



The Evaluation of Multiple Sclerosis Dispersal in Iran and Its Association with Urbanization, Life Style and Industry

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Abstract

Background: Multiple Sclerosis (MS) is an autoimmune disease with unknown factor. The prevalence and incidence rate of this disease had an upward trend in many regions in the world such as Middle east and consequently in Iran over the recent years. As the risk factors of this increased trend and high-prevalence is unknown in Iran, the current study has been designed to evaluate the correlation between MS dispersal with urbanization, life style and industry, as an ecological research.

Methods: This retrospective study was designed as an ecological approach in 2011. Data were collected from three databases by high precision (CI95%) from national registry plans. The subjects of study were provinces of Iran (n=31). The linear regression was used to perform statistical analyses.

Results: The obtained results indicated an ascendant trend of MS during the recent years, as the incidence of this disease reached from 26.24/100000 (CI95%) people in 2006 to 44.53/100000 (CI95%) in 2011. There is a direct correlation ($P<0.05$) between the percentage of urbanization and the percentage of male smokers with the prevalence of MS in provinces.

Conclusion: The role of smoking was more highlighted in this study as a probable factor in increasing risk and causing MS disease. Urbanization could be introduced as an augmentative factor, but this is a combination of several complex factors that this effect must be appraised with smaller scale in other researches.

Keyword: Ecological studv. Industrv. Life stvl. Multiple sclerosis. Urbanization

Introduction

Multiple Sclerosis (MS) is an autoimmune disease. It is diagnosed by inflammation, demyelination of neurons and damages to Central Nervous System (CNS). Most often, this disease has an ascendant and recurring trend. The appearance and symptoms of this disease are suddenly occurring and cause decease the patient over several weeks to

months. The senile range for this disease is from 17 to 50 years of age (1-3).

The population of MS reached to 2 million people in the world in 2007 and it was determined that the prevalence of this disease is being increased right across the globe (4, 5). The rampancy of MS has been more in north-hemisphere countries ra-

ther than to other ones and the countries with more distance to tropical line has the highest prevalence of mentioned disease. The prevalence of MS was too high in regions such as north- Europe and America and low in regions such as Middle-East, according to classifying of countries with MS spread geographically(6, 7).

Many factors have been introduced as possible agents in causing MS, but genetic- and environmental factors are more likely play role in that, totally. Some of the studies introduced a theory that expresses this disease has been developed by an autoimmune process, genetically, and these events are prognoses of contact with some environmental factors. Therefore, it could be said that this disease is a multi-factor disease that correlated with genetic- and environmental factors(8, 9) but it seems that the role of environmental factors is more highlighted (10). The potentially environmental factors for MS including infectious agents (especially Epstein Barr Virus), decreasing exposure with sunlight, lower intake of vitamin D, contact with chemical matters (especially chemical solutions), smoking and socio-economic factors (e.g. higher social class) (11, 12).

In 2005, WHO declared that unhealthy life style could play an important role in increasing chronic diseases and also intimated that modernization, urbanization, industrial- and mechanical life could influence on life style (13). One of the impressive factors in appearing chronic diseases correlates with changing life style, urbanization and growing of industries, consequently. Some studies have been performed in the aspect of MS and its correlation with life style. Smoking (among other life style factors) could be effective in MS risk increase (14). Life style could effect on MS disease appearing, according to mentioned research, of course, this theory has not been proved, perfectly. Furthermore, some researches have been conducted in the aspect of industries' effects on MS, which was demonstrated that there is a correlation between industrial activities with MS prevalence (15, 16). In accordance with the studies carried out in countries located in Persian Gulf margin such as Bahrain, Iran, Iraq, Oman, Qatar, Saudi Arabia and United Arab Emirates– with high level of in-

dustry, urbanization and modernization growth – demonstrated that their life style have been changed based on technology. These factors cause lower activity, decrease in receiving sunlight and unhealthy diet. These cause lack of vitamin D and chronic obesity diseases (17-19).

There was no comprehensive study in the aspect of simultaneous effects of urbanization, industry and life style on prevalence of MS, to date. On the other hand, Iran is one of the countries that has a daily ascendant trend of MS. Iran as a low-prevalence country is being changed toward a high-prevalence one (nevertheless, Iran is located in a low-prevalence zone, geographically), as the prevalence of MS in Tehran city was 51.9/100000 (20). Similar results have been obtained in the aspect of MS prevalence in Isfahan province (43.8/100000) (21).

The prevalence of MS in Iran might be correlated with urbanization, industry and factors relating to life style. Hence, the current study was designed to survey MS dispersal during the recent years and its correlation with industry, urbanization and life style in Iran with an ecological approach.

