

SAS[®] GLOBAL FORUM 2017

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The association between solar radiation and Multiple Sclerosis

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ABSTRACT

- There is evidence of a connection between the incidence of Multiple Sclerosis (MS) and geographic latitude.
- One possible explanation is that exposure to greater amounts of sunlight has a protective effect, suggesting the farther one lives from the equator, the greater the risk of MS.
- Using the National Inpatient Sample (NIS) database and estimates of average global, horizontal, and direct normal irradiance acquired from the State University of New York (SUNY) model, we conducted an observational study to investigate the association between exposure to sunlight and patients diagnosed with MS between 2000 and 2009 in California, United States.

METHODS

- Variograms were fit, and ordinary kriging was conducted on monthly averages of SUNY irradiance data from 24 locations throughout California to generate exposure estimates at the locations of the NIS hospitals. With monthly counts of inpatient MS hospital records, spatio-temporal Poisson models were used to examine association between solar irradiance and MS. Age, sex and race (Caucasian, Black, Hispanic, Asian and other), latitude, longitude, month and year were all considered as potential confounders and included in the Poisson model.

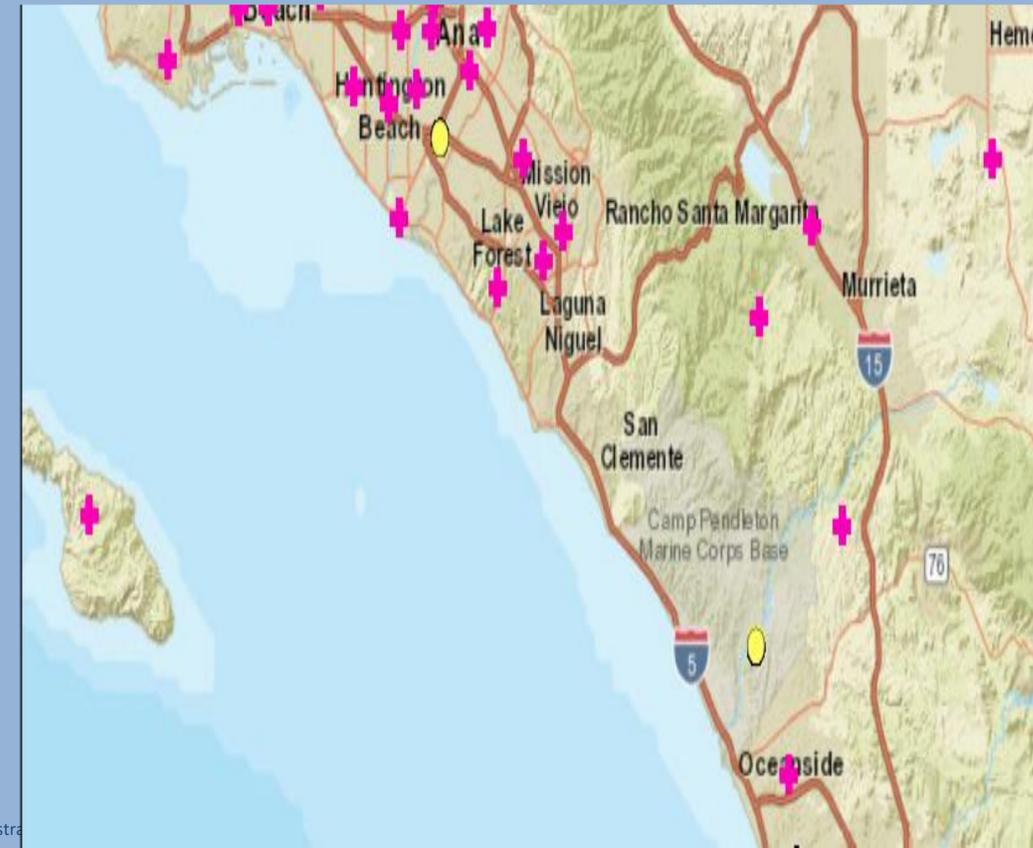
The Poisson regression model for the counts of MS discharges Y_i at hospital i (stratified by Northern and Southern California) with adjustment for confounders X_i had the form:

$$\log[E(Y_i | X_i)] = \beta_0 + \beta X_i$$

All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC) and ArcGIS 10.4.1.

RESULTS

There was a statistically significant negative association between MS and global solar radiation ($p=0.02$) after adjusting for age, sex, race, latitude, longitude, month and year but not direct solar radiation ($p=0.09$) and diffuse solar radiation ($p=0.43$). The number of MS attacks decreases by 42.7% (95% CI: 7.59%, 64.51%) per 1 kWh/m² increase in global solar irradiation after adjusting for age, sex, race, latitude, longitude, month and year. Further investigation indicated that age, sex and race (Caucasian, Black, Hispanic, Asian and other), latitude, longitude, month and year were confounders in this association.



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RESULTS CONTINUED (CLICK TO EDIT)

We rejected the null hypothesis and concluded that GHI was statistically significantly associated with MS after adjusting for age, sex, race, latitude, longitude, month and year (p=0.02). After adjustment, the number of MS hospital discharges decreased by 42.7% (95% CI: 7.59%, 64.5%) per 1 KWh/m² increase in GHI.. Compared to males, the number of MS discharges for females increased by 0.84% (95% CI: -3.35%, 4.88%). This result agrees with the findings that women are more likely to develop MS than men. Compared to Caucasians, the number of MS discharges for African Americans was higher by 3.15% (95% CI: -2.63%, 8.61%), for Hispanic/Latinos was lower by 37.7% (95% CI: 29.7%, 46.2%), for Asians was lower by 17.4% (95% CI: 1.92%, 36.3%), and for other races was 27.1% lower (95% CI: 10.3%, 46.2%) after adjusting for other dependent variables.

Table 1a: Poisson regression model of SUNY Global and MS attack

Variables	Estimated Parameter (95% CI)	Standard Error	P-Value
SUNY Global (KWh/m²)	-0.56 (-1.04, -0.01)	0.24	0.02
Gender			
Baseline (male)			
Female	0.01 (-0.03, 0.05)	0.02	0.69
Age (years)	-0.002 (-0.003, -0.001)	<0.01	0.01
Race			
Baseline(Caucasian)			
Black	0.032 (-0.026, 0.09)	0.03	0.28
Hispanic	-0.32 (-0.38, -0.26)	0.03	<0.01
Asian	-0.16 (-0.31, -0.02)	0.08	0.03
Other	-0.24 (-0.38, -0.10)	0.07	<0.01
Month	0.16 (0.03, 0.30)	0.07	0.02
Year	-0.14 (-0.2, -0.08)	0.03	<0.01
Longitude	-0.13 (0.15, -0.11)	0.01	<0.01
Latitude	-0.09 (-0.11, -0.07)	0.01	<0.01

CONCLUSIONS

Our study is the first research of association between MS and solar radiation in California. Our results demonstrated that there are negative significant associations between MS and global horizontal irradiance (p=0.02) after adjusting for confounders age, sex, race, latitude, longitude, month and year California. Further research will be conducted to analysis the association between Multiple Sclerosis and solar radiation in United States and other areas of the world and provide preventive strategy for MS.

REFERENCES



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