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## Brief Report

## Incidence, mortality, and cost trends in nonventilator hospital-acquired pneumonia in medicaid beneficiaries, 2015–2019



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## Key Words:

NVHAP  
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Nosocomial infection  
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Nonventilator hospital-acquired pneumonia is associated with substantial morbidity, mortality, and costs during an episode of acute care. We examined NVHAP incidence, mortality, and costs of Medicaid beneficiaries over a 5-year period (2015–2019). Overall NVHAP incidence was 2.63 per 1,000 patient days, and mortality was 7.76%, with an excess cost per NVHAP case of \$20,189.

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Nonventilator hospital-acquired pneumonia (NVHAP) represents the majority of cases of hospital-acquired pneumonia (HAP), with an estimated incidence rate of 1 out of every 100 hospitalized patients and a crude mortality rate of 13%–30%.<sup>1–3</sup> NVHAP is associated with increased hospital length of stay and 30-day hospital readmissions.<sup>2,3</sup> While exact costs of NVHAP to US health care are difficult to quantify, the combined costs for all HAP types are estimated at \$3 billion annually, including post-acute and long-term health care costs.<sup>4</sup> Targeted efforts to reduce hospital-acquired infections (HAI) have decreased many infections. Unfortunately, there has not been a similar effort to decrease NVHAP.<sup>5</sup> The goal of this research brief was to examine the incidence, mortality, and costs of NVHAP among Medicaid enrollees across a 5-year period (2015–2019).

## METHODS

## Study design and data source

Data from 13 de-identified states were obtained from the IBM Watson MarketScan Medicaid Database and used to examine trends in incidence of NVHAP from 2015 to 2019. Within certain low-income parameters, those eligible for Medicaid include children, families, pregnant women, elderly individuals, and persons with disabilities. This database captures de-identified person-specific information on inpatient and outpatient medical care, dental services, and administrative claims. Descriptive analyses included all Medicaid beneficiaries admitted to a hospital between 2015 and 2019 and had no missing inpatient claims data. The Western Institutional Review Board (#ANP0008, May 2018) approved this study.

The primary outcome variable was inpatient NVHAP diagnosis, defined as a diagnosis of pneumonia 48 hours or more after hospital admission, not present on admission, and not associated with mechanical ventilation. The International Classification of Diseases Tenth Revision, Clinical Modification (ICD-10-CM) was used to identify cases, and diagnoses were further verified by matching

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additional secondary diagnostic related group (DRG) codes for pneumonia.

## RESULTS

### Overall

Of the 5,668,417 Medicaid beneficiaries included in the 2015–2019 dataset, 75,909 were diagnosed with NVHAP, for an overall rate of 1.34% and incidence of 2.63 per 1,000 patient days. Comparative data for NVHAP incidence rates and mortality by age, sex, and race are provided in [Table 1](#).

### Age

Although they made up only 19.1% of the total sample, Medicaid beneficiaries aged 45–64 had the highest NVHAP incidence/1,000 patient days (5.18). This was only slightly higher than the 65+ age group, who made up 12% of the total sample but had an overall incidence of 4.47. Those aged 0–17 had the lowest overall NVHAP incidence (.71), followed by the 18–44-year-old age group (1.87).

### Sex and race

Males had a higher NVHAP incidence/1,000 patient days than females (3.1 vs 2.32 respectively), even though there were almost twice as many females (N = 3,625,421) as males (N = 1,971,500) in the sample. White and Black Medicaid beneficiaries accounted for 77% of the total sample and 83% of the total NVHAP cases. NVHAP incidence by race was White (2.99) and Black (2.59), followed by “Other” (2.07), and Hispanic (1.6).

### Mortality

While the overall 5-year mortality rate for NVHAP was 7.76%, there were differences by group ([Table 1](#)). Beneficiaries older than 65 had the highest rate (9.39%), followed by those in the 45–65 age group (8.64%). Minimal differences were found based on gender and race.

