

Clinical and Economic Burden of Pneumococcal Disease in Adults 19–64 Years With Immune-Compromising Conditions in the United States

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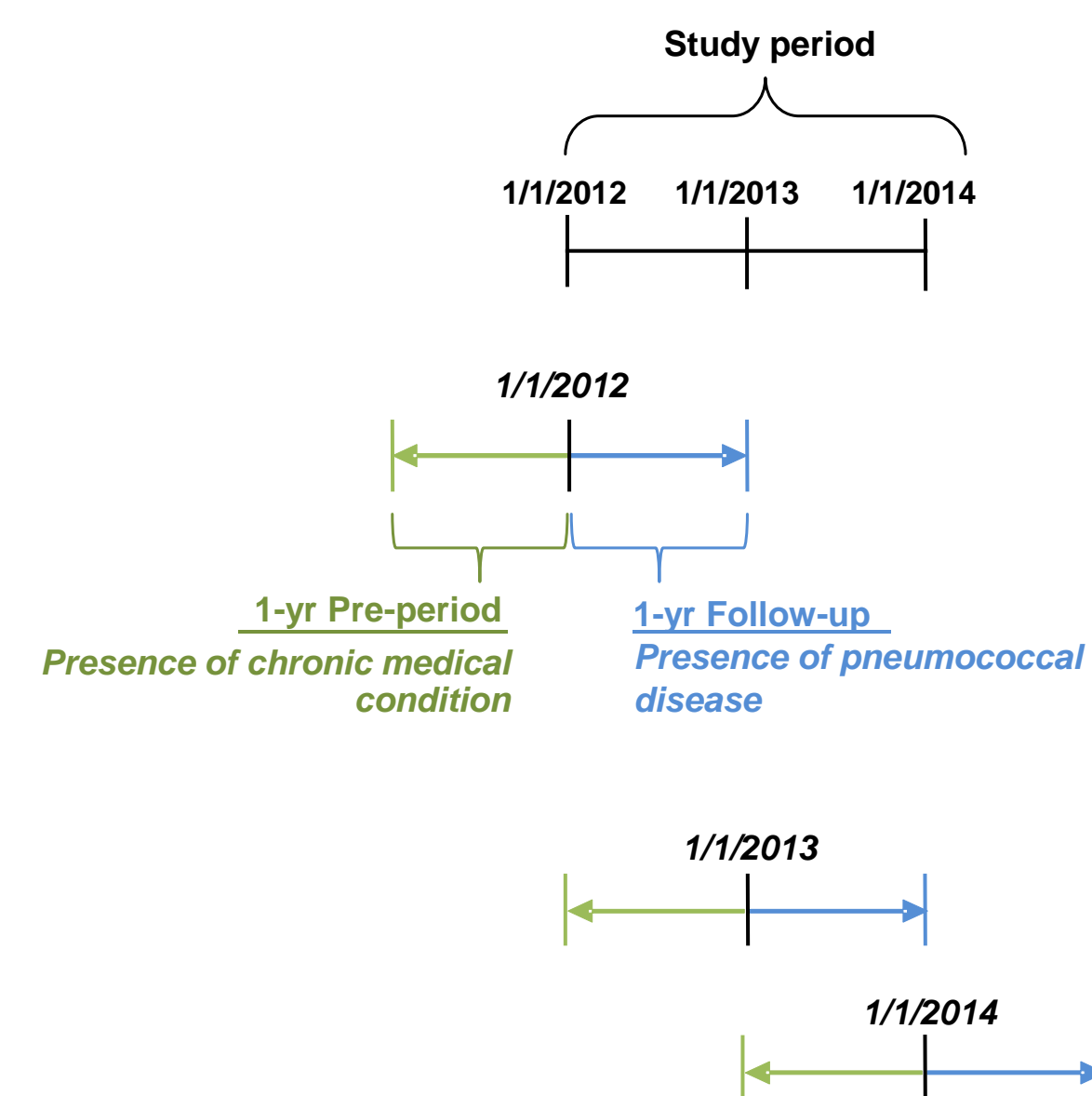
Background and Aims

