The sick immigrant – healthy immigrant phenomenon among Jews migrating from the USSR to Israel

**Abstract**

Background: The “healthy immigrant” phenomenon attributes a health benefit to immigrants. In this study we examined this phenomenon with respect to the relationship between immigration and mortality by all causes of death, according to income level, among immigrants from the USSR who immigrated during the 1990s to Israel, as an immigrant-absorbing country with a national health insurance law, in comparison to veteran immigrants with a similar genetic makeup.

Methods: Using data gathered from different sources (population registry, tax authority, education registry and Ministry of Health), a retrospective cohort study of mortality by all causes of death between 1996 and 2016 was conducted among 99,037 immigrants born between 1940 and 1955 who immigrated to Israel between 1990 and 1995 and were born in the USSR or Eastern Europe, compared to a control group of 119,150 Jews born between 1940 and 1955 who and/or whose parents were born in those same countries and immigrated to Israel by 1960.

Results: Higher mortality rates were found among immigrants compared to non-immigrants (10.7% vs. 8.3%), after accounting for gender, age, income level and marital status (adjusted hazard ratio (AHR) = 1.297, 99% confidence intervals (CI) = 1.248, 1.348). Testing males and females separately, by income level, and after accounting for age and marital status, it was found that:

Mortality rates were higher among immigrants compared to non-immigrants among 27,563 men (AHR = 2.941, 99%CI = 2.704, 3.199) and among 32,220 women (AHR = 1.756, 99%CI = 1.614, 1.909) with a low income level. The opposite relationship was found among 45,863 men (AHR = 0.714, 99%CI = 0.635, 0.804) and among 24,852 women (AHR = 0.738, 99%CI = 0.596, 0.913) with a high income level. At the middle income level, no significant relationship between immigration and mortality was found among 37,094 men (AHR = 1.039, 99%CI = 0.963, 1.121), while among 50,959 women, a “healthy immigrant” trend was observed (AHR = 0.846, 99%CI = 0.772, 0.927).

Conclusions: For the general population, the study found support for the “sick immigrant” phenomenon. However, among both genders in the high-income subgroup and among women in the middle-income subgroup, the “healthy immigrant” phenomenon was observed. Decision makers in Israel should devote particular attention to immigrants from a low socioeconomic level. The results of this study emphasize the need to examine the relationships between immigration and health outcomes with a focus on social stratification.

**Keywords:**

**Introduction**

In the 1990s, approximately one million immigrants from the USSR were brought to Israel [1] by authority of Israel’s Law of Return [2], which allows every member of a Jewish family to immigrate to the country. Previous studies conducted on these immigrants demonstrated poorer health outcomes compared to the local population [4-5]. In contrast, another study reported a certain advantage for life expectancy among female immigrants compared to non-immigrants; an opposite trend was found for males [3]. This result contradicts the results from studies conducted in the West, which reported a health advantage for immigrants compared to the local population [4, 6], in particular in countries that absorb immigrants and in countries with good health and welfare systems [6].

Besides the fact that immigrants usually come from countries with high health risks, the mental stress, low socioeconomic status and language barriers faced by immigrants when dealing with the healthcare system make it difficult to explain the “healthy immigrant” phenomenon [6]. Some explain the paradox by the advantage of correct health behavior, social support and genetic advantages [4, 6-7]. In contrast, some see this phenomenon as being biased in several ways, for example: immigration of healthy, strong people, intentional registration biases when entering the country of destination, filtering of health immigrants by the absorbing countries, a tendency of weak immigrants to return to their mother country, the “salmon effect” – in which immigrants with weakening health tend to return to their mother country prior to their death [4, 6-7].

In addition to these selection biases, we suggest that the groups compared in previous studies usually included the general population of the absorbing country without accounting for variance in genetic and cultural traits, which may provide an explanation for the differences in health outcomes and morbidity. The presence of a large population of veteran Jewish immigrants, who reached Israel from the same countries, and who have similar genetic and possibly cultural traits, allowed us to more accurately examine the relationship between immigration and mortality, in an immigration-absorbing country [2] in which the immigrant receives extensive health services provided within the framework of a national health insurance law [8].

Furthermore, in contrast to the global phenomenon of relatively young individual immigrants, mass immigration of Soviet Jews to Israel during the 1990s included groups and entire families covering a range of ages, whom were ‘brought’ to Israel during a short period, without any selection, encouraged by Israel’s prevailing immigration policy, due to the situation in the USSR at that time. This immigration was characterized by a higher level of education, lower income level, and higher proportion of women, with a lower proportion of married women, in comparison to the general Jewish population in Israel [1]. The unique characteristics of this immigration group, which includes educated, but relatively low-income earners, prompted us to examine the role of income level in the relationship between immigration and mortality.

This study aimed to examine the relationship between immigration and mortality from any cause of death, by income level, among people immigrating from the USSR during 1990–1995, in comparison to veteran immigrants who, or their parents, had immigrated from the USSR and Eastern Europe by 1960.

**Methods**

Using data gathered from different sources (Population Registry, Tax Authority, Education Registry, Ministry of Health), a retrospective cohort study was conducted on mortality by any cause of death during the 21 years from 1/1/1996 to 31/12/2016. The data were gathered and combined for this study by the Central Bureau of Statistics (CBS). Work on the combined file was conducted in the CBS research room.

