Dramatic Changes in Multiple Sclerosis Prevalence in Iran: A Descriptive Study in Ten Regions of Iran

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Abstract

Background and Objectives: The prevalence of multiple sclerosis (MS) differs between different regions of Iran. This study aimed to investigate changes in prevalence and incidence rates of MS in ten ethnic and cultural zones of Iran set by the Ministry of Health and Medical Education. **Materials and Methods:** Information on MS incidence and prevalence was obtained from the national registry of MS during the study period 2006–2013. Demographic data were acquired from the Statistical Centre of Iran. **Results:** A rising trend of MS prevalence was observed in Iran, and overall, the prevalence of MS increased by 3.67% per year. The highest prevalence rates of MS, and the most dramatic increase in MS prevalence, occurred in the central areas of Iran. However, during the 7-year period, the prevalence gradually increased also in southern and western areas. **Conclusion:** The prevalence and incidence of MS have been rapidly increasing in all regions of Iran, especially from central to western and southern regions.

Keywords: Incidence, Iran, location, multiple sclerosis, prevalence

INTRODUCTION

Multiple sclerosis (MS) is a chronic inflammatory disease of the central nervous system that mostly affects young adults.[1] The etiology of the disease is considered to involve both genetic and environmental factors as well as interactions between them.[2] Established environmental factors affecting MS risk include Epstein–Barr virus, Vitamin D deficiency, skin color, smoking, occupational exposure, toxics, and stress.[3,4] Previous studies have shown that MS prevalence differs depending on geographical latitude,[5] and people in Eastern Europe are more likely to suffer from MS than people in Asia, Africa, and Latin America.[6] In general, the risk of MS increases with the distance from the equator, but in recent years, the geographical distribution of MS has changed and the prevalence of the disease has increased in some areas. For instance, although the countries around the Persian Gulf have

been among those with low risk of MS, a rising trend of MS occurrence has been recently recorded.[7,8]

Iran is one of the Middle Eastern countries in which a dramatic increase has been observed in MS prevalence. For example, Isfahan and Tehran are two well-known cities in the case of MS. In addition, several cities of Iran studies related to risk factors of MS were conducted during recent years.[9,10] Dehghani *et al.* showed that the prevalence of MS was associated with the rate of industrialization in Iran.[8] Moreover, based on a study carried out with Pakdel *et al.*, it has been proven that inequalities in health facilities and specialists in different

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provinces of Iran can bring about significant differences between diagnosed cases of MS.[11]

In order to develop and meet health-related objectives, the Ministry of Health and Medical Education (MHME) of Iran has recently divided the country into ten zones based on the spatial planning project. In this project, provinces with similar climatic, cultural, and geographical characteristics have been zoned together [Figure 1]. Investigating and comparing MS occurrence between zones with different climatic, cultural, and geographical characteristics could result in valuable findings. Therefore, this study aimed to investigate the prevalence and incidence rates of MS in different zones of Iran during the 2006–2013 period.

MATERIALS AND METHODS

Study design

This descriptive study used the zones defined by the MHME in the spatial planning project to evaluate the situation of MS in Iran. The zones have been categorized based on the Kurtzke scale, in which the prevalence rates <5, 5–30, and >30 cases of MS per 100,000 persons are considered as low prevalence, moderate prevalence, and high prevalence, respectively.

Patients

We used MHME to obtain data regarding prevalent and incident cases of MS during 2006–2013 (because MS data were available during this time). While there is no integrated national registry which can cover all MS patients in Iran, most patients are registered in a computerized system holding by MHME. In this system, all MS patients who want to receive subsidized drug-like beta-interferon should be enrolled in this computerized registry system. This database was used in many studies as the most reliable resource of MS data in Iran.

The main diagnostic criteria were McDonald, however, the test has been changed several times during the study period,

and the patient may have been recognized according to any version of McDonald test.

