Health inequalities between Arabs and Jews in Israel: the impact of minority status and socioeconomic position

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Introduction

Health inequalities in Israel are most noticeable and persistent when comparing between the Arab minority and the Jewish majority. For example, a gap in life expectancy at birth ranging between 3 to 4 years has existed between the two population groups since 1970s. In 2009, life expectancy at birth for Jewish females reached 83.9 years compared to 80.7 for Arab females (a gap of 3.2 years) and for Jewish males it reached 80.5 years compared to 76.3 for Arab males (a gap of 4.2 years) (Israel Central Bureau of Statistics 2010). In the last decade, this gap was contributed mostly by mortality differentials in the ages 50 and above, where the contribution to the total gap, in both sexes, increased from about 50 percent in the 1990 to 75 percent in 2004 (Na'amneh et al 2010). Because most of death at ages 40-64 is caused by chronic diseases and with the gradual growing contribution of older ages to mortality differentials then an understanding of morbidity differences between the two groups is required. The need to examine morbidity differentials is further strengthened by the recent worrying increases, among Arabs, in diabetes and cancer incidence rates (Israel Center for Disease Control 2005).

Despite the persistence of lower health status among Arabs, this topic has received remarkably little attention and, with few exceptions, most of the research on ethnic and socioeconomic differentials in health and mortality in the Israeli society has focused on gaps between ethnic and social groups within the Jewish population only (e.g. Anson and Anson 2001; Eisenbach et al. 1997; Friedlander, Schellekens, and Cohen 1995; Jaffe et al. 2005a, 2005b, 2005c, 2006, 2007, 2008;

Jaffe and Manor, 2009; Manor and Eisenbach, 2003; Manor et al, 1999, 2000, 2004). This paper compares between Arabs and Jews in Israel in two most prevailing chronic conditions: diabetes and heart diseases with a focus on the health status of Arabs. Thus, it targets not only a less studied topic but also focuses on a sizeable and recently growing health gaps in the Israeli society. Specifically, this study examines how the minority status of Arabs in Israel is associated with their disadvantages in heart and diabetes morbidity.

Studies that addressed the Arab-Jewish gaps in health focused primarily on the role of the health care system in producing those gaps. Findings point to inequalities in the utilization of health services, especially among Arab women (Baron-Epel, Garty and Green 2007; Elnakav and Gross 2004; Israel Ministry of Health 2010); lower health-care provision to Arab localities compared to Jewish ones (Chernichovsky and Anson 2005); the neglect of Arabs' needs and health priorities and the lack of clear health policies towards them especially in the early decades after the establishment of the state of Israel (Shuval and Anson, 2000; Shvarts et al. 2003; Hamdan and Awad 2009). In addition, findings point to the lower rates of health-insurance coverage before the enactment of the National Health Insurance Law in 1995[1] (Gross, Rosen and Shirom 2001; Farfel and Yuval, 1999) and difficulties among Arabic speakers in getting referrals to specialists (Israel Ministry of Health, 2010). While these studies compellingly demonstrate

[1] The National Health Insurance Law, in effect since 1995, has extended health care coverage and health services especially to groups in the periphery with less access to health services.

inequality between Arabs and Jews in many aspects of provision and use of health services they do not explicitly demonstrate to what specific health outcomes these inequalities are translated. Moreover, the role of health-care system is believed to be more central in the treatment of medical conditions and less important when it comes to explain how the observed health gaps were created in the first place.

Because of the limited role of the health-care system in explaining the observed differences in morbidity other factors are expected to contribute to the formation of these differences. However, despite a well-established research about the association between social position and many health measures (e.g. see review by Elo 2009) and a long-lasting well-documented Arab-Jewish socioeconomic inequalities studies that examined this association are rare. A study by Baron-Epel and Kaplan (2009) reported that disparities in physical health-related quality of life[2] (measured as general self-rated health and limitation to daily functioning) between Arabs and non-immigrant Jews (all Jews excluding recent immigrants from former USSR) were found to be related to lower education and employment (but not income) among Arabs. Differences in SES explained all disparities among males but only partially among females. Chernichovsky and Anson (2005) reported that differences in life expectancy between a sample of Arab and Jewish localities were shown to be related to an index of SES of the locality, leading to the conclusion that

[2] Measured by SF-12 questionnaire. See: Ware, J., Jr., Kosinski, M., & Keller, S. D. (1996). A 12-Item short-form health survey: construction of scales and preliminary tests of reliability and validity. Medical Care, 34(3), 220–233. It measures self rated health, the degree of limitations to typical daily activities and work that were caused by health problems.

lower life expectancy in the Arab localities results from the fact that more Arab than Jewish communities are poor. In a study limited to Arab participants Daoud and Manor (2009) reported that those with higher education, higher family income, and who own land are less likely to report longstanding illnesses. These results, while far from providing a clear picture about the SES-health association in the studied context they positively demonstrate the relevance of SES in understanding inequalities in chronic diseases.

In the year 2000 (the year for which we compare in chronic diseases) the Arab population comprised about 20% (1.3 million) of the total population in Israel. Differences between the Arab minority and Jewish majority appear in many aspects like language, culture, religion, history and origin. However, what most distinguishes the two groups, and to some extent preserves their separation and cultural distinction, is the political position of Arabs within the Israeli society, or their minority status[3]. The involuntary minority status experienced by Arabs, started with the establishment of the state of Israel in 1948, is believed to affect most aspects of their life and to a large extent their health status.

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[3] The Israeli Jewish society is composed from many ethnic groups of different origins which upon arrival to Israel had differed in culture, language and social position. Unlike the maintained separation between Arabs and Jews many of the differences between Jewish ethnic groups eroded with time and gradually a more homogeneous society was shaped. An exception, maybe, is the case of the recent immigrants from former USSR who still retain some of their linguistic-cultural distinction; yet, compared to Arabs they are more integrated within the Israeli society.

One main pathway through which the minority status of Arabs could affect their health is through its influence on their social position within the Israeli society. Compared to Jews, Arabs are disadvantaged in almost every socioeconomic (SES) indicator and characterized with lower income, higher level of unemployment, and lower educational attainment (Okun and Friedlander 2005). The impact of minority status on social position works through various mechanism like residential segregations, discrimination in the labor market and discrimination in the allocation of resources to Arab localities or communities. I argue that health inequalities between Arabs and Jews can be reduced, to a large extent, to socioeconomic inequalities; the minority status of Arabs leads to inferior social position which in turn has a negative effect on their health.

Although socioeconomic disadvantages caused by the minority status can be central in explaining health inequalities, the minority status may impact health directly without the mediation of SES. Subjective experience of discrimination and racism may increase levels of stress experiences by minority members which adversely affect their health (Williams 1999). Evidence to the direct influence of minority status on health was found among minorities in different contexts: blacks in the US (Williams 1999, Williams, Neighbors and Jackson 2000), ethnic (immigrant) minorities in the UK (Nazroo 2003) and New Zealand (Harris et al 2006). This direct impact of the minority status on the health of Arabs in Israel was not investigated before. I argue then that a along-lasting Arab-Israeli conflict leaves the Arab minority under considerable stress and subject to expressions of discrimination that may have adverse effects on their health.

