary diagnosis, we found that patients with COPD had a higher dyspnea score at admission (median dyspnea score of 9) when compared with other patients (median dyspnea score of 8; *P*-value: 0.007) (Appendix I, available at jpsmjournal.com). Patients with CHF experienced greater initial improvement in symptoms, with a 5-point median reduction between admission and 24 hours, when compared to median change of 3 for those with COPD, and 4 for pneumonia (*P*-value: 0.01). On average, patients with COPD, CHF, and pneumonia were discharged at their baseline level of dyspnea, with median dyspnea scores of 3 for COPD, and 2 for pneumonia and CHF. Patients with a primary diagnosis other than CHF, COPD, or pneumonia did not return to their baseline level of dyspnea prior to discharge. In this cohort, median discharge dyspnea score was 2.5 (IQR 0.0, 5.5) versus a baseline score of 0.0 (IQR 0.0, 3.0). In the COPD cohort, 45.5% reported symptoms above their baseline at the time of discharge (Fig. 4)

There was no difference in median dyspnea severity score at admission, at discharge, or in the level of improvement between obese and non-obese patients. Similarly, there was no significant difference in admission dyspnea score between patients with low, moderate and high levels of comorbidity (defined as Gagne combined comorbidity score of: −1 to 2, 3 to 4, and 5 to 12, respectively).

After adjusting for patient characteristics, the change in dyspnea score from admission to discharge was not significantly different between patients hospitalized with CHF (mean [SE] 6.61 [0.36]), COPD (5.3 [0.32]) or pneumonia (5.4 [0.51]). Patients grouped in the “other” category (e.g., pulmonary embolism, lung cancer) had the smallest change in dyspnea score (4.43 [0.49].

Discussion

In this study of nearly 300 patients hospitalized for a broad range of acute cardiopulmonary diseases, we found that the majority of patients had severe dyspnea on presentation, which rapidly improved within the first 24 hours of admission. Subsequent improvements were more modest, with dyspnea levels practically unchanged at 48 hours. Although three quarters of the patients we studied had returned to their baseline levels of dyspnea or better by discharge, one in four patients continued to have residual levels worse than at baseline. The trajectory of dyspnea resolution was related to admission diagnosis but not to the presence of obesity. Patients with CHF experienced the largest decrease in symptoms in the first 24 hours and the lowest dyspnea score at discharge.

Few prior studies have reported on the prevalence and natural history of dyspnea in hospitalized patients. Most have investigated whether dyspnea was present at admission and found rates varying between 39% to 100%.[11,12,18-21] For example, the national heart failure audit for England and Wales analyzed more than 21,000 admissions between 2008-2010 and found that at the time of admission, approximately 70% of patients had breathlessness

limiting ordinary activity; however, dyspnea trajectory was not tracked throughout the hospital course.[22,23]

This study builds on prior work by quantitating dyspnea levels at several critical points during hospitalization, and examining the role that admission diagnosis, BMI and comorbidity play in altering the natural history of symptom resolution. We observed differences in the clinical course of dyspnea by diagnoses. Compared to patients with CHF, patients with COPD had a higher median dyspnea score at baseline, and at the time of admission. During hospitalization, the COPD cohort improved less, and also had more residual dyspnea at discharge when compared to the CHF cohort. While our study was not designed to identify the mechanisms underlying these observations; potential explanations include the relatively rapid effect of diuretic therapy in reducing pulmonary vascular hydrostatic pressure in CHF, compared to the longer time required to reduce the inflammatory component of an acute COPD exacerbation. Respiratory infection with a viral or atypical bacterial pathogen is also postulated to be a mechanism leading to COPD, and one can speculate that time is required for the immune system to respond appropriately.

Although in the unadjusted analysis the patients in the CHF group had a more significant reduction in dyspnea than the other three groups, after adjusting for patient demographics and comorbidities, the difference attenuated and was non-significant. Similarly, looking at the change in dyspnea score from admission to discharge, regardless of the principal diagnosis, was surprising, because we hypothesized that patients with CHF might improve faster than patients with pneumonia or COPD, but that was not the case.