- Streptococcus pneumoniae* is a gram-positive organism that causes invasive and noninvasive pneumococcal disease. The most common invasive syndromes are bacteremic pneumonia and meningitis. Acute otitis media and nonbacteremic pneumonia are common noninvasive syndromes
- Children less than 1 year and older adults are at increased risk for pneumococcal disease, as are adults with certain immune-compromising conditions
- Adults 19–64 years with immune-compromising conditions are recommended to receive pneumococcal vaccination by the Advisory Committee on Immunization Practices (ACIP). However, limited studies have examined the clinical and economic burden of pneumococcal disease in this population. We assessed pneumococcal disease rates, resource utilization, and costs in US adults 19–64 years old with chronic renal disease, cancer, asplenia, transplant, and HIV

Methods

- A retrospective observational cohort study was conducted using medical and pharmacy claims from Truven Health MarketScan® Commercial Claims and Encounters database. The database represents approximately 100 employer-sponsored private health plans covering approximately 45 million members
- Adults were included in the study if they were 19–64 years old between January 1, 2012, and December 31, 2014, had continuous enrollment (no gap of >45 days) for at least 1 year before and at least 1 day after January 1 of 2012, 2013, and/or 2014 (Figure 1)
- Adults were classified as healthy or having an immune-compromising condition based on whether they had the conditions of interest during the 1 year preceding January 1 of each calendar year. Conditions of interest were chronic renal disease, cancer, asplenia, transplant, and HIV. Two ICD-9 diagnosis codes were required to identify an individual as having a particular condition. If a patient had multiple conditions of interest in the 1 year pre-period, the patient was assigned to all diagnosed conditions. Persons without evidence of these conditions were classified as healthy
- Pneumococcal diseases (invasive pneumococcal disease [IPD] and all-cause pneumonia [ACP]) were identified through ICD-9 codes, CPT4 codes, and antibiotic use
- Outcomes included:
 - Pneumococcal disease rates:** Invasive pneumococcal disease and all-cause pneumonia
 - Rate ratios:** Comparing rates in adults 19–64 years with immune-compromising conditions to rates in healthy adults
 - Resource utilization:** Mean number of doctor's office visits, outpatient hospital visits, emergency department visits, inpatient hospitalization, and duration of inpatient hospitalization
 - Healthcare costs:** Mean total cost per episode was calculated based on claims submitted for pneumococcal disease and adjusted to 2014 dollars based on the medical care component of the Consumer Price Index (CPI)

Figure 1. Study design and study period



Characteristics

- 57 million person-years were included in the analysis; 83.0% had no condition; 3.2% had cancer, 0.9% organ transplant, 0.7% chronic renal disease, 0.2% HIV and 0.1% asplenia (Table 1)
- Among adults with chronic conditions, 88.8% of adults had only 1 condition, while 10.8% and 0.4% of adults had 2 and 3 immune-compromising conditions respectively (Table 1)

Table 1. Characteristics of study population

Variable	Value	Person-Years	%
Age	Mean ± SD	57,108,316	42.3 ± 13.2
Gender	Female	27,290,491	47.8
	Male	29,817,825	52.2
Immune-compromising conditions	Healthy	47,370,549	83.0
	Cancer	1,825,298	3.2
	Chronic renal disease	424,677	0.7
	Organ transplant	522,835	0.9
	HIV	108,116	0.2
Number of Immune-compromising conditions	Asplenia	40,692	0.1
	1	2,325,408	88.8
	2	283,603	10.8
3	9518	0.36	
Follow-up years	Mean (SD)	0.93	0.20
Age	Mean ± SD	57,108,316	42.3 ± 13.2

- Adults with immune-compromising conditions had approximately 11 times the rate of IPD and 5 times the rate of ACP compared to healthy adults (Table 2)
- Adults with 1 immune-compromising condition had approximately 10 times the rate of IPD and 5 times the rate of ACP compared to healthy adults (Table 2)
- Adults with 2 and 3 immune-compromising conditions had approximately 13 and 22 times the rate of IPD and 6 and 17 times the rate of ACP, respectively, compared to their healthy counterparts (Table 2)
- Compared to healthy adults, the risk of IPD was highest in chronic renal disease patients (RR=21.7), followed by patients with HIV (RR=17.4), organ transplant (RR=11.6), and cancer (RR=9.8) (Table 2)
- Compared to healthy adults, the risk of ACP was highest in chronic renal disease patients (RR=9.4), followed by patients with asplenia (RR=8.8), HIV (RR=4.1), and organ transplant (RR=3.7) (Table 2)

