

Invasive Meningococcal Disease Risk Factors in Individuals with Commercial and Medicare Insurance in the United States

Oscar Herrera-Restrepo¹, Marta Kwiatkowska², Samuel Huse³, Zeki Kocaata⁴, Michael Ganz⁵

¹GSK, Philadelphia, PA, USA; ²Evidera, London, UK; ³Evidera, Cambridge, MA, USA; ⁴GSK, Wavre, Belgium; ⁵Evidera, Waltham, MA, USA

Sample Selection Attrition Table, Optum CDM-SES/DODR

Criterion	Cases Remaining	Cases Excluded
Unique patients in Optum CDM-SES/DODR Jan. 1, 2010–Mar. 31, 2022	17,935	0
Had =1 emergency department or hospitalization claim with IMD diagnosis	952	16,983
At least 12 months without IMD claim prior to first IMD claim	933	19
Continuous enrollment in insurance plan ≥12 months before first IMD claim	676	257
No evidence of invasive pneumococcal disease	618	58
*Non-IMD controls will be selected and matched on up to a 1:5 basis	Cases	Controls
Matched sample:	616	3,058

Eligibility Criteria

Inclusion Criteria
Case patients, of all ages, must have had an IMD diagnosis code associated with an ED visit or hospitalization during the appropriate identification periods to be included in the study sample. IMD diagnoses were identified by International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes 0.36.X (for service dates before October 2015) or International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) diagnosis codes A39.0–A39.4, A39.5X, A39.8X, or A39.9 (for service dates in or after October 2015). Control patients must not have had any evidence of IMD during the study period to be included in the study sample. Furthermore, case and control patients must have been enrolled in their health insurance plans for at least 12 months, without any gaps greater than seven days, prior to their index date to be included in the study sample.

Exclusion Criteria
Case patients who had any evidence of IMD during their baseline periods, and all patients with evidence of invasive pneumococcal disease (IPD) at any time during the study period, were excluded from the study sample. IPD was excluded because some of its symptoms, including meningitis, coincide with IMD and because IPD and IMD also share some risk factors, including those associated with being immunocompromised, such as HIV. Other infections that may share symptoms and risk factors with IMD, such as streptococcal infection, were not excluded.

Baseline Demographic and Contextual Characteristics of IMD Cases and Non-IMD Controls (Matched Sample), Optum CDM-SES

Baseline Patient Characteristic	IMD Cases (N=616)	Non-IMD Controls (N=3,058)	Standardized Difference	p-value
Age at index date				
N	616	3058	<0.01	0.93
Mean (SD)	60.2 (21.7)	60.1 (21.6)		
Median (Range)	66.0 (0.0 - 90.0)	66.0 (0.0 - 90.0)		
Interquartile range	48.0 - 76.0	48.0 - 76.0		
Age category				
0-1	2 (0.3%)	10 (0.3%)	0.06	1
2-5	11 (1.8%)	55 (1.8%)		
6-10	5 (0.8%)	22 (0.7%)		
11-15	6 (1.0%)	30 (1.0%)		
16-20	19 (3.1%)	95 (3.1%)		

