

County-level social vulnerability is associated with lower pneumococcal vaccine uptake among Medicare beneficiaries in the United States (2016-2019)

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Background

- In the United States, pneumococcal disease contributes to significant morbidity, mortality, and economic costs.¹ Adults ≥65 years old are at increased risk for pneumococcal disease compared to adults aged 18-49 and 50-64²
- Pneumococcal vaccines are an effective way to reduce the burden of pneumococcal disease^{3,4}; however, the uptake of pneumococcal vaccines among adults who are eligible for pneumococcal vaccines (adults aged 65+ years and adults aged 19-64 with chronic or immunocompromising conditions) remains low⁵
- While there is evidence of individual-level disparities in pneumococcal vaccine uptake, there is limited evidence available on how neighborhood or community-level factors may impact these disparities in vaccine uptake^{6,7}
- The objective of this study is to examine area-level disparities in pneumococcal vaccine uptake among Medicare enrollees

Methods

- We calculated county-level pneumococcal vaccination rates among all Medicare enrollees using Medicare fee-for-service (FFS) and Medicare Advantage (MA) claims data from Centers for Medicare & Medicaid Services
- The study population included all enrollees aged ≥65 years who had Medicare as their primary payer and who were continuously enrolled in FFS or MA for at least 12 months between January 2016 and December 2019 and concurrently enrolled in Medicare Part B and Part D. Enrollees were followed until they disenrolled from Medicare or they died
- We identified pneumococcal vaccinations using the National Drug Code (NDC) and Current Procedural Terminology (CPT) codes for PPSV23 (PNEUMOVAX® 23) and PCV13 (Prevnar 13®) using prescription drug claims and outpatient and inpatient files
- The county-level vaccination rate was calculated as the percentage of enrollees who resided in a county between 2016 and 2019, who also met our enrollment criteria and received any pneumococcal vaccine
- We created a population-weighted average of vaccine uptake by quintile of the Minority Health Social Vulnerability Index (MHSVI) and its subthemes including Socioeconomic Status, Household Characteristics, Racial and Ethnic Minority, Housing Type and Transportation, Health Care Infrastructure and Access, and Medical Vulnerability⁸

Results

Table 1. Characteristics of all Medicare enrollees from 2016-2019

Demographic group	Total	Vaccinated with ≥1 pneumococcal vaccine	
	# of enrollees (millions)	# of enrollees (millions)	% of enrollees group with ≥1 vaccine
Number of enrollees	56.9	21.0	36.9%
Gender			
Male	25.6	8.9	34.7%
Female	31.3	12.1	38.8%
Race/ethnicity			
White, non-Hispanic	46.3	17.4	37.7%
Black, non-Hispanic	5.2	1.7	31.6%
Hispanic	1.4	0.43	30.9%
Asian	1.5	0.55	37.5%
Other	1.4	0.48	35.6%
Missing	1.1	0.45	39.9%
Age			
65 to 74	29.2	11.5	39.3%
75 to 84	18.0	6.7	37.3%
85+	9.7	2.9	30.4%
Risk status			
Low	9.8	1.9	20.0%
At-risk	17.9	6.8	37.8%
High-risk	29.1	12.3	42.2%
Urbanicity			
Urban	46.9	17.5	37.4%
Suburban	8.8	3.1	35.2%
Rural	1.1	0.35	30.8%

At-risk refers to chronic medical conditions and high-risk refers to immunocompromising conditions.

