

Pediatric Multiple Sclerosis in the United States in children ages 0-18

Dr. Kamleshun Ramphul , Dr. Stephanie G Mejias ,
Dr. Jyotsnav Joynauth

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Highlights

- 869 weighted cases of pediatric multiple sclerosis were found in 2016 of ages 0-18
- Male to female admission ratio of Pediatric multiple sclerosis was 1:2.4
- Mean total charges of Pediatric MS were \$50,379.72
- Mean length of stay of Pediatric MS admissions was 4.62 days.

Title: Pediatric Multiple Sclerosis in the United States in children ages 0-18

Authors:

1. Dr. Kamleshun Ramphul, M.D Pediatrics

Affiliation: Department of Pediatrics, Shanghai Xin Hua Hospital, Shanghai Jiao Tong University School of Medicine

2. Dr. Stephanie G Mejias , M.D

Affiliation: University Iberoamericana Unibe School of Medicine

3. Dr. Jyotsnav Joynauth, M.D Pediatrics

Affiliation: Zhejiang University

Corresponding author: Dr. Kamleshun Ramphul

Affiliation: Department of Pediatrics, Shanghai Xin Hua Hospital, Shanghai Jiao Tong University School of Medicine

Address: 1665 Kongjiang Road, Shanghai 200092, China

Telephone number: +23058283027

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Pediatric multiple sclerosis (Pediatric MS), previously known as juvenile multiple sclerosis or early onset multiple sclerosis (EOMS), is the onset of multiple sclerosis in children below 18. It is believed that only 5% of all multiple sclerosis cases occur before the age of 18 and only 1% below 1 year of age.¹⁻³

There are limited research data available on the burden of pediatric multiple sclerosis in the United States. Herein, we investigated various aspects of pediatric multiple sclerosis in the US from the Kid's Inpatient Database (KID) 2016 provided by the Healthcare Cost Utilization Project (HCUP). The HCUP is sponsored by the Agency for Healthcare Research and Quality (AHRQ) and their partners. The KID includes data from over 3 million patients below the age of 21 and provides a national estimate for pediatric discharges. It is made available every three years. The most current data of 2016, released in 2018, included over 40 states and 4000 hospitals.^{4,5}

International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) code for multiple sclerosis, 'G35', was applied to identify all cases of MS.⁶ We restricted the age group of our study to patients of ages between 0 to 18 inclusive. Data was weighted using the kid discharge weight (DISCWT) sampling scheme provided in the database to obtain more accurate national estimates.

SPSS 20.0 software (IBM Corporation, USA) was used to conduct statistical analysis. We investigated differences in sex, race, admission month, region of hospital, payer form as well as median household incomes. Mean and median age of admission, length of stay and total hospital charges were also calculated. Categorical variables were studied using Chi-square test or Fisher exact test. An analysis of variance (ANOVA) was used for comparing continuous variables in our study. For further comparison of the data, linear regression models were also set up if required. Statistical significance was set at $p < 0.05$.

The 2016 KID consisted of 6,266,285 weighted admissions for children aged below 21. On further analysis, we narrowed our database to 5,765,224 admissions for children aged 18 or less. There were 869 weighted admissions for patients who had a diagnosis multiple sclerosis (table 1). 259(29.8%) were males and 610(70.2%) were females ($P < 0.001$). The Southern part of the US had the highest admission rate for

pediatric MS with 382 cases (44.0%) ($P=0.001$) and the highest number of admissions was seen in white children (318 cases, 40.0%, $p<0.001$)

The highest monthly admission rate was noted in September (97 cases, 11.2%) but it was not statistically significant ($P=0.067$). There was also no statistical significance in the median household income ($P=0.128$) despite data showing that MS was higher among families within the 0-25th quartile (285 cases, 33.4%).

Medicaid was the most common form of payer for children with MS (445 cases, 51.2%) followed by private insurances (355 cases, 40.9%) ($P<0.001$). The mean age of admission was 15.08, median of 16.00 with a standard deviation of 2.955 ($P<0.001$). We further analyzed the ages as show in Figure 1. A gradual rise in admission was seen from age 13-18 despite a drop at age 17. Mean total charges were \$50,379.72 ($B= 21,995.688$, 95% confidence interval: 13453.798-30537.578, $P<0.001$), while the mean length of stay (LOS) of MS admissions was 4.62 days.