Methods

This retrospective study was designed as an ecological research in 2011 and all of the limitations and advantages have been considered. The current study was performed in Iran, a country located in the Middle East between northern 25-39 latitude and eastern 44-63 longitude. Iran area is 1,648,195 km², and its population was reported 75,149,669 in 2011, according to the last Population and Housing Census (22). Iran's provinces made the subjects (units) of study that have been surveyed according to the last vernacular divisions. Three databases have been involved in this study. For data needed to authorization, allowance letter was taken. These data are including:

Geographic data

Geographic data comprises of latitude and sunny hours. Latitude for each province has been considered as the latitude of the center of each province and sunny hours as annual mean of sunny hours

for each province that both of criteria were rates of exposure with sunlight. These data have been taken from National Center of Iran Statistics Portal (22).

Life style data

Data related to life style were obtained from Iran Non - Communicable Diseases Risk Factors Surveillance Provincial report 2009 included smoking, body mass index and physical activity. Each of these variables had an index as follows:

Percentage with low physical activity <600 meter/week-CI95% as physical activity index, percentage who smokes tobacco daily -CI 95% as smoking index, and Body Mass Index(BMI) (kg/m²) – mean – CI 95% as obesity index. These data are available on website <http://www.ncdinfobase.ir> for each province and gender (23).

Multiple Sclerosis data

Data related to MS and its prevalence for each province in National Registry has been collected by Deputy Minister of Health, Treatment and Medical Education and the prevalence of disease (CI 95%) was obtained for each province in 2006 and 2011. Method of data collection is the National Registry so that any patient who wishes to receive subsidized interferon medication should register in university of medical sciences in province of their residence. One of the sources of bias can be referred to those patients who do not receive subsidized interferon drug but these patients are very few and do not counted.

McDonald positive tests have been recorded in this research as inclusion criteria (24). To draw MS dispersal map in Iran, Kurtzke category was used, in which areas with lesser prevalence of 5 patients per 100000 people considered as low-prevalence areas, regions with 5- to 30 patients per 100000 people as mild-prevalence and regions with more than 30 patients per 100000 people as high-prevalence one (7).

Urbanization and industry data

Data related to urbanization and industries were taken from National Center of Iran Statistics Portal. Urbanization index was calculated as urbanite population/total population of province ratio, based on Population and Housing Census in 2006 and 2011

reports. Industry index was calculated as practitioner population (in industry)/total population of province ratio, based on the same reports (22).

All used data were secondary data as a retrospective study and these data were collected with valid questionnaires that validity of these ones was confirmed by the Deputy Minister of Health, Treatment and Medical Education. Beside the study was conducted using the latest available data that the last national census was performed in 2006 and 2011 (22-24).

There was no selection bias because all data were used. In addition, there is no missing data unless about Alborz Province that in 2006 this province has not had any data.

The linear regression was performed in statistical analyses, for the first stage, one-variant analyze was conducted to evaluate the correlation of MS prevalence in 2011 with independent variables. In the second stage, variables which had a significant correlation with dependent variable ($P<0.05$) entered to main stage of analyze (multivariate analysis). The method used for this stage was stepwise and data were reported in tables, ultimately. All the assumptions of linear regression were established. SPSS software (Chicago, IL, USA) was used to perform statistical analyses. This study did not have any ethical consideration since the secondary data were used in this study and the references of the data presented in the text.

Results

This study was performed as an ecological approach in which 31 provinces were involved. In the current study, we have focused on environmental factors' effects such as geographic conditions, industry, urbanization and factors related to life style on expressing MS prevalence in Iran, 2011 (Table 1).

The prevalence of MS has been increased from 24.26/100000 in 2006 to 44.53/100000 in 2011. Simultaneously, urbanization percentage has been increased in mentioned range (68.45 to 71.38 percent) (Table 1). Figures 1 and 2 have been drawn according to Kurtzke incidence category to determine MS prevalence in Iran's provinces, more accurately.

