Use of Palliative Care in Patients With End-Stage COPD and Receiving Home Oxygen

National Trends and Barriers to Care in the United States

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BACKGROUND: To investigate the use of palliative care (PC) in patients with end-stage COPD receiving home oxygen hospitalized for an exacerbation.

METHODS: A retrospective nationwide cohort analysis was performed, using the Nationwide Inpatient Sample. All patients ≥ 18 years of age with a diagnosis of COPD, receiving home oxygen, and admitted for an exacerbation were included.

RESULTS: A total of 55,208,382 hospitalizations from the 2006-2012 Nationwide Inpatient Sample were examined. There were 181,689 patients with COPD, receiving home oxygen, and admitted for an exacerbation; 3,145 patients (1.7%) also had a PC contact. There was a 4.5-fold relative increase in PC referral from 2006 (0.45%) to 2012 (2.56%) ($P < .01$). Patients receiving PC consultations compared with those who did not were older (75.0 years [SD 10.9] vs 70.6 years [SD 9.7]; $P < .01$), had longer hospitalizations (4.9 days [interquartile range, 2.6-8.2] vs 3.5 days [interquartile range, 2.1-5.6]), and more likely to die in hospital (32.1% vs 1.5%; $P < .01$). Race was significantly associated with referral to palliative care, with white patients referred more often than minorities ($P < .01$). Factors associated with PC referral included age (OR, 1.03; 95% CI, 1.02-1.04; $P < .01$), metastatic cancer (OR, 2.40; 95% CI, 2.02-2.87; $P < .01$), nonmetastatic cancer (OR, 2.75; 95% CI, 2.43-3.11; $P < .01$), invasive mechanical ventilation (OR, 4.89; 95% CI, 4.31-5.55; $P < .01$), noninvasive mechanical ventilation (OR, 2.84; 95% CI, 2.58-3.12; $P < .01$), and Do Not Resuscitate status (OR, 7.95; 95% CI, 7.29-8.67; $P < .01$).

CONCLUSIONS: The use of PC increased dramatically during the study period; however, PC contact occurs only in a minority of patients with end-stage COPD admitted with an exacerbation.

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KEY WORDS: chronic obstructive pulmonary disease; home oxygen; palliative care; United States

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ABBREVIATIONS: AHRQ = Agency for Healthcare Research and Quality; ICD9 = *International Classification of Diseases*, 9th edition; NIS = Nationwide Inpatient Sample; PC = palliative care; STROBE = Strengthening the Reporting of Observational studies in Epidemiology

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COPD is an emerging global health crisis, currently ranked as the fifth highest cause of mortality worldwide.¹ Patients admitted to hospital with a COPD exacerbation have a median survival of 2 years, and 50% will be readmitted within 6 months.² For patients with end-stage disease, receiving home oxygen therapy, and requiring mechanical ventilation for an exacerbation, their 1-year mortality is approximately 45%.³

Because of the poor prognosis of patients with advanced COPD, palliative care (PC) referral has been recommended by many respiratory societies around

the world for patients who are admitted with exacerbations.^{4,5} Despite large numbers of appropriate patients, referral to palliative care remains uncommon.⁶⁻⁸

The purpose of this study was to examine the use of palliative care in patients with end-stage COPD, who are dependent on home oxygen therapy and who are admitted with a COPD exacerbation, across the United States. Use of the Nationwide Inpatient Sample (NIS) allows for analysis of patients across all sizes and types of hospitals, producing a robust characterization of these patients.

Methods

Our study is reported in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement (see <http://www.strobe-statement.org/index.php?id=strobe-home>). A de-identified data set was used for this analysis, for which a waiver of consent was obtained from the University of British Columbia Institutional Review Board (H16-01635). The primary outcome for this analysis was referral to palliative care.