Obesity is known to alter respiratory mechanics and decrease functional residual capacity, and studies have found an increased oxygen cost of breathing in obese subjects.[24] Prior large, cross-sectional studies have noted increased complaints of dyspnea in community-dwelling obese patients.[25] However, we found that obesity is not a major determinant of patient-reported dyspnea at any time during the hospital stay. Therefore, a physician caring for an obese patient should hesitate when ascribing dyspnea severity or lack of improvement to obesity alone.

Our findings are novel and highly relevant to clinicians, as they help set expectations regarding the resolution of dyspnea symptoms in patients hospitalized with COPD, heart failure or pneumonia. In our study, only one-fourth of patients had a dyspnea score ≥ 6 at 48 hours. Additionally, at 48 hours, only one in ten patients reported lack of improvement in dyspnea and only one in five reported minimal improvement (1 or 2 VNS points). Failure to observe these levels of improvement should alert the clinician to the possibility of disease progression, treatment failure, complications of care, or missed diagnoses. For example, in the COPD cohort, a patient report of only one point improvement at 48 hours should be viewed as a “red flag” and might prompt additional investigation. Similarly, if a patient is hospitalized and treated for a CHF exacerbation yet experiences worsening dyspnea within the first 24 hours of admission, alternative or complicating diagnosis should be sought.

At the time of discharge, one-fourth of all patients still had a dyspnea score of 4 or greater, indicating at least moderate residual dyspnea. In the COPD cohort, one in four patients was

discharged with a dyspnea score of 5 of greater, and almost half reported symptoms above their baseline. The ATS consensus criteria for discharge after COPD exacerbation include "symptoms returning to baseline;"[26] however, there is lack of information on how discharge dyspnea score impacts long-term outcomes such as re-hospitalization and mortality. Our finding of increased residual dyspnea in the COPD cohort fits with prior studies that have shown impaired health-related quality of life for patients discharged after COPD exacerbation.[27, 28] In this patient group, the financial and emotional burden is high,[29] and increased residual dyspnea is a very plausible explanation for this.

Our study has several strengths. This is one of the largest studies to date that quantitates dyspnea at several critical time points during hospitalization. We enrolled a large and diverse patient population, with a broad range of cardiopulmonary diseases, which increases the generalizability of our findings. The dyspnea assessment was performed in a uniform way using a well-validated instrument.

The results of our study should be interpreted in light of several limitations. First, this was a single-center study and the admission threshold for patients with cardiopulmonary diseases may vary between hospitals. Second, we enrolled only English-speaking patients, and race and ethnicity may influence the way symptoms are reported.[30] Third, the results of this study apply only to patients admitted to a general medical ward, and not to critically ill patients or patients limited to comfort care only. Fourth, of the 677 patients screened for the study, 382 patients were excluded (56%). The most common reason for exclusion after screening was that the research assistant was unable to interview the patient, or the patient declined. This highlights the difficulty of gathering data within a limited time period. This also may explain the differences at the diagnosis-level seen with multivariable analysis. Finally, because we enrolled patients based on their admitting diagnosis, most subjects were asked to recall their admission level of dyspnea the next morning, and this may have resulted in some misclassification.

In this study of nearly 300 patients with a broad range of cardiopulmonary disease, we found that the majority had severe dyspnea on presentation, which rapidly improved within the first 24 hours of hospitalization. The natural history of symptoms was influenced by principal diagnosis, and at the time of discharge one in four patients did not return to their baseline level of dyspnea. Future research is needed to understand the factors that can hasten or delay improvement in symptoms, and to study the association between higher residual levels of dyspnea and other outcomes.

Acknowledgments

Dr. Stefan is supported by grant 1K01HL114631-01A1 from the National Heart, Lung, and Blood Institute of the National Institutes of Health. The funder had no role in data collection, management, analysis; study design, conduct, or interpretation of study findings; or the preparation, review, or approval of the manuscript submitted for publication.

The authors acknowledge Katherine Dempsey and Pradeep Kumbham for their help with data collection; and Anu Joshi for her help with formatting the manuscript.

Appendix I

Median (IQR) of Dyspnea Severity Score During Hospitalization Stratified by Admission Diagnosis

Diagnosis Group	Lower Quartile	Median	Upper Quartile
Congestive heart failure			
Admit day	7	8	10
Day one	0	3	6
Day two	0	3	5
Discharge day	0	2	3
Chronic obstructive pulmonary disease			
Admit day	8	9	10
Day one	3	6	7
Day two	3	4	6
Discharge day	2	3	5
Pneumonia			
Admit day	7	8	10
Day one	2	5	7
Day two	3	4	6
Discharge day	2	2.5	4
Other (e.g., pulmonary embolism, lung cancer)			
Admit day	5	8	10
Day one	1	3	6
Day two	1.5	3.5	5.5
Discharge day	0	2	6

IQR = interquartile range.

