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Cardiovascular Disease and hospital admissions in African immigrants and former Soviet Union immigrants: A retrospective cohort study

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ABSTRACT

Background: Previous studies reported low prevalence of cardiovascular disease (CVD) despite an increasing prevalence of metabolic abnormalities in immigrants who moved from low CVD-risk regions to Western countries. Nevertheless, little is known about hospital admissions due to CVD in immigrants.
Methods: A retrospective cohort study of East Africa immigrants (EAI), Former Soviet Union immigrants (FSUI) and native-born Israelis (NBI) over 11-year period. Associations between ethnicity, age, sex, CVD, and hospital admission were assessed using logistic and Poisson regression models. Incidence density rates per person-years were calculated.
Results: The age-adjusted prevalence rates of ischemic heart disease in EAI, FSUI and NBI, respectively, were 1.8%, 8.2%, and 5.8%, respectively ($p < 0.001$). The corresponding rates for stroke were 2.6%, 3.5%, and 2.5%, respectively. Multivariate odds ratios for all CVD were found to be significantly lower in EAI for both sexes. Hospitalizations rate due to CVD were 9, 17, and 6 per 1000 person-years in EAI, FSUI and NBI, respectively ($p < 0.001$). EAI were more likely to be hospitalized due to hypertensive disease, cerebral vascular diseases and heart disease, in comparison to NBI and FSUI. However, when controlling for CVD risk factors profile, EAI had similar admission rates to NBI. EAI were more likely to be hospitalized in internal medicine, geriatrics, and neurology departments, and less likely to be admitted to intensive care units or surgical department.
Conclusions: EAI had low rates of all types of CVD, and low risk of hospitalization after controlling for CVD risk factors profile.

1. Introduction

Cardiovascular disease (CVD) is the leading cause of death in the United States, Europe, and other countries across the globe. For more than a decade, CVD represents a major public health challenge. [1,2] Known risk factors for CVD are smoking, obesity, hypertension, hyperlipidemia, physical inactivity and diabetes mellitus [3–5].

Similarly to other parts of the world, Africa is in a process of epidemiological transition, from infectious diseases to non-communicable diseases, as CVD is becoming a major cause of morbidity and mortality [6]. The influx of African immigrants around the globe in the past decades has been unprecedented. Only in the United States the size of this population grew 40-fold between 1960 and 2007, from 35,555 to 1.4 million persons [7].

Likewise, Israel experienced influx for Africa; East African immigrants (EAI) from Ethiopia came to Israel in three waves of immigration. The first occurred in 1984–1985, the second took place in 1990–1991, and the third from 2000. Simultaneously, another immigration group from the former Soviet Union arrived in 1990–1991. Over the first few years following EAI arrival to Israel, a gradually rising prevalence of diabetes was reported in EAI with relatively low prevalence rates for hypertension and ischemic heart disease. As mentioned above, with the continues absorption of immigrants to Israel there was a decrease in the rate of most infectious diseases and a gradual increase in the prevalence of

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components of metabolic syndrome including hyperlipidaemia, diabetes, and hypertension. Of these, there is a high degree of acquired susceptibility for diabetes among EAI while maintaining low body-mass index compared to the local population [8–14], as also noted in a previously published study by our group [15]. In contrast, FSUI came from a region with a very high cardiovascular mortality rate. FSU countries have the highest cardiovascular mortality in the world, with rates about thrice those in Western European countries. Nevertheless, low cardiovascular risk and mortality rates were reported among FSUI who immigrated to Germany and Israel, compared to the general population in those countries [16].

Although this immigrant population continues to challenge the health care system, little is known about the CVD prevalence. The purpose of this study was to examine the prevalence of CVD, and hospital admissions due to CVD in East African immigrants (EAI).

2. Methods

2.1. Study population

Clalit is the largest health maintenance organization in Israel, providing medical services throughout the country to about 4.45 million enrollees, representing approximately 52.4% of the population [17]. With the aim of examining CVD and hospital admissions due to CVD, we focused on a sub-group of patients over the age of 35 years.

