

The association between the Minority Health Social Vulnerability Index and pneumococcal disease incidence among Medicare beneficiaries (2016-2019)

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Background

- Previous research has shown that racial and ethnic minority groups experience pneumococcal disease at higher rates and have lower vaccine uptake in comparison to their White counterparts^{1,2}. Additionally, in the US, Black individuals have a higher proportion of chronic and immunocompromising conditions which place them at higher risk for pneumococcal disease compared to non-Black individuals³
- While individual disparities in pneumococcal disease burden have been established, there is limited evidence on the effect of neighborhood and community factors on pneumococcal disease burden
- The objective of this study is to examine area-level disparities in pneumococcal disease incidence among Medicare enrollees

Methods

- The study population included all enrollees ≥65 years who had Medicare as their primary payer and who were continuously enrolled in Medicare fee-for-service (FFS) or Medicare Advantage (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 calculated pneumococcal disease incidence among all Medicare beneficiaries using Medicare FFS and MA inpatient and outpatient claims
- We identified pneumococcal disease events using ICD-10 diagnosis codes. We measured the incidence of all-cause pneumonia (ACP), pneumococcal pneumonia (PP), and invasive pneumococcal disease (IPD) (pneumococcal bacteremia, bacteremic pneumococcal pneumonia, pneumococcal meningitis, and other IPD)
- Disease incidence was estimated per 100,000 enrolled member-years. We did not count disease codes that recurred in claims within 30 days of an index disease event. We created a population-weighted average of disease incidence across all counties within each quintile of the Minority Health Social Vulnerability Index (MHSVI) and its six subthemes: socioeconomic status, household characteristics, racial and ethnic minority status, housing type and transportation, health care infrastructure and access, and medical vulnerability⁴

Results

Table 1. Characteristics of Medicare enrollees from 2016-2019

Demographic group	Total		≥1 Pneumococcal disease event during study period	
	# of enrollees (millions)	% of enrollees	# of enrollees (millions)	% of enrollees with ≥1 disease events
Number of enrollees	56.9		9.2	16%
Gender				
Male	26.6		4.2	16%
Female	31.3		5.0	16%
Race/ethnicity				
White, non-Hispanic	46.3		7.7	17%
Black, non-Hispanic	5.2		0.8	15%
Hispanic	1.4		0.2	15%
Asian	1.5		0.2	13%
Other	1.4		0.2	14%
Missing	1.1		0.08	8%
Age				
65-74	29.2		3.0	10.3%
75-84	18.0		3.4	18.8%
85+	9.7		2.8	29.2%
Risk of pneumococcal disease^a				
Low	9.8		0.1	1%
At-risk	17.9		2.4	14%
High	29.1		6.7	25%
Urbanicity				
Urban	46.9		7.4	15.7%
Suburban	8.8		1.5	17.4%
Rural	1.1		0.2	17.6%

^aLow-risk enrollees do not have any chronic or immunocompromising conditions that put them at increased risk for pneumococcal disease. At-risk enrollees are those who have chronic medical conditions. High-risk enrollees include those with immunocompromising conditions.

- Overall, 16% of enrollees had a pneumococcal disease episode during our study period
- There are substantial differences by risk status and age. Only 1% of low-risk enrollees had a disease episode as compared to 14% of at-risk, and 25% of high-risk enrollees. 29.2% of individuals aged 85+ had a pneumococcal disease episode, compared to 10.3% of individuals aged 65-74
- The proportion of individuals having had a pneumococcal disease episode are similar across gender, race, and urbanicity

Table 2. Disease incidence per 100,000 person-years by quintile of Minority Health Social Vulnerability Index