Study Population

The 2006-2012 NISs were used for this analysis. The NIS, a federal all-payer database produced by the Agency for Healthcare Research and Quality (AHRQ), captures approximately 20% of all in-patient hospitalizations in the United States.⁹ The NIS captures data from 44 states and represents the care delivered at 4,378 hospitals across the United States. Using a complex survey design, the NIS is capable of estimating the delivery of approximately 95% of all in-patient care delivered in the United States.

All patients ≥ 18 years of age with a diagnosis of COPD were segregated from the data set. The presence of COPD was defined as patients with *International Classification of Diseases*, 9th edition (ICD9) code 490.x, 491.x, 492.x, 494.x, or 496.x. We defined an acute exacerbation of COPD as a primary admission diagnosis of pneumonia (ICD9 code 48x.), or acute exacerbation of COPD/bronchitis (ICD9 code 49121, 4912, 4941, or 490). The use of home supplemental oxygen was identified by ICD9 code V462. Thus the main cohort consisted of patients with COPD reliant on home oxygen therapy and who were admitted to hospital with a COPD exacerbation. The main cohort of patients was then segregated into patients who received a palliative care encounter (ICD9 code V667) and those who did not. The reliance on ICD9 code V667 for characterizing a palliative care encounter as a primary exposure is not perfect. However, it has been validated to have a sensitivity of 81% and a specificity of 97% in patients with stroke.¹⁰ Of the hospitals included in the NIS samples during the entire study period, approximately 5% did not have any referrals to palliative care. We decided not to exclude patients treated in these hospitals

from the analysis in order to better characterize the delivery of PC across the United States. A patient selection flow diagram is displayed in Figure 1.

Patient-level characteristics obtained from the database included age, sex, race (white, black, Hispanic, other, missing), length of stay, in-hospital mortality, insurance coverage (yes vs no), and socioeconomic status (ZIP code income quartiles). Hospital characteristics gathered included bed size (small, medium, large as defined by the AHRQ⁹), region (Northeast, Midwest, South, West), and location (rural, urban nonteaching, urban teaching).

The use of both invasive (ICD9 codes 96.7x and 9604) and noninvasive (ICD9 code 93.90) mechanical ventilation was determined. Do Not Resuscitate status (ICD9 code V4986) was also identified. The presence of metastatic and nonmetastatic cancer was determined using the Elixhauser comorbidities for each category.¹¹

Cancer Cohort Selection

To compare the rate of change of palliative care access with that of a benchmark population, we created a cohort of patients with metastatic cancer during the same time period. We included patients ≥ 18 years of age with a diagnosis of metastatic cancer

Figure 1 – Patient cohort selection flow diagram. NIS = Nationwide Inpatient Sample.

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(ICD9 codes 196.x, 197.x, 198.x, and 199.x) in the cohort. Palliative care consultation was again coded with ICD9 code V667.

Statistical Analysis

All analysis was performed in SAS version 9.4, using complex survey weights and procedures for appropriate national projections. Percentages displayed in the tables and figures represent national estimates. Independent *t* tests were used for continuous variables; χ^2 tests for ordinal and nominal data. Data are presented with 95% CIs where appropriate; a *P* value < .05 was considered significant. Linear

regression analysis was used for trend analysis of palliative care usage by year.

A multivariate logistic regression model for the use of palliative care referral was created. Variables included in the model were as follows: age, sex, insurance coverage, socioeconomic status, race, hospital size, hospital location, and hospital region. A second model was made that included all of the baseline variables and added the following: Do Not Resuscitate status, invasive mechanical ventilation, noninvasive mechanical ventilation, metastatic cancer, and nonmetastatic cancer.

