

# The Incidence and Prevalence of Reported Multiple Sclerosis

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A national survey, sponsored by the National Institute of Neurological and Communicative Disorders and Stroke, to determine the incidence, prevalence, and economic impact of multiple sclerosis has just been completed. These data are the first report of the results. Based on the data gathered, it is estimated that on January 1, 1976, there were a reported 123,000 multiple sclerosis patients in the conterminous United States (a rate of 58 per 100,000). The annual incidence for the period 1970-1975 was estimated to be 8,800 (a rate of 4.2 per 100,000). The pattern of the disease being more common among females, whites, persons aged 30 to 50 years, and individuals living above the 37th parallel was also demonstrated. In addition to demographic characteristics, selected disease characteristics of the incidence and prevalence populations were also examined.

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In 1975 the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) initiated a series of surveys to estimate the incidence, prevalence, and costs for selected neurological disorders and thereby fill the existing void of reliable national data. One of these studies was the National Multiple Sclerosis Survey, conducted by the National Analysts Division of Booz-Allen & Hamilton under the auspices of the Office of Biometry and Field Studies, NINCDS. The aim of this paper is twofold: first, to present estimates of incidence and prevalence of reported multiple sclerosis as derived from the survey, and second, to present differences in disease characteristics by demographic subgroups. Papers pertaining to the cost of the disease and to patients' symptomatology, functional status, migrational patterns, and adaptation to the disease will be forthcoming.

## Methods

The estimates were generated by combining data gathered in a survey of physicians and hospitals with that from a survey of multiple sclerosis patients identified by these providers. In the first phase, a probability sample of 8,800 physicians and 725 hospitals was drawn from the universe of health care providers considered most likely to treat multiple sclerosis patients. All health care providers were located in the contiguous 48 states (conterminous United States). Physician specialties surveyed were: neurology, neurosurgery, general practice, family practice, internal medicine, ophthalmology, physical medicine, and psy-

chiatry. The hospitals surveyed were short-term general hospitals stratified by the existence or absence of an approved residency program in neurology and/or neurosurgery.

In phase one, the physicians and hospitals supplied selected information about their multiple sclerosis patients seen between January 1, 1970, and December 31, 1975. In addition to the total number of multiple sclerosis patients seen, the demographic/disease characteristics of each patient were requested. Each reported case was assigned a weight, the sum of which projected the total number of cases, including duplication. The data were thoroughly examined to identify patients reported from more than one source. An estimate of the duplication in the universe was calculated based upon that found in the sample. Prevalence and incidence estimates were subsequently derived.‡ Among physicians—after adjustment for death, retirement, and other factors—99% responded as to whether they had had contact with multiple sclerosis patients during the survey period. Approximately 70% of those seeing patients with multiple sclerosis provided data on the number of cases seen during the interval. Comparable data from hospitals was 93% and 89%.

During phase two, interviews were conducted with a sample of the patients reported; 76% of those eligible cooperated. The 1,240 interviewed patients supplied the data which form the basis for the distributions presented in this article.

*Prevalence* was defined in this study as the number of per-

‡A complete description of the sampling design and methodologies used in collecting the data and calculating these estimates is available from the authors upon request.

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sons diagnosed as having multiple sclerosis and residing in the conterminous United States on January 1, 1976. *Incidence* was defined as the average annual number of new multiple sclerosis cases diagnosed between 1970 and 1975 inclusive. The latter definition yielded more stable estimates than if the classic epidemiological definition—the number of new cases during a single year—had been used.

Both prevalence and incidence rates in the conterminous resident United States population are reported by sex, race, age, and current residence. The data are also analyzed by type of provider and the following general disease characteristics: disease classification, date of onset (first symptom of multiple sclerosis), age at onset, date of first diagnosis, age at first diagnosis, and interval between onset and diagnosis. In addition, the type of provider and the disease characteristics of the prevalence population are examined by sex and race. Type of provider and disease classification are examined by current residence. The limited number of new cases inhibits analysis of the incidence data by these demographics.