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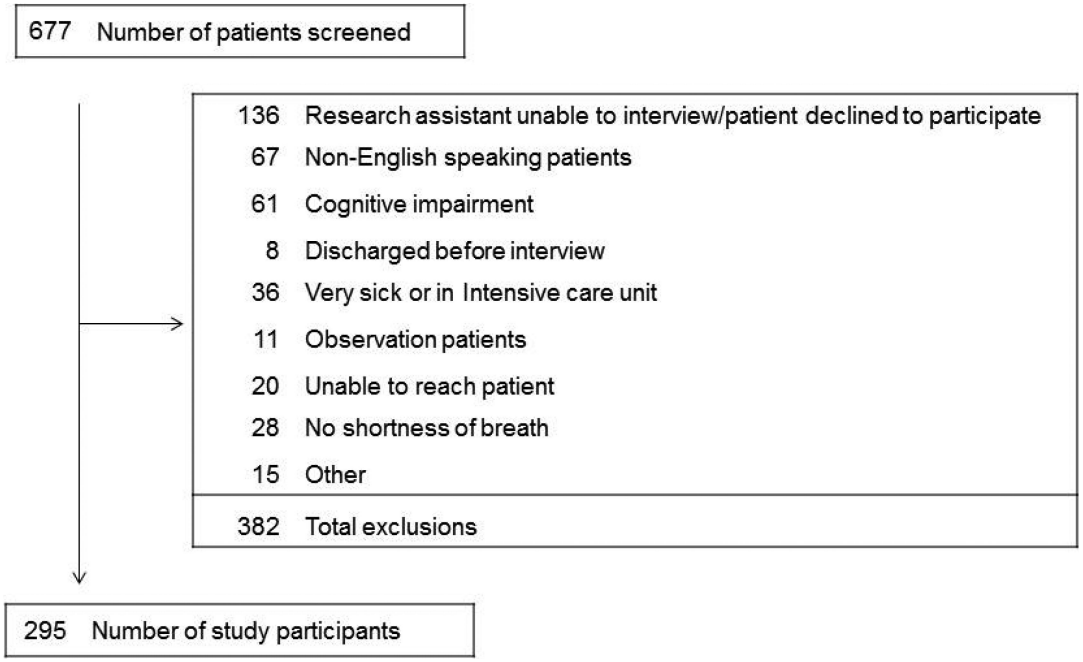

Fig, 1.
Patient selection flow chart.