Table 2: Rate ratios for invasive pneumococcal disease and all-cause pneumonia comparing adults 19–64 years with immune-compromising conditions to healthy adults

Risk Group	IPD Rate (per 100,000 Person-Years)	Rate Ratio	All-Cause Pneumonia Rate (per 100,000 Person-Years)	Rate Ratio
Healthy	1.9	—	429.7	—
High-risk	20.1	10.5	2265.3	5.3
Cancer	18.8	9.8	2132.1	5.0
Chronic renal disease	41.4	21.7	4045.2	9.4
Organ transplant	8	4.2	1611	3.7
HIV	33.3	17.4	1748.1	4.1
Asplenia	22.1	11.6	3801.8	8.8
Number of high-risk conditions				
1	19.4	10.2	2209.7	5.1
2	25	13.2	2555	5.9
3	42	22.1	7133.7	16.6

Results

- Per IPD episode, the average number of office and inpatient visits was similar for adults with immune-compromising conditions compared to their healthy counterparts (0.3 vs 0.4 office visits and 1.0 vs 1.0 inpatient visits). However, the average length of stay was slightly higher in adults with immune-compromising conditions compared to healthy adults (7.9 vs 7.6 days, respectively). Among adults with immune-compromising conditions, chronic renal disease patients had the highest average length of stay per IPD episode (8.5 days) (Table 3)
- Per ACP episode, the average number of office visits was similar for adults with immune-compromising conditions compared to their healthy counterparts (0.6 vs 0.6 visits). However, the average number of inpatient visits and the average length of hospital stay were slightly higher in adults with immune-compromising conditions compared to healthy adults (0.8 vs 0.4 visits and 1.6 vs 4.0 days, respectively) (Table 4). Among adults with immune-compromising conditions, those with asplenia had the highest average length of stay (4.6 days) followed by chronic renal disease patients (4.5 days)

Table 3. Resource utilization per episode of invasive pneumococcal disease in adults 19–64 years

Risk Group	Doctor's Office Visits		Inpatient Hospital Visits		Length of Hospital Stay	
	Mean	SD	Mean	SD	Mean	SD
Healthy	0.4	1.3	1.0	0.3	7.6	8.2
All immune-compromising conditions	0.3	0.8	1.0	0.3	7.9	8.1
Cancer	0.3	0.6	1.0	0.3	7.8	8.2
Chronic renal disease	0.3	0.6	1.0	0.3	8.5	8.6
Organ transplant	0.2	0.6	1.0	0.4	7.2	6.7
HIV	0.2	0.6	1.0	0.0	7.2	8.6
Asplenia	1.8	3.9	0.9	0.9	6.1	7.4

Table 4. Resource utilization per episode of all-cause pneumonia in adults 19–64 years

Risk Group	Doctor's Office Visits		Inpatient Hospital Visits		Length of Hospital Stay	
	Mean	SD	Mean	SD	Mean	SD
Healthy	0.6	1.0	0.4	0.5	1.6	4.7
All immune-compromising conditions	0.6	1.8	0.8	0.7	4.0	7.9
Cancer	0.7	2.0	0.8	0.7	4.0	7.6
Chronic renal disease	0.6	1.8	0.8	0.7	4.5	8.9
Organ transplant	0.6	1.6	0.7	0.7	3.3	7.6
HIV	0.5	1.1	0.6	0.6	3.4	7.4
Asplenia	0.5	1.6	0.9	0.7	4.6	9.1

- Due to higher disease rates, the cost of IPD and ACP per 100,000 person-years in high-risk patients was 10 and 12 times the cost in healthy adults, respectively (Figures 2 and 3)
- The cost of IPD per 100,000 person-years was highest for persons with HIV (\$2.6 mm), followed by those with chronic renal disease (\$1.7 mm), and cancer (\$913,041) (Figure 2)
- The cost of ACP per 100,000 person-years was highest for persons with chronic renal disease (\$98.3 mm), followed by those with asplenia (\$95.2 mm), and cancer (\$48.8 mm) (Figure 3)

Figure 2. Cost of invasive pneumococcal disease per 100,000 person-years in healthy and high-risk adults 19–64 years