- Between 2016 and 2019, 56.9 million enrollees met the inclusion criteria for the study. The majority of enrollees were female, White, non-Hispanic, 65-74 years old, at high-risk for pneumococcal disease, and lived in urban areas
- Overall, 37% of enrollees received a pneumococcal vaccine during the study period. Because the data allows us to observe vaccination events occurring between 2016 and 2019, enrollees who received their vaccine earlier may not be identified as such in our data, leading to lower estimated vaccine coverage rates overall
- We do not observe vastly different vaccination rates by gender and race/ethnicity
- There are substantial differences in vaccination rates by risk status. Vaccine uptake among low-risk enrollees (20%) is roughly half of that for at-risk (38%) and high-risk (46%) enrollees
- Vaccination rates were similar across the 65-74, 75-84, and 85+ age groups
- Enrollees in urban areas (37.4%) were more likely to have received a pneumococcal vaccine as their suburban and rural counterparts (35.2% and 30.8%, respectively)

Table 2. Pneumococcal vaccination rates among all Medicare enrollees, by quintile of the Minority Health Social Vulnerability Index

	Overall	Quintile of MHSVI index					Difference between 5th and 1st quintile
		1st quintile <20%	2nd quintile 20% – 40%	3rd quintile 40% – 60%	4th quintile 60% – 80%	5th quintile 80% – 100%	
Full sample	37%	39%	39%	38%	37%	35%	-4%*
Age							
65-74	39%	43%	42%	41%	39%	36%	-7%*
75-84	37%	37%	38%	38%	37%	36%	-1%
85+	30%	30%	31%	31%	30%	29%	-1%
Risk status							
Low	20%	24%	22%	21%	20%	17%	-7%*
At-risk	38%	40%	40%	39%	37%	36%	-4%*
High	46%	46%	47%	47%	46%	45%	-1%

Notes: Outcomes are aggregated from the enrollee-year level to the quintile and are expressed as the percentage of enrollees with a claim for a pneumococcal vaccination between 2016 and 2019. 1st quintile <20% (least vulnerable counties); 5th quintile 80%-100% (most vulnerable counties). * = P<0.001. MHSVI, Minority Health Social Vulnerability Index.

- Enrollees who live in more vulnerable areas are less likely to be vaccinated than those in less vulnerable areas, overall, among subgroups by age and by risk status
- The difference between the most and least vulnerable counties are statistically significant for the full sample, for the 65- to 74-year-old age group and by risk, with the exception of high-risk enrollees

Figure 1. County-level pneumococcal vaccination rates among all Medicare enrollees, 2016-2019

