Ethnicity and Prevalence of Multiple Sclerosis in East London

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	(female:male) were 2.2:1, 2.1:1 and 2.8:1 respectively. Conclusion: MS prevalence was considerably lower amongst Black and South Asian populations, compared to the White population, by 59% and 84% respectively. However, compared to available data in Africa and South Asia, MS is several times more prevalent among Black people and South Asians living in the UK than their territorial ancestry.

Ethnicity and Prevalence of Multiple Sclerosis in East London

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Figure 1. Map of London showing borough boundaries with 'east London' catchment area highlighted.

Figure 2. Ethnicity-specific MS Prevalence: Crude (white bars) and Age-Standardised (filled bars).

Figure 3. MS Prevalence for Women by Age, Stratified by Ethnicity.

Figure 4. MS Prevalence for Men by Age, Stratified by Ethnicity.

Abstract

Background: Incidence and prevalence rates of Multiple Sclerosis (MS) are generally higher in White populations than other ethnic groups. Relevant studies in the United Kingdom (UK) were conducted over 30 years ago.

Objectives: The aim of this study is to provide updated ethnicity-specific MS prevalence rates in the UK.

Methods: Electronic records from general practices in four east London boroughs were queried for the number of MS-diagnosed patients, grouped by ethnicity, into 5-year age bands. Compared against total registered GP patients in the area (c. 900,000), the age-standardised MS prevalence was calculated by ethnic group.

Results: The overall age-standardised prevalence of MS was 111 per 100,000 (152 for women, 70 for men), and 180, 74, and 29 for the White, Black and South Asian populations, respectively. The sex ratios (female:male) were 2.2:1, 2.1:1 and 2.8:1 respectively.

Conclusion: MS prevalence was considerably lower amongst Black and South Asian populations, compared to the White population, by 59% and 84% respectively. However, compared to available data in Africa and South Asia, MS is several times more prevalent among Black people and South Asians living in the UK than their territorial ancestry.

Background

Multiple sclerosis (MS) is an inflammatory demyelinating and neurodegenerative disease of the central nervous system. It is the most common chronic non-traumatic cause of disability in young adults, with a current prevalence rate in the United Kingdom (UK) of between 100-200 per 100,000.[1] Significant disability develops after a mean of eight years disease duration.[2-9] The cause of MS is unknown, although the evidence suggests MS is a complex disease with various contributing factors involved in risk.[10]

Epidemiological studies of MS prevalence and incidence suggest that ethnicity may be a risk factor for the development of MS. Both MS incidence and prevalence is significantly higher among White people compared to people of other ethnicities.[11–15] The lowest country-level prevalence rates have been reported in countries with very small proportions of White people such as Japan (7.7/100,000) and Iran (32/100,000), whereas the highest rates are in countries with predominantly White populations, such as Norway (151/100,000) and the UK (203/100,000).[1,16-19] What is more, in countries where there is a mix of local-born White and local-born non-White residents, MS risk is almost always higher amongst White residents.[11–15,19–21]

However, definitive studies to confirm a causal link between ethnicity and MS do not exist. The epidemiological work referred to above may be driven not by genetic differences, but by differing environmental exposures and behaviours. Current hypotheses incorporate genetics to varying extents, such as: (i) mostly genetics

through differences in major histocompatibility complex (MHC) haplotypes;[22,23] (ii) gene-environment interactions, such as the regulation of Class II Allele HLA-DRB1*1501 by the vitamin D response element;[24] and (iii) mostly environment through sun exposure,[25] or viral infections such as Epstein-Barr virus.[26]

The aim of this study is to update previous estimations of the UK prevalence of MS *by ethnicity*, last investigated over 30 years ago.[13,14] Findings will apply to the local vicinity of the Barts MS service in the Royal London Hospital in east London. This should be taken into account when extrapolating to the UK as a whole. The local area within east London is ideal for studying the interaction between ethnicity and migration in the UK context because of its ethnic diversity. The Black and South Asian populations make up 44% of the area based on the 2011 Census, with the older generation of these ethnic minorities generally representing immigrants from a period of mass immigration from the Caribbean, Africa, and the Indian subcontinent in the 1950s and 1960s, and the younger generation mostly representing UK-born children of these settled immigrants.