**Table 1**  
NVHAP rates and mortality by age, sex, and race

	Non-NVHAP	NVHAP	Overall NVHAP rate	NVHAP incidence per 1,000 patient D	Total NVHAP deaths	Overall NVHAP mortality
Total	5,592,508 98.66%	75,909 1.34%	1.34%	2.63	5,887	7.76%
Age in years			NVHAP rates	Rate per 1,000 Patient D	NVHAP Mortality (N/%) by Group	NVHAP Mortality Rate by Group
0–17	1,842,172 32.94%	6,461 8.51%	0.35%	0.71	230 (3.7%)	3.56%
18–44	2,039,318 36.47%	15,788 20.80%	0.77%	1.87	883 (17%)	5.59%
45–64	1,047,483 18.73%	34,165 45.01%	3.16%	5.18	2,943 (50.3%)	8.64%
65+	673,535 12.04%	19,495 25.68%	2.81%	4.47	1,831 (29%)	9.39%
Sex						
Male	1,971,500 35.17%	36,729 48.39%	1.83%	3.1	3,123 (52.7%)	8.50%
Female	3,625,521 0.65	39,178 51.61%	1.07%	2.32	2,764 (47.3)	7.05%
Race						
White	2,710,785 48.42%	41,114 54.16%	1.49%	2.99	3,098 (52.1%)	7.54%
Black	1,615,298 28.86%	22,023 29.01%	1.35%	2.59	1,833 (32.1%)	8.32%
Hispanic	227,054 4.06%	1,425 1.88%	0.63%	1.60	126 (2.4%)	8.84%
Other	1,044,796 18.66%	11,347 14.95%	1.07%	2.07	830 (13.5%)	7.31%

## Costs

[Fig 1](#) summarizes the overall costs and costs incurred after NVHAP diagnosis. In examining costs incurred *after* an NVHAP diagnosis, there were increases in both total costs as a percentage of total NVHAP encounters (28.8%) and costs as a percentage of total inpatient costs (14.6%). The mean cost per hospital stay was \$20,189 more for individuals with NVHAP vs those without.

## DISCUSSION

These NVHAP incidence and costs findings are consistent with previous research,<sup>2–5</sup> providing further support that NVHAP prevention in the United States health care system is a critical patient safety issue.

The incidence per 1,000 patient days found in this study was similar to those of reported in previous research, ranging from 0.12–3–4.9 cases per 1,000 patient days.<sup>2,6</sup> Consistent with age-group risk findings reported by Baker and Quinn,<sup>6</sup> we found the highest incidence in Medicaid beneficiaries aged 45–64 (5.18), with a slightly lower incidence in those aged 65+ (4.47). Even though Medicaid beneficiaries aged 45–64 represented only 19% of the total sample, they accounted for almost half of the cases (45%). While increased age is a known risk factor for NVHAP, these findings provide further support that younger patients not generally thought to be at risk are also at risk for NVHAP.

The finding that men had a higher incidence of NVHAP as compared to women warrants further study. Especially given that more women (54%) than men (46%) are enrolled in Medicaid and that Medicaid beneficiaries are especially impacted by the social determinants of health.<sup>7</sup>

The use of administrative claims data and DRG codes for research is a limitation, as variable accuracy cannot be confirmed. An additional limitation is that the diagnosis of pneumonia is not always straightforward. The findings in this Medicaid population are not generalizable to broader populations and the findings on overall mortality and the higher risk for men vs women require further study. Finally, while the descriptive nature of these data provides