Variables

After obtaining data on the population of cities and provinces for the study period from the Statistical Centre of Iran, the prevalence and the yearly incidence rates of MS were calculated for each zone. Prevalence and incidence were calculated using the number of cases and the population in the middle of the year based on estimations of the national center of statistics.

Table 1 presents the provinces, their location, and the racial and ethnic distribution in each zone.

Statistical analysis

First, the descriptive analysis was used for all dataset's variables. The statistical significance in the trends of incidence and prevalence was determined using the Chi-square for linear trends. We also used SPSS software (Version 16) (SPSS Inc. Chicago. USA) for our analysis on a personal computer.

Ethical consideration

This study was ethically approved by the Research Ethics Committee of Neyshabur University of Medical Sciences (IR. NUMS.REC.1396.10).

RESULTS

The results showed that the prevalence of MS has significantly increased between 2006 and 2013 ($P < 0.05$), and most of the zones had a high MS prevalence in 2013. Overall, the prevalence increased by 3.67% per year during the study period. The changes in MS prevalence between 2006 and 2013 are illustrated in Figures 1 and 2.

In 2006, only three zones had a high prevalence of MS, i.e., Zones 6, 7, and 10, whereas the prevalence within the other zones was moderate [Figure 1].
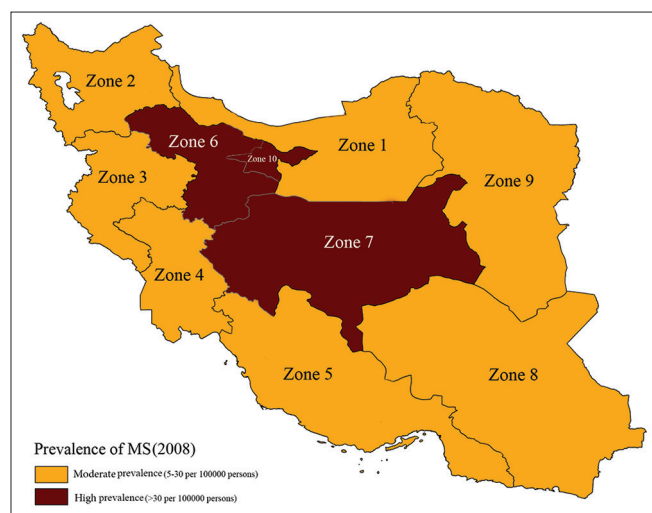

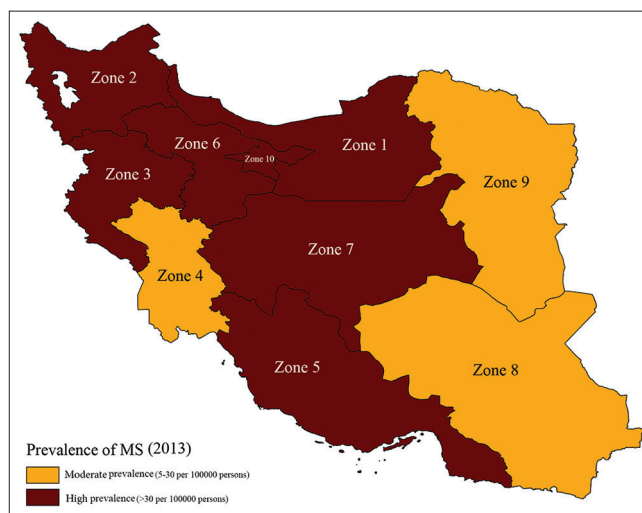**Figure 1:** Prevalence of multiple sclerosis in ten regions of Iran in 2006–2007

Figure 2: Prevalence of multiple sclerosis in ten regions of Iran in 2012–2013

Table 1: Provinces their location and the racial and ethnic distribution in each zone