Methods

The geographical area to calculate prevalence of MS was defined as the catchment area of the three nearest Clinical Commissioning Groups (CCG). These three are Tower Hamlets, Newham and City & Hackney, which correspond to the innermost boroughs in the east of London. Together they are referred to here simply as 'east London', highlighted in Figure 1.

[**Figure 1** Placeholder]

Data for both pwMS and the baseline population were extracted from a 2013 anonymised general practice (GP) based patient records database. The GP database was accessed for this study by the Clinical Effectiveness Group (KB) of Barts and The London School of Medicine & Dentistry. The GP database records all patients registered with a GP using the 'EMIS' electronic patient records system. The total number of patients represents the 'baseline population'. All patients coded with 'MS' represent the total number of pwMS. Data were grouped into 5-year age-groups and stratified by sex, ethnicity and CCG. Data from four GP practices in east London that do not use EMIS could not be included in this study.

MS prevalence rates were standardised for age using the direct method based on the 2013 European Standard Population, and expressed as n/100,000.[27] All prevalence rates reported here are age-standardised, unless otherwise specified. Using Microsoft Excel we calculated the overall MS prevalence rate, and specific MS prevalence rates stratified by sex and three ethnic groups: White, Black and South Asian. These ethnic groups are aggregates of standard ethnic classifications in the UK Census, which are used for self-classification on EMIS. 'White' includes Caucasian people such as those of British, American and European descent; 'Black' includes people of African and Caribbean descent; and 'South Asian' includes people of Indian, Bangladeshi, Pakistani and Sri Lankan descent. ~~Because of small counts once divided into age, sex and ethnicity, 95% c~~Confidence intervals were calculated at 95% confidence using the normal binomial method for proportions~~a Poisson~~

~~distribution~~. Upper and lower bounds were calculated for each age-group to allow for direct age standardisation.

Results

A total of 907,151 patients were registered with GP practices of east London. Of these, 776 had a diagnosis of MS. Table 1 shows a breakdown of this population by sex and ethnicity. Confidence intervals are not shown as each upper and lower limit was within 1 case per 100,000 from the estimate, using the normal binomial method of deriving 95% confidence intervals for proportions.

[Table 1 Placeholder]

The overall prevalence (per 100,000) of MS in east London was 111. For women prevalence was 152 and for men 70. The prevalence for MS in the White population was 180, for Black people it was 74, and for South Asians 29. The sex ratios (female:male) were 2.2, 2.1 and 2.8, respectively. Figure 2 illustrates the sex and ethnicity-specific prevalence rates. Figures 3 and 4 illustrate the age-specific prevalence rates for each sex and ethnic group. Table 2 provides these rates, including 95% confidence intervals. In this table confidence intervals were derived using a Poisson distribution because many of the subgroups had fewer than 10 counts.

[Figure 2 Placeholder]

[Figure 3 Placeholder]

[Figure 4 Placeholder]

Discussion

To our knowledge this is the first study reporting ethnicity-specific prevalence of MS in east London. The overall prevalence of MS we detected was slightly lower than in a recent UK-wide study.[1] Due to the limited sample size our prevalence rates at the extreme ends of the age spectrum are unreliable (see Table 2). Nevertheless, the prevalence peaks for the White population are virtually identical to those reported for the entire UK.[1,28] We also calculated the incidence rates of MS by ethnicity using new cases in the year up to date we used to calculate prevalence rates. ~~Differences in incidence by ethnicity roughly mirrored prevalence differences at~~Incidence rates per 100,000 (with Poisson distribution-derived 95% confidence intervals in brackets) were estimated at 8.6 (5.7-12.4)~~/100,000~~ for White people, 6.2 (2.8-11.7) ~~/100,000~~ for Black people, and 3.7 (1.8-6.7)~~/100,000~~ South Asians. The relative differences in incidence by ethnicity appear similar to our reported prevalence differences, however as indicated by overlapping confidence intervals around our incidence estimates these differences are not statistically significant. Confidence intervals were Poisson distribution-derived because of small numbers of incident cases. Also d~~D~~ue to small numbers, these incidence rates are not age-adjusted.

