Characterizing relapsing remitting multiple sclerosis patients with hypertension, hyperlipidemia, and asthma

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Background

1. I worked with the Neuroimmunology Disorders Gene-Environment Epidemiology Lab (NDGE) in the Department of Population and Quantitative Health Sciences to profile multiple sclerosis (MS) patients with common chronic comorbidities.
2. Hypertension, hyperlipidemia, and asthma are common in MS patients and negatively impact quality of life & long-term outcomes.
3. Unfortunately there is a paucity of data characterizing MS patients who are burdened by these chronic conditions.

Learning Objectives

1. Expand expertise in identifying and applying appropriate statistical modeling techniques on a novel data set.
2. Gain experience in using R throughout the data management process including cleaning, descriptive analysis, and modeling.
3. Effectively communicate statistical methods and results in a professional setting.

Activities

1. Conducted a descriptive analysis of the MS patient population.
2. Built multivariable logistic regression models with comorbidities as outcomes and socio-demographic attributes as predictors.

Deliverables

1. Table 1 of MS patients by comorbidity.
2. Comprehensive R Markdown portfolio that details the modeling process.
3. Abstract submission to the 2021 meeting of the Americas Committee for Treatment and Research in MS (ACTRIMS). This is the largest MS conference in the Americas.

Lessons Learned

1. Statistical modeling is very much an iterative process that requires countless revisions as new ideas emerge.
2. There is not always one obviously correct modeling technique, and relying on those with content and statistical experience is crucial to being successful.

Public Health Implications

1. There were distinct socio-demographic patterns associated with hypertension, hyperlipidemia, and asthma in MS patients.
2. These results may help healthcare providers identify at-risk MS patients who may benefit from health promotion and improved comprehensive care.

Results

Hypertension (Figure 1) was more common among Black Americans compared to White Americans (POR=2.05; p=0.0003) and in those with hyperlipidemia (POR=3.31; p<5x10-8) and asthma (POR=1.75; p=0.01), but less common in those whose median income was in the middle (POR=0.72; p=0.047) or highest (POR=0.62; p=0.006) terciles compared to the lowest. Hypertension odds increased with age (POR=1.07; p<5x10-8) and BMI (POR=1.06; p<5x10-8).

Hyperlipidemia (Figure 2) was more common in RRMS patients who were male (POR=1.78; p=0.0004), hypertensive (POR=3.27; p<5x10-8), and asthmatic (POR=1.94; p=0.008); but less common among Black Americans (POR=0.44; p=0.004). Hyperlipidemia odds increased with age (POR=1.08; p<5x10-8) and BMI (POR=1.03; p=0.02).

Asthma was more common in RRMS patients with hypertension (POR=1.71; p=0.02) and hyperlipidemia (POR=1.91; p=0.01).