Disease category	Overall	Quintile of MHSVI index					Difference between 5th and 1st quintile
		1: <20% (Least vulnerable)	2: 20% - 40%	3: 40% - 60%	4: 60% - 80%	5: 80% - 100% (most vulnerable)	
Full sample							
ACP	8,051.5	7,190.0	7,870.9	7,964.3	8,080.1	8,356.9	1166.9***
PP	42.9	42.6	41.2	41.2	41.0	46.9	4.3
IPD	42.1	39.6	39.7	41.1	43.4	43.7	4.1**
Risk for pneumococcal disease							
Low risk							
ACP	434.3	534.7	473.3	468.3	423.5	374.1	-160.6***
PP	1.9	2.0	2.0	2.1	1.9	1.9	-0.2
IPD	1.2	1.6	1.3	1.1	1.1	1.2	-0.4
Moderate risk							
ACP	5,791.6	5,777.5	5,971.7	5,898.6	5,851.7	5,585.2	-192.3**
PP	32.7	35.1	31.6	31.7	30.4	35.4	0.2
IPD	27.4	26.8	25.4	27.6	29.1	27.0	0.3
High risk							
ACP	6,816.1	6,760.9	6,558.9	6,673.4	7,013.6	6,943.0	182.1
PP	29.7	30.9	20.9	28.6	31.5	34.3	3.4
IPD	83.9	123.5	76.8	71.4	84.1	86.8	-36.7
Age							
65-74							
ACP	5,078.8	4,377.9	4,794.7	4,944.8	5,129.2	5,424.6	1,046.7***
PP	29.2	27.8	26.7	27.4	28.1	33.0	5.2
IPD	30.9	27.3	27.8	29.4	32.8	32.9	5.6
75-84							
ACP	9,551.3	8,616.3	9,300.2	9,428.3	9,573.5	9,939.5	1,323.2***
PP	50.7	50.5	48.5	48.4	48.9	55.1	4.6
IPD	48.5	46.1	45.6	48.6	49.5	49.8	3.8
85+							
ACP	17,211	15,767	17,284	17,276	17,126	17,474	1,707***
PP	83.9	86.8	84.7	82.5	77.7	88.9	2.1
IPD	75.2	76.8	75.3	73.4	73.9	77.2	0.4

***P<.001, **P<.01, *P<.05
ACP, all-cause pneumonia; PP, pneumococcal pneumonia; IPD, overall invasive pneumococcal disease, including bacteremia, bacteremic pneumonia, meningitis, and other IPD. Outcomes are aggregated from the enrollee-year level to the quintile-level and are expressed as cases per 100,000 enrolled enrollee-years.

- All-cause pneumonia represents over 99% of all events identified within our study population
- For each category of pneumococcal disease, incidence is higher in the most-vulnerable quintile compared to the least-vulnerable quintile
- Within each risk group, pneumococcal pneumonia and invasive pneumococcal disease do not increase significantly with vulnerability. For all-cause pneumonia, for low and moderate risk enrollees, disease incidence decreases as vulnerability increases. For high-risk enrollees, there is no relationship between vulnerability and disease incidence
- Within each age group, there is no significant relationship between vulnerability and pneumococcal pneumonia or invasive pneumococcal disease. Within each age group, the incidence of all-cause pneumonia increases as vulnerability increases. This increase is most pronounced within the 85+ subgroup

Figure 1. County-level all-cause pneumonia incidence per 100,000 enrolled member-years among Medicare enrollees from 2016-2019