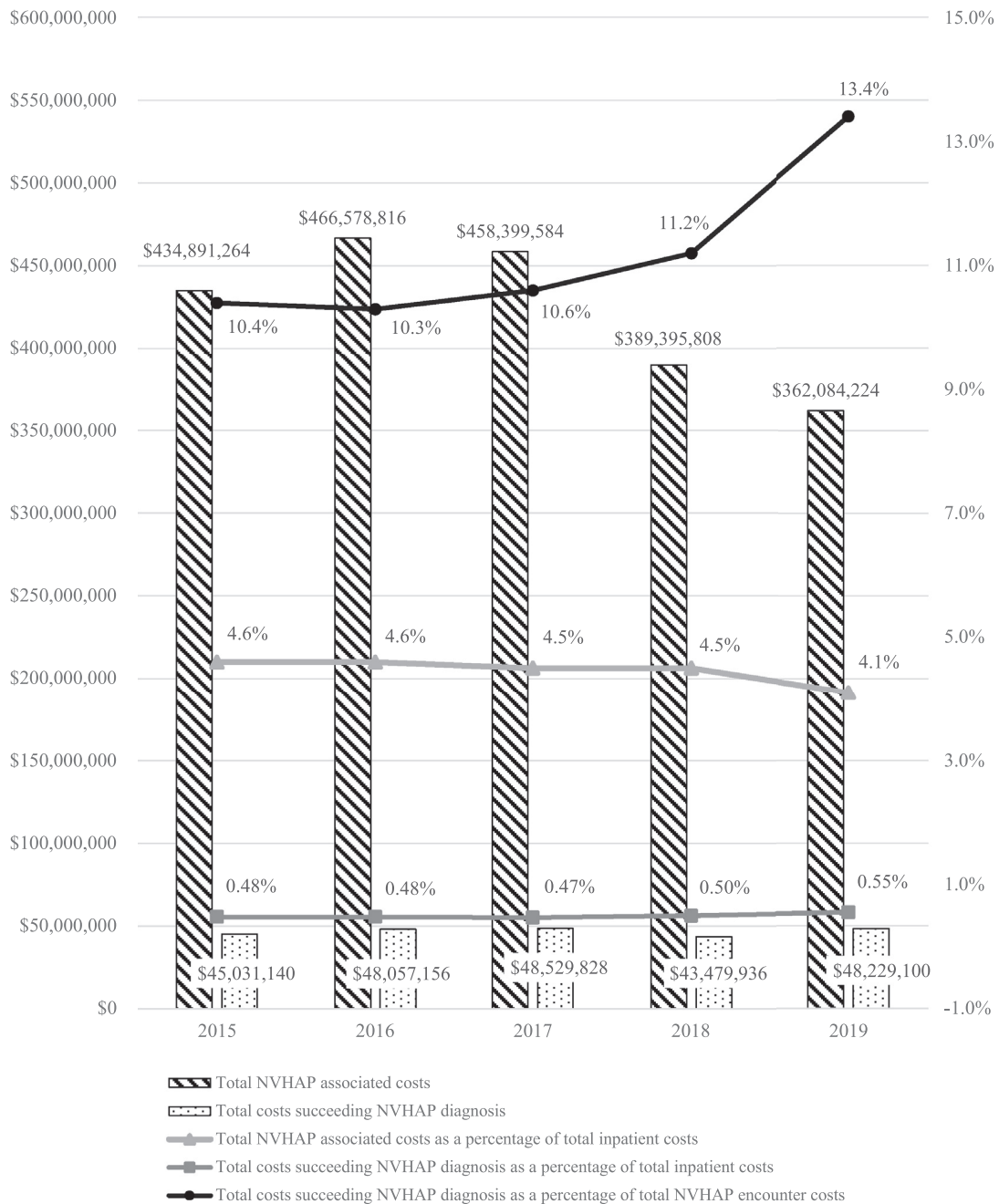


Fig 1. Costs associated with NVHAP before and after diagnosis.

some guidance for future research, it limits the interpretation of the findings.

**RELEVANCE OF FINDINGS**

There is an emerging body of evidence associating the use of comprehensive oral care and mobility to reduce the incidence of NVHAP<sup>8,9</sup> and findings provide additional support for The Joint Commission’s “Quick Safety Issue 61” call to action to implement and support NVHAP prevention and education.<sup>10</sup>

However, while Congress and the Centers for Medicare and Medicaid Services (CMS) have acted to reduce rates of some HAIs through the Hospital-Acquired Condition Reduction Program (HACRP), NVHAP is not currently included. Thus, most hospitals do not engage

in active NVHAP prevention. The time is right to include NVHAP as an HACRP HAI initiative.

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