



## Health Assessments of Iraqi Scientists Abroad: Chronic Diseases and Legal Status

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### Abstract

**Introduction:** Migrant health has become a key area of public health due to the recent increase in global migration. The aim of this study is to compare the prevalence of five chronic diseases (CDs) in highly educated immigrants versus refugees.

**Method:** Study questionnaires were distributed to Iraqi scientists via e-mail and social networking sites. A total of 598 Iraqis was included. Differences in characteristics and chronic conditions between the groups were determined using Chi-squared tests. Multivariate logistic regression was used to estimate the impact of legal migration status (immigrant versus refugee) and other factors on CD prevalence.

**Results:** Highly educated immigrants had a greater prevalence of diabetes (AOR 2.01, 95% CI 1.26-3.20) compared with highly educated refugees. Respondents with a master's degree or higher were found to be less likely to have heart disease (AOR=0.49, 95% CI=0.32, 0.74) than respondents with only a bachelor's degree. Employed participants had lower likelihood of having heart disease (AOR=0.38, 95% CI=0.18, 0.80), depression (AOR=0.50, 95% CI=0.25, 0.99) and diabetes (AOR=0.50, 95% CI=0.30, 0.82), and lower total number of CD (OR=-0.47, 95% CI=-0.73, -0.20) than unemployed participants.

**Conclusion:** Legal migration status did not have a significant impact on the prevalence of four out of five CDs studied (asthma, depression, hypertension, heart disease). However a greater prevalence of heart disease, depression, and diabetes was associated with unemployment and those with postgraduate qualifications had a lower prevalence of heart disease. Public health programs should consider targeted interventions such as promoting more efficient employment processes for highly educated groups at risk of poor health outcomes.

**Keywords:** Asthma; Diabetes; Depression; Hypertension; Heart Disease; Ethnicity; Risk Factors

### Introduction

Global migration is on the rise with major crises and conflicts contributing to forced migration and many seeking protection as refugees within and outside their countries. The recent wars and sustained conflicts in Iraq and neighbouring countries have resulted in a drastic increase in forced migration among Iraqi citizens both domestically and internationally. Thousands of Iraqis

had emigrated before the 1991 Gulf War mainly for economic and political reasons and postgraduate studies. However, the pattern of migration following the 1991 Gulf War represents a new wave of Iraqi immigration [1]. Many of the post-Gulf War Iraqi immigrants are refugees who suffered serious traumas before, during and after the Gulf War, and some of these individuals have appeared to suffer from a host of physical and mental health disorders [2].

Several lifestyle factors and behaviours are known to impact the risk of developing chronic diseases (CDs) and with their rising global prevalence, it is essential to further our understanding of less established factors such as migration status. Studies examining the prevalence of CDs in immigrants and how they compare with local citizens have found that immigrants typically show higher rates of diabetes [3-6], hypertension [7], heart disease [8] and asthma [9,10]. However, some studies found that Arab immigrants in the US had lower prevalence of diabetes and asthma than native born Americans [11-14]. Low prevalence of diabetes has also been reported in refugees [15], while other studies have found a higher prevalence of diabetes [12,13,16-18], hypertension [11,15,18-20], depression [13,21], and asthma [9,10] in refugees compared to local citizens. Research has also been conducted looking at CDs in immigrants versus refugees, finding higher prevalence rates of hypertension, heart disease and asthma in refugees [12-14]. It is important to keep in mind though that these studies analysed populations from different countries and are difficult to compare as CD rates vary even among refugees, depending on the country of origin [15].

Researchers have also observed that certain CDs were more prevalent in highly educated individuals (e.g. university graduates, physicians, engineers) than in the general population [22-25]. However, few studies have assessed both education and immigration status when examining the prevalence of chronic diseases. Current global migration trends, as well as rising numbers of highly qualified asylum seekers, have increased the importance of understanding the magnitude and impact of CDs in educated immigrants and refugees. This study aims to explore the general health assessment of Iraqi scientists around the world through studying the possible differences between the prevalence of CDs (diabetes, hypertension, heart disease, asthma and depression) and risk factors for CDs in relation to those who were residents outside Iraq before 1991 and entered as immigrants to these countries, as well as those who left Iraq after 1991 and entered other countries as refugees.

## Methods

The International Society of Iraqi Scientists plans to study the general health assessment of Iraqi scientists around the world.

