

Role of Ethnicity and Environment as Risk Factors on Asthma in Two Ethnic Groups in Michigan State, United States of America

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Summary:

Background: Asthma is an increasing worldwide health problem. The prevalence of asthma is higher in some ethnic minorities and lower in other ethnic groups. Environmental exposures, and psychosocial factors, have been suggested to be main mediators for asthma. Ethnicity related to racial background can influence the differences in asthma through the disease susceptible alleles.

Objective: To evaluate role environmental and cultural risk factors for asthma among different ethnic groups.

Methods: A random sample of 337 Iraqis selected from 5,490 Iraqi residents in the Greater Detroit area. Data collected using Validated questionnaire. Chi-square, t-test and logistic regression were used.

Results: Results showed a significant difference in the prevalence of asthma among Chaldeans (0.7%) and Arabs (8.7%). However environmental and psychosocial exposures and socioeconomic status were not significantly associated with asthma in Arabs, nor Chaldeans.

Conclusion: Even though Arabs and Chaldeans are from the same geographical region, and therefore share similar environmental background asthma prevalence was about 9 times higher in Arabs as compared to Chaldeans. Ethnic background was the only significant risk factor associated with asthma. Genetic differences could explain the high susceptibility to asthma in Arab compared to Chaldean.

Keywords: Genetics, Ethnicity, environment, Asthma.

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Introduction:

Asthma is an increasing worldwide health problem (1). In the US, the prevalence increased from 7.3% (20.3 million persons) in 2001 to 8.2% (24.6 million persons) in 2009. (1,2) (The prevalence and morbidity of asthma is higher in some ethnic minorities such as Puerto Ricans and African Americans.(3) and lower in other ethnic groups like Mexican American. (4) Environmental exposures, health care access, stress, psychological factors, and cultural factors have been suggested to be main mediators of the effect of socio economic status on asthma.(5) Higher level of exposure to indoor allergens in some minorities may be partially explained by residence in inner city areas.)3(Ethnicity is related to racial background, which can also influence the differences in asthma through the disease susceptible alleles.(6) Thus, studies focusing on ethnic-specific differences in asthma needs to account for established

environmental and psychosocial risk factors for asthma. Atopic dermatitis (Atopy) is a well-established risk factor for asthma in numerous ethnic groups.(6) Stress exposure and depression can also explain the difference in asthma phenotypes among ethnic groups.(6) Inaccurate reporting of asthma control among asthmatic adolescent in the U.S. were more likely in minorities and low socioeconomic status.(7) However, a survey conducted by Ledogar found that the difference in asthma prevalence among different ethnic groups was not affected by the residence, education, and house hold size.(8) The decline of the beneficial effect of asthma management may also be related to lack of adequate health insurance.(9) Flores and Tomany-Korman found a higher prevalence of asthma in ethnic groups who have low employment rate, income, and insurance coverage.(10) Exposure to stress.(11) violence,(12) depression and obesity (13), may partly explain the differences in asthma in different ethnic groups.(14,15) Chronic diseases like diabetes, depression may affect asthma..(16,17) Still, the influence of socio-economic factors on asthma can't explain all differences in asthma prevalence, severity and mortality in different ethnic minorities.(8) Environmental exposure of gulf war veteran deployed in Kuwait showed that the risk for asthma

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increased with increasing self reported exposure to oil fire & smoke.(18). Ledger et al. explain the difference in asthma prevalence among different ethnicity not to environment or socioeconomic but to genetic predisposition in different ethnicity as the heritability which was reported between 36-79%.(19) The genetics of Asthma is complex and the mode of inheritance is not clearly known. Studies by Los suggested that a gene may be involved.Evidence of genetic influences has been shown in twin studies. Multiple genes may be involved in the pathogenesis of asthma.(20), and genetics also involved in the variation in response of asthma patient to treatment (21) The aim of the study is to compare the prevalence of asthma in two ethnic groups who have similar cultural and environmental background immigrating to the U.S, and to identify possible differences in prevalence between the groups that might be due to genetically-related factors.