Table 1: Descriptive analyze of available variables

Variables	Mean	Std. Deviation
The prevalence of MS per10 ⁵ inhabitants2011	44.53	17.36
The prevalence of MS per10 ⁵ inhabitants2006	24.26	12.29
Urbanization index 2011	71.38	12.31
Urbanization index 2006	68.45	12.51
Industry index 2011	1.65	1.2
Industry index 2006	1.51	1.25
Percent of males who smoking cigarette 2009	19.09	4.92
Percent females smoking cigarette 2009	0.61	0.54
Percent males with low physical activity 2009	27.84	10.92
Percent females with low physical activity 2009	48.65	10.49
Average of BMI in males 2009	24.02	0.74
Average of BMI females 2009	25.41	1.00
Average of annual sunlight hours 2006	248.74	31.05
Average of annual sunlight hours 2007	241.32	35.01
Average of annual sunlight hours 2008	229.34	38.48
Average of annual sunlight hours 2009	254.30	29.15
Average of annual sunlight hours 2010	247.31	38.31



Fig.1: Prevalence of MS in Iran, 2006

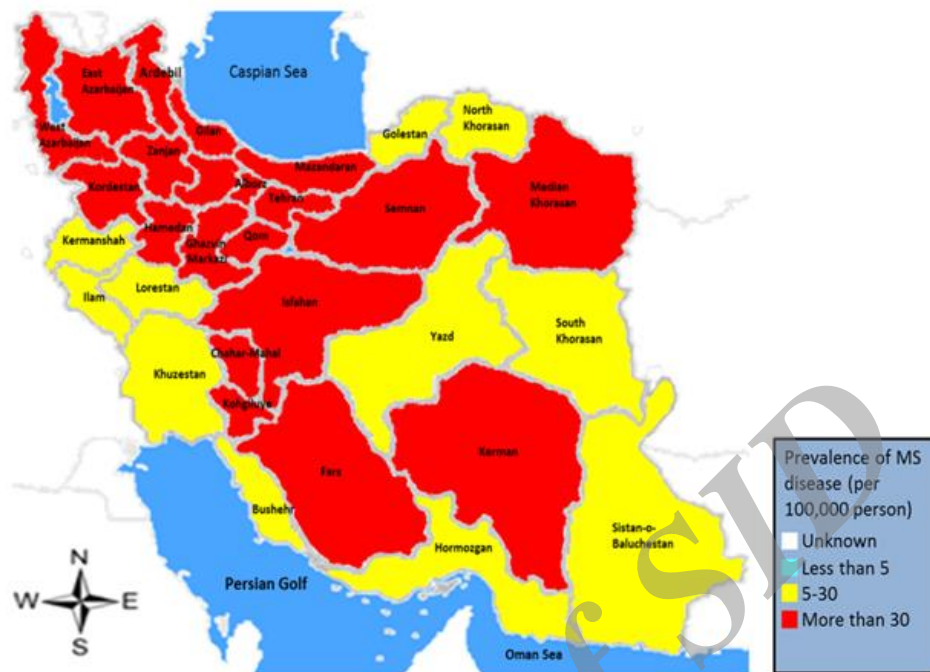


Fig. 2: Prevalence of MS in Iran, 2011

In Fig. 1 and 2, lesser prevalence of 5 patients per 100000 people considered as low-prevalence, the prevalence of 5- to 30 patients per 100000 people as mild-prevalence and more than of 30 patients per 100000 people as high-prevalence. The incidence of MS have been increased from 2006 to 2011, Sharply; as determined, 3-, 19-, and 8 provinces with low-, medium-, and high-prevalence in

2006, respectively. But it was determined that only 11 provinces had a medium -prevalence and remained provinces had a high-one in 2011. To perform statistical analyses, a linear regression was used. For the first step, one-variant analyze was conducted and then multivariate one. In one-variant analyze, variables correlations were thought out with MS in 2011(Table 2).

Table 2: Correlation coefficients between MS prevalence in 2011 with other variables

variables	P	Pearson correlation
Urbanization index 2011	<0.001*	0.597
Industry index 2011	0.007*	0.429
Industry index 2006	0.004*	0.465
Percent of males who smoking cigarette 2009	<0.001*	0.635
Percent females smoking cigarette 2009	0.168	0.179
Percent males with low physical activity 2009	0.293	-0.102
Percent females with low physical activity 2009	0.471	0.014
Average of BMI in males 2009	0.061	0.283
Average of BMI females 2009	0.168	0.179
Average of latitude	0.251	0.125
Average of annual sunlight hours 2007	0.351	0.073
Average of annual sunlight hours 2008	0.166	0.183
Average of annual sunlight hours 2009	0.362	0.067
Average of annual sunlight hours 2010	0.239	0.135
Average of annual sunlight hours 2011	0.259	0.121

*P<0.05

According to Table 2, MS distribution correlated with urbanization and industry distribution in 2 periods of Population and Housing Census in 2006 and 2001. There is only a significant correlation between smoking and MS prevalence in 2009, in the aspect of life style factors. There was no

significant correlation between other factors with MS prevalence and latitude and annual mean of sunny hours from 2007 to 2011. In the second stage of statistical analyze, multivariate regression was performed with significant variables that its results are detailed in Table 3.