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Ethnicity-specific MS risk in the UK and the US

The relative risks by ethnicity in this study are in line with previous findings in the UK from the 1970s which indicated that ethnic minorities have a lower MS risk than White people.[13,14] In one of these studies conducted in London, the incidence for Black people was about 16% that of White people, whilst the incidence for Indian

men and women was 26% and 6% that of White men and women.[13] In another study based in London and the Midlands, the incidence for Black people and South Asians combined was 13% that of White people.[14]

Interestingly the findings in UK studies (including ours) for Black people are in contrast to findings from two recent studies US studies. One of these studies detected a higher incidence in Black compared to White military veterans.[11] The other, which investigated members of the Kaiser Permanente managed care consortium in California, had similar findings.[12] One possible explanation for the high MS risk in Black people in the US is selection bias in these studies, but other explanations to consider are genetic, environmental or behavioural differences between Black people in the US and the UK. Further work is needed in this area.

MS Prevalence in Africa and South Asia

What remains striking is the difference in MS prevalence between Black people and South Asians living in temperate climates compared to those living in their territorial ancestry. Even the highest prevalence reported for any sub-Saharan African country, 0.24/100,000 in Ghana, is a small fraction of the prevalence of MS in Black people in east London (74/100,000).[29] The difference between the prevalence of MS in South Asians living in east London (29/100,000) and, for example, people living in India (7/100,000) or Pakistan (5/100,000), is also impressive.[29]

The prevalence differences above may be explained by less extensive case ascertainment in less resourced countries.[30,31] Indeed, estimates of prevalence in sub-Saharan Africa and South Asia by the Atlas of MS (MS International Federation) are based on very limited epidemiological studies of poor quality.[29] However, an alternative, or additional, explanation would be increased exposure in the UK to environmental agents or behaviours that facilitate the development of MS.[10,24-26] To further investigate true environmental or behavioural risk in future studies, we will test whether prevalence rates within ethnic minority groups vary depending on whether or not they were born in the UK. This will utilise our hospital-based dataset, the 'Barts MS Database', which includes migration and birth-country data that are unavailable through the GP database.

Limitations

The dataset on which our analysis is based has been derived from a system designed for clinical use by GPs. It is possible that pwMS may have been missed in the system. Residents who register with a GP outside of the catchment area, will inevitably be missed. A study of MS prevalence in Wales used a more extensive method for case ascertainment that overlapped multiple data sources.[28] In that study, the most comprehensive case source was GP records, which is equivalent to the source we relied on in our study. GP records covered 73% of all cases, with only hospital records contributing a significant proportion of additional cases. A previous study by the same group had similar case ascertainment.[32] In terms of diagnostic accuracy, the more recent Welsh study found that less than 2% had unclear diagnoses, which

is a testament to the reliability of GP records. Extrapolating from these studies, by only using GP records we are unlikely to have included misdiagnosed MS cases. However, we are likely to have underestimated prevalence estimates by approximately a quarter. Nevertheless, there appears to be little risk for biases in data by ethnicity as proportions of ethnic groups for pwMS in the east London GP database are very similar to the Barts MS Database, as such our relative comparisons between ethnicities are likely to be reliable. Once further developed, the Barts MS Database will be used in our future studies to account for missed pwMS and allow for diagnostic validation.

Our findings must be interpreted with caution when generalised to the rest of the UK, because of the risk of selection bias. It is possible that the Black and South Asian populations in east London are not representative when compared to the Black and South Asian population in the rest of the UK.