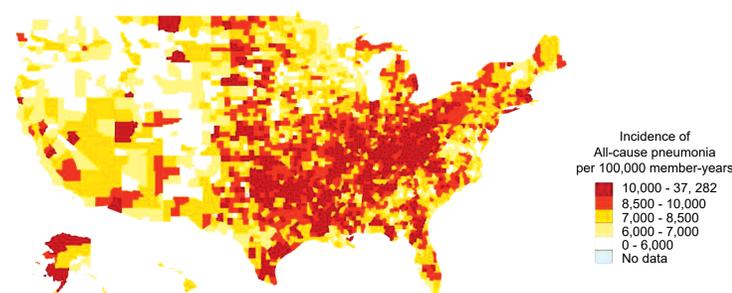
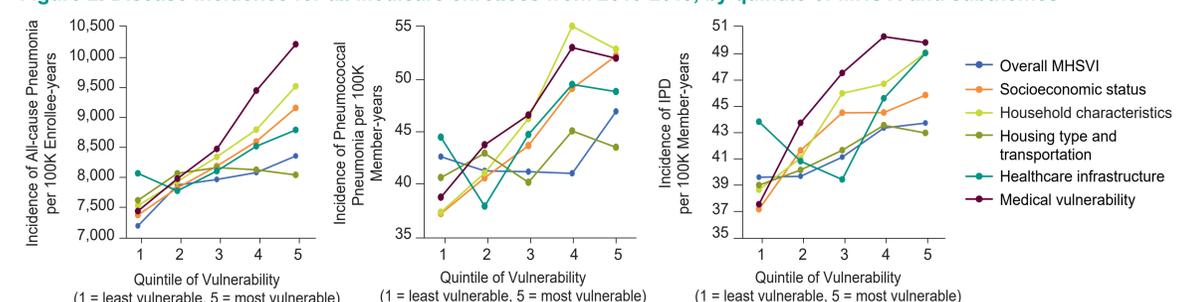


Figure 2. Disease incidence for all Medicare enrollees from 2016-2019, by quintile of MHSVI and subthemes



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."

- For the overall MHSVI index, and for each of its subthemes, disease incidence rises as vulnerability increases. These increases are largest for the Medical Vulnerability index and smallest for the Housing Type and Transportation index

Table 3. Difference in ACP, PP, and IPD incidence per 100,000 member-years among Medicare enrollees in the most versus least vulnerable quintiles, for MHSVI and subthemes

	MHSVI	Socioeconomic status	Household characteristics	Housing type and transportation	Healthcare infrastructure	Medical vulnerability
Full sample						
ACP	1,166.9***	1,788.6***	1,990.5***	424.4***	724.1***	2,784.9***
PP	4.3	15.2***	15.7***	2.9	4.4	13.4***
IPD	4.1**	8.7***	10.4***	4.0**	5.2***	12.3***
Risk group						
Low						
ACP	-160.6***	-86.3***	36.7**	-89.0***	1.2	40.9***
PP	-0.2	-0.5	-0.3	-0.5	-0.4	-0.6
IPD	-0.4	0.3	0.1	0.0	-0.5	-0.2
At-risk						
ACP	-192.3**	623.3***	1,415.9***	-116.9	347.7***	1,839.9***
PP	0.2	7.4**	9.1***	3.4	5.1*	6.6**
IPD	0.3	4.5**	8.4***	2.2*	2.1	8.1***
High						
ACP	182.1	1,046.5*	999.1*	706.8*	262.3	1,704.8**
PP	3.4	-4.4	-15.1	26.0	-2.1	-7.1
IPD	-36.7	-5.3	-56.6*	-26.1	94.7	3.3

***P<.001, **P<.01, *P<.05
Positive numbers indicate that more vulnerable areas have higher disease burden. Negative numbers indicate that more vulnerable areas have less disease burden. Statistically significant relationships where more vulnerable areas have higher disease incidence are highlighted.

- For all subthemes of the MHSVI, disease incidence increases as vulnerability increases
- Differences between the most- and least-vulnerable quintiles are largest for medical vulnerability. These differences are smallest for housing type and transportation vulnerability

Limitations

- This claims-based analysis cannot detect pneumococcal disease events in which an individual did not seek healthcare or attempt to be reimbursed by Medicare
- We limit our analysis to individuals who are continuously enrolled in Medicare. 82% of all individuals who ever enrolled in the Medicare program between 2016 and 2019 met the minimum continuous enrollment criteria for the study. Our results may not extrapolate to those who enroll and disenroll from the program
- Data quality varies significantly across MA plans. Some MA plans fail to submit information for all encounters, leading our estimates of disease incidence to be biased downward for these enrollees

Conclusions

- For each category of pneumococcal disease (IPD, PP, and ACP), incidence is higher in the most-vulnerable quintile compared to the least-vulnerable quintile
- There are significant disparities in pneumococcal disease between the most- and least-vulnerable counties. The magnitude of these disparities in disease incidence varies by how social vulnerability is defined

References

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