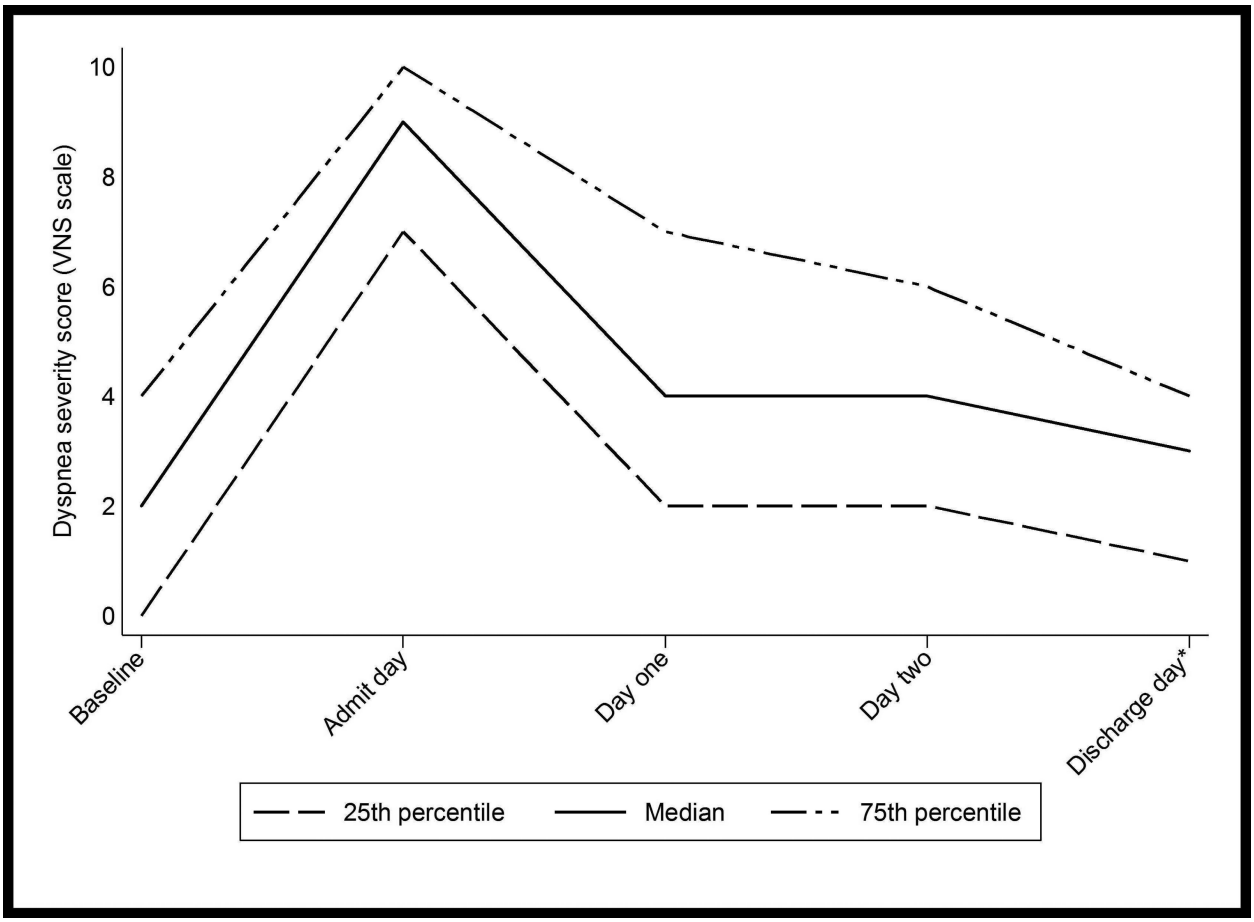

Fig. 2.
Dyspnea severity during hospitalization among included patients. *Discharged day 3 or later