The study methods were described in a previous publication [15]. In brief, the study population included all EAI over the age of 35 years in three districts of Clalit Health Services, which were compared with samples of FSUI and NBI among Clalit Health Services enrollees from the same districts, over the years 2001–2012. The country of origin was determined from Clalit Health Services database. Randomized sample of two cohorts (FSUI and NBI) aged 35 years and above, residing in Israel during the years 2001–2012 and matched for age and sex were selected and the NBI were defined as the study reference group. Data collected from the computerized database of Clalit Health Services included demographics, clinical data, hospitalizations events, smoking status, diagnoses (CVD, diabetes, hypertension and dyslipidemia).

For hospital admissions analyses we included all hospital admission in 8 general hospitals owned by Clalit, in all hospital departments, where the primary diagnosis was one of the ICD-9-CM codes diagnosis of hypertensive disease, ischemic heart disease (IHD), cerebrovascular disease (occlusion or stenosis), and transient cerebral ischemia.

In the present study, the SES was defined according to one of three categories (low, intermediate and high SES (which each clinic in the Clalit is classified, and each patient in a particular clinic receives the SES of the clinic which he is assigned.

2.2. Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, software version 22.0). Age adjustments made for CVD were calculated using direct standardization, with NBI as the reference group.

For continuous variables, mean values, standard deviations, Student's *t*-test and the one-way ANOVA test were used. For categorical variables, chi-square test and Kruskal-Wallis test were used. *P* values for all hypothesis testing were two-sided, and $p < 0.05$ was interpreted as statistically significant. Multivariate binary logistic regression models were used to assess the outcomes of CVD, and Poisson regression models were used to assess hospital admissions.

Incidence density rate or person-time incidence rate was calculated as the number of new cases per population at risk in a given time period, when a person was hospitalized more than once, all hospital admissions were included in the count as the numerator of a hospitalization rate. The denominator is the sum of the person-time of the at risk population. The study was approved by the Institutional Review Board of Meir Medical Center, Kfar Saba, Israel, which approves community-bases studies in Clalit.

3. Results

The study population included 58,901 individuals above the age of 35 years, of whom 17,626 were NBI, 20,507 were FSUI and 20,768 were EAI. Age-adjusted prevalence rates of IHD in EAI, FSUI and NBI, respectively, were 1.8%, 8.2%, and 5.8%, respectively ($p < 0.001$). The corresponding rates for stroke were 2.6%, 3.5% and 2.5%, respectively ($p < 0.001$), and for transient ischemic attack (TIA) – 0.3%, 0.8%, and 0.8%, respectively ($p < 0.001$). The corresponding rates for peripheral vascular disease (PVD) were 0.5%, 2.3% and 1.3% ($p < 0.001$), respectively, and for congestive heart failure (CHF) – 1.1%, 2.5% and 1.3% ($p < 0.001$), respectively (Table 1).

Table 1
Characteristics of hospitalizations due to CVD by study groups, individuals >35 years.

Hospitalization events	NBI (*N* = 1227)	EAI (*N* = 1088)	FSUI (*N* = 2848)	p value
Primary diagnosis				
Heart disease (N, %)	935 (76.2)	431 (39.6)	2286 (80.3)	<0.001
Cerebral vascular disease (N, %)	238 (19.4)	542 (49.8)	387 (13.6)	
Hypertensive disease (N, %)	41 (3.3)	110 (10.1)	131 (4.6)	
Cardiopulmonary disease (N, %)	13 (1.0)	5 (0.5)	76 (2.6)	
Urgent hospitalization (N, %)	831 (67.7)	676 (62.1)	2000 (70.2)	
Admitting department:				
Internal medicine, including geriatrics (N, %)	661 (53.9)	683 (62.8)	1798 (63.1)	<0.001
Surgery (N, %)	279 (22.7)	86 (7.9)	546 (19.2)	
Intensive care unit (N, %)	207 (16.9)	39 (3.6)	363 (12.7)	
Neurology (N, %)	45 (3.7)	64 (5.9)	130 (4.6)	
Other (N, %)	35 (2.9)	216 (20.0)	11 (0.5)	
Number of hospitalizations:				
1 (N, %)	447 (36.4)	434 (39.9)	911 (32.0)	<0.001
2 (N, %)	235 (19.2)	190 (17.5)	654 (23.0)	
3 (N, %)	180 (14.7)	111 (10.2)	414 (14.5)	
4≤ (N, %)	365 (29.7)	142 (13.1)	869 (30.5)	
Duration of hospitalization (days, mean ± SD)	5.5 ± 7.2	5.6 ± 7.2	6.6 ± 7.4	<0.001