Conclusion

This is the first study on the ethnicity-specific prevalence of MS in east London. With its ethnic diversity in a region where the overall risk of MS is amongst the highest in the world this cohort of pwMS may contribute to further explore the gene-environment interaction that ultimately determines the risk of developing MS, and the course of the disease.

[Table 2 Placeholder]

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Disclosures

KS has received speaking honoraria from, and/or served on advisory boards for Novartis, Biogen, Teva, Merck-Serono and Merck Inc, has received support for attending an international conference from Genzyme and is a PI on studies sponsored by Novartis, Roche and Teva.

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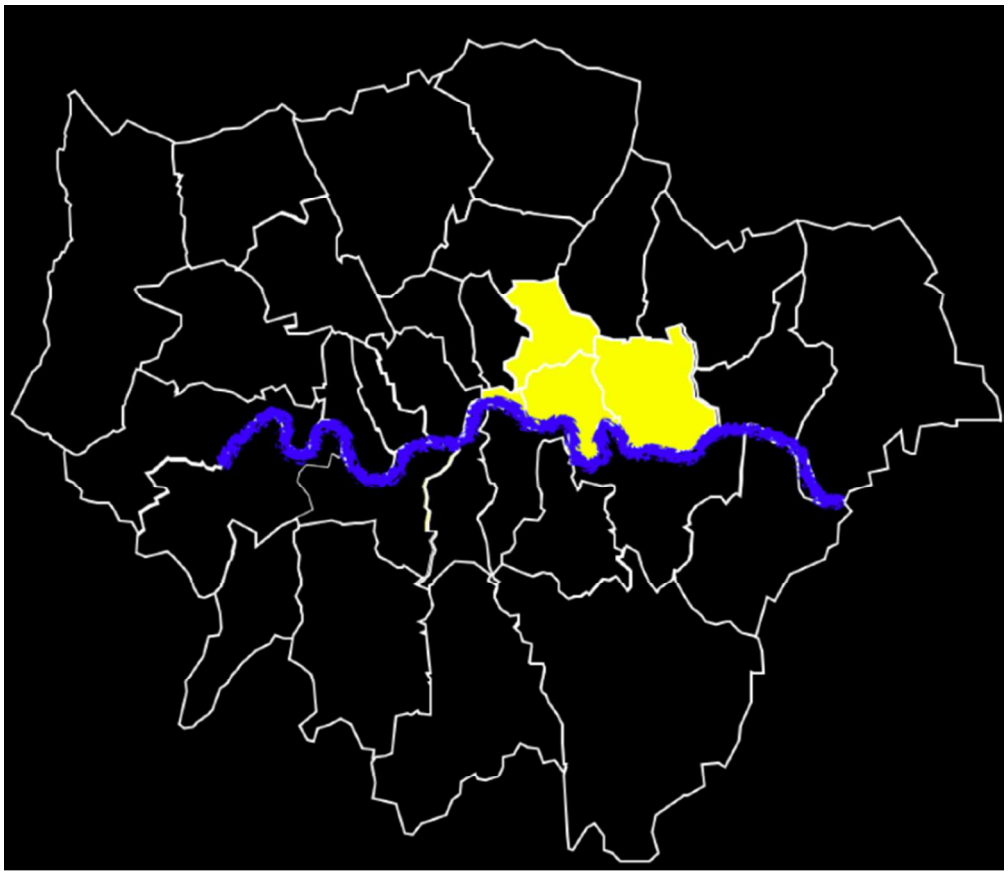

Figure 1. Map of London showing borough boundaries with 'east London' catchment area highlighted.
269x232mm (72 x 72 DPI)

Table 1. Numbers of people with multiple sclerosis registered in GP practices within inner East London, by sex and ethnicity

Ethnicity	Female	Male	Total
White	345	162	507
Black	77	34	111
South Asian	47	24	71
Other	15	9	24
Unknown	38	25	63
Total	**522**	**254**	**776**