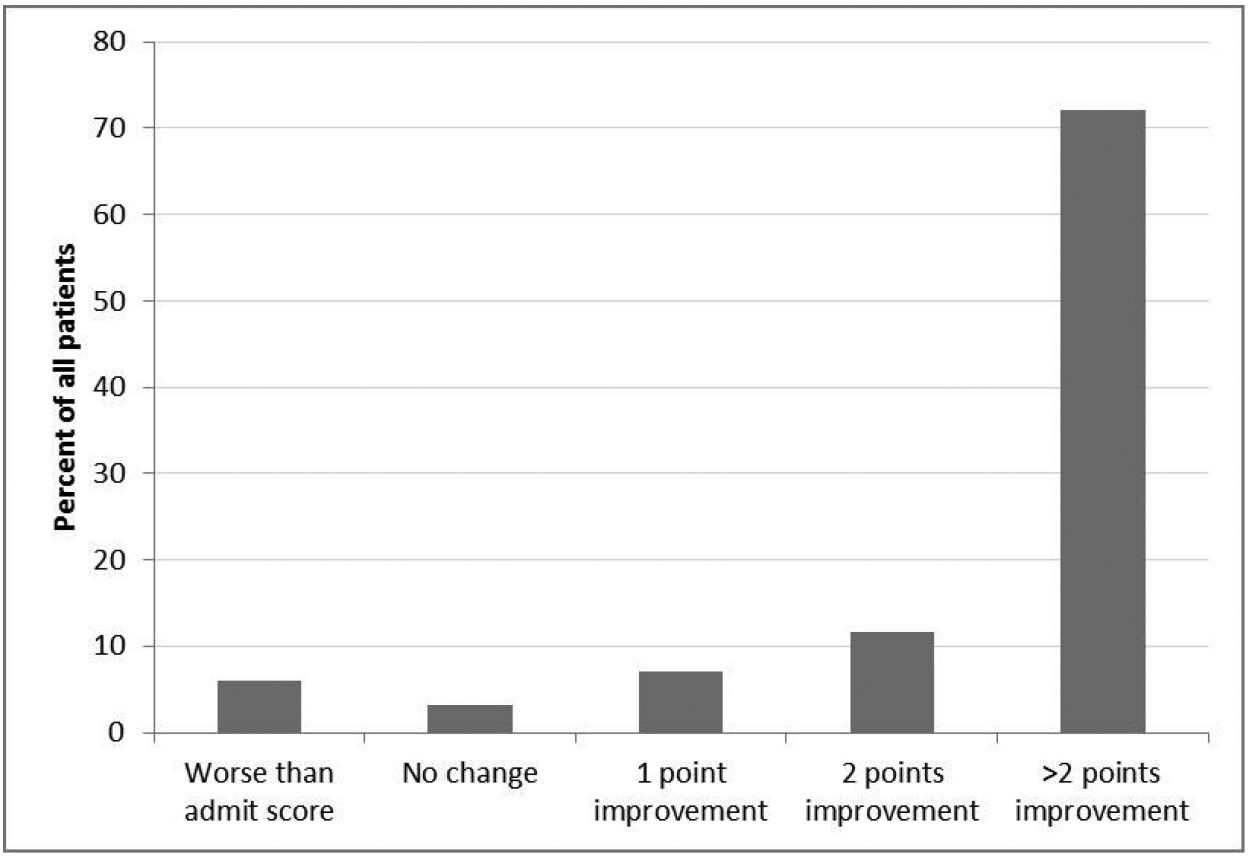

Fig. 3.
Distribution of change in dyspnea severity at 48 hours.

