Characterizing RRMS patients with hypertension, hyperlipidemia, and asthma

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DISCLOSURES

None to report.

BACKGROUND

- Hypertension is 25% more common in those with MS than the general population (1).
- Th exact prevalence of hyperlipidemia in the MS population is unknown, however, the MS population has higher rates of obesity and vascular comorbidities than the general population (2-4).
- Asthma is three times more common in persons with MS, and even more common for persons with MS who are women, Black Americans, or less than 30 or greater than 80 years of age (5).
- Presence of comorbidities, in particular hypertension, hyperlipidemia, and obstructive lung disease, in the MS population have been associated with more rapid disease progression, reduced daily functioning, and lower quality of life scores (6-9).

OBJECTIVE

- To determine the socio-demographic and clinical attributes associated with hypertension, hyperlipidemia, and asthma in relapsing remitting (RR) MS.

1. Briggs, Hill, Abboud, *Eur J Neurol* 2021. 2. Khurana, Bamer, Turner, et al, *Am J Phys Med Rehabil* 2009. 3. Pilutti, Dlugonski, Pula, et al, *J Obes* 2012. 4. Karmon, Ramanathan, Minagar, et al, *Neurol Res* 2012. 5. Marrie, Horwitz, Cutter, Tyry, *Acta Neurol Scand* 2012. 6. Conway, Thompson, Cohen, *Mult Scler*. 7. Marrie, Rudick, Horwitz, et al, *Neurology* 2010. 8. Tettey, Simpson, Taylor, et al, *Mult Scler* 2014. 9. Kowalec, McKay, Patten, et al, *Neurology* 2017.

STUDY POPULATION

- The initial study population consisted of 2,012 RRMS patients with >1 clinical visit between 1/2009-6/2012 at the Mellen Center for MS Treatment and Research, a tertiary MS referral center at the Cleveland Clinic.

- The sample was restricted to **1,778 patients** who had body mass index (BMI) scores, age ≥18 years, and ≥1 impairment measure recorded in their electronic health record (EHR).

VARIABLES OF INTEREST

- Key outcomes were a diagnosis of hypertension, hyperlipidemia, and asthma.

- Key covariates extracted from the EHR were age, sex, BMI, median income of ZIP code of residence, race (non-Hispanic White, non-Hispanic Black, and Other), smoking status (current, former, never), and insurance payer (private, self-pay [paying out-of-pocket pay or use of financial aid], Medicare, and Medicaid).

STATISTICAL ANALYSES

- Descriptive analysis including means, percentages, and standard deviations were performed to assess the demographic and clinical characteristics of the study population.

- Three multivariable logistic regression models were conducted with each outcome as the dependent variable and the other two outcomes plus covariates age, sex, BMI, race, smoking status, insurance payer, and median income terciles as independent variables. Prevalence odds ratios (ORs) and 95% confidence intervals were calculated.

- All analyses were conducted using RStudio v1.3.1056. A two-sided alpha of 5% was considered statistically significant.

RESULTS

Descriptive Analysis - Means & Percentages

- Mean age was 42.9 years
- Mean MS onset age was 33.7 years
- Female:male ratio was 3:1.
- 86.2% and 11.6% were White and Black Americans, respectively.
- 58.2% ever smokers
- 55.8% had private insurance