EAI: East Africa immigrants; FSUI: Former Soviet Union immigrants; NBI: Native born Israelis.

The distribution of CVD prevalence in different age groups and by country of origin is presented in Fig. 1. The prevalence of CVD was lower in EAI than in NBI and FSUI in all age groups, except for stroke in elderly patients, for whom the prevalence in EAI was higher than in NBI, and for congestive heart failure, where the prevalence in EAI was identical to NBI across age groups.

Age, sex, and SES were added as confounders to the multivariate logistic regression models for CVD, presented in Fig. 2. Multivariate ORs for all CVD were found to be significantly lower in EAI for both sexes. However, for FSUI females, ORs of IHD, stroke and CHF were significantly higher. For FSUI males, OR of TIA were significantly lower, while PVD and CHF were significantly higher (Supplementary 1).

During the years 2001–2012 there were 37,618 hospital admissions of EAI, 36,194 admissions of FSUI, and 35,163 admissions of NBI. EAI patients were more likely to be hospitalized due to hypertensive disease or cerebral vascular diseases and less likely to be admitted due to heart disease in comparison to NBI and FSUI. EAI were less likely to be hospitalized in intensive care units or surgical departments, and more likely to be hospitalized in internal medicine, geriatrics and neurology departments. EAI patients had less readmissions, and similar length of stay in comparison to NBI (Table 1).

FSUI had the highest rate of hospital admissions due to cardiovascular disorders (17 per 1000 PY), as compared with 6 and 9 per 1000 PY for NBI and EAI individuals, respectively ($p < 0.001$).