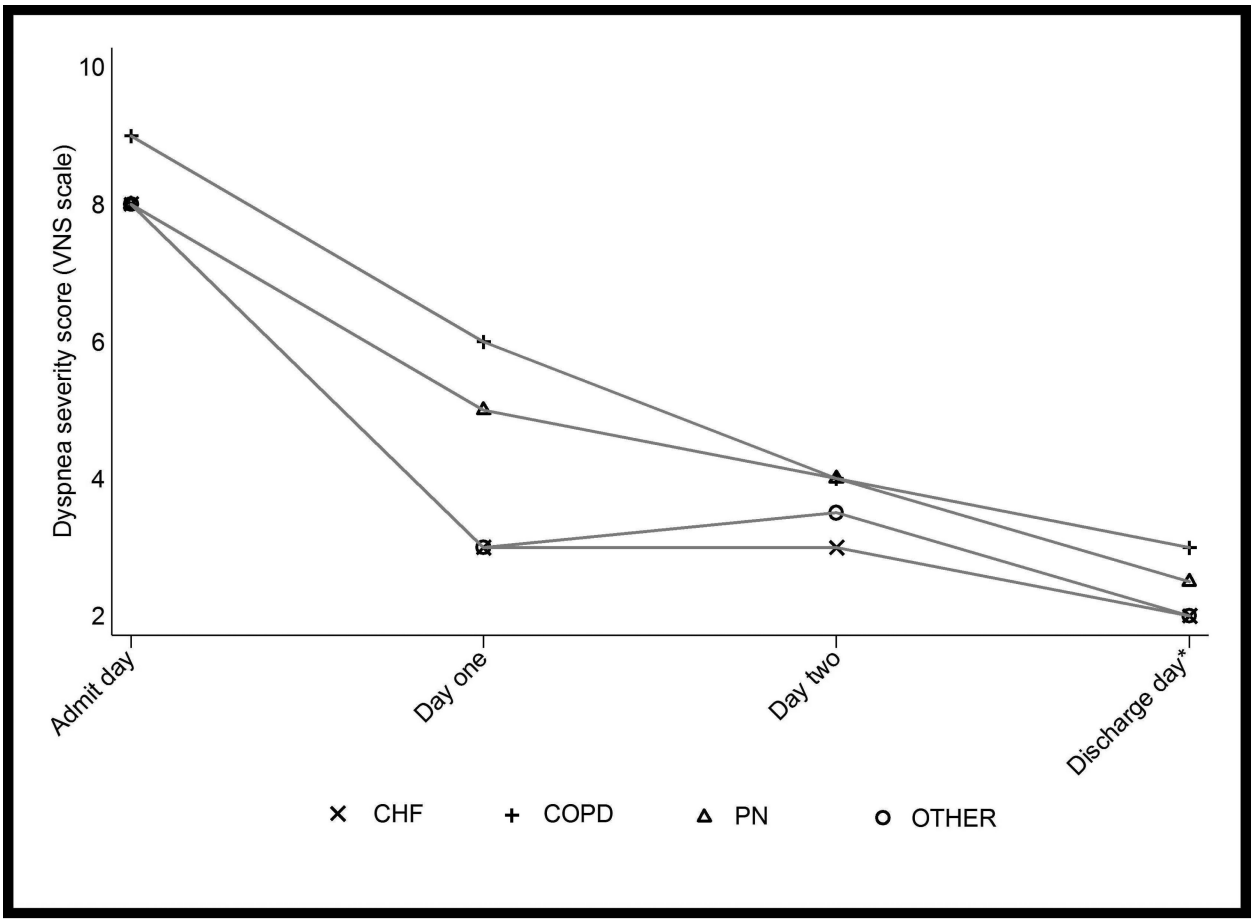

Fig. 4.

Dyspnea severity during hospitalization stratified by admission diagnosis. *Discharged day 3 or later.

Table 1

Characteristics of patients included in the study

Characteristic	Overall N (%)	CHF n (%)	COPD n (%)	PN n (%)	Other n (%)	p-value
	295 (100)	94 (31.9)	116 (39.3)	39 (13.2)	46 (15.6)	
Age, Median (IQR), years	68 (55 - 79)	77 (65 - 82)	61.5 (51 - 74)	68 (58 - 81)	61.5 (48 - 76)	<0.001[3]
Gender						0.09[2]
Female	161 (54.6)	43 (45.7)	73 (62.9)	20 (51.3)	25 (54.4)	
Male	134 (45.4)	51 (54.3)	43 (37.1)	19 (48.7)	21 (45.7)	
Race						0.48[1]
White	224 (75.9)	77 (81.9)	83 (71.6)	28 (71.8)	36 (78.3)	
Black or African American	31 (10.5)	9 (9.6)	13 (11.2)	4 (10.3)	5 (10.9)	
Hispanic	39 (13.2)	7 (7.5)	20 (17.2)	7 (18.0)	5 (10.9)	
Other	1 (0.3)	1 (1.1)	-	-	-	
Number of prior admits (1 year)						0.49[2]
0	112 (38.0)	29 (30.9)	51 (44.0)	14 (35.9)	18 (39.1)	
1	69 (23.4)	27 (28.7)	25 (21.6)	7 (18.0)	10 (21.7)	
2 or more	114 (38.6)	38 (40.4)	40 (34.5)	18 (46.2)	18 (39.1)	
History of smoking	209 (70.9)	63 (67.0)	90 (77.6)	28 (71.8)	28 (60.9)	0.14[2]
Current smoker	83 (28.1)	21 (22.3)	46 (40.0)	8 (20.5)	8 (17.4)	0.005[2]
Chronic steroid use	21 (7.1)	1 (1.1)	13 (11.2)	5 (12.8)	2 (4.4)	0.005[1]
Nursing home resident	11 (3.7)	4 (4.3)	2 (1.7)	3 (7.7)	2 (4.4)	0.27[1]
Non-Invasive ventilation	45 (15.3)	19 (20.2)	22 (19.0)	2 (5.1)	2 (4.4)	0.01[1]
Transfer to Intensive care unit	5 (1.7)	1 (1.1)	3 (2.6)	0 (0)	1 (2.2)	0.74[1]
Admitted to Inter-care	12 (4.1)	1 (1.1)	8 (6.9)	0 (0)	3 (6.5)	0.06[1]
Transfer to inter-care	6 (2.0)	1 (1.1)	3 (2.6)	1 (2.6)	1 (2.2)	0.83[1]
Gagne combined comorbidity score, Median (IQR)	3 (1 - 6)	5 (4 - 6)	2 (1 - 4)	4 (2 - 6)	2 (1 - 5)	<0.001[3]
Comorbidities						
Hypertension	201 (68.1)	62 (66.0)	82 (70.7)	27 (69.2)	30 (65.2)	0.86[2]
Obesity (BMI >= 30)	123 (41.7)	43 (45.7)	50 (43.1)	11 (28.2)	19 (41.3)	0.30[2]
Diabetes	96 (32.5)	34 (36.2)	37 (31.9)	14 (35.9)	11 (23.9)	0.50[2]
Chronic pulmonary disease	86 (29.2)	37 (39.4)		25 (64.1)	19 (41.3)	
Renal failure	85 (28.8)	42 (44.7)	20 (17.2)	13 (33.3)	10 (21.7)	0.0001[2]
Depression	72 (24.4)	15 (16.0)	35 (30.2)	8 (20.5)	14 (30.4)	0.07[2]
Deficiency anemias	65 (22.0)	21 (22.3)	16 (13.8)	19 (48.7)	9 (19.6)	0.0001[2]
Congestive heart failure	64 (21.7)		31 (26.7)	14 (35.9)	13 (28.3)	
Peripheral vascular disease	42 (14.2)	14 (14.9)	15 (12.9)	8 (20.5)	5 (10.9)	0.60[2]