Results

The records of 55,208,382 hospitalizations from the 2006-2012 NISs were examined. There were 181,689 patients with COPD who were receiving home oxygen

and who met inclusion criteria for the study. Of this cohort, there were 3,145 (1.7%) patients who also received a palliative care consultation during their admission. The results of univariate analysis are

TABLE 1] Baseline Demographic and Patient Characteristics for Patients Referred to Palliative Care and for Those Who Were Not Referred

	No Palliative Care Consultation (n = 178,544)	Palliative Care Consultation (n = 3,145)
Age, mean (SD), y	70.6 (9.7)	75.0 (10.9)
Length of stay, median (IQR), d	3.5 (2.1-5.6)	4.9 (2.6-8.2)
Hospital mortality, No. (%)	2,648 (1.5)	1,008 (32.1)
Male sex, No. (%)	75,909 (42.5)	1,369 (43.6)
Race		
White, No. (%)	131,667 (73.8)	2,537 (80.6)
Black, No. (%)	12,575 (7.0)	183 (5.8)
Hispanic, No. (%)	4,430 (2.5)	64 (2.1)
Other, No. (%)	3,998 (2.2)	66 (2.1)
Missing, No. (%)	25,864 (14.4)	295 (9.5)
Insurance coverage, No. (%)	173,156 (97.0)	2,992 (95.1)
ZIP code income quartile		
1st, No. (%)	54,868 (31.4)	700 (22.7)
2nd, No. (%)	49,784 (28.4)	812 (26.3)
3rd, No. (%)	41,608 (23.7)	814 (26.2)
4th, No. (%)	28,823 (16.5)	772 (24.8)
Hospital location and teaching status		
Rural, No. (%)	36,553 (20.7)	329 (10.6)
Urban nonteaching, No. (%)	81,229 (45.7)	1,385 (43.8)
Urban teaching, No. (%)	59,538 (33.6)	1,412 (45.6)
Hospital region		
Northeast, No. (%)	32,083 (18.6)	462 (15.3)
Midwest, No. (%)	45,800 (25.8)	746 (23.8)
South, No. (%)	68,469 (38.1)	1,017 (32.2)
West, No. (%)	32,192 (17.6)	920 (28.8)
Invasive mechanical ventilation, No. (%)	3,890 (2.2)	344 (11.0)
Noninvasive ventilation, No. (%)	12,534 (7.0)	655 (20.9)
Do Not Resuscitate status, No. (%)	6,071 (3.4)	916 (29.0)
Solid organ cancer, No. (%)	8,279 (4.6)	501 (15.9)
Metastatic cancer, No. (%)	2,632 (1.5)	239 (7.5)

Figure 2 – Rates of palliative care (PC) use in patients with end-stage COPD and metastatic cancer, 2006-2012; test for trend for both cohorts: $P < .01$.

displayed in Table 1. There was a 4.5-fold relative increase in PC referral from 2006 (0.45%) to 2012 (2.56%; $P < .01$) (Fig 2). During the same time period, PC referral for patients with metastatic cancer increased by fourfold from 2.94% in 2006 to 11.9% in 2012 ($P < .01$) (Fig 2).

Patients receiving palliative care consultations compared with those who did not were older (75.0 years [SD 10.9] vs 70.6 years [SD 9.7]; $P < .01$), had longer hospitalizations (4.9 days [IQR 2.6-8.2] vs 3.5 days [IQR 2.1-5.6]), were less likely to have insurance coverage (95.1% vs 97.0%; $P < .01$), and more likely to die in hospital (32.1% vs 1.5%; $P < .01$).

There were 4,234 patients who underwent invasive mechanical ventilation, of whom 344 (8%) received a palliative care consultation. Similarly, there were 13,189 patients who underwent noninvasive mechanical ventilation, of whom 655 (5.0%) received a palliative care consultation. Do Not Resuscitate status was more common among those referred to PC compared with those who did not (29.0% vs 3.4%; $P < .01$). Both metastatic cancer (7.5% vs 1.5%; $P < .01$) and nonmetastatic cancer (15.9% vs 4.6%; $P < .01$) were more common in patients referred to PC.

The results of multivariate logistic regression modeling for the outcome of palliative care consultation for baseline patient variables are displayed in Table 2. After controlling for all variables in the model, factors associated with a higher rate of PC referral were as follows: age (OR, 1.03; 95% CI, 1.02-1.04; $P < .01$), socioeconomic status, hospital region, hospital size, and hospital location.