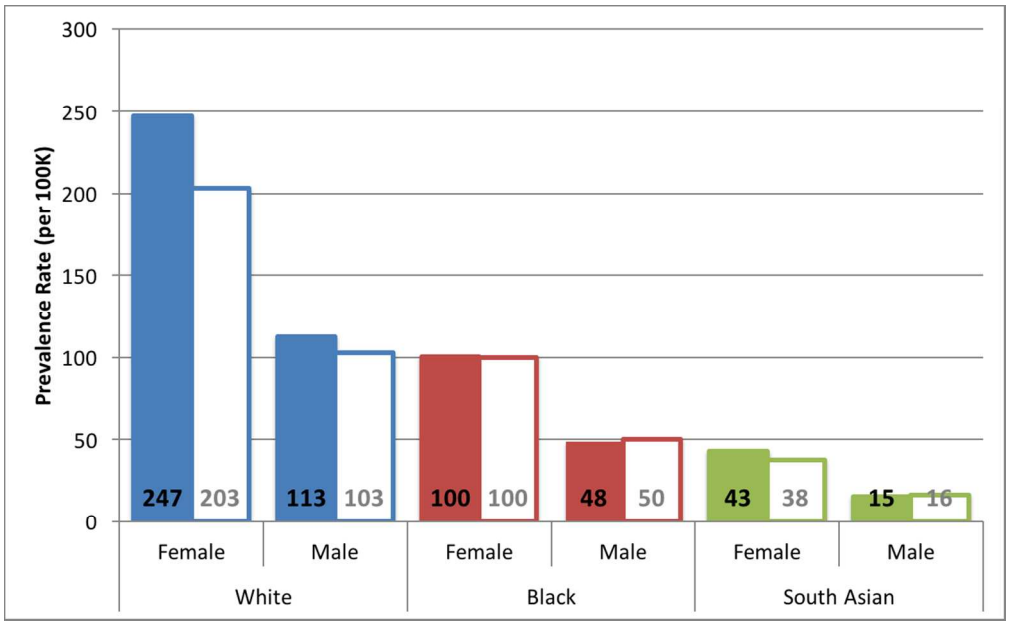

Figure 2. Ethnicity-specific MS Prevalence: Crude (white bars) and Age-Standardised (filled bars).
213x131mm (150 x 150 DPI)