Remaining health inequalities unexplained by the proposed two pathways (direct and indirect) could results from cultural differences. However, cultural differences are not easily theorized and many expressions of cultural differences can be attributed to differences in social class or social position. In addition, unlike minority status or social position cultural differences are more dynamic and hard to conceptualize and measure thus it is left unspecified. In summary, the minority status of Arabs in Israel is suggested as an explanation to the observed health inequalities between the Arabs and Jews in Israel. Its impact on health is assumed to operate through two main pathways (see figure 1). One pathway suggests that the minority status has a negative impact on health indirectly through SES. The second pathway suggests that the minority status could affect health directly through personal experiences of discrimination.

insert figure 1 about here

DATA AND METHODS

Data is based on the 1999-2000 Israel Health Survey- a cross sectional survey conducted by the Central Bureau of Statistics on households over a time span of 12 months. The survey is representative of the Israeli population excluding military personnel, residents of institutions and Bedouins living outside of localities. In this study analysis is restricted to participant ages 40-65 years. Excluded from analysis were also former USSR immigrants. The vast majority of them arrived during the 90s therefore much of their health experience has to do with their social position and experience in their countries of origin. The distribution of the sample (n=6,057) by age, sex, and population group appears in Table 1.

insert table 1 about here

Variables

All variables were self reported. Socioeconomic status was measured by three variables: years of schooling (*0, 1-8, 9-10, 11-12 and 13+*), employment status (*employed and un-employed*) and household density defined as number of persons living in household per rooms (*up to 1 person, 1-2, 2-3, and 4+*). Higher density signifies lower social status. Other control variables were: age category (*40-44*, *45-49*, *50-54*, *55-59* and *60-64 years*) smoking (*current smoker* and *non-smoker*), marital status (*single, married, separated/divorced, and widowed*), and type of answering the survey (*proxy answering* and *self answering*). Table 2 presents the distribution of each of those variables by sex and population group (columns titled “Arabs” and “all Jews”). In additions, each respondent was asked if he/she was ever diagnosed with each of the following medical conditions: heart attack, other heart problem, and diabetes[4]. The answers to each question ("yes" or "no") define the outcome variables. Heart attack and other heart problems were combined into one condition: heart diseases. Prevalence rates are presented in table 3. It is important to note here that observed differences in the outcome variable used in this study (*ever diagnosed with diabetes or heart disease)* might be biased if varying diagnosis rates exist between the two populations. For example, Shuval (2000) mentions that prevalence rates measured by the 1992 Israeli Health Survey suggested a lower diagnosis rates among Arabs especially in medical conditions without clear symptoms, and which could be "missed" without a frequent contact with the health-care system. In this case the differences in prevalence measured by our survey will tend to underestimate the prevailing true differences.

insert tables 2 & 3 about here

Statistical analysis

The framework of analysis applied in this study is the formation of matched samples of Arabs (treated subjects) and Jews (control subject) based on the estimated propensity score and on the differences in each individual background variable (Rosenbaum 2010: chap. 8). The motivation for using this framework is explained by the following.

[4] The survey asked about other conditions like stroke, cancer, malignant disease, ulcer and asthma. Power analysis showed that the Arab sample size is not big enough to detect significance differences in those low-prevailing conditions.

As mentioned earlier, Arabs and Jews in Israel differ substantially in socioeconomic status. For example, in table 2 we can see that only 18% of Arab females reported more than 10 year of schooling compared to 74% of Jewish females. Employment rates, too, show a large contrast: 11% among Arab females versus 62% among Jewish females. Similar disparities in education and employment were also found among males (see table 2). Once considering multivariate comparisons the degree of imbalance between the two populations is expected to be even higher.

A useful tool to examine the degree of (multivariate) imbalance between the two samples is the use of propensity scores (PSs). The PS is defined as the conditional probability of being in the treatment group given the observed background covariates (Rosenbaum and Rubin, 1983). By applying a logistic regression model I estimated the probability of being member of the Arab population group given the backgrounds: education, employment, household density, smoking, type of answering, and marital status (the PS of being an Arab). Separate models were applied for males and females separately. Because the PS can be considered as a one-dimensional summary of the of the background variables for each subject, a comparison in the distribution of PSs is informative about the degree of imbalance between the two samples. The boxplots in figure 2 (for males) and figure 3 (for females) show the distribution of the estimated PS by population group (the two left-side boxplots). The high degree of imbalance between the two samples is clear. Most of the Jewish subjects, males and females, have low PS values which indicate a substantial difference in background variables, with larger imbalance observed between females. In addition to indicating imbalance the PS graphs are useful in verifying the *degree of overlap* between the two samples. In general, overlap defines the range over which the comparisons between the two study groups is supported and areas where overlap is lacking a meaningful comparison between the two groups cannot be supported (Dehejia and Wahba 1999). The graphs show lack of overlap in the higher range of PS values where only Arab subjects are found. In other words, there are Arab subjects (with very high PS) to whom a comparable Jewish subjects are not found in the dataset.

insert figures 2 & 3 about here

The previous examination of our data showed a *high degree of imbalance* and also a *lack of overlap* over the range of high PSs. The strategy of analysis applied to handle these two shortcomings of the data was the formation of matched samples. Matching (or matching in combination with regression) is expected to outperform regression analysis only, a strategy commonly used in many similar cases. While both regression and matching may be useful in adjusting for imbalance differences between the two can be summarized in two main points (Gelman and Hill 2007; Morgan and Winship 2007; Rubin 1979[5]): First, Regression adjustment

[5] Most of comparisons are made between matching and *linear* regression.

estimators are model-based and depend on functional form assumptions. With the high degree of imbalance observed in our data the estimation of the group effect using regression model relies heavily on the correctness of the specified model[6]. An ill-fitted model will result in a biased estimation of the population group effect. Unlike regression matching is considered a non parametric method that does not rely on any model-based assumptions. Matching will reduce imbalance by creating two samples that are "similar' in the covariates and thus the comparison becomes less model dependent.

The second difference between the two methods regards lack of overlap. A regression model will ignore this limitation of the dataset and produces and estimator (through extrapolation) also in regions without common support. Matching, however, can be more explicit about lack of overlap and through the process of matching it is easier to limit comparisons (estimation) to regions of common support only (Dehejia and Wahba, 1999). In addition, Daniel et al. (2008) who examined a similar case of black-white disparities in cancer survival where a relatively small black sample was compared to a larger white sample note that "unaided by matching a model fitted to the entire population would give disproportionate weight to the large and comparatively healthy white population, and that model may substantially misrepresent the situation in the small, sicker black population" Daniel et al 2008:915).

[6] To some degree his limitation can be offset by including interaction terms between the treatment effect and all other covariates enabling a more flexible relationship between the outcome and control variables. However, the small sample size of the Arabs don't allow such flexible specification.

The matching procedure used in this study is optimal pair matching as suggested by Rosenbaum (2010: chap. 8). First I estimated a distance matrix which measured the "similarity" between each treated and control subject and based on the distance matrix a matching algorithm paired each treated subject to *one different* control subject. The similarity between any two subjects is based on the distance in PS (as defined earlier) and on the distance in each of the background variables. The method asked that subjects be first within a close distance of propensity scores and once that is achieved it "preferred" the control subject which is also most similar on the values of the background variables. In other words, among two or more potential control subjects (who have similar propensity score to a specific treated subject) the matching algorithms choose the one which also have similar values to the treated subject on the individual background variables[7].