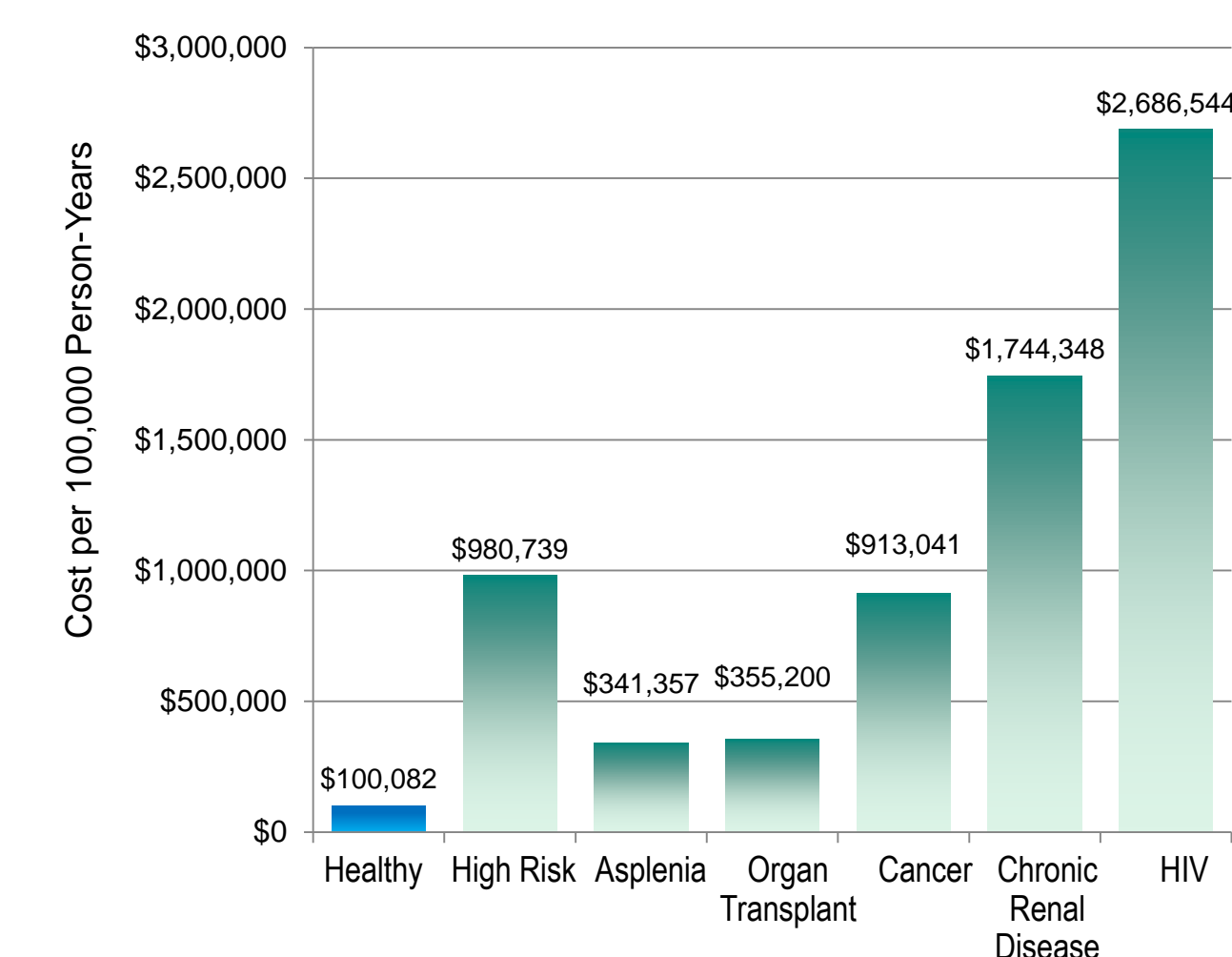
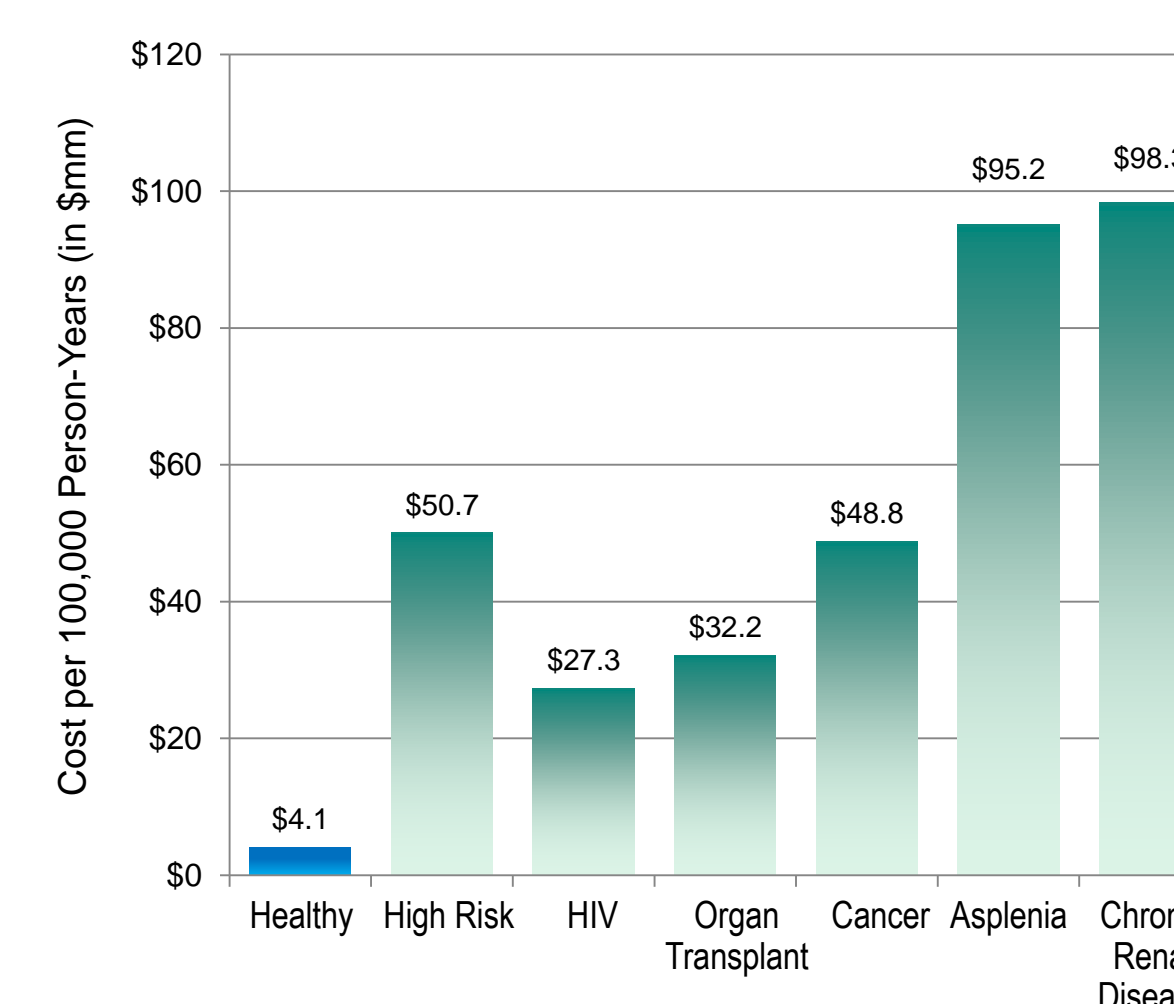


Figure 3. Cost of all-cause pneumonia per 100,000 person-years in healthy and high-risk adults 19–64 years



Limitations

The study has several limitations:

- Pneumococcal disease and immune-compromising conditions were identified using diagnosis/procedure codes, which may lead to misclassification
- Pneumococcal diseases are typically undercoded in claims, which may lead to an underestimate of the disease burden
- The study included US managed care enrollees and therefore results may not be generalizable beyond this population

Conclusions

- Limited data are available on the clinical and economic burden of pneumococcal disease in older adults with specific immune-compromising conditions
- We assessed pneumococcal disease rates, resource utilization, and costs in US adults 19–64 years with chronic renal disease, cancer, asplenia, transplant, and HIV
- Adults with immune-compromising conditions are at greater risk of pneumococcal disease compared to their healthy counterparts and they incur greater costs



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