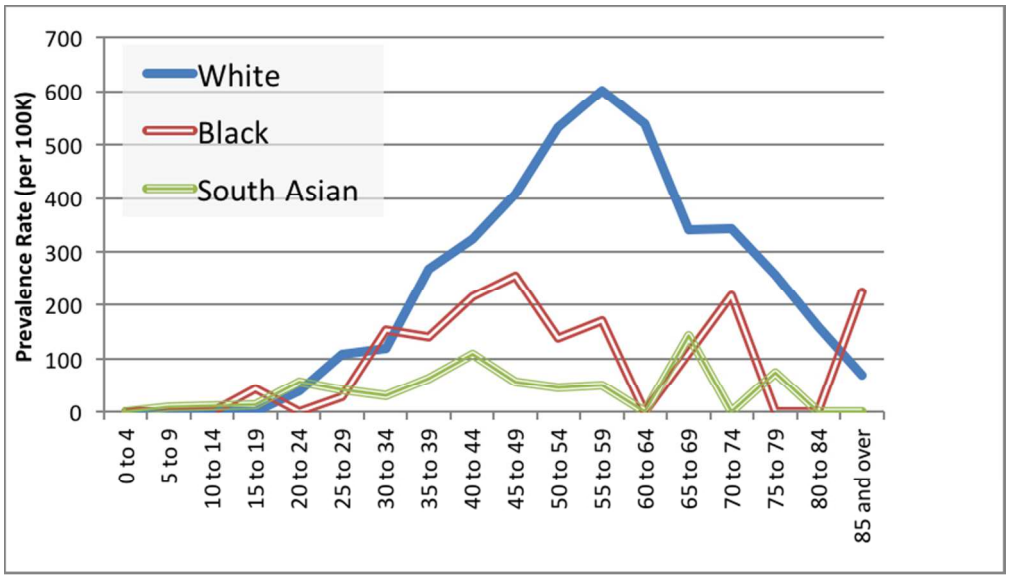

Figure 3. MS Prevalence for Women by Age, Stratified by Ethnicity
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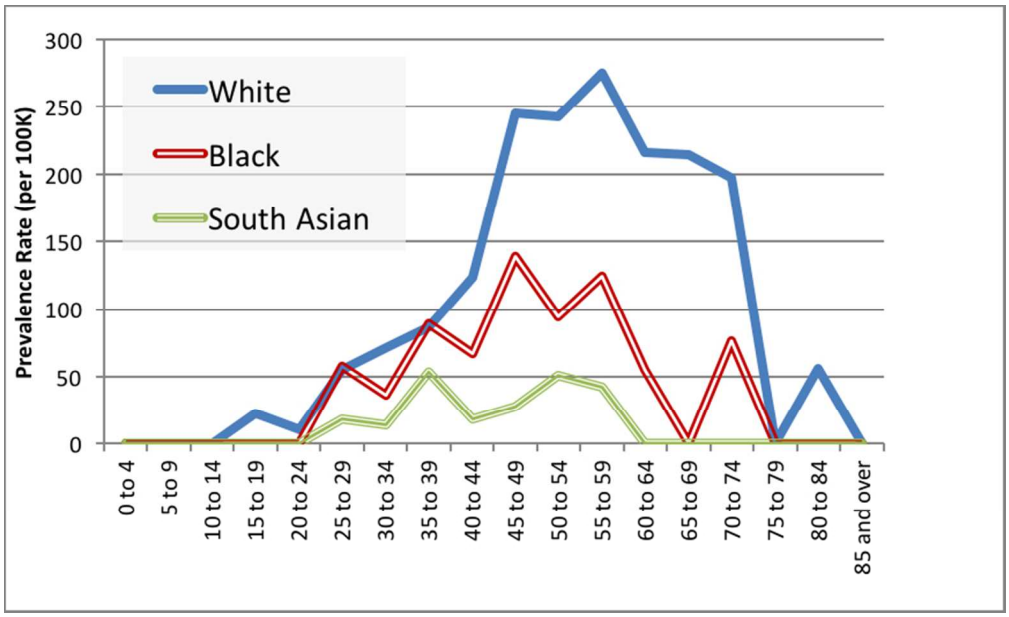

Figure 4. MS Prevalence for Men by Age, Stratified by Ethnicity
146x89mm (150 x 150 DPI)

Table 2. Standardised prevalence rates (per 100,000) for each age group, specific to sex and ethnicity, including 95% confidence intervals*