21-25	24 (3.9%)	120 (3.9%)		
26-30	15 (2.4%)	75 (2.5%)		
31-35	13 (2.1%)	65 (2.1%)		
36-40	21 (3.4%)	105 (3.4%)		
41-45	24 (3.9%)	120 (3.9%)		
46-50	28 (4.5%)	140 (4.6%)		
51-55	42 (6.8%)	207 (6.8%)		
56-60	39 (6.3%)	200 (6.5%)		
61-65	51 (8.3%)	250 (8.2%)		
66-70	68 (11.0%)	340 (11.1%)		
71-75	77 (12.5%)	384 (12.6%)		
76-80	67 (10.9%)	333 (10.9%)		
81-85	67 (10.9%)	333 (10.9%)		
86-90	37 (6.0%)	174 (5.7%)		
Sex				
Male	318 (51.6%)	1,587 (51.9%)	0.01	0.9
Female	298 (48.4%)	1,471 (48.1%)		
Census region				
Northeast	71 (11.5%)	349 (11.4%)	0.04	1
Midwest	115 (18.7%)	567 (18.5%)		
South	269 (43.7%)	1,340 (43.8%)		
West	161 (26.1%)	802 (26.2%)		
Census division				
New England	24 (3.9%)	114 (3.7%)	0.04	1
Middle Atlantic	47 (7.6%)	235 (7.7%)		
East North Central	65 (10.6%)	321 (10.5%)		
West North Central	50 (8.1%)	246 (8.0%)		
South Atlantic	143 (23.2%)	715 (23.4%)		
East South Central	23 (3.7%)	114 (3.7%)		
West South Central	103 (16.7%)	511 (16.7%)		
Mountain	66 (10.7%)	327 (10.7%)		
Pacific	95 (15.4%)	475 (15.5%)		
Race/Ethnicity				
Asian	31 (5.0%)	154 (5.0%)	0.16	0.02
Black	82 (13.3%)	275 (9.0%)		
Hispanic	74 (12.0%)	387 (12.7%)		
White	395 (64.1%)	2,087 (68.2%)		
Unknown	34 (5.5%)	155 (5.1%)		
Education level				
Less than 12th Grade	4 (0.6%)	12 (0.4%)	0.23	0.01
High School Diploma	175 (28.4%)	689 (22.5%)		
Bachelor Degree Plus	95 (15.4%)	613 (20.0%)		
Unknown	22 (3.6%)	107 (3.5%)		
Household income				
<\$40,000	155 (25.2%)	641 (21.0%)	0.18	<0.01
\$40,000-\$49,999	59 (9.6%)	258 (8.4%)		
\$50,000-\$59,999	42 (6.8%)	236 (7.7%)		
\$60,000-\$74,999	60 (9.7%)	308 (10.1%)		
\$75,000-\$99,999	85 (13.8%)	461 (15.1%)		

\$100,000+	133 (21.6%)	852 (27.9%)		
Unknown	82 (13.3%)	302 (9.9%)		
Poverty status				
Above 400% FPL	533 (86.5%)	2,747 (89.8%)	0.03	0.03
Below 400% FPL	1 (0.2%)	9 (0.3%)		
Unknown	82 (13.3%)	302 (9.9%)		
Number of adults in household				
N	616	3058	0.11	0.02
Mean (SD)	1.5 (1.2)	1.6 (1.3)		
Median (Range)	1.0 (0.0–8.0)	1.0 (0.0–9.0)		
Interquartile range	1.0–1.0	1.0–2.0		
Number of children in household				
N	616	3058	0.07	0.08
Mean (SD)	0.1 (0.6)	0.2 (0.6)		
Median (Range)	0.0 (0.0–5.0)	0.0 (0.0–7.0)		
Interquartile range	0.0–0.0	0.0–0.0		
Resides in state with MenACWY vaccination mandate*				
Yes	262 (42.5%)	1,297 (42.4%)	<0.01	0.96
No	354 (57.5%)	1,761 (57.6%)		
% of children ≤18 in state covered by insurance (State-level)				
N	285	1409	0.01	0.93
Mean (SD)	93.2 (2.7)	93.2 (2.7)		
Median (Range)	93.9 (86.5–98.4)	93.8 (86.5–98.4)		
Interquartile range	91.3–95.2	91.3–95.2		
% of children ≤18 in state with a medical home** (State-level)				
N	285	1409	0.01	0.87
Mean (SD)	46.8 (4.9)	46.7 (4.9)		
Median (Range)	47.6 (35.2–59.9)	47.6 (35.2–59.9)		
Interquartile range	42.3–50.6	42.3–50.6		
Number of Pediatricians per 10,000 Population (State-level)				
N	343	1696	<0.01	0.98
Mean (SD)	18.0 (4.1)	18.0 (4.0)		
Median (Range)	16.8 (9.9–30.5)	16.8 (9.9–30.5)		
Interquartile range	15.5–19.3	15.5–19.3		
Per capita healthcare expenditures (State-level)				
N	346	1711	0.01	0.8
Mean (SD)	10,177.6 (1,410.5)	10,156.7 (1,388.4)		
Median (Range)	9,982.6 (7,433.2–4,577.7)	9,982.6 (7,433.2–4,577.7)		
Interquartile range	9,240.7–10,547.5	9,234.6–10,521.1		