Finding an optimal pair match was performed by the Hansen's *pairmatch* function in his *optmatch* package available in the statistical R code. By applying the described pair-match method each treated subject (501 Arab females and 487 Arab males) was paired with one "most similar" control subject resulting in a male sample (n=974) and a females sample (n=1002) each consists of the same number of Arab and Jewish subjects.

[7] Distance in background variables is measured as Mahalanobis distance. More details about the estimation of the distance matrix are found in Rosenbaum (2010), pages 168-172.

Table 2 shows the distribution of the background variables in the Arab sample and in the Jewish samples before and after matching. A comparison between the three distributions tells that in every variables the degree of imbalance is lower in the matched samples. Examining the distribution of the PSs provides an equivalent multivariate comparison which advises similar conclusions (see figures 2 & 3). A formal measure of variable imbalance uses a version of absolute standardized difference (ASD) in means defined as (Rosenbaum and Rubin 1985; Rosenbaum 2010:187-188):

$$SD = \frac{| x_{ak} - x_{jk} |}{\sqrt{(S_{ak}^2 - S_{jk}^2)/2}}$$

where *Xak* denotes the mean of variable *k* for Arab subjects and *Xjk* denotes the mean of variable *k* for Jewish subjects. *Sak* and *Sjk* denote the standard deviation before matching in the Arab and Jewish samples, respectively. ASD measures the distance between means in units of standard deviation and is computed before and after matching. Balance is achieved when large ASDs before matching are reduced to smaller ones after matching (see table 4 and boxplots in figures 4 & 5). The results show that ASDs before matching were substantially reduced by the matching procedure, except for mean differences in age among females which was slightly higher after matching (.22 after matching compared to 0.15 before matching).

Insert table 4 about here

The comparison between the ASD values before and after matching can be seen as a difference-in-difference comparison which indicates the extent to which differences in the population-based samples were reduced by the matching procedure. This comparison, however, is not informative whether the differences observed after matching are statistically significant or not. In the matched male sample differences between the two groups were not statistically significant at a 0.05 level except for differences in household density, education, and employment. Among females remaining imbalance in age, household density, and employment were all significant at 0.05 level. Remaining imbalance was further reduced by regression adjustment. When combined together, matching and adjustment by regression could result in better estimation than either alone (Rubin 1979).

insert figure 4 & 5 about here

As mentioned earlier lack of overlap between the two matched samples was evident in the region of high PS values (values between .90 and 1.0). To examine how lack of overlap affects our results a separate set of comparisons was produced based on the region of common support only, namely PS values between 0.0 and 0.90. Trimming the samples this way resulted in excluding 41 Jewish male subjects (compared no exclusion of Arabs subjects) and in excluding 53 Jewish female subjects compared to two female Arab subjects. The size of the female trimmed-female is 931 subjects (499 Arabs and 432 Jews) and the male trimmed-sample is 933 subjects (487 Arabs and 446 Jews).

In general, the applied pair-match procedure created samples with Arab and Jewish subjects who are more similar on background variables. A comparison between the two groups, based on the matched samples, thus is less biased by imbalance in backgrounds or by possible model misspecification. The results section compares between estimators of the group effect based on: population-based (unmatched) samples, matched samples and trimmed-matched samples (matched samples limited to the region of common support).

RESULTS

The comparison between Arabs and Jews in the matched samples is a comparison between two groups that have similar SES profile. If differences that were first observed in the population-based samples were removed after matching then disparities in the outcome are associated with SES differences which gives support to the hypothesis that the minority status impacts health through the mediation of SES. On the other hand differences in the outcome which remain after matching tell that factors other than SES influence health disparities, and give some *indirect* support to the impact of subjective experience of discrimination on health or to the impact of cultural differences.

Tables 5-8 show results of various comparisons between Arabs and Jews in the outcome variables: ever diagnosed with diabetes or with heart disease. Comparisons were conducted by fitting logistic regression and results are presented in terms of odds ratios. Of particular interest is the population-group's odds ratio which is defined as the Arab to Jewish odds of being diagnosed with a medical conditions (versus not diagnosed). Each table present results from three models: models one and two both estimate the population group effect while controlling for age only, but model one was applied to the population-based samples before matching, and model two was applied over the matched samples. The difference between the two lies in the amount of reduction of imbalance achieved by the matching procedure. Model three was applied over the matched samples with all covariates included (in addition to age) and thus balancing the two groups in covariates not completely balanced by the pair-matching procedure. It represents the most "robust" estimation. In addition, models two and three were fitted again over the trimmed-samples and results appear in tables 9 (for females) and 10 (for males).

Insert tables 5-8 about here

Comparisons between females in diabetes are presented in table 5. In the population based sample odds among Arab females are 3.1 times higher compared to Jewish females ($p<.0001$). The estimated odds ratio based on the matched sample (model two) is reduced to 1.7 and remains statistically significant ($p<.01$). The estimated odds ratio from model three, which controls for more covariates was reduced to 1.5 and is not statistically significant ($p=0.0841$). In summary, the observed difference between Arab and Jewish females in prevalence of diabetes in population-based samples was substantially reduced when comparing subjects with similar socioeconomic background. This result suggests that observed differences in diabetes are strongly associated with differences in socioeconomic position. The comparison in heart diseases indicates a different pattern. Higher odds of being diagnosed with heart disease among Arabs observed in the population-based samples (OR=1.9, $p<0.01$) were not reduced after matching (OR=1.9, $p=.038$ in model two; OR=2.0, $p=0.028$ in model three) (see table 6).

Results for males, presented in tables 7 and 8, show a different pattern than obtained for females. Observed higher odds of diabetes in the Arab male population (OR=2.3, $p<0.01$; model one) did not change when making the comparison over the matched samples (OR=2.3, $p<0.01$) (see table 7). The regression based estimation (model four) was slightly lower (OR=2.0, $p<0.01$). The odds of being diagnosed with heart diseases, based on the unmatched samples (model 1, table 8) is 1.8 times higher among Arab males compared to Jewish males ($p<0.01$). Again, using the matched samples did not change the estimated odds (OR=1.8, $p<0.01$) in both model two and three (see table 8). The regression based estimation (model four) was slightly lower (OR=1.6, $p<0.05$).

Comparisons based on the trimmed samples produced very close estimation to the previously reported equivalent results (over the entire matched samples) with only slight differences, indicating probably the absence of serious lack of overlap in the matched samples (see tables 9-10).

Insert table 9-10 about here

DISCUSSION

Results show that the applied pair-matching method formed two groups of comparison that are more similar in three SES indicators: education, employment, and household density in addition to the other background variables (age, smoking, proxy answering and marital status). Remaining imbalance in any of those variables was adjusted by a regression model fitted over the matched samples, resulting in two groups similar and highly comparable in socioeconomic variables. The results show that when comparing females with similar socioeconomic background, the higher rates of diabetes observed among Arab females were substantially reduced. Higher rates of heart diseases, however, were not reduced. For males results show that balancing socioeconomic background variables did not reduce the observed higher odds among Arabs, neither in diabetes nor in heart diseases.