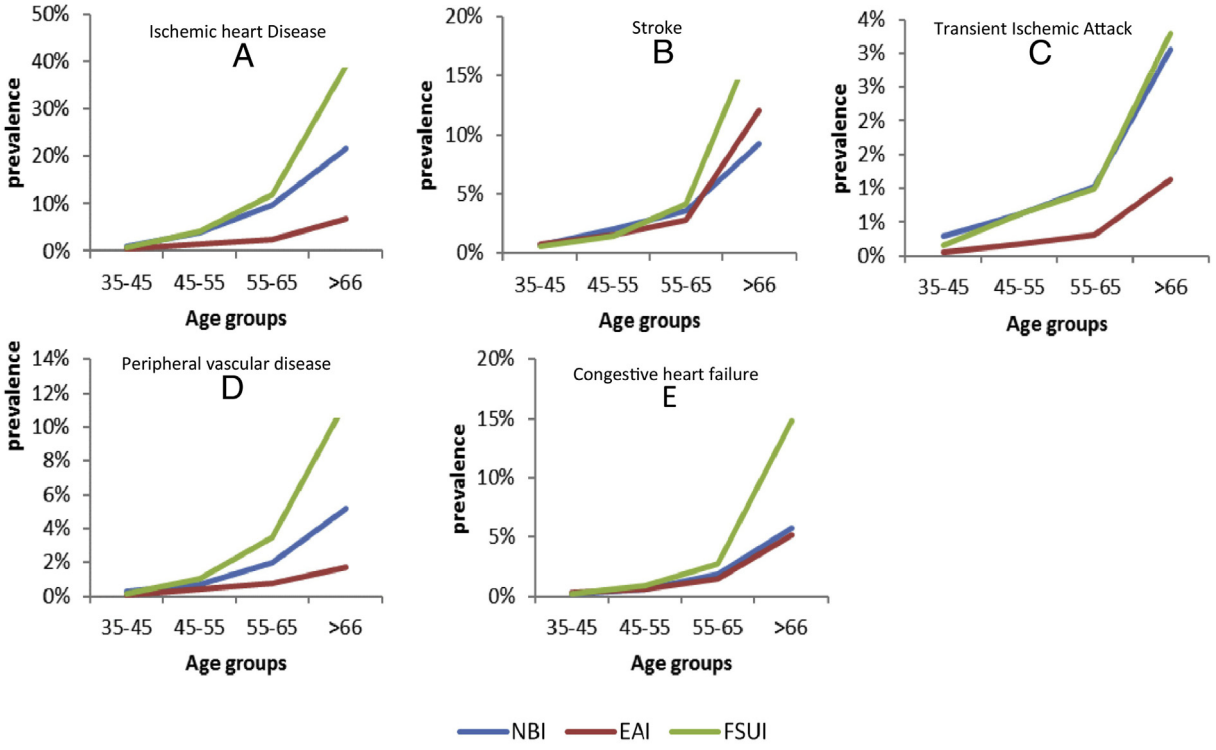

Fig. 1. Prevalence of cardiovascular diseases by age group and country of origin. Green line – Former Soviet Union immigrants, Blue line – East Africa immigrants, Red line – NBI – native-born Israelis (reference group). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Three-step Poisson regression models of factors associated with hospitalization due to CVD are presented in Table 2. Age and male sex were the two sole factors associated with hospitalization, whereas people of higher socioeconomic status were less likely to be admitted for CVD. When controlling for CVD risk factors profile, EAI had similar admission rates compared to NBI.