For the analysis, it was necessary that a single type of provider be determined for patients reported by more than one provider. This was achieved by assigning a patient to a single provider based on a hierarchy which reflected an assumed ability to make an accurate diagnosis. The following order was used: board-certified neurological specialists, non-board-certified neurological specialists, hospitals with a neurological service, other hospitals, and other physician providers.

Finally, two fundamental methodological issues should be considered. It is often difficult to make a diagnosis of multiple sclerosis, especially early in the course of the disease, and the impact of this difficulty upon the quality of the data was a concern to the investigators. To minimize variability among medical providers, all were sent a uniform set of criteria to be used in determining the diagnostic certainty of each reported case. Physicians were sent a list of six diagnostic codes. "Probable" multiple sclerosis was defined as a history of exacerbations and remissions with more than one lesion of the central nervous system. "Possible" multiple sclerosis ranged from *one lesion of the central nervous system with an exacerbation and remission to progressive neurological illness with one lesion of the central nervous system and no exacerbations or remissions*. Hospital personnel relying upon the 8th Revision of the ICDA (International Classification of Diseases, Adapted) designated cases with code 340 as probable multiple sclerosis and those with codes 349.9 or 367 as possible multiple sclerosis.

The other important issue is that the estimates resulting from this sample survey may differ from estimates that would have been derived if a complete census of health care providers and patients had been taken using the same methods of data collection. This difference—sampling error—is due to chance variation, and its magnitude, mainly a function of sample size and sample design, has been estimated.

## Findings

### Prevalence

The estimated prevalence of reported multiple sclerosis in the conterminous United States on

January 1, 1976, was 123,000 cases\* for a prevalence rate of 57.8 per 100,000 population. Table 1 displays the prevalence rate per 100,000 population by selected demographic factors. The rate among females was 1.7 times that among males; the rate among whites was twice that among nonwhites. The prevalence rate by age rose sharply from the group below 20 years old to the 30–39 age group, increased less rapidly until the 50–59 group, and then rapidly decreased for those 60 years and older.

The marked differential in the prevalence and incidence of multiple sclerosis with respect to latitude is widely accepted [2]. Previous studies [2, 4] have indicated that the 37th parallel in the United States is a good demarcation between the high- and low-risk regions for contrasting disease rates. By allocating persons in this study to these high- and low-risk regions based upon current residence, we observed that prevalence in the region above the 37th parallel was 1.9 times that in the lower region (see Table 1). Many reasons (e.g., climate, sanitation, diet) have been postulated to account for this geographic variation, but none as yet are definitive. When the three tiers of Kurtzke et al [5] are used, the trend of rising prevalence rates with increased latitude was also present. The prevalence rates for the high-, medium-, and low-risk areas in this study were 74, 65, and 36 per 100,000, respectively.

Table 2 presents the prevalence data with respect to type of health care provider. Overall, 59% of the cases were reported by physicians. Nearly half of these cases were from nonneurological specialists and slightly more than one-third from board-certified neurological specialists. This difference in percentages is more pronounced for hospitals: three-fourths of the cases were from institutions without approved neurological residency programs.

Examination of the data by demographic factors reveals that females are identified by physicians with greater frequency than males (61 versus 55%), particularly by nonneurological specialists (32 versus 25%). A larger percentage of nonwhites than whites (47 versus 41%) was reported from hospitals. Nearly twice the percentage of nonwhites as whites was reported from hospitals with neurological services.

The proportion of cases identified by physicians and by hospitals was the same for the two geographic regions of residence. In the high-risk region, 48.1% of the physician cases were from nonneurologists and 73.2% of the hospital cases were from hospitals without approved neurological residency programs. This compares to 55.8% and 82.6% for the low-risk region.

The data presented in Table 3 illustrate that almost

\*A 95% confidence interval was calculated as 106,000 to 140,000.