The results suggest that the role of socioeconomic status in explaining health disparities is more relevant in the case of females and less crucial for males, at least when considering the differences in diabetes. At the same time, results from males imply that minority status may impact health directly without the mediation of SES. Does that mean that social position is more an adequate explanation for the patterns of diabetes among females but not among males? Or maybe minority status has different meaning for each gender group and thus it impacts health differently among males and females.

As mentioned earlier a possible direct effect of minority status on health is the exposure of minority group members to expressions of racism and discrimination which can have adverse effects on health (Harris et al 2006; Williams 1994). However, it is less clear in this case why this psycho-social effect is more significant to males and less to Arab females.

One possible mechanism that could result in differential exposures to discrimination is the participation of the labor market. Perhaps because of their higher participation in the labor market and higher mobility males are expected to come in more frequent contact with the Jewish majority and thus more exposed to experiences of racism and discrimination. For example, in a survey from 2004 about 45% of employed Arab males reported working in Jewish localities or in the Jewish labor market compared 28% among females (Galilee Society 2005). Because of different employment rates (males, 63%; females, 23%) it is estimated that about 30% of males and less than 7% of females come into frequent contact with the Jewish community which indicates male's higher exposure to expressions of discrimination or racism.

Another possible explanation for the observed gender difference in SES effect on health is related to the specific indicators I used to measures social position. For example, employment status was used to signify social status such that subjects in the category "employed" have higher status than unemployed subjects. However, within the "employed" category there might be considerable variations in income levels and in occupation class. In the UK for example, within an occupational group "ethnic minorities may be more likely to be found in lower or less prestigious occupational grades, to have poor job security, to endure more stressful working conditions." (Nazroo 1998:159). Official statistics from Israel indicate that the profile of employed Arabs is not far from what described regarding minorities in the UK (Manna 2008). Also, our data suggest that Arabs (mostly males) are more likely to be workers (skilled or unskilled) and less likely to be in managerial or professional occupations[8]. Then one should expect that employed Arabs are likely to be in a *lower* social position than employed Jewish males. In this case gaps in health are still expected to exist between supposedly "comparable"

[8] The reason why I did not include occupation as one of the controls is the relatively high number of missing values in the Arab sample.

employed subjects. At the same time a comparison between *unemployed* Arabs and *unemployed* Jews might involve fewer variations between the two and thus indicates higher similarity in social position. Since most of Arab females are unemployed then the overall unmeasured variation in the "true" social position is expected to be lower in the female samples. Same argument might apply for education, too. Arabs and Jews who report the same educational level might still vary in some unmeasured aspects like returns to education. If that is true then the variation is expected to be lower among females than males only because more females are concentrated in the lower levels of education where returns to education are minimal.

In general, matching on education and employment probably brought together two females groups (Arabs and Jews) that are more close to each other in social position than was the case among males. This means that controlling for SES was more effective in the case of females than in the case of males which might explain the pattern of results reported earlier. In review of ethnic differences in health in the UK Nazroo (1998) concludes that "while standard indicators of socio-economic status have some use of making comparison *within* ethnic groups, they are of little use for 'controlling out' the impact of socio-economic differences when attempting to reveal a pure 'ethnic/race' effect" (Nazroo 1998:160). My results suggest similar conclusions when comparing between males and highlight the need for more accurate measures of SES.

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Figure 1: Pathways of minority Status effect

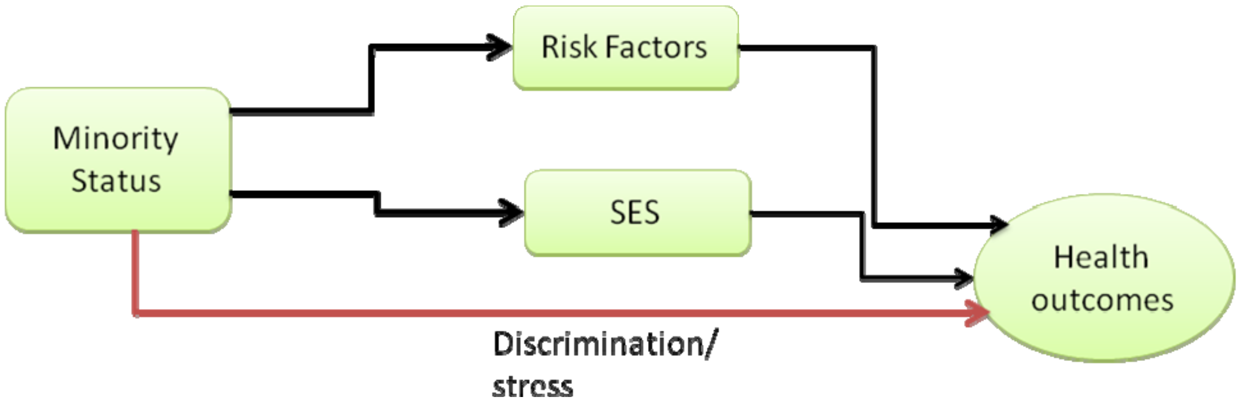

Table 1: Sample size by population group, age group, and sex, n (%)

	Arabs	**Jews**	**Total**
Males			
40-44	561 (23)	151 (31)	712
45-49	599 (25)	129 (26)	728
50-54	561 (23)	82 (17)	643
55-59	342 (14)	66 (14)	408
60-64	348 (14)	59 (12)	407
Total	**2411 (100)**	**487 (100)**	**2898**
Females			
40-44	615 (23)	149 (30)	764
45-49	688 (26)	131 (26)	819
50-54	601 (23)	92 (18)	693
55-59	385 (14)	68 (14)	453
60-64	369 (14)	61 (12)	430
Total	**2658 (100)**	**501 (100)**	**3159**

Table 2: The distribution of the socioeconomic variables and other controls in the two population groups, before and after matching

	Females			Males		
	Arabs	All Jews	Matched Jews	Arabs	All Jews	Matched Jews
N	501	2658	501	487	2411	487
Age						
40-44	30	23	27	31	23	31
45-49	26	26	24	26	25	26
50-54	18	23	15	17	23	17
55-59	14	14	15	14	14	10
60-64	12	14	20	12	14	15
	100	100	100	100	100	100
Education						
0-8	75	16	57	51	13	36
9-10	7	9	11	16	10	19
11-12	12	31	21	16	32	21
13+	6	43	11	16	45	23
	100	100	100	100	100	100
Employment						
Unemployed	89	37	81	43	20	36
Employed	11	63	19	57	80	64
	100	100	100	100	100	100
Smoking						
Non smoker	93	80	88	48	69	53
Smoker	7	20	12	52	31	47
	100	100	100	100	100	100
Household Density (persons per rooms)						
Up to 1	13	51	25	6	44	7
1 to 2	47	44	59	52	50	66
2 to 3	32	4	14	32	5	24
4+	8	0	2	11	1	3
	100	100	100	100	100	100
Marital Status						
Married	78	79	80	98	89	98
Separated/Divorced	2	10	2	0	6	0
Widowed	13	6	12	1	1	1
Single	8	5	6	1	4	1
	100	100	100	100	100	100
Type of answering						
Proxy answering	43	60	48	31	38	30
Answered him/her self	57	40	52	69	62	70
	100	100	100	100	100	100