### Sample and data collection

This study was a joint research project between the International Society of Iraqi Scientists and Wayne State University. During data collection and examination, highly educated Iraqis were defined as holding a bachelor's degree or higher. The other selection criterion was living outside of Iraq since 1991 and entering the host country either as a legal immigrant or refugee. The study

and link to the study questionnaire were announced on the International Society of Iraqi Scientists website as well as on: <http://www.iraqpress.net/index.php?mod=article&cat=c10&article=1156> (Closed at 2016) a website containing up-to-date Iraqi news with large traffic from Iraqi citizen's all over the world. During the study period there was no charge to visit the webpages. Additionally, the link to the study questionnaire was distributed to all International Society of Iraqi Scientists members via email and all members were asked to send the survey link to all scientists they knew even if they were not members of the society. The International Society of Iraqi Scientists, established in Michigan, USA in 2000, At the time of the study, the numbers of scientists in the society were around six hundred members. However, the final study participants were residents in 16 host countries summarized as follows: USA n=226, European Union n=203, Canada n=116, and Australia and New Zealand n=59. The study was conducted from July to October 2009.

### Variables

The primary outcome measure was the presence of self-reported CDs: hypertension, diabetes, heart disease, depression, and asthma. We also defined respondents as having a CD if they answered affirmatively to the following survey question: "Are you now taking medicine for any of the following diseases, if yes please mark that disease". The total number of chronic diseases for each participant was also collected.

### Statistical analysis

Differences in characteristics and chronic conditions of refugees and immigrants were determined using Chi-squared tests. Multivariate logistic regression was used to estimate the impact of legal migration status (refugee or immigrant) on the presence of chronic diseases. The model was adjusted for age (18-44, 45-54,  $\geq 55$ ), sex, education (Bachelor's degree, MSc/PhD), ethnicity (Arab, other ethnic group), marital status (currently married, single/other) and employment status (currently working, not working). Adjusted odds ratios (AOR) and 95% confidence intervals (CI) were reported. A negative binomial model was used to assess the impact of legal status on the total number of chronic diseases while accounting for the over dispersion of data. Multi-collinearity was quantified by the variance inflation factor, which indicated independence of the predictor variables ( $VIF < 1.5$ ). Clustered standard errors were used for hypothesis testing to account for the residual dependence by the country of residence (a total of 16 countries of residence). All statistical analyses were performed using Stata 11. Statistical significance was set to a two-tailed p-value of  $< 0.05$ . The study was approved by the Institutional Review Board of Wayne State University.

**Results**

Within the three-month data collection period, 1060 Iraqis residing in a total of 16 countries responded to the survey. A total of 462 participants were excluded from the study as they did not fulfil the study criteria, of these: 220 held a work visa, 151 had a special legal status (e.g. visitor, student, or marriage visa), and 14 did not report legal status. Furthermore, 55 respondents were excluded because they failed to answer key questions of the survey and 22 reported as student residents in the host country. The final sample contained 598 individuals, of whom 365 were refugees and 233 were immigrants.

Table 1 Shows a significant difference between refugees and immigrants in any of the following variables: the host country, years between leaving Iraq and entering the host country and the years in the host country by legal status.

Variable	Refugees [n=365] N (%)	Immigrants [n=233] N (%)	P-value
Host country			
USA	147(40.3)	73(31.3)	<0.001
European Union (12 countries)	165(45.2)	38(16.3)	
Canada	28(7.7)	88(37.8)	
Australia/New Zealand	25(6.9)	34(14.6)	
Years between left Iraq and enter host country			
0 - 1 Year	165(45)	102(44)	<0.001
2 - 3 Year	106(29)	52(22)	
4 - 5 Year	59(16)	24(10)	
6 - 9 Year	26(7)	32(14)	
10 - 16 Year	9(2)	23(10)	
Years in the host country			
1 - 5 Year	170(47)	65(27.9)	<0.001
6 - 10 Year	75(21)	63(27)	
11 - 15 Year	75(21)	73(31.3)	
16 - 19 19	45(12)	32(13.7)	

**Table 1:** Shows the study population and host country, year before entering the host and in the host.

Table 2 shows the characteristics of the study population by legal status. Iraqi refugees in the study were significantly younger than Iraqi immigrants, and a greater proportion held only a bachelor’s degree rather than postgraduate qualification compared with immigrants. Furthermore, a lower proportion of refugees were employed compared with immigrants. Most participants were married, male, and with Arab ethnicity.