TABLE 2] Results of Multivariate Logistic Regression Analysis for Baseline Covariates for the Prediction of Palliative Care Referral in Patients With COPD

Variable	OR	CI (95%)	P Value
Older age	1.03	1.02-1.04	< .01
Female sex	0.98	0.91-1.05	.49
White race	0	0	0
Black race	0.83	0.71-0.97	.02
Hispanic race	0.68	0.52-0.88	< .01
Other race	0.70	0.54-0.90	< .01
Missing race	0.79	0.69-0.90	< .01
ZIP code income quartile 1	0	0	0
ZIP code income quartile 2	1.19	1.07-1.32	< .01
ZIP code income quartile 3	1.20	1.08-1.34	< .01
ZIP code income quartile 4	1.41	1.26-1.58	< .01
Northeast hospital	0	0	0
Midwest hospital	1.59	1.40-1.80	< .01
South hospital	1.44	1.28-1.62	< .01
West hospital	2.27	2.01-2.56	< .01
Small hospital	0	0	0
Medium hospital	1.19	1.05-1.34	< .01
Large hospital	1.22	1.10-1.36	< .01
Rural hospital	0	0	0
Urban nonteaching hospital	1.42	1.25-1.62	< .01
Urban teaching hospital	2.19	1.93-2.48	< .01

For race analysis, white is the reference. For ZIP code income quartile, the 1st quartile is the reference. For hospital region, northeast hospitals are the reference. For hospital size, small hospitals are the reference. For hospital location, rural hospitals are the reference.

Using the lowest ZIP code income quartile as a reference, PC was more common as income quartiles increased: 2nd quartile OR, 1.19 (95% CI, 1.07-1.32; $P < .01$); 3rd quartile OR, 1.20 (95% CI, 1.08-1.34; $P < .01$); and 4th quartile OR, 1.41 (95% CI, 1.26-1.58; $P < .01$). Where white race serves as a reference, all other races had less access to PC: black race OR, 0.83 (95% CI, 0.71-0.97; $P = 0.02$); Hispanic race OR, 0.68 (95% CI, 0.52-0.88; $P < .01$); other race OR, 0.70 (95% CI, 0.54-0.90; $P < .01$); and missing race OR, 0.79 (95% CI, 0.69-0.90; $P < .01$). There was, however, a larger amount of data on race missing in the no-PC cohort than for those who received PC (14.4% vs 9.5%; $P < .01$).

Compared with hospitals in the northeast of the country, all other regions of the country had higher access to PC:

Midwest location OR, 1.59 (95% CI, 1.40-1.80; $P < .01$); south location OR, 1.44 (95% CI, 1.28-1.62; $P < .01$); and west location OR, 2.27 (95% CI, 2.01-2.56; $P < .01$). Treatment in large hospitals (OR, 1.22; 95% CI, 1.10-1.36; $P < .01$) as well as medium-sized hospitals (OR, 1.19; 95% CI, 1.05-1.34; $P < .01$) was associated with more access to PC referral. Using rural hospitals as a baseline, PC referral was more common at urban nonteaching hospitals (OR, 1.42; 95% CI, 1.25-1.62; $P < .01$) and urban teaching hospitals (OR, 2.19; 95% CI, 1.93-2.48; $P < .01$).

The results of multivariate regression modeling for PC referral for covariates associated with palliative care are displayed in Table 3. Metastatic cancer (OR, 2.40; 95% CI, 2.02-2.87; $P < .01$), nonmetastatic cancer (OR, 2.75; 95% CI, 2.43-3.11; $P < .01$), invasive mechanical ventilation (OR, 4.89; 95% CI, 4.31-5.55; $P < .01$), noninvasive mechanical ventilation (OR, 2.84; 95% CI, 2.58-3.12; $P < .01$), and DNR status (OR, 7.95; 95% CI, 7.29-8.67; $P < .01$) were all significantly associated with referral to palliative care.

