

Introduction

- Persons with multiple sclerosis (MS) are commonly burdened with comorbid conditions such as hypertension, hyperlipidemia, depression, anxiety, and other autoimmune disorders (e.g. autoimmune thyroid disease and psoriasis)¹, which adversely impact long-term outcomes.
- Asthma is a common condition in adults. However the prevalence in those with MS are unclear. It is important to characterize the burden of asthma in MS as both diseases are disruptive to daily living, diminish quality of life, and are costly; thus, together these negative influences may be compounded in those with both diseases.

Objective

To evaluate the age-, gender-, and race-specific prevalence rates of asthma in MS patients compared to non-MS individuals using electronic health record (EHR) information from the **IBM® Explorys EPM: Explore database (Explorys)**.

Explorys Database

- Extracts clinical, operational, and financial data from various sources (e.g. ambulatory, in-patient)
- Contains de-identified data from **26 major integrated health networks, 50 states, and 56.5 million US patients**.
- Has demonstrated external validity for investigating complex medical conditions, including MS.²

References

- Marrie, R. A. *et al. Mult Scler* (2015).
- Mirsky, M. M. *et al. Int J MS Care* (2016).
- Howard, J. *et al. Neurol Clin* (2016).
- Koch-Henriksen, N. *et al. Lancet. Neurol* (2010).
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Contact Eddie Hill
exh279@case.edu
Case Western Reserve University School of Medicine

Methods

- Patient cohorts were built in May 2018 based on combinations of SNOMED-CT diagnoses of “multiple sclerosis” and “asthma” at any point in time, by age, gender, and racial attributes.
- Age-, gender-, and race-specific prevalence rates of asthma were determined in those with and without MS.
- Age- and gender- adjusted prevalence rates were compared using **direct standardization** and tests for proportions. Prevalence ratios (PRs) and 95% confidence intervals (CI) were calculated.

Results

- In the MS cohort (N=141,880), the prevalence of asthma had a **U-shaped distribution**, with the greatest burden on the young and the elderly. There was a uniform distribution in the non-MS cohort (N= 56,416,790) (**Figure 1**).
- The **crude prevalence of asthma was 2.48** (95% CI: 2.45, 2.52; p<0.0001) times higher in the MS cohort than the non-MS cohort (16.5% versus 6.7%, respectively) (**Table 1**).
- After adjusting for age and gender, asthma was 2.97 times more common in MS patients** than in the general population (95% CI: 2.96,2.97) (**Table 2**).
- Comparing asthma prevalence among subgroups, the burden of asthma was greater in MS than in non-MS patients as follows (**Table 2**):
 - White Americans, PR: 2.48 (2.48,2.48).
 - African Americans, PR: 1.48 (1.47,1.48).
 - All females, PR: 2.65 (2.65,2.66).
 - All males, PR: 3.39 (3.38,3.40).

Figure 1. Prevalence of asthma by age, gender, and MS dx in the total population (A), in White Americans (B), and in African Americans (C).