Zone number	Provinces in each zone	Location	Ethnicity	Population per million people[a]
1	Guilan, Mazandaran, Golestan, Semnan	North and a small region from center	Mazani, Guilak, Torkaman, Balouch, Fars, Turk	7,963,049
2	Western Azarbaijan, East Azarbaijan, Ardabil	Northern west	Mostly Turk, Kurd in small quantity	8,053,684
3	Kermanshah, Hamadan, Kordestan, Ilam	West	Mostly Kurd, LAK, Turk, Fars	5,754,739
4	Ahvaz, Lorestan	Western south and some regions in west	Mostly Lor and Arab, Fars in small quantity	6,285,963
5	Fars, Hormozgan, Boushehr, Kohgiluyeh and Boyr-Ahmad	Center to the south	Mostly Fars, Lor, Arab in small quantity	7,866,419
6	Zanjan, Markazi, Ghazvin, Ghom, Alborz	Center to the west	High population mixing, but mostly Turk	4,782,930
7	Isfahan, Yazd, Chaharmahal and Bakhtiari	Center	High population mixing	6,849,003
8	Kerman, Zahedan	Eastern south, some regions in south and center	Mostly Balouch and Fars	5,473,315
9	North Khorasan, Razavi Khorasan, South Khorasan	Eastern north, north	High population mixing of several ethnics	7,524,663
10	Tehran	Center to the north	High population mixing, but higher Turk population that other provinces	12,183,391

In 2013, the number of zones with high prevalence had increased to include seven zones. High prevalence rates were observed in northern, southern, and western areas, while eastern areas still had a moderate prevalence rate [Figure 2].

The yearly prevalence changes of MS in different zones are presented in Figure 3. The most dramatic change in prevalence rate occurred in Zone 10, in which the prevalence reached 87.63 per 100,000 in 2013 from 33.11 per 100,000 in 2006. Less pronounced changes were observed in Zones 8–9, in which the prevalence increased by 11–12/100,000.

According to Table 2, the incidence of MS increased significantly in several zones, especially in Zone 10. In other areas, such as in Zone 4 and Zone 8, low incidence rates of MS were observed during the whole study period. The incidence rates in Zones 4 and 8 were 1.71 and 1.88 per 100,000, respectively. In contrast, the incidence rate in Zone 10 was 9.27 per 100,000 in a year.

Discussion

The present study investigated the prevalence and incidence of MS in different zones of Iran during the 7-year period of 2006–2013. The prevalence of MS has increased in the central regions, as well as in the north, south, and northwest. The higher prevalence rates in the central provinces can be due to the better diagnostic facilities in these provinces as well as accumulation of cases in these parts. However, along with that, it should also be noted that the determinants of MS are also more present in these areas. Several studies that have investigated the regional prevalence of MS in the Middle East have observed that environmental factors, such as increased air pollution as a consequence of urbanization and industrialization, and changes in lifestyle habits, such as increased prevalence of smoking and use of sun protection
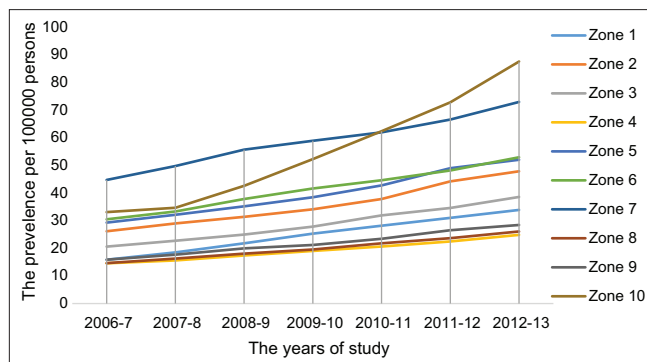

Figure 3: Yearly prevalence of multiple sclerosis in ten different zones of Iran during 2006–2013

products, are more common in areas with increasing prevalence of MS.[8,12-17]

Urbanization increases air pollution (especially particles like PM_{10} that could increase MS risk).[18-20] Air pollution, especially PM, has caused some concerns in many areas of Iran.[21,22] Although high levels of PM have been associated with MS risk, and areas such as Zones 7 and 10 with high air pollution have a high prevalence of MS, other highly polluted areas such as Zones 4 and 9 have a lower prevalence of the disease. However, it should be noted that the cities of Tehran and Isfahan, which are the main cities of Zones 7 and 10, have been experiencing air pollution problems the past two decades, but air pollution in Zone 4 has intensified over the past few years and its effect on MS incidence may not yet be apparent.[23-26]