	Female White	95% Confidence Interval		Female Black	95% Confidence Interval		Female South Asian	95% Confidence Interval	
Age	Rate	Lower	Upper	Rate	Lower	Upper	Rate	Lower	Upper
0 to 4	**0.0**	0.0	1.7	**0.0**	0.0	2.8	**0.0**	0.0	1.3
5 to 9	**0.0**	0.0	2.5	**0.0**	0.0	2.9	**0.5**	0.0	2.8
10 to 14	**0.0**	0.0	3.9	**0.0**	0.0	3.8	**0.7**	0.0	3.6
15 to 19	**0.0**	0.0	3.2	**2.4**	0.3	8.8	**0.7**	0.0	3.9
20 to 24	**2.4**	0.9	5.2	**0.0**	0.0	3.3	**3.4**	1.2	7.3
25 to 29	**6.5**	4.4	9.1	**1.7**	0.2	6.1	**2.5**	1.0	5.1
30 to 34	**7.8**	5.3	11.0	**10.0**	5.0	17.9	**2.0**	0.6	4.7
35 to 39	**18.7**	13.5	25.3	**9.9**	4.5	18.8	**4.4**	1.8	9.1
40 to 44	**22.7**	15.9	31.4	**15.1**	8.2	25.3	**7.6**	3.3	14.9
45 to 49	**28.6**	20.3	39.1	**17.8**	10.6	28.2	**3.9**	0.8	11.5
50 to 54	**37.3**	27.2	49.9	**9.7**	4.2	19.2	**3.2**	0.4	11.4
55 to 59	**39.0**	28.0	52.9	**11.1**	4.1	24.3	**3.3**	0.4	11.8
60 to 64	**32.4**	22.0	45.9	**0.0**	0.0	8.4	**0.0**	0.0	5.4
65 to 69	**18.7**	10.7	30.4	**6.1**	0.7	22.1	**7.8**	1.6	22.8
70 to 74	**17.2**	8.9	30.0	**11.0**	3.0	28.0	**0.0**	0.0	7.9
75 to 79	**10.3**	4.4	20.3	**0.0**	0.0	8.6	**2.9**	0.1	16.4
80 to 84	**4.0**	1.1	10.2	**0.0**	0.0	9.7	**0.0**	0.0	10.8
85 and over	**1.7**	0.2	6.3	**5.6**	0.1	31.3	**0.0**	0.0	18.4
	Male White	95% Confidence Interval		**Male Black**	95% Confidence Interval		**Male South Asian**	95% Confidence Interval	
Age	Rate	Lower	Upper	Rate	Lower	Upper	Rate	Lower	Upper
0 to 4	**0.0**	0.0	1.6	**0.0**	0.0	2.7	**0.0**	0.0	1.2
5 to 9	**0.0**	0.0	2.4	**0.0**	0.0	2.9	**0.0**	0.0	1.5
10 to 14	**0.0**	0.0	3.9	**0.0**	0.0	3.7	**0.0**	0.0	1.9
15 to 19	**1.2**	0.0	6.8	**0.0**	0.0	3.8	**0.0**	0.0	2.1
20 to 24	**0.6**	0.0	3.5	**0.0**	0.0	4.1	**0.0**	0.0	1.3
25 to 29	**3.3**	1.7	5.8	**3.5**	0.7	10.2	**1.1**	0.3	2.8
30 to 34	**4.6**	2.7	7.4	**2.4**	0.3	8.5	**0.9**	0.2	2.7
35 to 39	**6.1**	3.4	10.0	**6.3**	2.0	14.6	**3.7**	1.6	7.3
40 to 44	**8.7**	5.0	14.1	**4.7**	1.3	12.0	**1.3**	0.2	4.6
45 to 49	**17.2**	11.3	25.0	**9.7**	4.4	18.4	**2.0**	0.2	7.1
50 to 54	**17.0**	10.6	25.7	**6.6**	2.2	15.5	**3.6**	0.7	10.5
55 to 59	**17.9**	10.9	27.6	**8.1**	2.2	20.7	**2.8**	0.3	10.0
60 to 64	**13.0**	6.9	22.2	**3.3**	0.1	18.4	**0.0**	0.0	6.7
65 to 69	**11.8**	5.9	21.1	**0.0**	0.0	13.8	**0.0**	0.0	11.4
70 to 74	**9.9**	3.6	21.5	**3.8**	0.1	21.2	**0.0**	0.0	9.4
75 to 79	**0.0**	0.0	5.1	**0.0**	0.0	9.4	**0.0**	0.0	8.2
80 to 84	**1.4**	0.0	7.8	**0.0**	0.0	11.2	**0.0**	0.0	8.9
85 and over	**0.0**	0.0	5.6	**0.0**	0.0	22.4	**0.0**	0.0	21.4

*95% Confidence Intervals are calculated directly from the Poisson distribution as each specific age, sex and ethnicity specific count of people with MS is less than 10 in most subgroups.