Table 1. Estimates of Prevalence and Incidence, Populations at Risk, and Rates per 100,000 for Reported Multiple Sclerosis Cases<sup>a</sup> by Selected Demographic Characteristics, January 1, 1976

Characteristic	Prevalence			Incidence		
	No.	Population <sup>b</sup> (in 000's)	Rate per 100,000	No.	Population <sup>b</sup> (in 000's)	Rate per 100,000
<b>Sex</b>						
Male	43,772	103,430	42.32	3,039	101,246	3.00
Female	79,101	109,158	72.46	5,754	106,636	5.40
<b>Race</b>						
White	114,312	185,040	61.78	8,125	181,880	4.47
Nonwhite	8,561	27,548	31.08	688	26,003	2.65
<b>Age on prevalence day (yr)</b>						
Under 20	1,576	73,606	2.14	583	76,011	0.77
20-29	13,767	36,260	37.97	1,881	32,940	5.71
30-39	28,631	25,616	111.77	2,470	23,618	10.46
40-49	28,723	22,723	126.40	2,103	23,446	8.96
50-59 <sup>c</sup>	33,420	22,518	148.41	1,756	51,868	3.39
60+	16,756	31,867	52.58			
<b>Region of current residence</b>						
37th parallel or higher (high risk)	97,904	142,279	68.81	6,878	140,913	4.88
Below 37th parallel (low risk)	24,969	70,306	35.51	1,915	66,965	2.86
Total	122,873	212,588	57.80	8,793	207,822	4.23

<sup>a</sup>Conterminous United States only.

<sup>b</sup>Source: Current Population Reports, Series P-25, no. 727. (Note: numbers may not add due to rounding.)

<sup>c</sup>For incidence, this category represents 50+.

80% of the patients were classified as having probable multiple sclerosis. A smaller percentage of males than females was reported as probable cases. A greater percentage of probable cases was found among nonwhites as compared to whites and among persons residing below the 37th parallel compared to those residing above it. These differences may be partially due to the interrelationships among the three demographic characteristics.

Disease classification was examined by type of health care provider. Among the probable cases of multiple sclerosis, 59.1% were identified by physicians and 40.9% by hospitals. Comparable data for possible multiple sclerosis are 55.7% and 44.3%, implying that a greater proportion of the probable cases were from physicians. Neurological specialists and "other" physicians each contributed approximately 30% of the probable cases. For hospitals, 80% of the probable cases were from institutions without approved neurological residency programs.

The mean reported date of onset among the prevalence population was 1963, and the median was a year later. (It should be noted that the date of onset may be subject to bias. Subtleties in signs and symptoms often mar the accuracy with which a patient may recall specific onset dates.) Thus, it may be stated that the average patient had had the disease for approxi-

mately twelve years as of the prevalence date. No difference in the average duration of illness by sex was found. A slight difference by race was noted in that the median date for whites was 1964, and for nonwhites, 1963. The observed percentage with onset prior to 1961 was larger for nonwhites than for whites.

The mean age at onset was 33 years and the median, 31. The average age at onset for females was two to three years earlier than for males (mean, 31 versus 33 years; median, 32 versus 35 years). A much larger difference was found between nonwhites and whites, with the mean age for the former being six years younger (28 versus 34 years old) and the difference in the medians being nine years (23 versus 32 years). However, the difference in the median ages for whites and nonwhites in the civilian United States population in 1976 was also six years [13].

The reported date of first diagnosis of multiple sclerosis was, on the average, approximately ten years prior to the prevalence date. A two-year difference between the mean and median was observed (1966 versus 1968). A one-year difference in the medians by sex (males, 1968; females, 1967) and a one-year difference in the means by race (whites, 1966; nonwhites, 1967) was noted.

The mean age at first diagnosis was 37, and the

Table 2. Number and Percentage Distribution for the Reported Prevalence<sup>a</sup> of Multiple Sclerosis by Type of Provider and Selected Demographic Characteristics, January 1, 1976