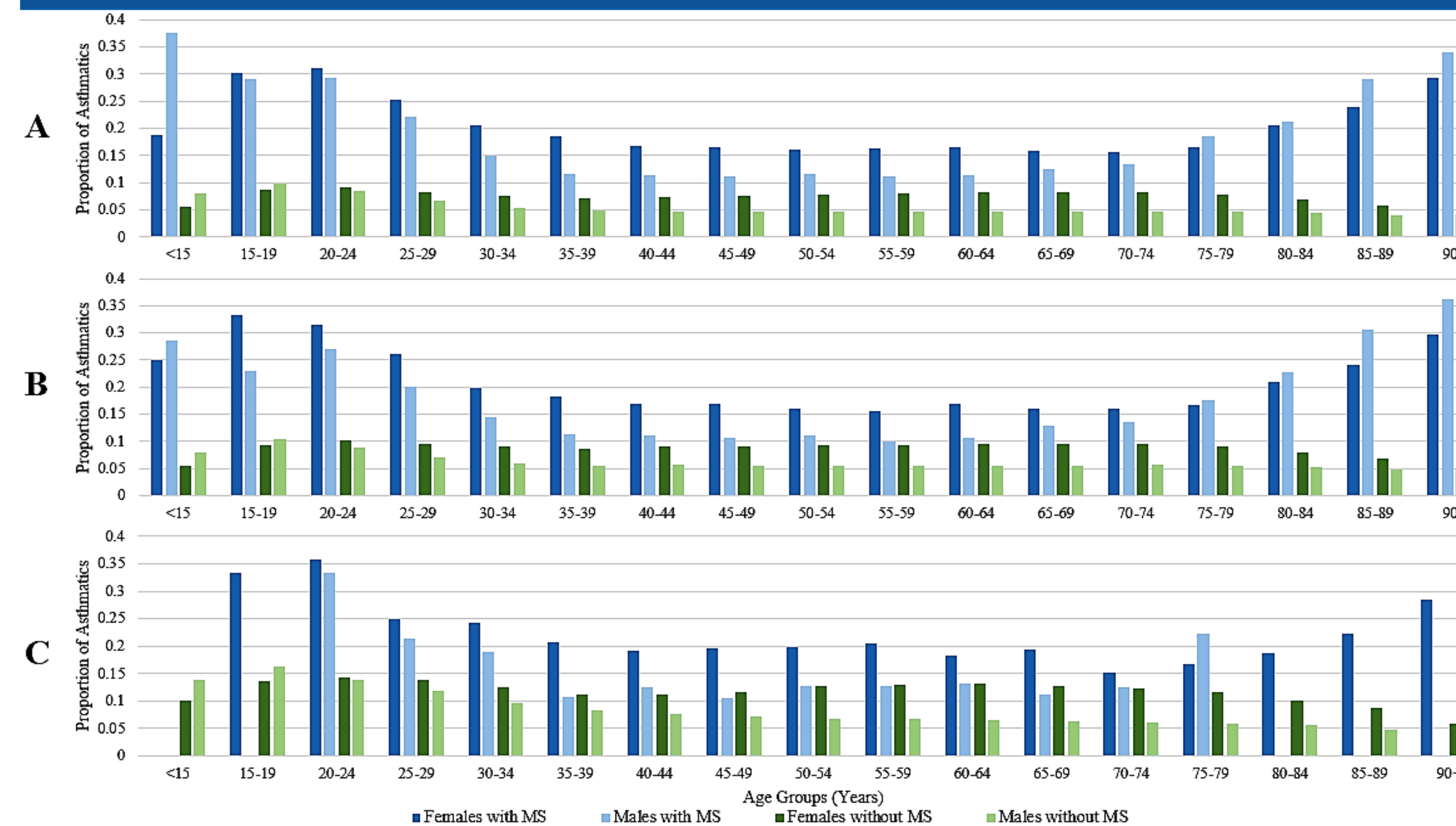


Table 1. Prevalence of asthma in the total population by MS dx.