Table 3: Ever diagnosed with chronic disease (%), by age, sex and population-group

	Females			***Males***		
	Arabs	Jews		Arabs	Jews	
Sample size	501	2658		487	2411	
	Diabetes					
Age group	*%*	*%*	*Odds Ratio*	*%*	*%*	*Odds Ratio*
40-44	3	2	1.9	7	2	3.5
45-49	13	3	5.0	9	4	2.1
50-54	17	5	4.0	16	7	2.5
55-59	25	10	2.9	18	9	2.2
60-64	28	15	2.2	25	14	2.0
Total	**14**	**6**	**2.6**	**13**	**7**	**2.0**
	Heart diseases					
	%	*%*	*Odds Ratio*	*%*	*%*	*OR*
40-44	0	2	0.0	5	3	1.8
45-49	5	3	1.8	7	4	1.8
50-54	5	3	1.8	13	7	2.0
55-59	13	4	3.8	17	8	2.2
60-64	15	8	1.9	25	20	1.4
Total	**6**	**4**	**1.8**	**11**	**7**	**1.5**

Table 3: Ever diagnosed with chronic disease (%), by age, sex and population-group

	Females			***Males***		
	Arabs	Jews		Arabs	Jews	
Sample size	501	2658		487	2411	
	Diabetes					
Age group	*%*	*%*	*Odds Ratio*	*%*	*%*	*Odds Ratio*
40-49	8	2	3.5	8	3	2.5
50-59	21	7	3.4	17	8	2.4
60-64	28	15	2.2	25	14	2.0
Total	**14**	**6**	**2.6**	**13**	**7**	**2.0**
	Heart diseases					
	%	*%*	*Odds Ratio*	*%*	*%*	*OR*
40-49	3	2	1.2	6	3	1.7
50-59	8	3	2.6	15	8	2.0
60-64	15	8	1.8	25	20	1.4
Total	**6**	**4**	**1.8**	**11**	**7**	**1.5**

Israel Health Survey 1999-2000

Figure 2: Distribution of Propensity scores for Arab male and for Jewish males before and after matching

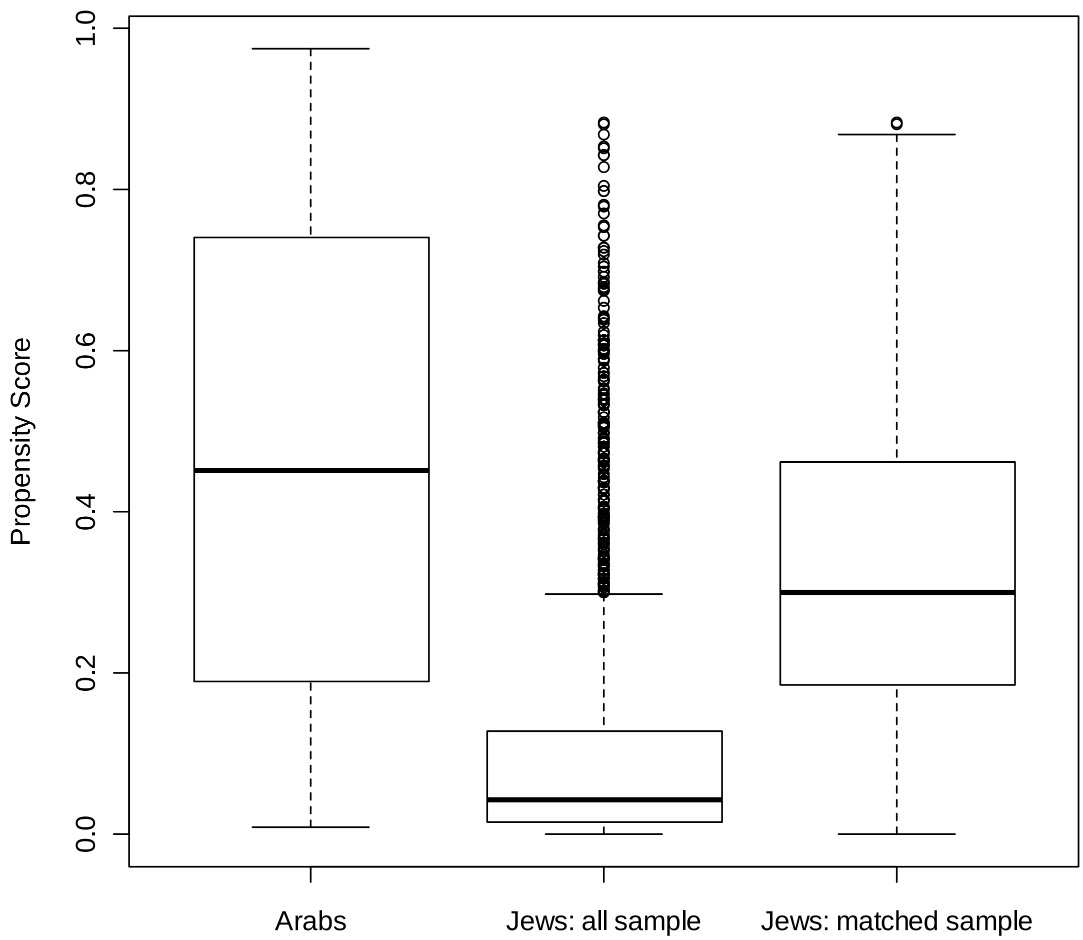

Figure 3: Distribution of Propensity scores for Arab female and for Jewish females before and after matching