Characteristic	Physicians				Hospitals		
	All	Neurological Specialists		Others	All	With Approved Neurology Residency Program	Others
		Board-certified	Non-Board-certified				
<b>Sex</b>							
<b>Male</b>							
No.	24,100	9,852	3,511	10,737	19,672	6,249	13,423
%	(55.06)	(22.51)	(8.02)	(24.53)	(44.94)	(14.28)	(30.66)
<b>Female</b>							
No.	48,232	15,888	7,145	25,199	30,869	6,360	24,509
%	(60.98)	(20.09)	(9.03)	(31.86)	(39.02)	(8.04)	(30.98)
<b>Race</b>							
<b>White</b>							
No.	67,756	24,481	9,505	33,768	46,556	11,042	35,514
%	(59.27)	(21.42)	(8.31)	(29.54)	(40.73)	(9.66)	(31.07)
<b>Nonwhite</b>							
No.	4,576	1,259	1,151	2,168	3,985	1,567	2,418
%	(53.45)	(14.40)	(13.44)	(25.32)	(46.55)	(18.30)	(28.24)
<b>Region</b>							
<b>37th parallel or higher (high risk)</b>							
No.	57,521	21,163	8,688	27,670	40,383	10,819	29,564
%	(58.75)	(21.61)	(8.87)	(28.26)	(41.25)	(11.05)	(30.20)
<b>Below 37th parallel (low risk)</b>							
No.	14,811	4,577	1,968	8,266	10,158	1,790	8,368
%	(59.32)	(18.33)	(7.88)	(33.11)	(40.68)	(7.17)	(33.51)
<b>Total</b>							
No.	72,332	25,740	10,656	35,936	50,541	12,609	37,932
%	(58.87)	(20.95)	(8.67)	(29.25)	(41.13)	(10.26)	(30.87)

<sup>a</sup>Conterminous United States only.

median was a year earlier. At the time of first diagnosis the mean age for males (39 years) was three years greater than that for females (36 years). The difference in the medians was two years (37 versus 35). In addition, the average age for whites was three years older than for nonwhites at the time of first diagnosis (mean, 37 versus 33; median, 36 versus 33).

Subtracting either the ages or dates of onset from those of first diagnosis yields an interval between these events (Table 4). Trichotomizing the number of cases into groups of equal size according to the length of the interval yields the following categories: less than one year, one to four years, and five or more years. A mean interval of four years and median of two years was observed. Since extreme values cause distortion in the mean, attention is focused on the median. Differences in the interval between onset

and diagnosis are very pronounced by race, with a median interval of two years for whites and six years for nonwhites. The four-year difference is surprising, given that the reported median date of onset and first diagnosis are more recent for nonwhites.

In summary, a larger percentage of females were diagnosed as having probable multiple sclerosis as compared to males, despite their being more frequently reported by physicians who were not neurological specialists. No differences by sex for date of onset or diagnosis were observed; however, females were, on the average, two years younger at the time of onset and of diagnosis than males. Health surveys have repeatedly shown that women seek physician care more often than men [14], which presumably accounts for their earlier age at diagnosis.

More pronounced differences in disease characteristics emerge when whites and nonwhites are con-

Table 3. Number and Percentage Distribution for the Reported Prevalence<sup>a</sup> of Multiple Sclerosis by Disease Classification and Selected Demographic Characteristics, January 1, 1976

Characteristic	Probable MS	Possible MS with:		Possible MS
		Optic Neuritis	Transverse Myelitis	
<b>Sex</b>				
<b>Male</b>				
No.	31,167	2,370	3,783	6,703
%	(70.80)	(5.38)	(8.59)	(15.23)
<b>Female</b>				
No.	65,987	4,216	4,962	3,685
%	(83.69)	(5.35)	(6.29)	(4.67)
<b>Race</b>				
<b>White</b>				
No.	90,091	6,163	7,859	10,334
%	(78.71)	(5.39)	(6.87)	(9.03)
<b>Nonwhite</b>				
No.	7,063	423	886	54
%	(83.82)	(5.02)	(10.52)	(0.64)
<b>Region</b>				
<b>37th parallel or higher (high risk)</b>				
No.	75,722	5,396	7,236	9,617
%	(77.29)	(5.51)	(7.38)	(9.82)
<b>Below 37th parallel (low risk)</b>				
No.	21,432	1,190	1,509	770
%	(86.07)	(4.78)	(6.06)	(3.09)
<b>Total</b>				
No.	97,154	6,586	8,745	10,388
%	(79.07)	(5.36)	(7.12)	(8.45)

<sup>a</sup>Conterminous United States only.

trasted. Although nonwhites are less likely to suffer from multiple sclerosis, they had proportionately fewer possible and more probable cases. Nonwhites were more frequently reported by hospitals, and particularly those hospitals with approved neurological residency programs. A six-year interval between date of onset and diagnosis was observed for nonwhites as compared to four years for whites and the total multiple sclerosis population.