Characteristic		Study population	Hypertension	Hyperlipidemia	Asthma	No comorbidity
N		1,778	360	243	130	1219
Percent of study population			20.2%	13.7%	7.3%	68.6%
Age (years)		42.9 (10.4)	48.8 (9.4)	50.5 (8.9)	42.8 (10.3)	40.9 (9.9)
Males		25.9%	26.6%	34.2 %	19.2%	25.1%
Age of onset (years; N=1340)		33.7 (9.6)	37.8 (9.8)	38.7 (9.8)	34.4 (9.6)	32.3 (9.1)
Disease duration (years; N=1340)		9.1 (8.1)	10.6 (8.5)	12.0 (8.7)	8.9 (7.6)	8.5 (7.9)
Body mass index (kg/m^2; N=1778)		28.8 (7.2)	31.8 (7.3)	30.3 (6.3)	30.6 (7.2)	27.8 (6.9)
Median 2010 household income for ZIP code of residence		$54,409	$51,814	$54,438	$51,679	$55,187
Medium Income Tercile	$11,792-$45,575	33.1%	41.4%	32.9%	39.2%	31.2%
	$45,579-$59,919	32.8%	31.3%	31.7%	36.2%	32.6%
	$59,919-$159,713	34.1%	27.3%	35.4%	24.6%	36.3%
Race	Black	11.6%	19.6%	8.2%	15.4%	9.7%
	White	86.2%	79.4%	89.7%	82.3%	87.9%
	Other	1.1%	0.3%	1.2%	1.5%	1.2%
	Missing	1.0%	0.6%	0.8%	0.8%	1.1
Smoking status	Current	16.9%	13.5%	12.8%	16.2%	18.4%
	Former	25.9%	28.8%	33.7%	25.4%%	24.0%
	Never	41.3%	39.0%	38.3%	43.1%	42.3%
	Missing	15.9%	18.7%	15.2%	15.4%	0.7%
Insurance	Medicaid	4.8%	5.8%	1.6%	6.9%	4.7%
	Medicare	10.3%	14.7%	15.2%	13.8%	8.3%
	Private	55.8%	55.1%	57.6%	46.2%	57.2%
	Self-pay	28.5%	25.8%	24.7%	33.1%	29.2%
	Missing	0.6%	0.6%	0.8%	0%	0.7%

RESULTS I

Associations from MLR for hypertension in RRMS patients

- Hypertension prevalence increased per year increase in age (OR=1.07; $p<5x10^{-8}$) as well as per unit increase in BMI (OR=1.06; $p<5x10^{-8}$).
- Hypertension was more common among Black Americans compared to White Americans (OR=2.05; p=0.0003), less common in those whose median income was in the middle (OR=0.72; p=0.047) or highest (OR=0.62; p=0.006) tercile compared to the lowest.
- Hypertension was also more common in those with the hyperlipidemia (OR=3.31; $p<5x10^{-8}$) and asthma (OR=1.75; p=0.01).

Predictors		Hypertension	
		OR	P
Male (vs female)		1.07 (0.78, 1.45)	0.67
Age		**1.07 (1.06, 1.09)**	**0.00**
BMI		**1.07 (1.05, 1.08)**	**0.00**
Comorbidities	Hypertension	-	-
	Hyperlipidemia	**3.31 (2.40, 4.58)**	**0.00**
	Asthma	**1.75 (1.11, 2.73)**	**0.02**
Median Income Tercile (vs 1)	2	**0.72 (0.51, 0.99)**	**0.05**
	3	**0.62 (0.44, 0.87)**	**0.01**
Race (vs White American)	Black American	**2.05 (1.38, 3.02)**	**0.00**
	Other	0.33 (0.02, 1.68)	0.29
	Missing	0.53 (0.08, 2.17)	0.43
Smoking status (vs never)	Current	0.88 (0.58, 1.33)	0.55
	Former	1.08 (0.77, 1.50)	0.67
	Missing	1.26 (0.86, 1.84)	0.24
Insurance (vs private)	Medicaid	1.62 (0.85, 2.98)	0.13
	Medicare	1.06 (0.69, 1.60)	0.80
	Self-pay	0.99 (0.72, 1.36)	0.96
	Missing	1.13 (0.16, 5.11)	0.88

RESULTS II

Associations from MLR for hyperlipidemia in RRMS patients

- Hyperlipidemia prevalence increased per year increase in age (OR=1.08; $p<5x10^{-8}$) and unit increase in BMI (OR=1.03; p=0.02).
- Unlike with hypertension, however, hyperlipidemia was more common in RRMS patients who were male (OR=1.78; p=0.0004), and less common among Black Americans (OR=0.44; p=0.004).
- Hyperlipidemia was more common in those who were also hypertensive (OR=3.27; $p<5x10^{-8}$) and asthmatic (OR=1.94; p=0.008).

