

Assessment of Spirometry Testing and Inpatient Readmission in Patients With Chronic Obstructive Pulmonary Disease

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BACKGROUND

- Chronic obstructive pulmonary disease (COPD) is a progressive condition characterized by fixed airflow limitation.
- Chronic lower respiratory diseases (including COPD) are recognized as a major public health concern and are the third-leading cause of death in the United States (US).¹
- Spirometry testing measures the degree of airflow limitation and is recommended to confirm a suspected COPD diagnosis.
 - However, spirometry testing is not always routinely used by physicians to confirm COPD diagnosis.^{2,5}
 - Previous research indicates that only a third of patients with newly diagnosed COPD have a spirometry test performed.^{3,6,7}
- Studies have found that patients with COPD have a high rate of hospitalization and readmission.⁸⁻¹⁰
- Limited real-world data exist comparing rates of spirometry testing and hospitalization and readmission across states in the US.

OBJECTIVES

- To assess the percentage of patients with newly diagnosed COPD who had received spirometry testing around the time of their initial COPD diagnosis in 2011.
- To assess the percentage of patients experiencing COPD-related hospitalizations and 30-day readmissions in 2011.

METHODS

Study Design

- Retrospective cohort study using a nationally representative administrative claims database from 2007 to 2011.
- RTI International's institutional review board determined that this study met all criteria for exemption.

Data Source: PharMetrics Plus Database

- Commercially available source of computerized administrative claims information covering more than 150 million lives across the US.
- Information includes demographics, health plan enrollment, diagnoses, dates and place of service, diagnostic testing, procedures, inpatient and outpatient physician services, and prescription drug use.
- Data are tracked longitudinally for enrollees via deidentified and unique identification numbers.

Study Population

- Patients with at least one emergency room or one inpatient claim or at least two outpatient claims on different dates with a diagnosis code of COPD (*International Classification of Diseases, Ninth Edition, Clinical Modification* [ICD-9-CM] codes 491.xx, 492.xx, 494.xx, 496.xx) between 2007 and 2011 were initially selected.
- All patients were required to be at least 40 years of age on the date of their first observed COPD diagnosis.
- Two study cohorts were created.

Spirometry Testing Cohort

- First observed medical claim with an ICD-9-CM code for COPD on or after 1/1/11. The date of the first COPD diagnosis recorded in 2011 was designated as the index date.
- At least 24 months of continuous enrollment before the index date and no ICD-9-CM diagnosis of COPD recorded during that period.
- At least 6 months of continuous enrollment after the index date.