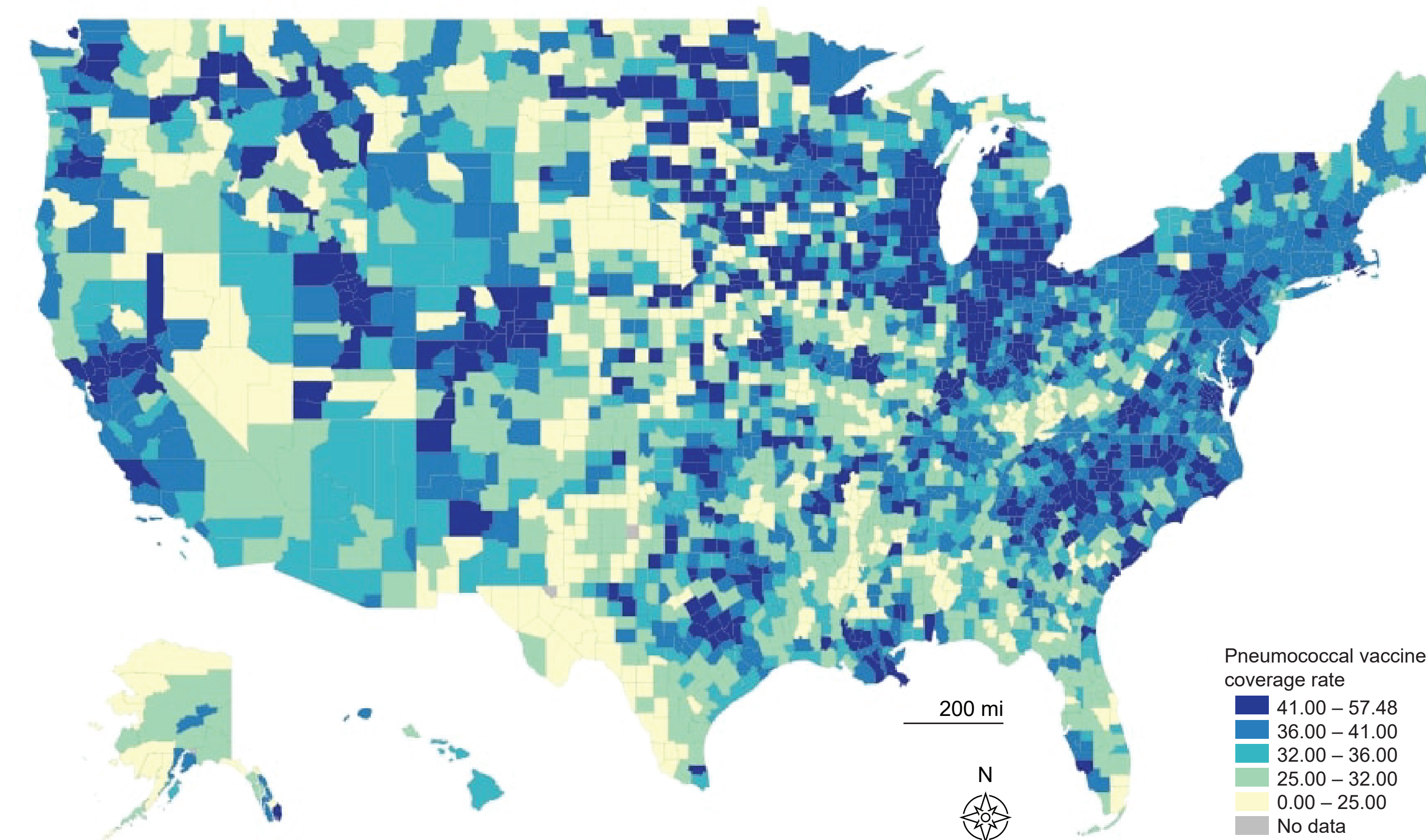
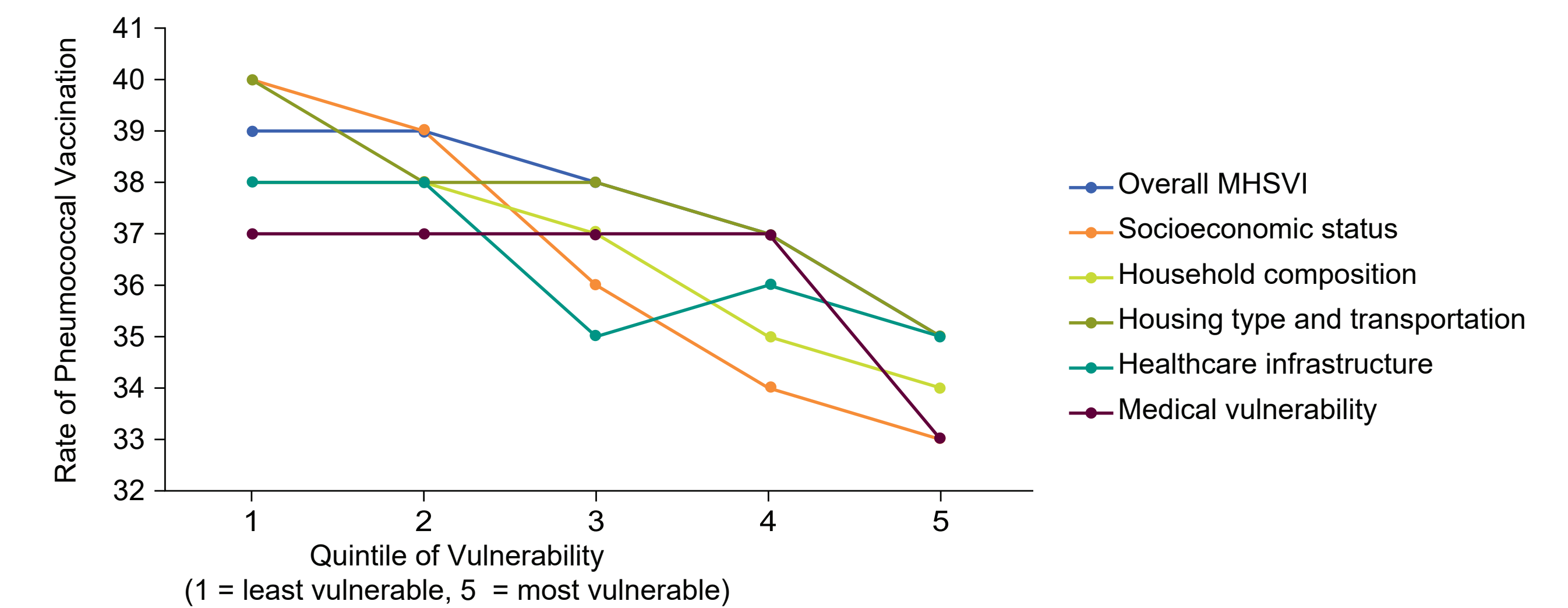