The observation that, in general, nonwhite cases were reported from large teaching hospitals with neurological residency programs may explain the larger proportion of probable diagnoses among these cases. The longer interval between onset of symptoms and diagnosis may be due in part to the assumption that multiple sclerosis is primarily a disease of whites. A diagnosis of multiple sclerosis in a nonwhite patient, therefore, may be delayed or made only after a period of extended observation.

#### Incidence

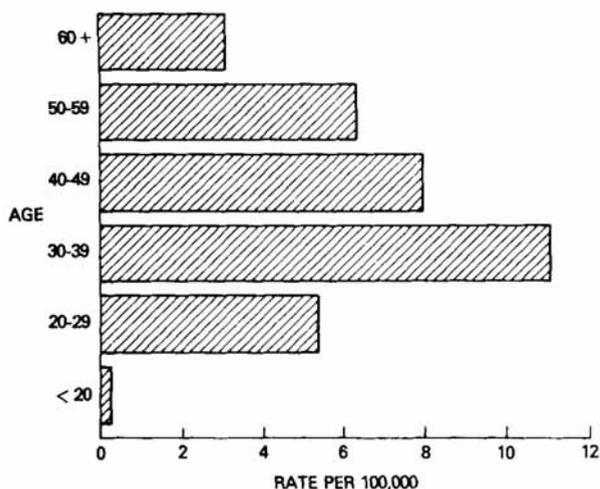
The estimated average annual incidence of suspected multiple sclerosis is 8,800, yielding an incidence rate of 4.2 per 100,000 population. Sex and racial differences with respect to the rates are consistent with those of the prevalence figures (see Table 1). The data by age corroborate the clinical findings of others [1]. The average age at first diagnosis was 38. Relatively few new cases occurred among individuals younger than age 20. There was a steady increase in the rate up through age 39, and thereafter the rate decreased again (Figure). The incidence rates by region of residence show a gradient of latitude similar to that for prevalence (see Table 1). The rates for the high-, medium-, and low-risk residence regions—5.3, 4.6, and 2.0 per 100,000 population—also show these trends.

Slightly more than half of the incidence cases were identified by physicians; the majority of these cases

**Table 4. Number and Percentage Distribution for the Reported Prevalence<sup>a</sup> of Multiple Sclerosis by Interval between Dates of Onset and First Diagnosis and Selected Demographic Characteristics, January 1, 1976**

Characteristic	Interval (yr)			Mean	Median
	<1	1-4	5+		
<b>Sex</b>					
<b>Male</b>					
No.	16,844	12,541	14,291	4	2
%	(38.57)	(28.71)	(32.72)		
<b>Female</b>					
No.	26,116	26,926	26,155	4	2
%	(32.97)	(34.00)	(33.02)		
<b>Race</b>					
<b>White</b>					
No.	40,992	37,760	35,801	4	2
%	(35.78)	(32.96)	(31.25)		
<b>Nonwhite</b>					
No.	1,968	1,707	4,645	6	6
%	(23.65)	(20.52)	(55.83)		
<b>Total</b>					
No.	42,960	39,467	40,446	4	2
%	(34.96)	(32.12)	(32.92)		

<sup>a</sup>Conterminous United States only.



*Annual age-specific incidence rates for reported multiple sclerosis per 100,000 population (1971-1975).*

came from board-certified neurological specialists (Table 5). In contrast, the overwhelming proportion of hospital cases came from institutions without approved neurological residency programs.

Three-fourths of the incidence cases were probable multiple sclerosis (Table 5). Almost 50% of the cases had their onset and first diagnosis during the incidence period, suggesting a relatively short interval between these events. It was found, however, that the mean interval between date of onset and first

**Table 5. Number and Percentage Distribution for the Estimated Average Annual Incidence of Reported Multiple Sclerosis by Selected Disease Characteristics, United States<sup>a</sup>**

