Online Data Supplement
Beyond Access: Factors Associated with Spirometry Underutilization Among Patients With a Diagnosis of COPD in Urban Tertiary Care Centers

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## Contents of Online Data Supplement:

Supplementary Table 1. International Classification of Diseases (ICD)-Ninth Revision and Tenth Revision COPD Diagnosis Codes

ICD-9-Clinical Modification Diagnosis Codes	
490	Bronchitis, not specified as acute or chronic

491
491.0
491.1
419.20
491.21
491.22
491.8
491.9
	Chronic bronchitis
	    Simple chronic bronchitis
	    Mucupurulent chronic bronchitis
	    Obstructive chronic bronchitis without exacerbation
	    Obstructive chronic bronchitis with acute exacerbation
	    Obstructive bronchitis with acute bronchitis
	    Other chronic bronchitis
	    Unspecified chronic bronchitis

492
492.0
492.8
	Emphysema
	    Emphysematous bleb
	    Other emphysema

496	Chronic airway obstruction, not elsewhere classified
ICD-10-Clinical Modification Diagnosis Codes	
J40	Bronchitis, not specified as acute or chronic

J41
J41.0
J41.1
J41.8
	Simple and mucopurulent chronic bronchitis
	    Simple chronic bronchitis
	    Mucopurulent chronic bronchitis
	    Mixed simple and mucopurulent chronic bronchitis

J42	Unspecified chronic bronchitis

J43
J43.0
J43.1
J43.2
J43.8
J43.9
	Emphysema
	    Unilateral pulmonary emphysema
	    Panlobular emphysema
	    Centrilobular emphysema
	    Other emphysema
	    Emphysema, unspecified

J44
J44.0
J44.1
J44.9
	Other chronic obstructive pulmonary disease
	    Chronic obstructive pulmonary disease with (acute) lower respiratory infection
	    Chronic obstructive pulmonary disease with (acute) exacerbation
	    Chronic obstructive pulmonary disease, unspecified
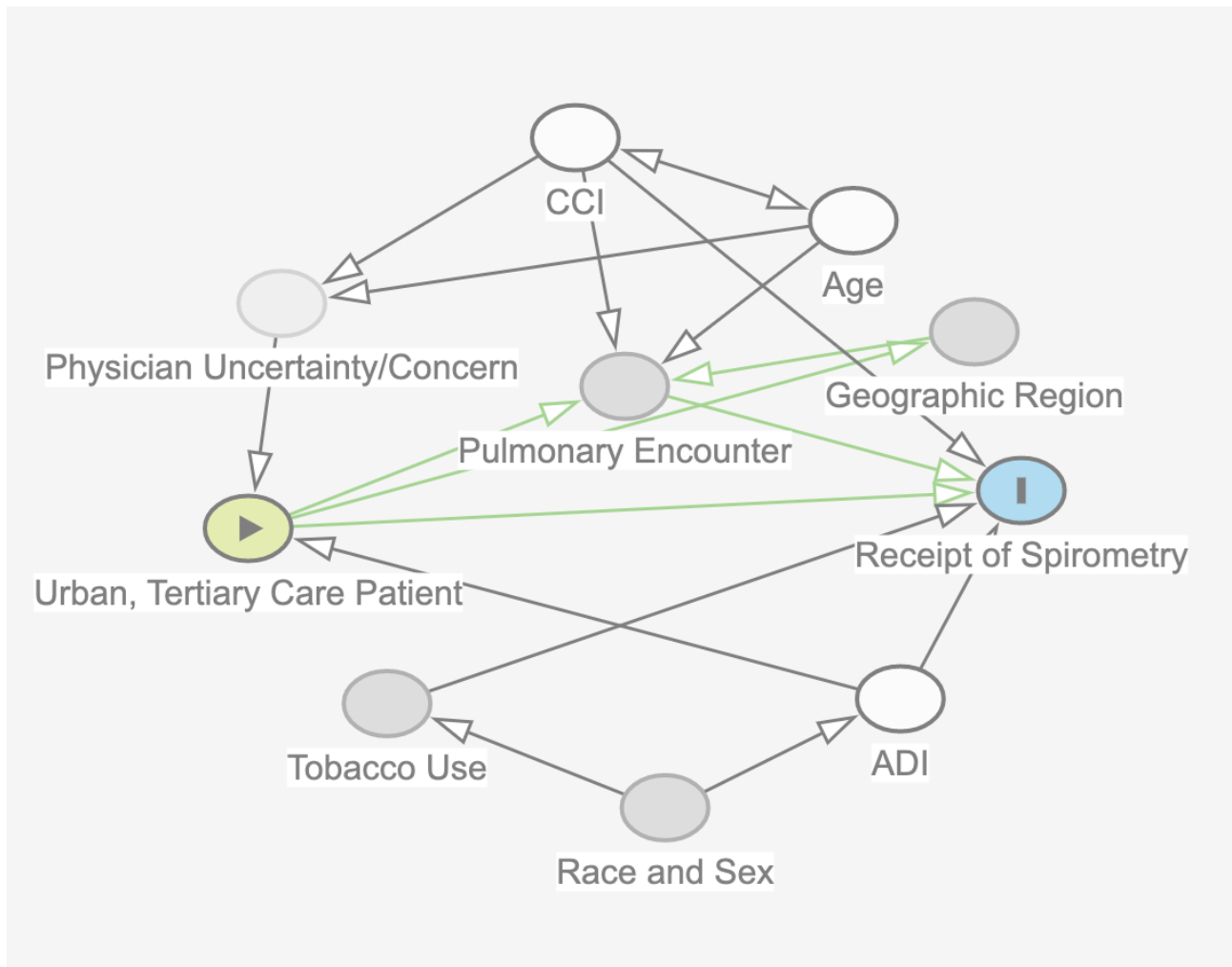
Supplementary Figure 1. Directed Acyclic Graph (1). This directed acyclic graph represents associations between covariates (grey circles) and primary exposure (green circle, urban-dwelling, tertiary care center patient) and outcome (blue circle, receipt of spirometry). Green lines represent causal paths. Age, Area Deprivation Index (ADI), and Charlson Comorbidity Index (CCI) were identified as the minimal sufficient adjustment variables (white circle). These potential confounders were accounted for by adjusting the logistic regression models. Other covariates shown above are pulmonary encounter, geographic region, tobacco use, race, sex, and physician uncertainty/concern (light grey, unobserved). DAGitty software (2) was used to construct this directed acyclic graph.