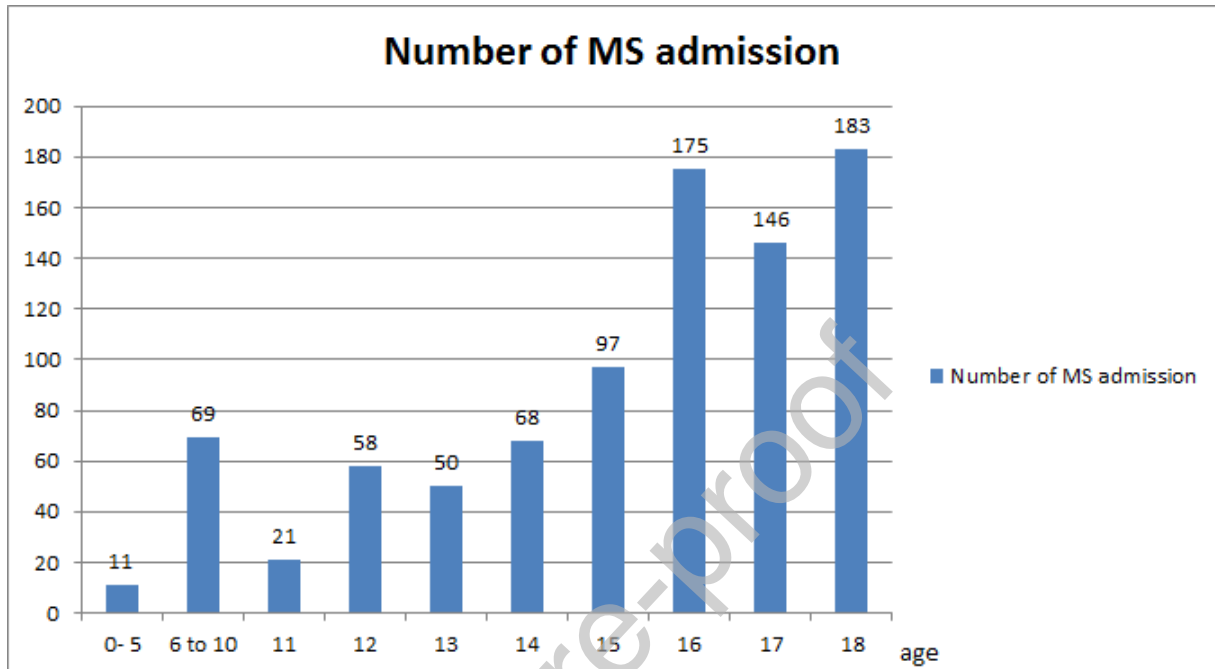
Multiple sclerosis is a multifactorial condition⁷ and our study showed that pediatric multiple sclerosis had a male to female admission ratio of 1:2.4. This finding is very identical to findings among adult multiple sclerosis patients.⁸ The racial differences in the prevalence of pediatric multiple sclerosis and the higher incidence among Caucasian white children are also compliant to similar comparisons made among the adult population.⁹ The combined higher population of Caucasian and Hispanics in the southern regions of the United States could explain the results shown by the KID.¹⁰

There are several limitations to our study. ICD-10 code for multiple sclerosis can also include “MOG related demyelination” and children with possible but not confirmed MS. Our study was not able to distinguish first admissions from readmissions of MS. However, since the HCUP’s KID provides a very large sample, we believe that our study can be used as a stepping stone to further clinically investigate the findings.

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Figure 1. A steady rise in admission rate was seen from ages 13-18 with a drop at age 17. Admissions for multiple sclerosis at age 0-5 consisted of 1.27% of all pediatric MS admissions.



Characteristic	Multiple Sclerosis (%)	P-value
Sex		
Male	259 (29.8)	<0.001
Female	610 (70.2)	
Race		
White	318 (40.0)	<0.001
Black	201 (25.7)	
Hispanic	209 (26.3)	
Asian or Pacific Islander	16 (2.0)	
Native American and other	48 (6.0)	
Admission month		
January	84 (9.7)	0.067
February	75 (8.6)	
March	64 (7.4)	
April	72 (8.3)	
May	58 (6.7)	
June	76 (8.7)	
July	69 (7.9)	

August	80 (9.2)	
September	97 (11.2)	
October	74 (8.5)	
November	63 (7.2)	
December	57 (6.6)	
Region of hospital		0.001
Northeast	129 (14.8)	
Midwest	149 (17.1)	
South	382 (44.0)	
West	209 (24.1)	
Median household income national quartile		0.128
0-25 th percentile	285 (33.4)	
26 th -50 th percentile	193 (22.6)	
51 st -75 th percentile	207 (24.2)	
76 th to 100 th percentile	169 (19.8)	
Primary expected payer		<0.001
Medicaid	445 (51.2)	
Private insurance	355 (40.9)	

Self-pay	21 (2.4)	
Medicare, No charge or other	48 (5.5)	

Table1.
Character
istics of
patients

with Multiple sclerosis aged 18 or less