Age	MS			Non-MS (Control)			Total Population	Expected Asthma Count Based on Asthma Prevalence in MS cohort	Expected Asthma Count Based on Asthma Prevalence in Non-MS cohort	Prevalence Ratio	P-Value
	Asthma Count	Total Count	Prevalence of Asthma	Asthma Count	Total Count	Prevalence of Asthma					
<15	90	320	0.281	440,380	6,354,960	0.069	6,355,280	1,787,422.50	440,402.18	4.06	<0.0005
15-19	170	570	0.298	235,510	2,533,330	0.093	2,533,900	755,724.56	235,562.99	3.21	<0.0005
20-24	470	1,540	0.305	262,080	2,986,970	0.088	2,988,510	912,077.73	262,215.12	3.48	<0.0005
25-29	890	3,640	0.245	284,720	3,705,540	0.077	3,709,180	906,914.89	284,999.68	3.18	<0.0005
30-34	1,220	6,370	0.192	258,310	3,881,040	0.067	3,887,410	744,527.50	258,733.97	2.88	<0.0005
35-39	1,680	9,950	0.169	241,070	3,914,300	0.062	3,924,250	662,586.93	241,682.79	2.74	<0.0005
40-44	1,800	11,680	0.154	221,410	3,553,470	0.062	3,565,150	549,423.80	222,137.76	2.47	<0.0005
45-49	2,270	14,810	0.153	233,660	3,736,580	0.063	3,751,390	574,993.61	234,586.12	2.45	<0.0005
50-54	2,490	16,610	0.150	240,350	3,753,420	0.064	3,770,030	565,164.04	241,413.62	2.34	<0.0005
55-59	2,800	18,690	0.150	261,680	4,019,920	0.065	4,038,610	605,035.21	262,896.64	2.30	<0.0005
60-64	2,730	17,900	0.153	252,890	3,846,660	0.066	3,864,560	589,399.37	254,066.80	2.32	<0.0005
65-69	2,260	15,020	0.150	226,320	3,444,030	0.066	3,459,050	520,469.57	227,307.02	2.29	<0.0005
70-74	1,580	10,560	0.150	194,410	2,941,320	0.066	2,951,880	441,663.86	195,107.98	2.26	<0.0005
75-79	1,100	6,390	0.172	147,950	2,351,110	0.063	2,357,500	405,829.42	148,352.11	2.74	<0.0005
80-84	750	3,600	0.208	108,140	1,897,660	0.057	1,901,260	396,095.83	108,345.15	3.66	<0.0005
85-89	580	2,270	0.256	80,340	1,587,960	0.051	1,590,230	406,314.27	80,454.85	5.05	<0.0005
90+	600	1,960	0.306	71,370	1,908,520	0.037	1,910,480	584,840.82	71,443.30	8.19	<0.0005
All	23,480	141,880	0.165	3,760,590	56,416,790	0.067	56,558,670	11,394,513.93	3,769,711.58	2.48	<0.0005

Race	Crude PR (95% CI)	P-value	Sex/age adjusted PR (95% CI)	P-value	Female age-adjusted PR (95% CI)	P-value	Male age-adjusted PR (95% CI)	P-value
All	2.48 (2.45, 2.52)	<0.0001	2.97 (2.96, 2.97)	<0.0001	2.65 (2.65, 2.66)	<0.0001	3.39 (3.38, 3.40)	<0.0001
White American	2.17 (2.14, 2.21)	<0.0001	2.48 (2.48, 2.48)	<0.0001	2.38 (2.37, 2.38)	<0.0001	2.80 (2.79, 2.80)	<0.0001
African American	1.70 (1.64, 1.77)	<0.0001	1.48 (1.47, 1.48)	<0.0001	1.63 (1.63, 1.64)	<0.0001	1.24 (1.24, 1.25)	<0.0001

Discussion

- Asthma prevalence among **persons with MS is significantly greater than asthma prevalence in non-MS individuals** across age, gender, and racial subpopulations.
- In the MS cohort, the greatest asthma burden occurred among the young and the elderly (>20% prevalence among those < 30 or ≥ 80 years; prevalence range: **15 to 30%**).
- The differences in the underlying Th1/Th2 mechanisms contributing to MS onset and asthma onset may support an inverse relationship between the two diseases. However, the co-occurrence of MS and asthma is not unexpected, considering both diseases have increasing incidence, increasing prevalence, and overlapping risk factors (including genetic factors, tobacco smoke exposure, vitamin D insufficiency, and obesity).³⁻⁵
- The co-occurrence of MS and asthma may impact daily functioning, quality of life, and prognosis of patients. **The results emphasize the need for continued research and need for comorbidity management as part of comprehensive MS care.**

Table 2. Prevalence ratios (PRs) for asthma between the MS and non-MS cohorts