Inpatient Readmission Cohort

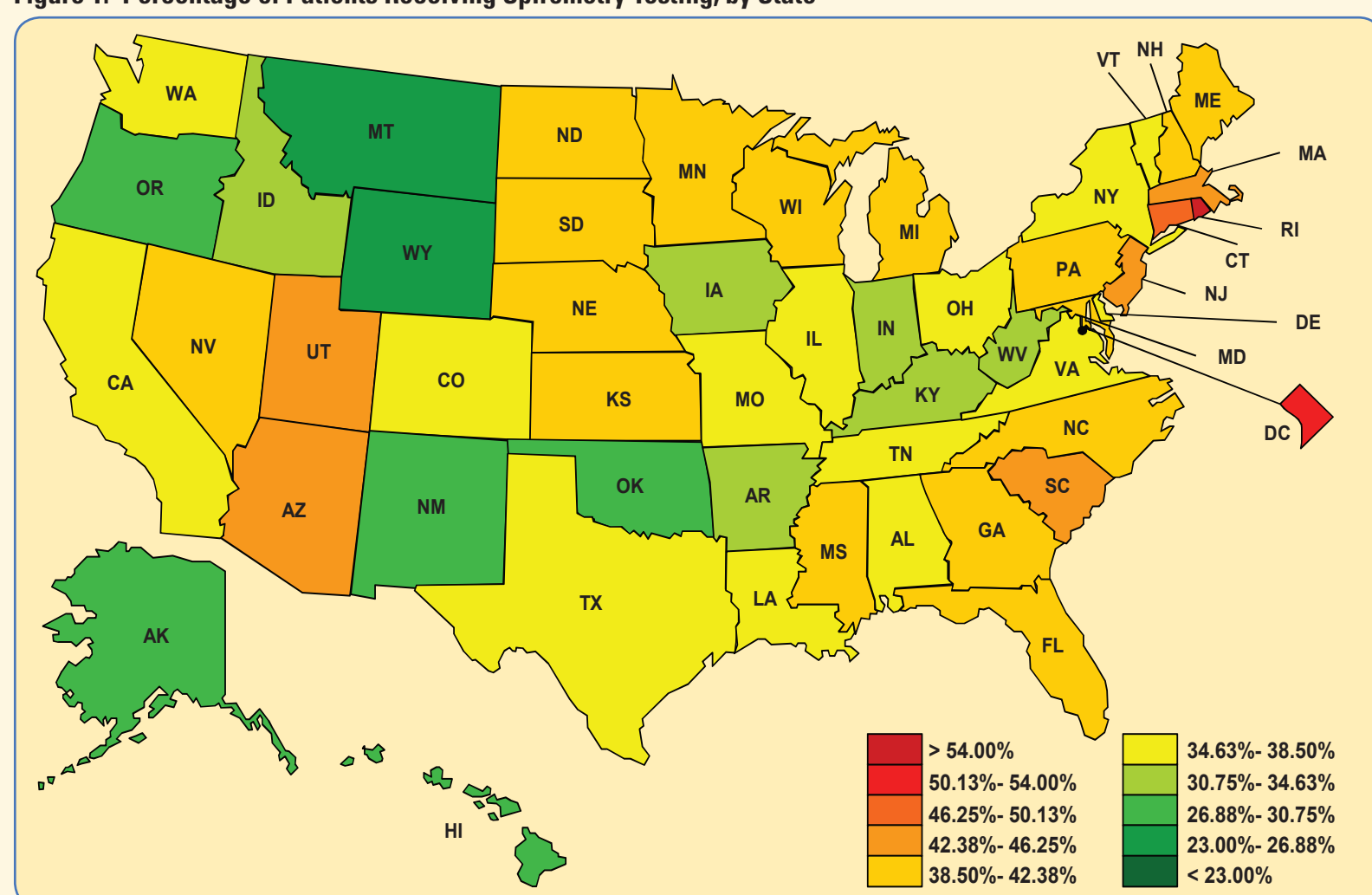
- Having a hospitalization with a primary diagnosis code of COPD (ICD-9-CM codes 491.xx, 492.xx, 494.xx, 496.xx, COPD-related hospitalization) on or after 1/1/11. The discharge date of the first COPD-related hospitalization recorded in 2011 was designated as the index date.
- Continuous enrollment for a minimum of 30 days after the index date.

Table 1. Demographic Characteristics, by Cohort

Characteristic	Spirometry Testing Cohort						Inpatient Readmission Cohort					
	Overall		Patients With Spirometry Testing		Patients Without Spirometry Testing		Overall		Patients With a COPD-Related Readmission		Patients Without a COPD-Related Readmission	
Total (n, %)	94,778	100.0	35,676	37.6	59,102	62.4	49,986	100.0	3,564	7.1	46,422	92.9
Age in years, mean (SD)	62.9	(12.5)	61.4	(11.1)	63.9	(13.2)	68.9	(13.1)	71.3	(12.8)	68.7	(13.1)
Female (n, %)	47,508	50.13	18,123	50.80	29,385	49.72	25,745	51.50	1,890	53.03	23,855	51.39
Geographic region (n, %)												
Northeast	23,125	24.4	9,314	26.1	13,811	23.4	12,341	24.7	973	27.3	11,368	24.5
South	32,162	33.9	12,015	33.7	20,147	34.1	15,904	31.8	994	27.9	14,910	32.1
Midwest	30,588	32.3	11,534	32.3	19,054	32.2	17,587	35.2	1,303	36.6	16,284	35.1
West	8,903	9.4	2,813	7.9	6,090	10.3	4,154	8.3	294	8.3	3,860	8.3
Health plan type (n, %)												
HMO	12,086	12.8	4,551	12.8	7,535	12.8	7,635	15.3	758	21.3	6,877	14.8
PPO	72,269	76.3	27,356	76.7	44,913	76.0	35,595	71.2	2,382	66.8	33,213	71.6
Other	10,423	11.0	3,769	10.6	6,654	11.3	6,622	13.3	409	11.5	6,213	13.4
Missing	—	—	—	—	—	—	134	0.3	15	0.4	119	0.3
Payer type (n, %)												
Commercial	51,062	53.9	19,490	54.6	31,572	53.4	24,152	48.3	1,517	42.6	22,635	48.8
Medicaid	707	0.8	222	0.6	485	0.8	539	1.1	48	1.4	491	1.1
Medicare	6,618	7.0	1,980	5.6	4,638	7.9	6,895	13.8	828	23.2	6,067	13.1
Missing	36,391	38.4	13,984	39.2	22,407	37.9	18,400	36.8	1,171	32.9	17,229	37.1
CCI score, mean (SD)	3.1	(3.0)	2.9	(2.9)	3.1	(3.1)	5.4	(3.8)	6.6	(3.8)	5.3	(3.7)

CCI = Charlson Comorbidity Index; COPD = chronic obstructive pulmonary disease; HMO = health maintenance organization; PPO = preferred provider organization; SD = standard deviation.