Characteristic	No.	Percent
<b>Provider type</b>		
Physician	4,952	56.32
Board-certified neurological specialist	2,113	24.03
Non-board-certified neurological specialist	948	10.78
Other physicians	1,892	21.52
Hospital	3,841	43.68
Hospitals with approved neurology residency program	1,068	12.15
Other hospitals	2,772	31.52
<b>Disease classification</b>		
Probable MS	6,592	74.97
Possible MS with idiopathic optic neuritis	685	7.79
Possible MS with transverse myelitis	947	10.77
Possible MS	569	6.47
<b>Date of onset</b>		
1973-75	2,009	22.85
1971-72	1,946	22.13
1966-70	2,968	33.75
1961-65	988	11.24
Before 1961	883	10.04
Mean		1968
Median		1969
<b>Age at onset (yr)</b>		
< 20	1,159	13.18
20-29	2,608	29.66
30-39	2,414	27.45
40-49	1,258	14.31
50+	1,354	15.40
Mean		34
Median		33
<b>Interval between symptom and diagnosis (yr)</b>		
< 1	2,916	33.16
1-4	2,989	34.00
5+	2,888	32.84
Mean		4
Median		2

<sup>a</sup>Conterminous United States only.

diagnosis was four years and the median interval was two years, virtually identical to the prevalence cases. The median age at first symptom was 33 years, with approximately 29% of the reported patients being either under 20 years or over 49 years when their first symptom occurred.

The incidence cases differ from the prevalence cases in that: (1) the percentage of probable cases was less, (2) a greater proportion of physician-reported cases was from board-certified neurological specialists, and (3) both mean and median ages at onset and first diagnosis were higher. The difference with respect to disease classification is not surprising, given the shorter period of observation (approximately three years for incidence cases versus eleven years for prevalence cases). Based upon recent and continuing changes in the patterns of medical care, it is likely that recently diagnosed patients would be reported by neurological specialists. The age differences for onset and initial diagnosis may be a function of the proximity of these occurrences to the period of recall and the time at which medical care was obtained.

### Discussion

Like some other diseases, multiple sclerosis is often difficult to diagnose early in its course. The diagnosis reported by the medical providers is therefore subject to uncertainty, and this results in a number of cases being given either a false-negative or false-positive diagnosis. With respect to multiple sclerosis, the size of these groups is unknown and the impact on the disease rates is indeterminate.

A study of incidence and prevalence must address these issues. There is no easy way to adjust the results for false negatives. The detailed data possibly permit the reader to examine the issue of false positives using the classification of disease information. An experienced neurologist reviewing the patient records might be able to validate the diagnosis and form the basis for an estimate of the number of false positives; however, making a diagnosis solely on the basis of patient records is often difficult. Although the patients with a false-positive diagnosis do not have multiple sclerosis, the important point is that they are currently labeled by the medical community as having multiple sclerosis, are treated as if they have the disease, and may adopt a lifestyle reflecting the diagnosis; therefore we believe that they cannot be excluded from a count of incidence and prevalence.

Several reasons can be postulated concerning some of the differences previously noted. The prevalence rate is clearly higher for females and nonwhites, and this difference appears to be real. The marked decrease in the prevalence rate for the 60 and older age group probably results from a combination of how the data were aggregated and the high mortality at these ages.

The general differences with respect to type of health care provider may reflect geographic or temporal differences regarding the patterns and avail-

ability of medical care in the United States. The manner in which men and women respond to medical problems is probably the reason for the observed differences by sex. Men may delay their initial medical visit until symptoms are severe, at which point hospital care is sought. In contrast, women, who more often receive routine medical services, are more likely to consult physicians in private practice for less severe or more subtle signs and symptoms. One explanation for the large percentage of nonwhites from hospitals with approved residency programs is that there is a high concentration of nonwhites in urban areas, and many of these individuals receive their primary health care at university-based hospitals in the inner city.