Sample effect sizes

Figure 1

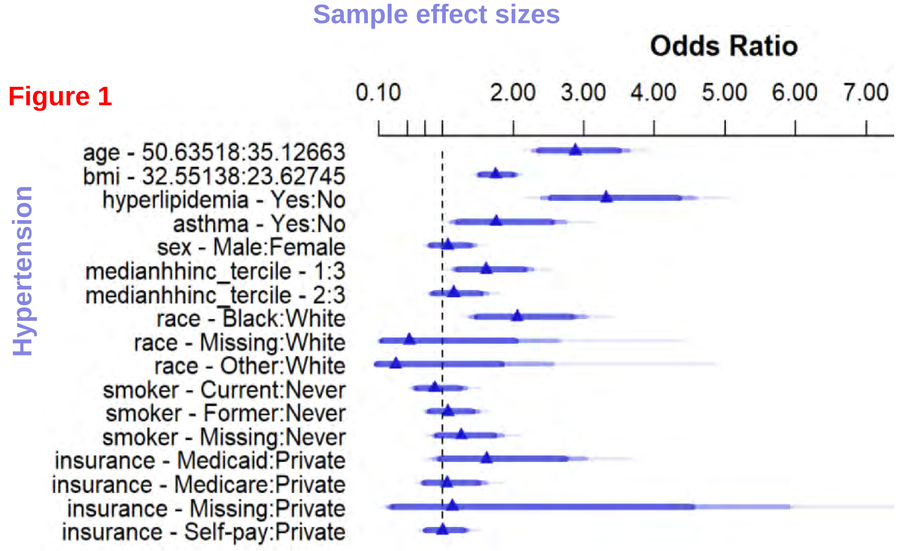
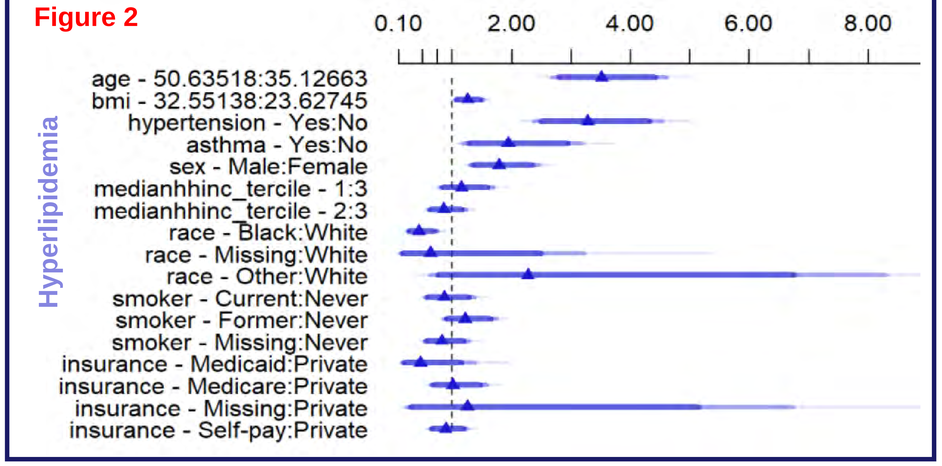


Figure 2



Population

The research population includes 2,012 MS patients with >1 clinical visit between 1/1/2009 to 5/29/2012 at the Mellen Center for MS Treatment and Research, a tertiary MS referral center at the Cleveland Clinic.

Methods

Electronic health record (EHR) review determined whether each patient had hypertension, hyperlipidemia, or asthma, and age, sex, race, smoking status, insurance payer, body mass index (BMI), disease duration, and ZIP code of residence were subsequently extracted. Median household income terciles by ZIP code was determined using 2010 US Census data. A multivariable logistic model was conducted with hypertension as the dependent variable and all other variables as well as hyperlipidemia and asthma as independent variables. Similar models were conducted with hyperlipidemia and asthma as the dependent variable. A two-sided alpha of 5% was considered statistically significant.

Table 1. Characteristics of the study population by comorbidity

Characteristic		Study population	Hypertension	Hyperlipidemia	Asthma
N		2,012	360	275	137
Percent of study population			17.9%	13.7%	6.8%
Age (years)		43.0 (10.4)	48.9 (9.4)	50.5 (8.9)	42.5 (10.2)
Males		25.6%	25.6%	32.4%	19.0%
Age of onset (years; N=1340)		33.7 (9.6)	37.8 (9.8)	38.7 (9.8)	34.4 (9.6)
Disease duration (years; N=1340)		9.1 (8.1)	10.6 (8.5)	12.0 (8.7)	8.9 (7.6)
Body mass index (kg/m^2; N=1778)		28.8 (7.2)	31.7 (7.3)	30.3 (6.3)	30.6 (7.2)
Median 2010 household income for ZIP code of residence		$54,409	$51,814	$54,438	$51,679
Race (N=1991)	Black	10.9%	18.2%	8.1%	14.7%
	White	88.0%	81.5%	90.8%	83.8%
	Other	1.1%	0.3%	1.1%	1.5%
Smoking status (N=1632)	Current	19.6%	15.7%	14.7%	19.1%
	Former	30.8%	35.7%	40.4%	29.6%
	Never	49.6%	48.6%	44.9%	51.3%
Insurance (N=2001)	Medicaid	4.6%	5.6%	2.2%	8.0%
	Medicare	10.3%	15.4%	14.3%	13.1%
	Private	56.2%	53.6%	59.0%	46.0%
	Self-pay	28.7%	25.4%	24.5%	32.9%