Abbreviations: FPL = Federal poverty limit; ICU = intensive care unit; IMD = Invasive Meningococcal Disease; MenACWY = Meningococcal A, C, W, and Y serogroup; PCP = primary care provider, SD = Standard Deviation. Note: *Mandate for school/college entry by age 16-21. ** Percentage of children in the state who receive coordinated, care within a medical home.

Baseline Clinical Characteristics of IMD Cases and Non-IMD Controls (Matched Sample), Optum CDM-SES

Baseline Patient Characteristic	IMD Cases (N=616)	Non-IMD Controls (N=3,058)	Standardized difference	p-value
Risk factors for IMD				
Eculizumab use	1 (0.2%)	0 (0.0%)	0.06	0.17
Functional/anatomic asplenia	2 (0.3%)	3 (0.10%)	0.05	0.2
Human immunodeficiency virus	8 (1.3%)	6 (0.2%)	0.13	<0.01
Complement component deficiencies	1 (0.2%)	1 (0.03%)	0.04	0.31
Sickle-cell disease	0 (0.0%)	2 (0.07%)	0.04	1
Number of pediatrician/PCP visits				
N	616	3058	0.34	<0.01
Mean (SD)	5.1 (6.1)	3.3 (4.4)		
Median (Range)	3 (0–46)	2 (0–42)		
Interquartile range	1–7	0–4		
Number of other physician visits				
N	616	3058	0.32	<0.01
Mean (SD)	9.0 (12.3)	5.6 (8.9)		
Median (Range)	5 (0–89)	2 (0–102)		
Interquartile range	1–12	0–7		
Number of office visits				
0	35 (5.7%)	430 (14.1%)	0.44	<0.01
1	33 (5.4%)	223 (7.3%)		
2-3	68 (11.0%)	466 (15.2%)		
4-5	70 (11.4%)	405 (13.2%)		
6-7	55 (8.9%)	296 (9.7%)		
8-9	45 (7.3%)	248 (8.1%)		
10-12	70 (11.4%)	268 (8.8%)		
13-15	43 (7.0%)	185 (6.0%)		
16+	197 (32.0%)	537 (17.6%)		
Number of emergency department visits				
N	616	3058	0.49	<0.01
Mean (SD)	1.6 (2.5)	0.5 (1.8)		
Median (Range)	1 (0–28)	0 (0–34)		
Interquartile range	0–2	0–0		
Number of hospitalizations				
N	616	3058	0.88	<0.01
Mean (SD)	1.3 (1.8)	0.2 (0.6)		
Median (Range)	1 (0–13)	0 (0–7)		
Interquartile range	0–2	0–0		
Number of ICU visits				
N	616	3058	0.86	<0.01
Mean (SD)	0.6 (0.9)	0.0 (0.3)		
Median (Range)	0 (0–6)	0 (0–5)		
Interquartile range	0–1	0–0		

Abbreviations: IMD = Invasive Meningococcal; Disease; PCP = primary care provider, SD = Standard Deviation

Abbreviations

IMD invasive meningococcal disease, US United States, aOR adjusted odds ratios, HIV human immunodeficiency virus

References

1. Harrison LH, Pelton SI, Wilder-Smith A, et al. The Global Meningococcal Initiative: recommendations for reducing the global burden of meningococcal disease. *Vaccine*. 2011;29(18):3363-3371

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