Characteristic	Overall N (%)	CHF n (%)	COPD n (%)	PN n (%)	Other n (%)	p-value
Hypothyroidism	41 (13.9)	17 (18.1)	12 (10.3)	6 (15.4)	6 (13.0)	0.44[2]
Alcohol abuse	21 (7.1)	3 (3.2)	13 (11.2)	0 (0)	5 (10.9)	0.02[1]
Drug abuse	18 (6.1)	5 (5.3)	5 (4.3)	3 (7.7)	5 (10.9)	0.4[1]
Valvular disease	18 (6.1)	2 (2.1)	7 (6.0)	4 (10.3)	5 (10.9)	0.09[1]
Other neurological disease	16 (5.4)	3 (3.2)	5 (4.3)	1 (2.6)	7 (15.2)	0.03[1]
Psychoses	15 (5.1)	5 (5.3)	7 (6.0)	2 (5.1)	1 (2.2)	0.86[1]
Outcomes						
Discharged to Palliative care	14 (4.8)	3 (3.2)	5 (4.3)	4 (10.3)	2 (4.4)	0.39[1]
Discharged on home oxygen	94 (31.9)	22 (23.4)	45 (38.8)	14 (35.9)	13 (28.3)	0.11[2]
Length of stay, Median (IQR), days	4 (2 - 6)	5 (3 - 7)	3 (2 - 5)	4 (3 - 7)	4 (2 - 7)	<0.001[3]

IQR, Inter-quartile range

[1]p-value from Fisher's exact test

[2]p-value from Chi-square test

[3]p-value from Kruskal-Wallis test

Table 2

Change in dyspnea severity (VNS[1]) between admission and discharge according to admission diagnosis, body mass index and comorbidity.

	Admit score	Discharge score	Change in Dyspnea Score	p-value[2]
	Median (IQR)	**Median (IQR)**	**Median (IQR)**	
All patients (242)	9.0 (8.0, 10.0)	2.8 (1.0, 4.0)	6 (4, 8)	
Group				0.03
CHF (77)	8.0 (7.0, 10.0)	2.0 (0.0, 3.0)	7 (5, 8)	
COPD (97)	9.0 (8.0, 10.0)	3.0 (2.0, 5.0)	6 (4, 8)	
PN (32)	8.0 (7.0, 10.0)	2.0 (2.0, 3.5)	6 (4, 7)	
Other (36)	8.0 (5.0, 10.0)	2.5 (0.0, 5.5)	4 (2, 8)	
BMI group				0.45
High (BMI ≥ 30) (110)	9 (8, 10)	3 (0, 5)	6 (4, 8)	
Normal (BMI < 30) (132)	9 (7, 10)	2 (1, 4)	6 (4, 8)	
Comorbidity score group				0.16
Tertile 1 - Low (99)	9 (8, 10)	3 (1, 5)	5 (4, 8)	
Tertile 2 - Medium (53)	9 (8, 10)	2 (0, 3)	7 (4, 8)	
Tertile 3 - High (90)	9 (7, 10)	3 (1, 5)	6 (3, 8)	

[1]VNS is a 0-10 scale that has been validated for the measurement of breathlessness in the acute care setting

[2]Kruskal-Wallis test