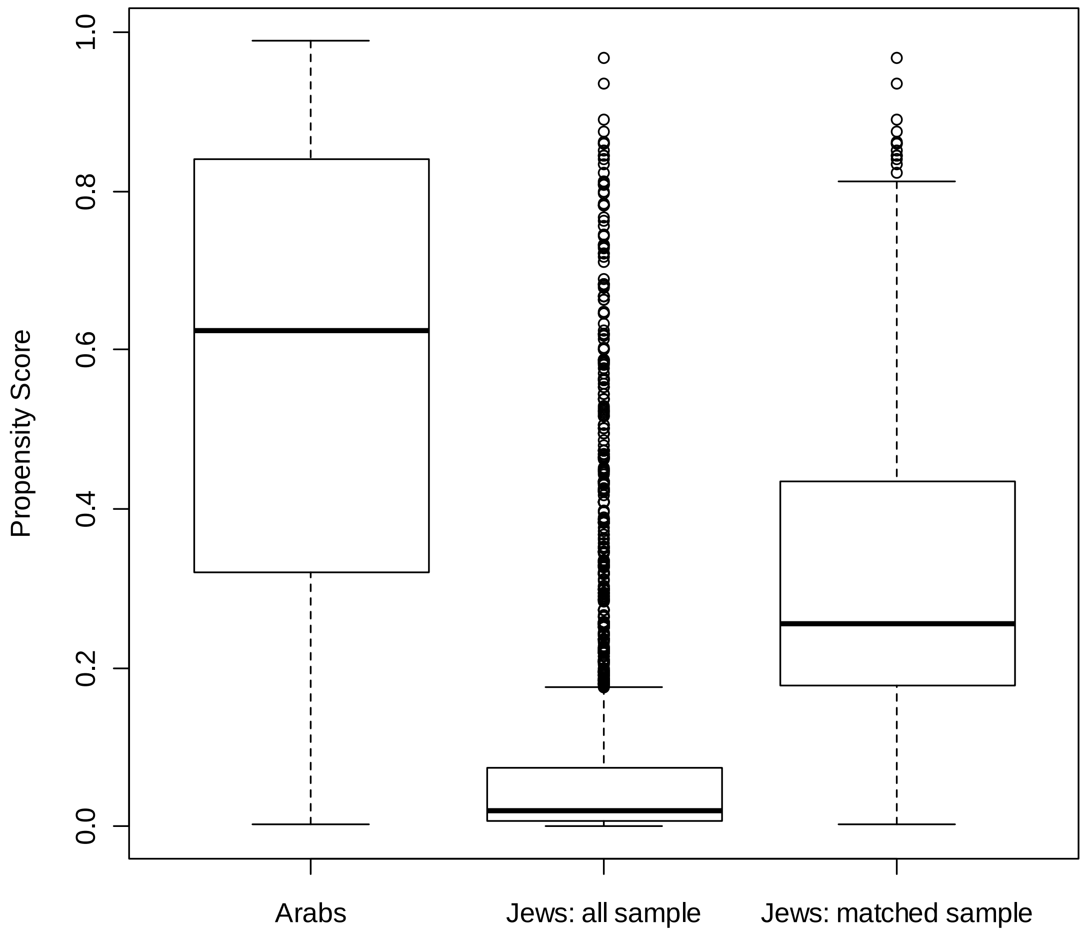

Table 4: Absolute standardized differences in means before and after matching

	Females		*Males*	
Variable	Before	After	Before	After
Age	0.15	0.22	0.19	0.03
Current smoking	0.26	0.10	0.30	0.06
Educ0	0.25	0.05	0.02	0.02
Educ1	0.24	0.18	0.13	0.10
Educ2	0.41	0.07	0.45	0.15
Educ3	0.05	0.07	0.10	0.04
Educ4	0.34	0.16	0.26	0.08
Educ5	0.39	0.11	0.23	0.05
Educ6	0.59	0.02	0.34	0.09
Household Density	0.90	0.48	0.97	0.27
Type of answering	0.24	0.06	0.10	0.02
Work1	0.91	0.13	0.32	0.10
Work2	0.10	0.01	0.02	0.02
Work3	0.95	0.12	0.31	0.09
Propensity Score	0.89	0.46	0.67	0.25
MS1	0.02	0.03	0.22	0.01
MS2	0.23	0.01	0.21	0.01
MS3	0.12	0.01	0.01	0.01
MS4	0.05	0.04	0.09	0.01

Notes: Educ0-Educ6 are dummy variables which represent six education levels; MS1-MS4 are dummy variables which represent marital status levels (married, single, divorced/separated, and widowed). Work1-work3 are dummy variables for the three employment levels (employed, unemployed, and not in the labor force).

Figure 4: the distribution of absolute standardized difference (ASD) before and after matching in the male sample.

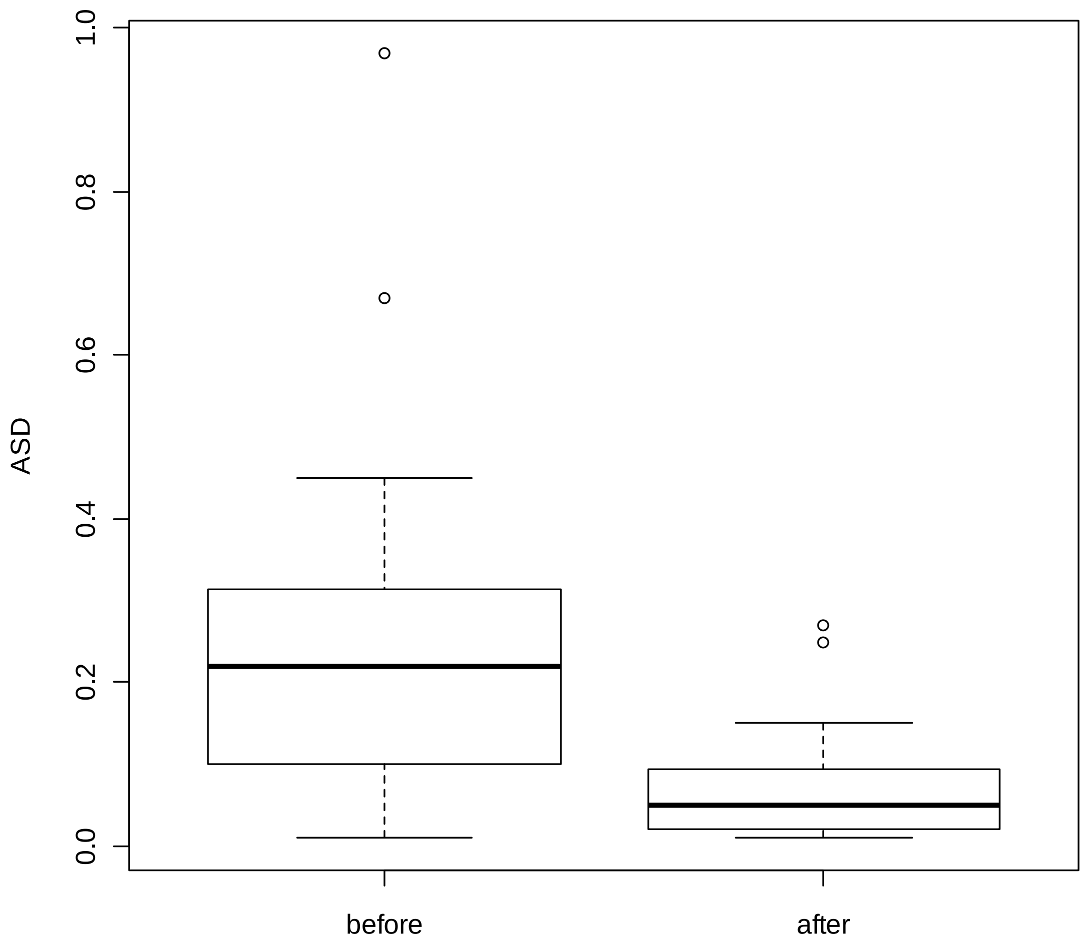

Figure 5: the distribution of absolute standardized difference (ASD) before and after matching in the female sample.