The differences in MS incidence may also be attributed to the heterogeneity in ethnicity in different areas in Iran. In regions where Balochistan ethnicity is dominant, such as in Zone 8, MS incidence is low and may indicate that this ethnic group is more resistant to MS compared to other ethnic groups. Other

Table 2: The changes in incidence of MS in ten zones of Iran during whole study period (2006‑2013)

Zone	B	P	95% CI
1	3.04	<0.001	2.91‑3.17
2	3.64	<0.001	2.93‑4.35
3	3.02	<0.001	2.65‑3.39
4	1.71	<0.001	1.53‑1.88
5	3.91	<0.001	3.34‑4.47
6	3.70	<0.001	3.46‑3.95
7	4.45	<0.001	3.93‑4.97
8	1.88	<0.001	1.73‑2.03
9	2.10	<0.001	1.87‑2.33
10	9.27	<0.001	7.30‑11.24

CI: Confidence interval

studies have reported that some Iranian races may be more susceptible to the disease. For example, Abdollahpour *et al.* showed in a small‑scale study that people of Lor ethnicity are at a higher risk of MS. However, although there are a high degree of air pollution and a high percentage of people of Lor ethnicity in Zone 4, the prevalence and incidence of disease in this area are low.[27]

The prevalence of MS in Iran thus seems to be affected by other factors than ethnicity. It has been suggested that the development of the disease is associated with the migration and transmission of infections among different populations,[28] but the distinction between immigration and tourist attraction (both of which has the potential to transmit infections) has not been established. For example, Tehran and Isfahan are areas attracting tourism and immigration in Iran and the prevalence in these areas is very high; however, in contrast to cities such as Mashhad and Qom (close to Tehran and Isfahan), a strong religious attraction varies widely between inland and foreign tourist, but the prevalence in these areas is much lower than in Tehran and Isfahan. Unfortunately, from this point of view, the distribution of the disease has not yet been addressed in the world. However, further studies are needed on the impact of migration and infection.

This study as a country‑level evaluation has some limitations; first, our study has the lack of possibility to compare the ethnicities statistically, because no accurate data on the ethnic groups of each zone are gathered in Iran, and information on the dominant ethnicity in each zone was obtained from local inquiries. Second, method of data collection is the registry system so that any patient who wishes to receive subsidized beta‑interferon medication should register in the University of Medical Sciences in province of their residence. This registry covers a considerable percent of MS patients; regarding some limitation of this database, the national registry of received beta interferon is the most important source of MS studies in Iran.[7,15,29,30] Finally, as this is a national‑wide study and the goal of this kind of study is to create a hypothesis, so we cannot speak with high certainty, but in order to make findings more reliable, it can be accomplished by further small‑scale studies.

CONCLUSION

We studied the prevalence and incidence rates of MS in 10 zones of Iran during 2006–2013. Due to cultural, climatic, and geographic heterogeneity of these zones, the high prevalence rates of MS spread from central areas in 2006 to northern, southern, and northwest areas in later years. The higher rates of disease in central areas could be due to better diagnostic facilities, urbanization, immigration, and also the presence of determinants of MS in these areas. These determinants include the stresses resulting from the change in lifestyle and the lack of adaptability to new conditions, Vitamin D deficiency, increased accommodation in apartments, increased exposure to anthropogenic contaminants (population mixing and its related stresses), and other factors associated with urban life. However, this issue needs more studies to prove further. It was also found that the incidence in the central regions of Iran was much higher, indicating that the risk in these areas is much higher than in other areas. In further studies, the effect of air pollution, Vitamin D supplementation, and socioeconomic determinants on MS prevalence can be assessed.

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Conflicts of interest

There are no conflicts of interest.

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