Figure 1. Percentage of Patients Receiving Spirometry Testing, by State



Note: The selection of deciles was based on the observed percentages of patients with spirometry testing in each three-digit zip code prefix.

Study Measures

- Patient characteristics (i.e., age, sex, geographic location, health plan type, and payer type) and Charlson Comorbidity Index (CCI) score,¹¹ measured in the up to 12 months before and after the index date, based on available health plan enrollment (with COPD excluded from the score), were assessed for both cohorts.

Spirometry Testing Cohort

- Spirometry testing was identified using Current Procedural Terminology 4 (CPT-4) codes 94010, 94060, 95070, 94070, 94150, 94200, 94375, and 94664.
- The number and percentage of newly diagnosed COPD patients who received spirometry testing in the 24 months before and 6 months after the index date were estimated. Data were reported at the national, regional (i.e., Northeast, South, Midwest, and West), and state levels (including the District of Columbia).

Inpatient Readmission Cohort

- A COPD-related readmission was identified as a hospitalization with a primary ICD-9-CM diagnosis of COPD after the index date.
- The number and percentage of patients with a COPD-related readmission occurring within 30 days after the index date were estimated. Data were reported at the national, regional, and state levels (including the District of Columbia).

Data Analyses

- Descriptive analyses were conducted for both cohorts:
 - Means and standard deviations were reported for continuous variables.
 - Numbers and percentages were reported for categorical variables.
- All analyses were conducted using SAS version 9.3 (SAS Institute, Inc., Cary, North Carolina).

RESULTS

- Demographic and clinical characteristics for both study cohorts are shown in Table 1.

Spirometry Testing Cohort

- 94,778 patients met all criteria for the spirometry testing cohort and were included in the overall COPD study population.
- Overall, 37.6% of the patients with newly diagnosed COPD in 2011 had evidence of spirometry testing in the 24 months before or 6 months after the index date.
- The percentage of patients with spirometry testing was highest in the Northeast (40.3%), followed by the Midwest (37.7%) and the South (37.4%), and lowest in the West (31.6%).
- The percentage of patients receiving spirometry testing varied by state, with the lowest percentage in Wyoming (24.6%) and the highest percentage in Rhode Island (61.2%) (Figure 1).

Inpatient Readmission Cohort

- 49,986 patients met all the criteria for the inpatient readmission cohort and were included in this portion of the analysis.
- Overall, 7.1% (n = 3,564) of the patients with a COPD-related hospitalization had a COPD-related readmission within 30 days of discharge from the first COPD-related hospitalization in 2011.
- The percentage of patients with a 30-day COPD-related readmission was highest in the Northeast (7.9%), followed by the Midwest (7.4%) and the West (7.1%), and lowest in the South (6.3%).
- The 30-day COPD-related readmission rates varied by state, from 2.0% of patients in South Dakota to 20.8% of patients in the District of Columbia (Figure 2).

LIMITATIONS

- This study is subject to limitations common to retrospective analyses using claims data including coding errors and incomplete claims.
- No clinical data or electronic medical records were available to confirm diagnoses or clinical events. For example, COPD patient identification was based on diagnosis codes, the validity of which may be impacted by provider, region, or site-specific coding practices, and was not confirmed by airway testing.
- Because the PharMetrics Plus database covers a commercially insured population, findings from this study may not be generalizable to patients with COPD in fee-for-service Medicare or Medicaid programs or other payer types.
- Because of small sample sizes in some instances, results should be interpreted with caution. For example, only 60 patients in the District of Columbia were identified in the spirometry testing cohort, with 31 patients (51.7%) receiving spirometry testing.