Patients Methods:

A cross sectional study was conducted among Iraqi immigrants who are residents in the Greater Detroit area. The data used in this study is part of health assessment survey which was conducted in 2004-05 after the ethical clearance from Wayne State University was taken. The questionnaire was developed initially through collaboration between Iowa Persian Gulf war study group and the Center for Disease Control and it was used among American veterans and Iraqi immigrant and refugees.(22,23) The final study sample consisted of 411 Iraqi immigrants which were derived from 5,490 Iraqi residents addresses in the Greater Detroit area (7.5% random sample). Of 411 participants selected, 44 participants did not fit the study criteria, 17 persons (4.6%) declined to participate. The final number of participants was 350, representing a response rate of 95%. The study was interested in studying the asthma among Iraqi Arab and Iraqi Chaldean, all other were excluded. The end sample was 337 (153 Chaldean and 184 Arab). Questionnaires were administered to participants with two different languages, Arabic and English. If the participant can't read, the questions were verbally addressed during the interview. The questionnaire included: demographic characteristics, medical conditions, environmental and stress exposure during Gulf war, and self-rated health of the participants. The medical conditions questionnaire included 33 medical conditions including asthma. In order to be classified as an asthma participant in this study, he had to state that he had been diagnosed by a physician to have asthma and received medical treatment. If these criteria were not met, participants were excluded (3 cases). The other 32 questions were classified into three categories: 25 somatic medical condition (e.g. hypertension, diabetes, skin disorder, kidney disorder); five psychosomatic disorder (migraine, recurrent headache, chronic fatigue, sleep disorder, memory loss) and three neuro-psychiatric illnesses

(Epilepsy, depression and psychotic disorder). Another set of questions were to address environmental and psychosocial stressor (Stressor) exposures. The validated exposure indices include: 1) Aggregate Environmental Exposure (AEE) dose, and 2) Aggregate Stressor Exposure (ASE) dose. (24) The environmental exposure scale consists of 15 questions including chemicals, smoke from oil well fires, and other petrochemical fuels. The range of the scale for environmental exposure was between 0 and 45 points. The stressor exposure scale included 8 questions, e.g. witnessed anyone dying, been under small arms fire and exposure to dead bodies. The range of stressor scale was between 0 and 24. The environmental and stressor scales exhibited excellent psychometric properties with a Cronbach's alpha of >.85. Questions to assess the self-rated health status were included in the questionnaire, the first question was asking the participants to rate their health self-rated health (SRH) at the time of interview and the second to compare their current health with their health in the last year based on a Likert-type scale ranging from 5, excellent health to 1, poor health. The SRH scale is well-used to predict future health and mortality in currently healthy person. (25,26).

Statistical Analysis:

Chi square was used for discrete variable and t-test for continuous independent variables, and Binary logistic regression analysis was used to predict asthma risk factors.

Results:

Asthma prevalence for study population was 5.0% with significant difference ($p < 0.001$) between the Chaldean (0.7%) and Arab (8.7%) groups. However, there was a significant difference between the Chaldean (represent 45.4%) group and Arab (represent 54.6%) group in terms of age, years in US, marital status, as well as, occupation and health insurance (p range 0.05-0.001). However, there wasn't a significant difference in gender, education and smoking status. Table 1 shows the prevalence of asthma among study groups by demographic variables. Significant differences were found between the two ethnic groups in most demographic variables and in some of the subcategories of each demographic variable.

Table 1: Prevalence of asthma by demographic variables and by ethnicity

Variable	Chaldean [n=1 of 153]	Arab [n=16 of 184]
No. (%)	No. (%)	
For Total Study Population***	1(0.7)	16(8.7)
Age group		
32-44 Y	1(2.2)	9(8.7)
40-49 Y **	0(0.0)	7(8.8)
Years in USA		
6-9 Years *	0(0.0)	6(10.5)
10 + Years ***	1(0.8)	10(8.9)
Gender		
Male **	0(0.0)	6(6.1)
Female **	1(1.6)	10(11.8)
Marital status		
Married ***	1(0.8)	16(9.5)
Education		
< H.S. *	1(1.2)	7(6.1)
H.S or more ***	0(0.0)	9(13)
Occupation		
Have no work *	0(0.0)	5(10.6)
have work ***	1(0.7)	11(8)
Health insurance		
No health insurance	0(0.0)	2(4.7)
Have health insurance ***	1(1.1)	14(9.9)
Smoking status		
Do not smoke ***	0(0.0)	14(10.7)
Current smoker	1(1.7)	2(3.8)