Variable	Refugees [n=365] N (%)	Immigrants [n=233] N (%)	P-value
Age group			
18-44	222 (60.8)	87 (37.3)	<0.001
45-54	84 (23.0)	72 (30.9)	0.03
≥ 55	59 (16.2)	74 (31.8)	<0.001
Gender			
Male	292 (80.0)	174 (74.7)	0.13
Female	73 (20.0)	59 (25.3)	
Education level			
Bachelors degree	219 (60.0)	114 (48.9)	0.008
MSc/PhD	146 (40.0)	119 (51.1)	
Ethnicity			
Arab	248 (67.9)	149 (64.0)	0.31
Other Ethnicity	117 (32.1)	84 (36.1)	
Marital status			
Currently Married	288 (78.9)	194 (83.3)	0.19
Single/other	77 (21.1)	39 (16.7)	
Employment status			
Currently working	219 (60.0)	160 (68.7)	0.03
Not working	146 (40.0)	73 (31.3)	

**Table 2:** Participant characteristics by legal status.

Note: Participants were residents in 16 host countries, summarized in the following regions: USA n=220, European Union n=203, Canada n=116, Australia and New Zealand n=59.

Table 3 shows the prevalence of heart disease was found to be 4.7% for refugees and 7.7% for immigrants (p=0.12); depression was 5.8% for refugees and 5.2% for immigrants (p=0.75); and asthma was 2.5% for refugees and 3.9% for immigrants (p=0.33). Significant differences were found in prevalence of diabetes (5.5% vs. 12.9%, p-value <0.001) and hypertension (16.7% vs. 23.2%, p-value 0.05), both were lower in refugees. As expected, the older immigrant group reported more co-morbidity (3+ CD) than the refugee group (5.2% versus 1.4%, p=0.007).

The regression analysis (Table 4) showed that legal migration status of highly educated Iraqis did not have a significant effect on the prevalence of most chronic conditions analysed after adjusting for age, sex, ethnicity, education level, marital status, and employment. A significant association was seen only with diabetes, in that highly educated immigrants had a significantly higher prevalence of diabetes (AOR=2.01, 95% CI=1.26, 3.20) when compared to highly educated refugees.

Variable	Refugees [n=365] N (%)	Immigrants [n=233] N (%)	P-value
Hypertension	61 (16.7)	54 (23.2)	0.05
Heart disease	17 (4.7)	18 (7.7)	0.12
Depression	21 (5.8)	12 (5.2)	0.75
Asthma	9 (2.5)	9 (3.9)	0.33
Diabetes	20 (5.5)	30 (12.9)	0.001
Total number of CD			
0	266 (72.9)	150 (64.4)	0.03
1	76 (20.8)	57 (24.5)	0.30
2	18 (4.9)	14 (6.0)	0.57
3 +	5 (1.4)	12 (5.2)	0.007

**Table 3:** Participant chronic conditions (CD) by legal status.

As expected, older age ( $\geq 55$  years) was strongly associated with a greater prevalence of hypertension, heart disease, asthma, and diabetes. Ethnicity (Arab or not) was not significantly associated with any of the chronic conditions. Female participants reported a lower prevalence of diabetes compared to males. Respondents with a master’s degree or higher were found to be less likely to have heart disease (AOR=0.49, 95% CI=0.32, 0.74) than respondents with only a bachelor’s degree. Finally, employed participants had lower odds of having heart disease (AOR=0.38, 95% CI=0.18, 0.80), depression (AOR=0.50, 95% CI=0.25, 0.99) and diabetes (AOR=0.50, 95% CI=0.30, 0.82), and a lower total number of chronic conditions (OR=-0.47, 95% CI=-0.73, -0.20) than unemployed participants.