CONCLUSIONS

- Despite clinical guidelines recommending spirometry testing to confirm COPD diagnosis,¹² a high percentage of patients newly diagnosed with COPD (62.4%) did not have evidence of spirometry testing in the 24 months before or 6 months after their first COPD diagnosis.
- Consistent with previous findings,^{8,9} in this study, COPD-related 30-day readmissions were present in approximately 7% of the hospitalized COPD population in 2011.
- There is a substantial variation in these rates across the US at the state level.

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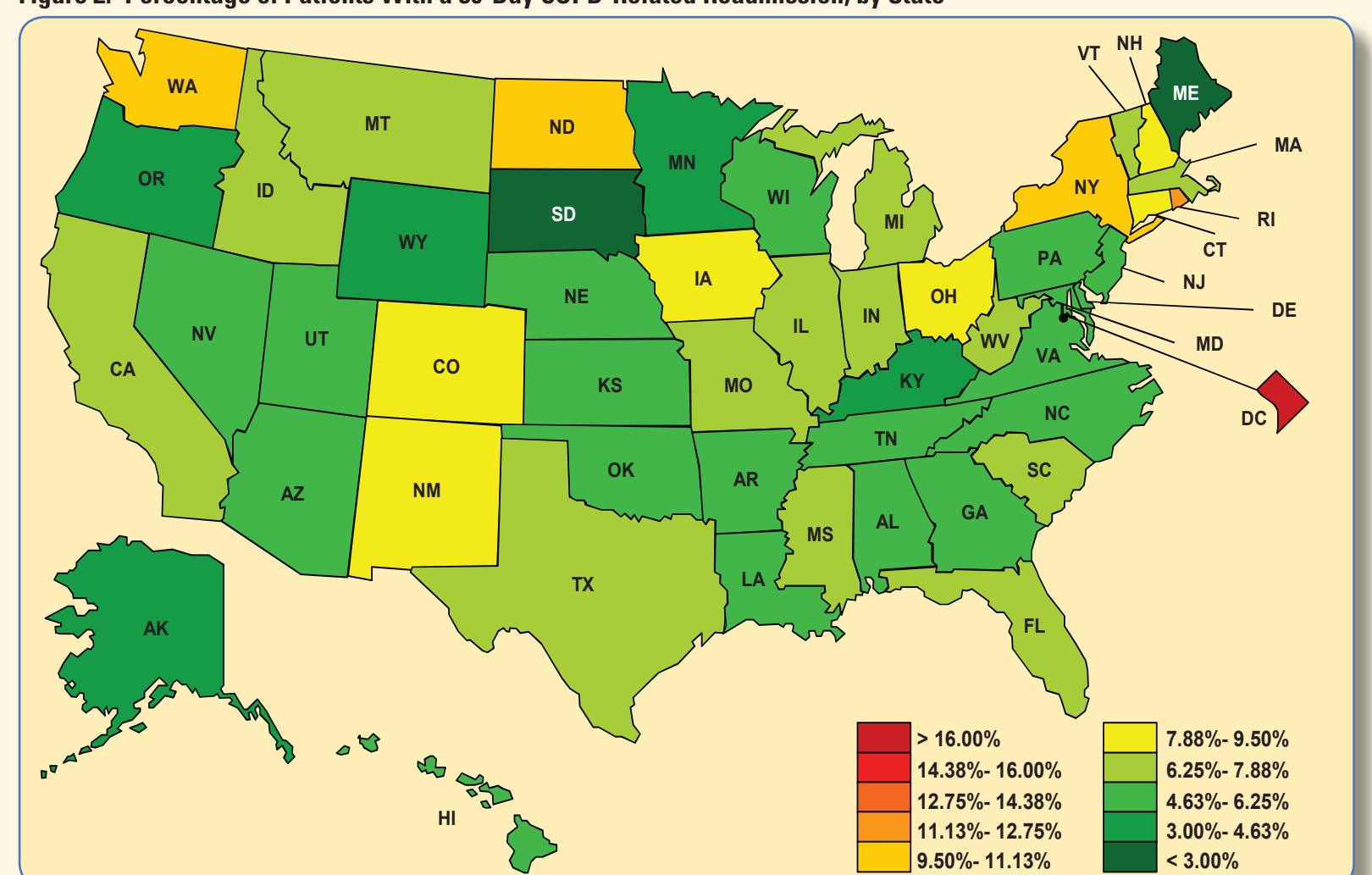
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Figure 2. Percentage of Patients With a 30-Day COPD-Related Readmission, by State



COPD = chronic obstructive pulmonary disease.
Note: The selection of deciles was based on the observed percentages of patients with a 30-day COPD-related readmission in each three-digit zip code prefix.