* P < 0.05, ** P < 0.01, *** P < 0.001

Chi-Square test was used (Table 2) among asthmatic participants (Chaldeans vs. Arabs) after splitting the study groups into those who have no environmental exposure vs. environmental exposure. The same applied to stress exposure (no stress exposure vs. stress exposure). The results revealed a significant difference in those who reported to have environmental exposure as well as stress exposure compared to those who reported no environmental and no stress exposure. The study group was classified into those who reported somatic disorders (psychosomatic disorder and psychiatric disorders) and those who did not report somatic disorders. Results revealed that there is a significant difference among the Chaldean and Arab groups to those who endorsed having somatic, psychosomatic, or psychiatric disorders, with the Arab group reporting higher prevalence rate for all three disorders. Binary Logistic Regression analysis was used to predict the risk factor for asthma after adjusting all variables (Table 2). The result revealed that only ethnicity was significant; Arab group has 14.5 more asthma than the Chaldeans group (Odds ratio 14.5 (95% C.I. 1.90 – 110.43). Table 3 shows that Arabs had worse health (53.6%) versus Chaldean (26.3%) when they were asked during the interview to rate their health status, but binary logistic regression analysis (Table 2) showed that those who rated their health as an excellent to good were typically Chaldean, male, young, have a more recent arrival to the U.S., have no asthma condition, and were employed.

Table 2: Prevalence of Asthma by certain variables and ethnicity

Variable	Chaldean [n=1 of 153]	Arab [n=16 of 184]	
	No.(%)	No.(%)	
Environmental exposure			
No environmental exposure	1(1)	4(6.3)	
One or more environmental exposure ***	0(0.0)	12(10)	
Stressor exposure			
No stressor exposure	1(1)	4(6.3)	
One or more stressor exposure ***	0(0.0)	12(10)	
Somatic disorders			
No somatic disorders	0(0.0)	0(0.0)	
One or more somatic disorders ***	1(0.9)	16(100)	
Psychosomatic disorders			
No psychosomatic disorders	0(0.0)	2(10.5)	
One or more psychosomatic disorders***	1(1.4)	14(10.5)	
Psychiatric disorders			
No psychiatric disorders	1(0.7)	5(5.2)	
One or more Psychiatric disorders ***	0(0.0)	11(12.5)	
Binary logistic regression analyses for asthma to predict risk factor			
Likelihood Asthma	Sig.	Odds Ratio	95% C.I. for OR
Chaldean is reference	0.01	14.5	1.89-110.40

Adjusted for age, gender, marital status, education, occupation, health insurance, occupation, smoking status, any other somatic illnesses, psychiatric illnesses , psychosomatic disorders, environmental exposure and stressor exposure

Table 3: Binary logistic regression analysis for Self Rated Health to predict risk factors

Likelihood Self Rated Health	Sig.	Odds Ratio	95% C.I. for OR	
			Lower	Upper
Age [continuous]	0.005	0.9	0.91	0.98
Years in US [continuous]	0.001	1.1	1.05	1.13
Female is reference	0.002	2.4	1.36	4.11
No work is reference	0.001	4.8	2.17	10.57
Arab is reference	0.027	2	1.09	3.81
Have Asthma is reference	0.041	4.5	1.06	18.95

Adjusted for marital status, education, health insurance, smoking status, any other somatic illnesses, psychiatric illnesses , psychosomatic disorders, environmental exposure and stressor exposure

Discussion:

The study compared two ethnic groups of the same nationality who exposed to many of the same types of war zone exposures, and consequently were exposed to almost the same stressors and living circumstances. They also now share comparable new environments as they had immigrated to the U.S. in comparable periods. However, despite these similarities, we found that there is a significant difference in the prevalence of asthma. There is a much higher prevalence of asthma among Arabs (8.7%) compared to Chaldeans (0.7%). Overall asthma prevalence in our study (5.0%) is in agreement with the global prevalence of asthma. With respect to demographic variables between the Chaldeans and Arabs, we found a significant difference in age, occupation, health insurance, income and smoking status. Also, when we analyzed the sub-cohort of people who have asthma from both ethnic groups, we found that most of the demographic variables are significantly different. However, when we studied the impact of those variables on the prevalence of asthma by using the binary logistic regression test, we found that the only factor that influenced and had an impact on the risk of asthma was a person’s ethnic background. This draws us to the fact that the difference in the prevalence of asthma in those ethnic groups who came from and live in almost comparable environmental circumstances is related to their ethnicity, which probably reflects their genetic background. This is in accordance with a study which demonstrated the influence of ethnic background on the incidence of asthma.(3) Our study showed smoking as a significant risk factor in the prevalence of asthma. This fact is in agreement with a study done by Rayens and colleagues who showed that cigarette smoking is associated with asthma morbidity.(27) Furthermore; they showed that smoke free laws are associated with fewer doctor visits due to asthma associated symptoms in both children and adults.(27) Wright related the difference in the asthma prevalence among different ethnic groups to the impact of their socioeconomic status, environmental exposures, health care access, stress, psychological factors, and cultural factors.(5) However, in

our study when we applied binary logistic regression analysis and controlled for all of these variables, only ethnicity was significant. Our findings are in agreement with Ledogar and colleagues who found that the asthma prevalence among different ethnic groups was not affected by either socioeconomic or environmental factors.(8) Our study showed a significant relationship for being employed, having health insurance and a high income as positive risk factors affecting the prevalence of asthma. However, other studies done by Shanawani and colleagues and Flores and colleagues showed that the negative impact of poor asthma management may also be related to lack of adequate health insurance, and that the higher prevalence of asthma is found in ethnic groups who have low employment rates, income, and insurance coverage type.(9,10) Forno and colleagues showed that stress exposure and depression are significant factors in the prevalence of asthma in ethnic groups, which was not the case in our study.(6) Our study showed a significant relationship between having asthma and either depression or diabetes in both Arabs and Chaldeans. Stawarz found that diabetes increases the prevalence of asthma, (16) while Zielinki showed that depression symptoms are common in asthmatic patients.(17) Our study shows that Chaldeans are less likely to report having one or more chronic diseases compared to Arabs, while Jamil and colleagues showed no difference between Chaldeans and Arabs.(28) This might be due to (Siglec-8) protein variations which is associated with variation in asthma susceptibility in different racial groups. (29)Our study showed that 75% of asthmatic Arabs have self-reported environmental exposures while only 25% of asthmatic Chaldeans reported environmental exposures. This difference might be due to the geographic areas of the two populations, as many of the Arabs immigrants to U/S. came from southern Iraq, which is the area nearest to the war zone with Kuwait. However, when we compared the exposure and non-exposure for both Arabs and Chaldeans asthmatics, we found no significant difference between the ethnic groups. Lange and colleagues showed that veterans’ environmental exposure during the first Gulf war had an odds ratio for asthma

that increased with increasing self-reported exposure to Gulf war oil fire and smoke.(19) In contrast, our study showed no relationship between stressor exposure and the prevalence of asthma between Arabs and Chaldeans. Forno and colleagues argued that stressor exposure and depression can significantly explain the difference in asthma phenotypes among ethnic groups. (6) The limitation of this study, it didn't demonstrate the different genetic factors in those two groups and the impact of these differences on the asthma. In conclusions The ethnic background was the only predictor risk factor associated with the asthma among Chaldean and Arab immigrants who share similar culture and environmental backgrounds. Also the study found little relationship between shared environmental factors in the new host country and the prevalence of asthma. The shared environmental factors include environmental exposure, stressor exposure, socioeconomic status, and other demographic variables in a random sample of Chaldeans and Arabs. We recommend further comprehensive epidemiological studies including genetic risk factors to reveal possible genetic and epigenetic contributors to ethnic-specific differences in prevalence of asthma.

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