	Hypertension	Heart disease	Depression	Asthma	Diabetes	Any CD	Total # CD
Legal Status (refugee as reference)							
Immigrant	0.93 (0.55, 1.57)	1.26 (0.44, 3.63)	0.85 (0.50, 1.44)	1.47 (0.59, 3.65)	2.01 (1.26, 3.20)	0.99 (0.79, 1.25)	0.13 (-0.06, 0.32)
Age group (18-44 as reference)							
45-54	6.61 (4.34, 10.07)	2.51 (0.81, 7.80)	2.19 (0.88, 5.40)	2.71 (1.19, 6.15)	2.69 (0.83, 8.68)	5.13 (3.42, 7.71)	1.16 (0.72, 1.60)
$\geq 55$	14.16 (8.56, 23.43)	12.39 (4.40, 34.96)	2.20 (0.76, 6.37)	2.22 (1.02, 4.84)	6.48 (3.84, 10.92)	10.18 (7.29, 14.23)	1.72 (1.34, 2.10)
Gender (male as reference)							
Female	0.76 (0.32, 1.82)	0.55 (0.23, 1.30)	0.93 (0.49, 1.75)	0.94 (0.27, 3.25)	0.36 (0.20, 0.65)	0.86 (0.70, 1.58)	-0.31 (-0.63, 0.01)
Ethnicity (not Arab as reference)							
Arab	0.70 (0.49, 1.01)	1.19 (0.64, 2.19)	1.98 (0.96, 4.08)	1.48 (0.55, 4.02)	0.75 (0.33, 1.73)	1.05 (0.71, 1.56)	-0.04 (-0.33, 0.25)
Education (Bachelor Diploma as reference)							
MSc/PhD	1.24 (0.69, 2.24)	0.49 (0.32, 0.74)	1.06 (0.54, 2.10)	0.97 (0.35, 2.69)	0.95 (0.54, 1.65)	1.28 (0.72, 2.25)	-0.03 (-0.34, 0.29)
Marital status (Single/others as reference)							
Currently Married	1.10 (0.49, 2.47)	4.91 (0.52, 46.35)	0.36 (0.12, 1.09)	0.23 (0.14, 0.39)	1.68 (0.76, 3.71)	0.95 (0.43, 2.08)	-0.12 (-0.66, 0.42)
Employment (not currently working as reference)							
Currently working	0.63 (0.38, 1.04)	0.38 (0.18, 0.80)	0.50 (0.25, 0.99)	0.90 (0.42, 1.93)	0.50 (0.30, 0.82)	0.50 (0.39, 0.64)	-0.47 (-0.73, -0.20)

**Table 4:** Association between chronic conditions and legal status (adjusted odds ratio with 95% confidence intervals).

### Discussion and Conclusions

This is one of the first studies to analyse the prevalence of chronic diseases in highly educated immigrants and refugees from a single country of origin. Even though both groups had common backgrounds (culture and habits such as smoking and diet) they differed in some characteristics, such as the country of residents which have different health systems and have a significant difference in years staying in the host country or number of years out-

side of Iraq until they were able to enter the host country, all of which could have an impact on chronic diseases. Iraqi immigrants tended to be older, with a higher level of education, and more often married and employed in comparison to refugees. We found that the burden of chronic diseases was similar in immigrants and refugees; however, refugees reported fewer conditions per person. Highly educated Iraqi immigrants had a higher prevalence of diabetes and hypertension compared with highly educated Iraqi refugees. These findings are consistent with previous research showing



increased prevalence of hypertension [7] and diabetes [3-6,16,17] among different groups of immigrants including Arab Americans in the United States, although other studies [12,13] have found immigrants with a lower prevalence of hypertension than refugees.

As expected, employment was protective for some of the chronic diseases studied, specifically heart disease, depression, and diabetes. Employment is a challenge for both immigrants and refugees. In the current study, only 68.7% of immigrants, and 60% of refugees were employed. This is despite the education level achieved by this Iraqi population living abroad. It is of interest to mention that there were significant differences between refugees and immigrants in the following barriers, but not in the others (E.g. financial independence, skill deficiency, no jobs available): 34.5% of immigrants reported discrimination versus 18.4% among refugees, 20.6% of refugees reported language barriers versus 11.4% among immigrants. It was of interest to find that 17% of immigrants reported not knowing how to find job versus 8.9% of refugees, which could be due to the help they received from different community organizations. These factors may have an impact on certain chronic diseases such as heart disease, hypertension, depression, and diabetes, in addition to stress having a role. As unemployment is a chronic stressor and recognized risk factor for the development of numerous chronic diseases [26], public health programs may wish to consider targeted interventions such as promoting more efficient employment processes for highly educated groups at risk of poor health outcomes.

### Strengths and Limitations

The main strength of this study was the comparison of two highly educated groups with the same nationality that mainly differed by legal migration status thus allowing the impact of this social factor on prevalence of chronic disease to be assessed. The study limitations were that the responses to the online questionnaire and the diagnosis of chronic diseases were self-reported. Furthermore, the results cannot be generalised as the study was based on a convenience sample that consisted mostly of scientists.

### Recommendations

With rising numbers of highly qualified migrants and asylum seekers, a prospective epidemiological study to increase understanding of the magnitude and impact of chronic diseases in educated immigrants and refugees could bring insight into the differing needs of these populations and inform public health approaches such as the promotion of employment processes.

### Author Contributions

All authors have read the submitted version of the manuscript and agree with its content. HJ initiated the project and designed the study. HJ, AA and TH conducted the original research and drafted

the paper. SR, BA, ED, AM, and AS revised the paper. JL contributed to data analysis, FH reviewed the English and editing.

### Compliance with Ethical Standards

Informed consent is not necessary because all authors involved voluntarily in this study, as there was no funding available.

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