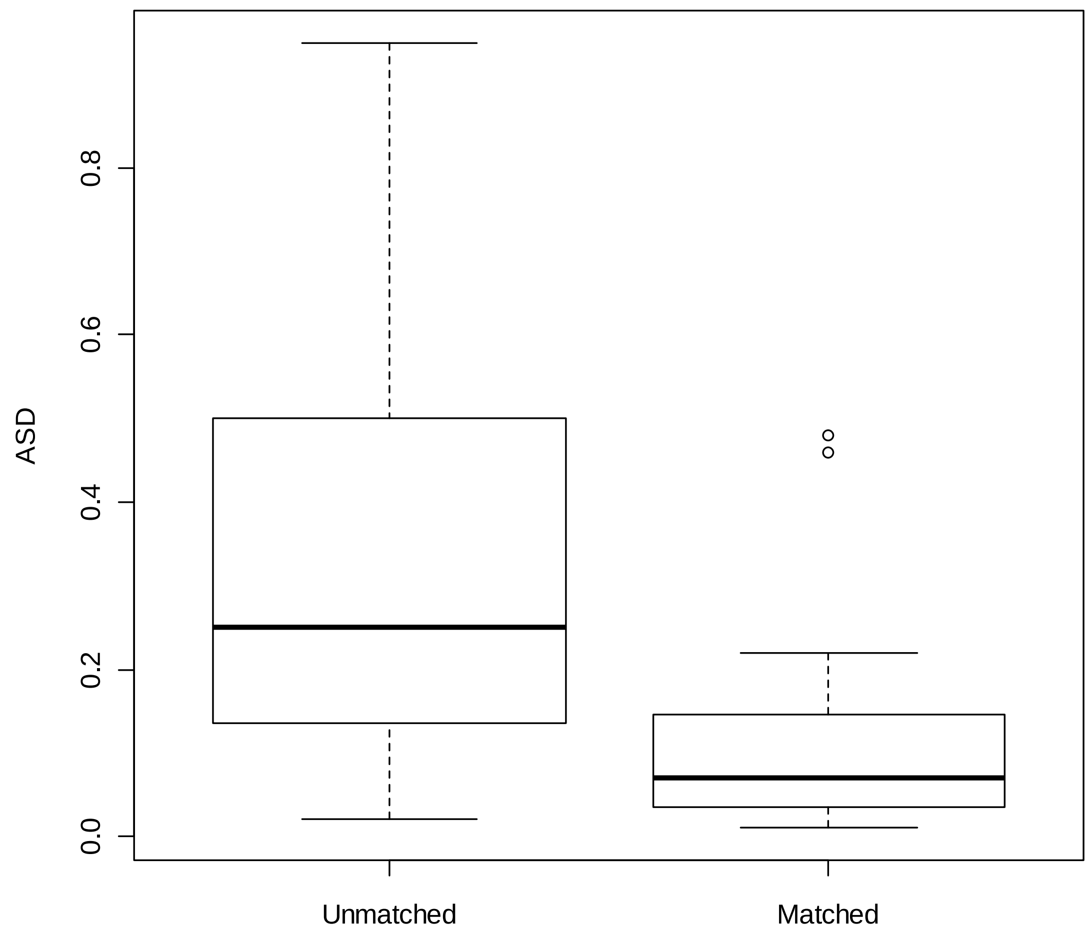

Table 5: Estimated odds ratio (Arabs versus Jews) of being diagnosed with diabetes among females

	Model one		Model two		Model three	
	OR	P value	OR	P value	OR	P value
Arabs vs. Jews	**3.1 [2.3 - 4.3]**	**<.0001**	**1.7 [1.2 - 2.6]**	**0.0081**	**1.5 [0.9 - 2.3]**	**0.0841**
age 45-49 (ref 40-44)	2.4 [1.3 - 4.3]	<.0001	3.1 [1.4 - 6.8]	0.0052	2.7 [1.2 - 6.1]	0.0152
age 50-54	3.7 [2.1 - 6.6]	0.0051	5.1 [2.3 - 11.3]	<.0001	4.0 [1.7 - 9.1]	0.0012
age 55-59	7.4 [4.2 - 13.2]	<.0001	9.3 [4.3 - 20.1]	<.0001	6.8 [3 - 15.6]	<.0001
age 60-64	10.6 [6.1 - 18.7]	<.0001	9.1 [4.2 - 19.7]	<.0001	6.0 [2.6 - 13.9]	<.0001
Educ 0-8 (ref 13+ yrs)					1.2 [0.4 - 3.7]	0.7405
Educ 9-10					0.2 [0 - 1.2]	0.0767
Educ 11-12					0.6 [0.1 - 2]	0.3699
Unemployed					3.7 [1.3 - 10.9]	0.0178
Non smoker					1.0 [0.5 - 2.1]	0.9222
No proxy-answering					0.7 [0.5 - 1]	0.0833
Household Density					1.0 [0.8 - 1.3]	0.8749
Divorced/separated (ref married)						
Widowed						
Single						

Notes:
Model one: population-based sample (before matching)
Model two: pair-matched samples controlling for age only
Model three: pair-matched samples controlling for age and other covariates
Marital status was not included in the matched samples because of small numbers of cases in categories other than “married”

Table 6: Estimated odds ratio (Arabs versus Jews) of being diagnosed with heart disease among females

	Model one		Model two		Model three	
	OR	P value	OR	P value	OR	P value
Arabs vs. Jews	**1.9 [1.3 - 3]**	**<.0001**	**1.9 [1 - 3.3]**	**0.0388**	**2.0 [1.1 - 3.8]**	**0.0282**
age 45-49 (ref 40-44)	1.8 [0.9 - 3.6]	0.0021	2.6 [0.8 - 8.6]	0.1150	2.8 [0.8 - 9.4]	0.0943
age 50-54	2.2 [1.1 - 4.3]	0.0931	3.0 [0.9 - 10.5]	0.0818	3.6 [1 - 12.9]	0.0553
age 55-59	3.4 [1.7 - 6.7]	0.0255	6.1 [1.9 - 19.5]	0.0024	7.7 [2.2 - 26.6]	0.0013
age 60-64	6.2 [3.3 - 11.8]	0.0005	11.4 [3.8 - 34.2]	<.0001	14.6 [4.3 - 49.2]	<.0001
Educ 0-8 (ref 13+ yrs)					0.3 [0.1 - 1.2]	0.0958
Educ 9-10					0.6 [0.1 - 2.5]	0.4428
Educ 11-12					0.2 [0 - 1.2]	0.0763
Unemployed					2.3 [0.6 - 9]	0.2497
Non smoker					1.9 [0.8 - 4.5]	0.1651
No proxy-answering					0.5 [0.3 - 1]	0.0398
Household Density					1.1 [0.7 - 1.6]	0.7393
Divorced/separated (ref married)						
Widowed						
Single						

Notes:
Model one: population-based sample (before matching)
Model two: pair-matched samples controlling for age only
Model three: pair-matched samples controlling for age and other covariates
Marital status was not included in the matched samples because of small numbers of cases in categories other than "married"

Table 7: Estimated odds ratio (Arabs versus Jews) of being diagnosed with diabetes among males

	Model one		Model two		Model three	
	OR	P value	OR	P value	OR	P value
Arabs vs. Jews	**2.3 [1.7 - 3.2]**	**<.0001**	**2.3 [1.4 - 3.6]**	**0.0005**	**2.3 [1.4 - 3.7]**	**0.0009**
age 45-49 (ref 40-44)	1.8 [1.1 - 3.2]	<.0001	1.9 [0.9 - 3.9]	0.1099	1.7 [0.8 - 3.7]	0.1627
age 50-54	3.2 [1.9 - 5.4]	0.0300	3.2 [1.5 - 6.8]	0.0025	2.5 [1.2 - 5.5]	0.0201
age 55-59	4.2 [2.5 - 7.3]	<.0001	4.0 [1.8 - 8.7]	0.0005	2.7 [1.2 - 6.1]	0.0206
age 60-64	6.8 [4.1 - 11.4]	<.0001	6.0 [2.9 - 12.5]	<.0001	3.7 [1.6 - 8.3]	0.0018
Educ 0-8 (ref 13+ yrs)					1.2 [0.6 - 2.6]	0.5677
Educ 9-10					1.7 [0.7 - 3.7]	0.2226
Educ 11-12					0.9 [0.3 - 2.2]	0.7903
Unemployed					2.0 [1.2 - 3.2]	0.0047
Non smoker					0.8 [0.5 - 1.2]	0.2706
No proxy-answering					0.7 [0.4 - 1.1]	0.1381
Household Density					0.9 [0.6 - 1.2]	0.3639
Divorced/separated (ref married)						
Widowed						
Single						