Many researchers have estimated the incidence and prevalence of multiple sclerosis in the United States. The majority of these studies have applicability only to restricted population groups. Because the incidence and prevalence of the disorder are latitude dependent, these regional figures cannot be generalized to national estimates. Aside from the present study, the only recent data collected on a nationwide basis are from the Health Interview Survey of the National Center for Health Statistics. Estimates of prevalence were made for 1973 and 1978 based upon household interviews that included a general question whether anyone in the household had multiple sclerosis ([11] and Black E, National Center for Health Statistics: personal communication, 1980). These estimates are 90,000 and 121,000 for 1973 and 1978, respectively.\* Based upon data observed in the National Multiple Sclerosis Survey, it is estimated that approximately 14% of those reported to have the disease are unaware of their diagnosis and would be unlikely to be included in the Health Interview Survey. Therefore, the Health Interview Survey estimates should be increased to 104,700 and 140,700 to include the uninformed cases. Our estimate is midway between these two. The closeness of the estimates, considering the independence of the methodologies, is quite remarkable.

Assuming that the biological characteristics of the disease do not vary by locality, some of the results from this survey may be compared with those from more localized clinical studies. Such comparisons could serve to highlight similarities and differences between our data and those from other multiple sclerosis studies. Differences in definitions and case ascertainment procedures among the studies will result in different rates; therefore, the focus of the following comparisons is on relationships between cate-

\*The sampling variation at the 95% confidence interval is  $\pm 36,000$  ([11] and Black E: personal communication, 1980).

gories of a specific characteristic. To limit the effect of differences in diagnostic techniques and health care practices, all comparisons are restricted to studies performed in either the United States or Canada.

A sex ratio in the range of 1.5 to 1.9 females per male has been established by researchers in other studies [3, 7-9]. Matthews [6] reports the usual ratio to be 1.5 females per male. The sex ratio of 1.8 females per male observed in this study is at the upper end of the range. Kurtzke et al [5], in their study of veterans, found that among males, 96% of the patients were white. Comparable data from this study yielded 95%.

In the study of veterans [5], 43.6%, 42.1%, and 14.3% of the men with multiple sclerosis lived in the high-, medium-, and low-risk regions, respectively, at the time of entry into active duty. Comparable figures from our study are 35.6%, 42.6%, and 21.8%. Differences in the distributions for the two studies are partially due to differences in definitions of residence. In the study of veterans, this was defined as residence at the time of entry into active duty, and a criterion for selection was that the veteran served in either World War II or Korea. In the 1950s, the center of population continued its westward movement but also started a distinct shift southward [13]. Therefore it would be expected that a smaller proportion of the veteran cases would come from the low-risk region as compared to the proportion observed in this study. This explanation may also account for the lower proportion found in the high-risk region by this study.

As with other prevalence data [8], the age-specific rates increase with age and attain their maximum between the ages of 50 and 59 years. There are some slight differences between the findings of this study and those from Rochester, MN. The Rochester data [8] indicate that the rates for the age group 40-59 are approximately 2.4 times those of the 20-39 age group and 1.3 times those for the group 60 and older. Comparable data from this study yield factors of 2.0 and 2.6, respectively. One reason for the discrepancy between the studies is that Percy et al [8] excluded cases of possible multiple sclerosis. The definite cases, according to the criteria [10] many researchers use, would be restricted to having ages at onset between 10 and 50. That limitation was not applied in this study because, as McAlpine and Compston [7] noted, occasional cases have onset after age 50, and Matthews [6] found that new cases without any prior history or suggestion of previous attacks continue to occur into the sixties. As a result, in the Rochester incidence population, 2% of the patients were 50 years of age or over, but this group accounted for 15% in our study.

## Conclusions

The prevalence of reported multiple sclerosis in the conterminous United States on January 1, 1976, is estimated to be 123,000 cases, for a rate of 57.9 per 100,000 population. Comparable figures for incidence indicate an average of 8,800 cases annually, for a rate of 4.2 per 100,000.

This investigation corroborates other research which indicates that multiple sclerosis is a disease that most often affects females, whites, and young adults, and those living above the 37th parallel. Moreover, the data from this population are very similar to those obtained from clinical multiple sclerosis populations.

The findings from this study partially validate the commonly accepted age-related patterns of multiple sclerosis. The data substantiate that the disease primarily affects adults between the ages of 30 and 50; however, over 15% of the incidence cases had ages at onset of 50 years and over. This latter fact was surprising, because by some diagnostic criteria these cases would not have been diagnosed as definite multiple sclerosis. Our data and those of Matthews [6] indicate that the age limits established by these diagnostic criteria may need to be reevaluated.

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