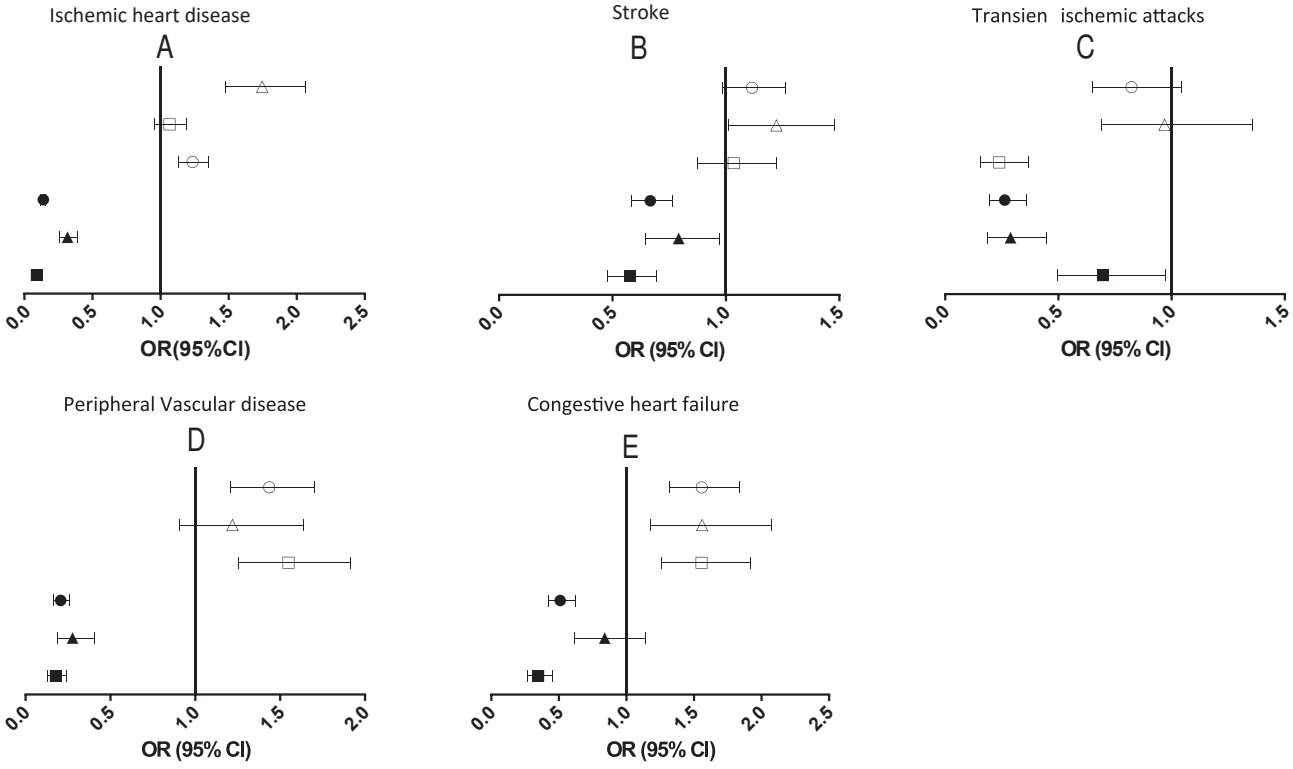

Fig. 2. Odds ratios from multivariate logistic regression of cardiovascular diseases and country of origin, native-born Israelis as the reference group, controlled for confounders. White circle = All Former Soviet Union immigrants; White triangle = Former Soviet Union immigrant females; White squares = Former Soviet Union immigrant males; Black circle = All East African immigrants; Black triangle = East African immigrant females; Black squares = East African Immigrant males.

Table 2
Hospitalization due to CVD multivariate Poisson regression model.

	Model 1			Model 2			Model 3		
Variable	RR	Cl 95%	P value	RR	Cl 95%	P value	RR	Cl 95%	P value
EAI	1.4	1.3–1.5	<0.001	0.7	0.6–0.7	<0.001	1.0	0.9–1.1	0.70
FSUI	2.6	2.4–2.8	<0.001	1.3	1.2–1.4	<0.001	1.3	1.2–1.4	<0.001
NBI`	1.0	(Reference group)		1.0	(Reference group)		1.0	(Reference group)	
Age				1.1	1.1–1.2	<0.001	1.1	1.1–1.2	<0.001
Male sex				1.9	1.7–2.0	<0.001	1.8	1.7–2.0	<0.001
High SES				0.8	0.8–0.9	<0.001	0.9	0.8–0.9	<0.001
Obesity							1.5	1.4–1.7	<0.001
Diabetes							1.8	1.7–2.0	<0.001
Hypertension							3.1	2.9–3.4	<0.001
Hyperlipidemia							1.3	1.2–1.4	<0.001
Smoking							1.5	1.4–1.6	<0.001

EAI: East Africa immigrants; FSUI: Former Soviet Union immigrants; NBI: Native born.

4. Discussion

The results of our study demonstrate low prevalence rates of IHD, TIA, and PVD in EAI than in FSUI and NBI, while the prevalence of stroke and CHF in EAI was similar to that of NBI. EAI had lower ORs of all types of CVD. Regarding hospitalizations due to CVD, EAI were more likely to be hospitalized due to hypertensive disease or cerebral vascular diseases and less likely to be admitted due to heart disease in comparison to NBI and FSUI. In addition, EAI were less likely to be hospitalized in intensive care units or surgical departments, and more likely to be hospitalized in internal medicine, geriatrics and neurology departments.

The results demonstrate that the risk of hospitalization in the EAI group is lower due to their lower prevalence of CVD risk factors; when controlling for CVD risk factors profile, EAI had the same chances of being hospitalized as the NBI reference group.

Our results are similar to previous studies, suggesting that EAI have a higher incidence of stroke, whereas CHD is less common [18–20], but do not concur with some other studies describing African origin immigrants and their descendants living in developed countries found as having a higher incidence of CVD morbidity and mortality compared to Western populations [21,22].

FSUI had the highest rate of hospitalizations due to cardiovascular disorders (17 per 1000 person-years) in comparison to 6 per 1000 person-years for NBI ($p < 0.001$). In addition, FSUI patients were more likely to be hospitalized due to hypertensive and heart disease, and to be admitted to internal medicine and geriatrics departments. The risk of hospitalization in the FSUI group is higher even after controlling for their CVD profile. Findings similar to those of the present study were likewise attained in another study investigating IHD mortality and risk factor burden across FSU counties. The age-standardized IHD death rates in Eastern European were almost two times that of satellite states of Central Europe [23–25].