Notes:
Model one: population-based sample (before matching)
Model two: pair-matched samples controlling for age only
Model three: pair-matched samples controlling for age and other covariates
Marital status was not included in the matched samples because of small numbers of cases in categories other than “married”

Table 8: Estimated odds ratio (Arabs versus Jews) of being diagnosed with heart disease among males

	Model one		Model two		Model three	
	OR	P value	OR	P value	OR	P value
Arabs vs. Jews	**1.8 [1.3 - 2.5]**	**<.0001**	**1.8 [1.1 - 2.9]**	**0.0128**	**1.8 [1.1 - 2.9]**	**0.0204**
age 45-49 (ref 40-44)	1.5 [0.9 - 2.6]	0.0009	1.6 [0.7 - 3.5]	0.2913	1.5 [0.7 - 3.5]	0.3111
age 50-54	2.9 [1.8 - 4.9]	0.1328	3.5 [1.6 - 7.5]	0.0015	2.9 [1.3 - 6.4]	0.0105
age 55-59	3.5 [2.1 - 6.1]	<.0001	3.2 [1.4 - 7.4]	0.0061	2.0 [0.8 - 4.9]	0.1360
age 60-64	8.5 [5.2 - 13.9]	<.0001	7.8 [3.7 - 16.2]	<.0001	4.3 [1.9 - 9.8]	0.0007
Educ 0-8 (ref 13+ yrs)					1.2 [0.6 - 2.6]	0.6426
Educ 9-10 s					1.4 [0.6 - 3.4]	0.4678
Educ 11-12					1.2 [0.5 - 3.1]	0.6875
Unemployed					2.5 [1.5 - 4.2]	0.0005
Non smoker					0.9 [0.6 - 1.5]	0.7325
No proxy-answering					0.4 [0.2 - 0.6]	<.0001
Household Density					0.8 [0.5 - 1.1]	0.1305
Divorced/separated (ref married)						
Widowed						
Single						

Notes:
Model one: population-based sample (before matching)
Model two: pair-matched samples controlling for age only
Model three: pair-matched samples controlling for age and other covariates
Marital status was not included in the matched samples because of small numbers of cases in categories other than “married”

Table 9: Odds ratio estimated by models two and three based on trimmed-sample for males

	Model two, diabetes		Model three, diabetes		Model two, heart disease		Model three, health disease	
	OR	P value	OR	P value	OR	P value	OR	P value
Arabs vs. Jews	**1.8 [1.2 - 2.7]**	**0.0070**	**1.7 [1 - 2.6]**	**0.0312**	**1.8 [0.9 - 3.3]**	**0.0801**	**2.0 [1 - 3.9]**	**0.0375**
age 45-49 (ref 40-44)	6.2 [2.1 - 18.4]	0.0010	5.1 [1.7 - 15.3]	0.0039	3.9 [0.8 - 18.9]	0.0934	4.4 [0.9 - 21.6]	0.0707
age 50-54	9.2 [3.1 - 27.5]	<.0001	6.6 [2.1 - 20.5]	0.0011	5.0 [1 - 25]	0.0512	5.9 [1.1 - 30.9]	0.0366
age 55-59	18.4 [6.3 - 53.6]	<.0001	12.3 [4 - 37.5]	<.0001	10.2 [2.2 - 47.4]	0.0030	13.2 [2.7 - 65.8]	0.0016
age 60-64	18.1 [6.2 - 52.4]	<.0001	10.7 [3.5 - 32.7]	<.0001	19.1 [4.4 - 83.3]	<.0001	24.7 [5.1 - 119.9]	<.0001
Educ 0-8 (ref 13+ yrs)			0.8 [0.2 - 2.7]	0.7395			0.3 [0.1 - 1.5]	0.1546
Educ 9-10 s			0.2 [0 - 1]	0.0462			0.7 [0.1 - 3.9]	0.6581
Educ 11-12			0.3 [0.1 - 1.2]	0.0797			0.3 [0 - 1.7]	0.1754
Unemployed			3.7 [1.2 - 11.5]	0.0253			1.9 [0.4 - 8.4]	0.3746
Non smoker			1.2 [0.5 - 2.4]	0.7159			2.1 [0.9 - 5.2]	0.0968
No proxy-answering			0.8 [0.5 - 1.2]	0.2086			0.6 [0.3 - 1.1]	0.0814
Household Density			0.9 [0.7 - 1.2]	0.5254			0.9 [0.6 - 1.4]	0.7070

Table 10: Odds ratio estimated by models two and three based on trimmed-sample for males

	Model two, diabetes		Model three, diabetes		Model two, heart disease		Model three, health disease	
	OR	P value	OR	P value	OR	P value	OR	P value
Arabs vs. Jews	**2.4 [1.5 - 4]**	**0.0006**	**2.4 [1.5 - 4.1]**	**0.0007**	**1.7 [1.1 - 2.8]**	**0.0289**	**1.7 [1 - 2.9]**	**0.0384**
age 45-49 (ref 40-44)	2.5 [1 - 5.8]	0.0411	2.3 [1 - 5.5]	0.0634	1.8 [0.7 - 4.5]	0.1889	1.9 [0.7 - 4.7]	0.1888
age 50-54	4.3 [1.8 - 10.1]	0.0010	3.3 [1.4 - 8.1]	0.0081	4.2 [1.8 - 9.9]	0.0011	3.7 [1.5 - 9]	0.0047
age 55-59	5.2 [2.1 - 13]	0.0004	3.4 [1.3 - 8.9]	0.0138	3.9 [1.5 - 10.1]	0.0044	2.5 [0.9 - 6.8]	0.0820
age 60-64	8.5 [3.6 - 19.8]	<.0001	4.8 [1.9 - 12.4]	0.0011	10.5 [4.6 - 24.1]	<.0001	6.0 [2.3 - 15.2]	0.0002
Educ 0-8 (ref 13+ yrs)			1.0 [0.5 - 2.1]	0.9876			1.0 [0.4 - 2.2]	0.9805
Educ 9-10 s			1.5 [0.7 - 3.4]	0.3392			1.3 [0.5 - 3.1]	0.6301
Educ 11-12			0.8 [0.3 - 2]	0.5684			1.2 [0.5 - 3]	0.7472
Unemployed			2.2 [1.3 - 3.6]	0.0036			2.3 [1.4 - 4]	0.0020
Non smoker			0.8 [0.5 - 1.3]	0.2916			1.0 [0.6 - 1.6]	0.8718
No proxy-answering			0.7 [0.4 - 1.1]	0.1324			0.4 [0.2 - 0.6]	<.0001
Household Density			0.8 [0.5 - 1.2]	0.2251			0.7 [0.5 - 1.1]	0.1509