Supplementary Table 2. Logistic Regression Analyses of Factors Associated with Spirometry Utilization

	Odds Ratio (95% Confidence Interval)		
	Model 1: Unadjusted	**Model 2: Adjusted for Age, Comorbidities, and ADI**	**Model 3: Adjusted for all Covariates**
Age			
40-54	1.00	-	1.00
55-64	1.19 (1.09-1.29)	-	1.20 (1.10-1.32)
65-74	1.20 (1.10-1.31)	-	1.24 (1.12-1.36)
75-84	0.81 (0.73-0.90)	-	0.88 (0.79-0.99)
≥85	0.43 (0.38-0.49)	-	0.52 (0.44-0.60)
Sex			
Male	1.00	1.00	1.00
Female	1.00 (0.88-1.14)	0.98 (0.86-1.12)	0.92 (0.80-1.06)
Race			
White	1.00	1.00	1.00
Black or African American	1.00 (0.94-1.06)	0.98 (0.92-1.04)	0.98 (0.92-1.05)
American Indian	0.99 (0.75-1.33)	0.95 (0.71-1.28)	1.00 (0.73-1.36)
Asian	0.88 (0.60-1.31)	1.06 (0.72-1.59)	1.10 (0.72-1.67)
Native Hawaiian	0.89 (0.65-1.23)	0.86 (0.63-1.19)	0.93 (0.66-1.31)
Declined	0.70 (0.62-0.78)	0.71 (0.63-0.81)	0.77 (0.67-0.87)
Area Deprivation Index*			
≤20	1.00	-	1.00
21-40	1.01 (0.93-1.11)	-	0.97 (0.88-1.08)
41-60	1.06 (0.97-1.16)	-	0.98 (0.88-1.08)
61-80	1.09 (1.00-1.19)	-	1.00 (0.90-1.11)
81-100	1.08 (0.99-1.18)	-	0.99 (0.89-1.09)
Smoking Status			
Never Smoker	1.00	1.00	1.00
Current or Former Smoker	0.98 (0.91-1.06)	0.92 (0.85-1.00)	0.94 (0.86-1.02)
Unknown	0.80 (0.73-0.88)	0.82 (0.74-0.90)	0.84 (0.76-0.93)
Comorbidities			
Congestive Heart Failure	1.08 (1.01-1.14)	-	1.08 (1.00-1.16)
Coronary Artery Disease	1.03 (0.98-1.08)	-	1.00 (0.94-1.07)

Chronic Kidney Disease	0.93 (0.87-0.99)	-	0.91 (0.85-0.99)
Diabetes mellitus	0.99 (0.94-1.05)	-	0.89 (0.84-0.95)
Obesity	1.23 (1.16-1.31)	-	1.14 (1.06-1.22)
Geographic Region‡			
Midwest	1.00	1.00	1.00
Northeast	0.83 (0.76-0.91)	0.86 (0.78-0.94)	0.78 (0.71-0.86)
South	0.85 (0.79-0.91)	0.86 (0.80-0.92)	0.89 (0.83-0.96)
West	0.91 (0.84-0.98)	0.92 (0.84-1.00)	0.92 (0.85-1.00)
Pulmonary Specialty Care			
Yes	1.00	1.00	1.00
No	0.35 (0.33-0.38)	0.55 (0.52-0.58)	0.37 (0.34-0.40)

*Area Deprivation Index (ADI) provides percentile ranking of neighborhoods by census block groups based on the aggregated domains of income, education, employment, and housing quality (percentile ranged from 1 to 100, with higher scores indicating higher levels of socioeconomic disadvantage) (3).

†Charlson Comorbidity Index scores range from 0 to 33 with higher scores indicating greater disease burden and increased risk of death within 1 year (4).

‡Geographic regions were divided into four categories according to each patient's Veterans Integrated Services Networks (VISN) (5). Midwest includes VISNs 17, 19, and 23; Northeast includes VISNs 1, 2, 4, 10, and 12; South includes VISNs 20, 21, and 22; and West includes VISNs 5, 6, 7, 8, 9, 15, and 16.

References

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