Several explanations can be proposed for these findings. The relatively low rate of CHD may be explained by the lower rates of other risk factors, including a more favourable lipid profile and the lower prevalence of smoking, compared to NBI. The prevalence of risk factors is on the rise, especially among African women [15].

There are still no clear answers as to why hypertension is more prevalent among African immigrants. Several explanations including genetic factors, low renin levels as a result of a genetic 'maladaptation' which benefited their earlier ancestors [26,27] stress and social pressure of having a dark skin that causes the high blood pressure have been suggested [28].

Immigration-related stress could be a possible cause of health problems. Studies have shown that a high incidence of psychopathology may still exist, even after several years of residence in Israel. Main stress-related issues concern level of Hebrew fluency, financial situation, and the attitude of religious institutions toward the Ethiopian community. In addition, a high level of psychopathology was found to be related to a high level of trauma due to the journey to Israel, as well as to increasing age and a low level of education. Another stress-related aspect concerns the high percentage of Ethiopians residing in specific neighbourhoods. Previous studies have associated the prevalence of CVD risk factors found in certain ethnic minority groups with their greater susceptibility to the adverse neighbourhood environment, in which many ethnic minorities live. There are several mechanisms through which neighbourhood environment may be linked to the development of CVD risk factors, for instance, through their influence on health-related behaviors or through psychosocial pathways. Recent studies indicate the possible role of a neighbourhood's environment in influencing physical activity and diet [29–31]. It has been shown that neighbourhoods characterized by poor physical quality are associated with psychosocial stress [32]. Living in stressful neighbourhoods may discourage residents from taking up important lifestyle measures such as physical activity, the absence of which, in turn, may lead to the development of CVD risk factors [33–36].

The vast majority of Israel's Ethiopian population are of lower economic status. Socioeconomic status is inversely correlated with CVD risk and hospitalizations. Individuals with lower socioeconomic status are more likely to engage in behaviors that increase risk, such as tobacco use, unhealthy diet and physical inactivity. These behaviors are in part due to marketing strategies that target these populations, and also as a consequence of environmental and community factors, such as fewer opportunities for physical activity and less access to fresh fruits and vegetables [37].

The present study has several strengths. Firstly, the ability to compare two major immigration groups from very different parts of the world that live in the same country, have similar immigration characteristics, and are treated in the same health care system, with basically similar access to care. Above all, the use of a computerized data file reduced the possibility of typing errors and allows data verification. Uniform and objective definitions of diseases as documented by Clalit's physicians from a fixed and uniform list were used for this study.

Currently, Clalit's database contains an 18-year collection of extensive information on its members, including demographics, SES, and inpatient and outpatient clinical data such as medical diagnoses including chronic diseases, laboratory results, medication prescription and dispensing, imaging studies, and anthropometric data [38].

At the same time as it featured strengths, our study also had some inevitable limitations. Information regarding lifestyle factors, such as physical activity and alcohol consumption was not reliably

available from the database used for the study. A bias in hospitalization data can be assumed, due to the fact that data regarding hospitalization were only available for Clalit hospitals and not from all hospitals (such as government-owned hospital).

5. Conclusion

The issue of health in the Ethiopian population 30 years post-immigration continues to pose a significant challenge to the Israeli health system. The relatively low rate of CHD may be explained by the low rates of other risk factors including a more favourable lipid profile and the low prevalence of smoking. The risk factors and the generations are changing, and more efforts are also needed to improve data quality by recognizing the important heterogeneity within African descent populations between the first and the second generations.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcard.2019.08.022.

List of abbreviations

EAI	East Africa immigrants
FSUI	Former Soviet Union immigrants
NBI	Native born Israelis

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Declaration of competing interest

No potential financial/non-financial conflicts of interest relevant to this article were reported.

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