Discussion

In this large, nationally representative analysis of patients with end-stage COPD who were receiving home oxygen and who were admitted with a COPD exacerbation, only a small minority of patients received a palliative care consultation. Further, there were significant barriers to accessing palliative care, including race, socioeconomic status, hospital size, and region of the country.

The results of our analysis demonstrating poor access to palliative care services for patients with end-stage COPD extends on the work of Brown et al¹² and others.^{7,8} Even though PC involvement is endorsed for these patients by most respiratory societies throughout the world, the vast

majority of patients do not receive PC services as an inpatient in times of crisis.^{4,5} Thankfully, the dramatic increase in use of PC observed during the study period provides hope that practitioners (and possibly patients) are becoming aware of the benefits of PC.

The race-based differences observed in our analysis are similar to those of previously published literature demonstrating barriers to PC for ethnic minorities.^{13,14} However, differences relating to ethnicity have not been demonstrated for patients with COPD before this report. However, the missing race data in the non-PC cohort indicate that caution should be exercised in the interpretation of these findings. More research is needed to further explore this association and to better understand ethnic barriers to accessing timely PC in patients with end-stage COPD.

Our finding of increasing referral to palliative care as ZIP code-based income quartile increases has not been demonstrated previously in a COPD population. In other populations, low socioeconomic status has been shown to be associated with both higher and lower rates of referral for hospice and palliative care.¹⁵⁻¹⁹ The increased referral to PC seen in larger teaching hospitals likely reflects the presence of subspecialty PC services in these hospitals compared with smaller rural hospitals.

As demonstrated by the increased frequency of referral to PC for the cohort of patients with metastatic cancer, the availability of in-patient palliative care consultation teams has likely increased during the study period. This is a likely explanation for the increased access to PC observed for patients with COPD. As palliative care becomes more prevalent, both physician and patient understanding of its role in the management of patients with life-limiting diseases increases. In addition, PC practitioners may be invaluable for complex goals of care discussions. The normalization of the role of PC practitioners and the focus on symptom relief may alleviate some of the stigma around palliative care and its traditional association with dying.

The strengths of this analysis lie in the large sample size and the generalizability by examining patients across the entire United States. By including data from hospitals of all sizes and types, located across the United States, we were able to investigate the delivery of palliative care in diverse settings. The NIS allows for robust estimation of the delivery of health care on a national basis, representing approximately 95% of all in-patient care.⁹

TABLE 3] Results of Multivariate Logistic Regression for Covariates Associated With Access to Palliative Care Referral in Patients With COPD

Variable	OR	CI (95%)	P Value
Metastatic cancer	2.40	2.02-2.87	< .01
Nonmetastatic cancer	2.75	2.43-3.11	< .01
Invasive mechanical ventilation	4.89	4.31-5.55	< .01
Noninvasive mechanical ventilation	2.84	2.58-3.12	< .01
DNR status	7.95	7.29-8.67	< .01

DNR = do not resuscitate.

The results of this analysis must be interpreted in the context of its study design. Use of retrospective discharge database information is inherently susceptible to coding errors and missing data. It is possible that there were patients who received a palliative care consultation, but this information was not included on their discharge summary. We were also unable to delineate whether the increased PC consultation rate was the result of a better understanding of the role of PC for patients with end-stage COPD or whether it was due to a general increase in PC access. Many hospitals have developed formal palliative care programs, which could explain the increased referral observed. It is also possible

that PC encounters were more frequently included on discharge summaries over time, due to improvements in coding practices.

Conclusion

The use of palliative care consultation for patients with end-stage COPD, dependent on home oxygen, and who are admitted for a COPD exacerbation in the United States, based on the NIS, is approximately 1.7%. Race, socioeconomic status, and hospital size and location all were associated with differential rates of referral. There was a 4.5-fold increase in palliative care use observed from 2006 to 2012.

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