Predictors		Hyperlipidemia	
		OR	P
Male (vs female)		**1.78 (1.29, 2.46)**	**0.00**
Age		**1.08 (1.07, 1.10)**	**0.00**
BMI		**1.03 (1.00, 1.05)**	**0.02**
Comorbidities	Hypertension	**3.27 (2.36, 4.54)**	**0.00**
	Hyperlipidemia	-	-
	Asthma	**1.94 (1.17, 3.15)**	**0.01**
Median Income Tercile (vs 1)	2	0.74 (0.51, 1.09)	0.12
	3	0.87 (0.59, 1.27)	0.46
Race (vs White American)	Black American	**0.44 (0.24, 0.75)**	**0.00**
	Other	2.27 (0.50, 7.36)	0.21
	Missing	0.63 (0.09, 2.66)	0.58
Smoking status (vs never)	Current	0.86 (0.53, 1.37)	0.53
	Former	1.21 (0.85, 1.74)	0.29
	Missing	0.82 (0.52, 1.27)	0.38
Insurance (vs private)	Medicaid	0.46 (0.13, 1.23)	0.17
	Medicare	1.00 (0.63, 1.58)	0.99
	Self-pay	0.88 (0.62, 1.25)	0.50
	Missing	1.25 (0.17, 5.88)	0.80

RESULTS III

Associations from MLR for asthma in RRMS patients

- Asthma was more common in RRMS patients with hypertension (OR=1.71; p=0.02) and hyperlipidemia (OR=1.91; p=0.01)
- No significant association between asthma and the available socio-demographic measures.
- Neither smoking status, insurance payer, nor disease duration were significantly associated with the prevalence of any of the three comorbidities across models.

Predictors		Asthma	
		OR	P
Male (vs female)		0.64 (0.39, 0.99)	0.05
Age		0.99 (0.97, 1.01)	0.16
BMI		1.02 (1.00, 1.05)	0.09
Comorbidities	Hypertension	**1.71 (1.09, 2.66)**	**0.02**
	Hyperlipidemia	**1.91 (1.16, 3.10)**	**0.01**
	Asthma	-	-
Median Income Tercile (vs 1)	2	1.09 (0.70, 1.68)	0.71
	3	0.71 (0.43, 1.14)	0.16
Race (vs White American)	Black American	1.08 (0.61, 1.82)	0.79
	Other	1.22 (0.19, 4.51)	0.79
	Missing	0.86 (0.05, 4.41)	0.88
Smoking status (vs never)	Current	0.86 (0.49, 1.45)	0.58
	Former	0.90 (0.57, 1.42)	0.67
	Missing	0.91 (0.52, 1.55)	0.74
Insurance (vs private)	Medicaid	1.49 (0.64, 3.16)	0.32
	Medicare	1.55 (0.85, 2.71)	0.13
	Self-pay	1.43 (0.94, 2.16)	0.09
	Missing	NA	NA

CONCLUSIONS

- Socio-demographic characteristics such as **older age, higher BMI, lower income, and being Black increased odds** that an individual with MS had **hypertension**.

- **Being male, older age, higher BMI, and being Black increased odds** that an individual with MS had **hyperlipidemia**.

- All three comorbidities under study have **significant odds** of occurring in combination in MS patients.

- Understanding common traits of RRMS patients with particular comorbidities may better equip healthcare providers to identify at-risk MS patients who may benefit from health promotion and improved comprehensive care.

- Collectively, these findings add to the growing literature that demonstrates comorbidity management must be a central part of comprehensive MS care.