Table 3: Results of multivariable regression

Variables	Unadjusted Beta	Unadjusted S E	Adjusted Beta	t	P	LB (95%)	UB (95%)
Percent of urban resident(2011)	0.718	0.181	0.506	3.943	0.001	0.341	1.086
Percent males who smoking cigarette(2009)	1.701	0.453	0.482	3.758	0.001	0.769	2.633

SE: standard error, LB: Lower Bound, UB: Upper Bound

According to Table 3, there was a significant correlation ($P = 0.001$) between MS prevalence with distribution of urbanites percent in Iran's provinces in 2011. Moreover, there was a significant correlation ($P = 0.001$) between percent of male smokers with MS prevalence in Iran. There was no correlation between other variables with MS prevalence.

Discussion

This study was performed with the aim of surveying MS prevalence condition during recent years and effects of urbanization, industry and life style on its distribution in Iran as an ecological approach.

The obtained results indicated that MS prevalence had an ascendant trend with acute slope, over the recent years; as its prevalence has been increased from 24.26/100000 people to 44.53/100000 from 2006 to 2011 (Table 1). Its distribution was the same with its prevalence, as well. The number of provinces with high-prevalence (more than 30 patients per 100000 people) was only 8 in 2006, but this rate reached to 20 in 2011 (Fig. 1 and 2). This additive trend has been reported for other countries (25-27).

Growing prevalence over time could be influenced by improvement of the diagnostic facilities but results of this study showed that increasing prevalence of MS is visible in outlying provinces;

as a result, effects of environmental factors and migration to urban and changes of lifestyle could be more likely. Hereupon, improving of diagnostic facilities might not be correlated with increase in MS prevalence.

In another face of results, the prevalence of MS for each province with its urbanization percentage was correlated. On other words, provinces with more urbanization percentage have more prevalence of MS. As mentioned above, with increasing in modernization and mechanical life, risk factors of chronic diseases would be increased, consequently. Hence, one of the reasons of this high-prevalence in provinces with more urbanization is due to change of life style, diet and increase in unhealthy alimentary regimens, probably (13, 17, 19). Air pollution in more urban areas could be counted as another factors influence on this correlation; since it is showed that more urbanization provides more air pollution. Air pollution (especially particles like PM_{10}) could increase MS risk (28, 29). Air pollution and especially PM_{10} caused some concerns in many areas of Iran (30, 31).

Beside, people in larger- and modernized cities are contacting with lesser malady factors rather than people in rural areas, owing to higher social class and providing better health care facilities in childhood, they have lesser adaptation with outer factors in adulthood, consequently. This has been counted as an increasing factor in MS risk (10).

There was a significant correlation between male smokers' percent with MS prevalence in 2011 for each province. Smoking has been introduced as an increasing factor in MS risk in other studies (32, 33). This could be correlated with different effects of smoking on immune system. Of course, one of the reasons could be related to huge effects of smoking to appear chronic diseases, is passive- or second hand smoking by people surrounds smokers (34, 35).

There was no MS gradient based on changing of latitude that is incompatible with some studies (12, 36). The cause of this difference in findings is probably due to less discrepancy of latitude (maximum and minimum; 14 degrees) in Iran, since many ecological studies reported the correlation between MS prevalence with latitude, have been conducted in territorial- and continental scale (with high latitude discrepancy). Recent researches illustrated that there is no latitude gradient in MS appearing (37).

The information was collected from 3 different databases, this difference caused limitations, as the last information of 2 databases were not simultaneous, but it should be considered that they were the last available ones. Similar to other ecological researches, this study was designed in large scale with high-expending effectiveness to answer scientific questions based on available data. Data used in this study were valuable and had high accuracy, since they have been collected with methods such as Population and Housing Census and National Registry.

MS prevalence in Iran had a significantly upward trend in past years and this can be related to many factors, possible effects of urban life and unhealthy lifestyle were observed in this study.

It seems that performing studies with smaller scale and focusing on other effective factors such as level of education, social class, level of salary, contact with air pollution and chemical solutions and also passive- or second hand smoking is necessary. In addition to focusing on environmental factors, effects of genetic factors and mutuality of environmental- and genetic ones should be considered.

Conclusion

Civic life style and smoking could play pivotal roles in MS risk increase, briefly. Urbanization index comprised of multifarious factors that could effect on increase and decrease of diseases.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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