Figure 2. Pneumococcal vaccination rate for all Medicare enrollees, by quintile of MHSVI and subthemes



Note: We did not report results broken out by the racial and ethnic minority because there is no hypothesized mechanism for us to believe that individuals living in areas that correspond to higher quintiles of this theme are "vulnerable."

- Pneumococcal vaccination rates decrease as vulnerability increases; this pattern was consistent for the overall MHSVI and all subthemes

Table 3. Difference in pneumococcal vaccination rate for Medicare enrollees in the most- and least-vulnerable quintiles of MHSVI and subthemes

MHSVI	Socioeconomic status	Household characteristics	Housing type and transportation	Healthcare infrastructure	Medical vulnerability
Full sample					
-4%*	-7%**	-4%**	-5%**	-3%**	-4%**
Risk					
Low					
-7%**	-8%**	-4%**	-5%**	-3%**	-4%**
At-risk					
-4%**	-9%**	-6%**	-5%**	-4%**	-7%**
High					
-1%	-5%**	-3%*	-2%*	0%	-3%*

Note: This table reports the difference in vaccination rate between the most- and least-vulnerable quintiles. Negative numbers indicate that more vulnerable areas have lower vaccination rates. Positive numbers indicate that more vulnerable areas have higher vaccination rates. Significant results are highlighted. * = P<.01, ** = P<.001. MHSVI, Minority Health Social Vulnerability Index.

- For all subthemes of the MHSVI, vaccination rates decrease as vulnerability increases
- Differences between the most- and least-vulnerable quintiles are largest when vulnerability is defined by socioeconomic status and smallest when vulnerability is defined as healthcare infrastructure

Limitations

- The vaccination rate estimates for older Medicare enrollees are biased downward as we were only able to capture vaccinations that occurred between 2016 and 2019. If an enrollee was vaccinated either before or after this time window, we do not observe it
- Our analysis is limited to Medicare enrollees that are continuously enrolled in Medicare for at least one year. We do not include individuals that disenroll and re-enroll in Medicare
- Data quality varies significantly across Medicare Advantage (MA) plans. Some MA plans do not submit information for all encounters, which can introduce a source of potential error into the estimates

Conclusions

- Enrollees who resided in the most vulnerable counties had lower vaccination coverage rates compared to those who lived in less vulnerable counties
- There are notable disparities in vaccination rates between the most- and least-vulnerable counties. The magnitude of these disparities is dependent on the definition of vulnerability used
- Increased efforts to improve vaccination rates in socially vulnerable areas have the potential to meaningfully decrease the clinical and economic burden of pneumococcal disease

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