This study was approved by the Ethics Committee of the Population Registry, Tax Authority and CBS. Moreover, all statistical analyses extracted from the CBS research room were approved as meeting ethical standards.

*Study population*

Study group (immigrants): numbers 99,037 people born during 1940–1955 who immigrated to Israel during 1990–1995 and were born in a former Soviet state or Eastern European country, not including Ukraine and Belarus (in this study we chose not to include immigrants that may have come from the region of the Chernobyl disaster 9 which is considered to have potentially long-term health outcomes).

Control group: numbers 119,150 Jews born during 1940–1955 who, and/or one of their parents, were born in an Eastern European country or former Soviet state (including Ukraine and Belarus) and reached Israel by 1960.

*Research variables*

The variables: year of birth, gender, country of birth, year of immigration to and/or emigration from Israel were obtained from the Population Registry.

We combined ‘marital status’ at the beginning of the monitoring period, as obtained from the Population Registry, with the dichotomous variable ‘married/not married’ at the beginning of the monitoring period.

Socioeconomic status by residential area was obtained from the Population Registry at levels of 1-10 as defined by the national census of the State of Israel. We classified this variable into low (1-5), middle (6-7) and high (8-10) socioeconomic status.

Income level was determined according to the highest relative income level per individual during the monitoring period, based on data obtained from the Tax Authority regarding individual income from wages or from annual business earnings (not including income from dividends, national insurance or any other income which is not wages or self-employed work). To build a combined variable that represents the highest relative income level per individual during the monitoring period, we initially examined the distribution of annual income, and for each of these years the income level was combined and classified according to deciles. These variables were classified as a combined level of income into three categories: Low income level, in which the individual reached a relative income level of decile 3, at the most; Middle income level, in which the highest relative income level of the individual during this period stood at deciles 4–7; and High income level, in which the highest relative income level of the individual during this period stood at deciles 8–10.

Education level was constructed using data obtained from the Education Registry, managed by the CBS and based on education data from different sources such as: academic institutions, administrative files, surveys, censuses, administrative data and more. We classified these data into three categories education level: High – 15 years of education or more; Intermediate – 11-14 years of education; Low – up to 10 years of education. The effect variables for this study – mortality and year of death – were obtained from the Ministry of Health.

*Statistical analysis*

First stage – we examined the distribution of the variables: gender, age, marital status, education, socioeconomic status by residential area and immigration/emigration of immigrants and non-immigrants. The level of significance of differences between the groups was calculated by χ2 for categorical variables and t-test for age.

Second stage – mortality rates were examined with respect to the variables: immigration, gender, marital status, education, socioeconomic status by residential area. To estimate the effect size of the difference between the groups and the significance level of the difference we calculated the Adjusted Hazard Ratio (AHR) for mortality, even after adjusting for age and/or gender.

We note that due to a relatively high rate of missing information for the education variable among non-immigrants (20%), and a high correlation between this variable and the income variable, we decided not to include the education variable in the models in the remainder of the analysis.

Third stage – using Cox regression and adjusted Kaplan Meier curves we constructed models to evaluate the relationship between immigration and mortality, adding variables and the interactions among them. A formal test to compare the quality of the models, to inform decision making about the next stage of the data analysis, is described in Online Resource 1.

In Model 1 we included the base variables: gender, age, immigration, income level and marital status. In Model 2, in addition to the base variables in the first model we also included interactions – gender X immigration, gender X income and immigration X income. In Model 3, in addition to the base variables and the interactions in Model 2, we included the interaction gender X immigration X income.

Fourth stage – following the role of the gender X income X immigration interaction in predicting mortality we decided that for the next stage of the analysis we would divide the study population into six groups by income level (3) and gender (2), using Cox regression and adjusted Kaplan Meier curves. For each of these models we included the variables: age, immigration, marital status.

We note that for people who emigrated from Israel during the study period and did not return by the end of the study period there was no information about death; these people were included into the calculation of the period of survival until the year they left Israel. Thus, they ‘contributed’ years of life until they left Israel.

**Results**

*Demography*

218,187 people participated in this study, including 99,037 (45.4%) immigrants and 119,150 (54.6%) non-immigrants. The percentage of women in the immigrant population was higher (52.3%) than in the non-immigrant population (46.9%) (p<0.001). Immigrants were older, more educated, lived in areas with lower socioeconomic status, and received lower incomes than non-immigrants (p<0.001). Similarly, the proportion of married immigrants among males at the beginning of the study period was higher than that of non-immigrants (p<0.001) and lower among females than non-immigrants (p<0.001) (Table 1).

*Deaths*

The overall death rate during the study period among the 218,187 participants in the study was 9.4%. Examination of the distribution of mortality rate by study variable (Table 2) showed that the mortality rate was higher among immigrants than non-immigrants (10.7% vs. 8.3%) even after adjusting for age and gender (AHR = 1.337, 99%; confidence intervals (CI) = 1.290, 1.386). Similarly, a higher mortality rate was found even after adjusting for gender and age among those who were not married at the beginning of the study period, compared to those who were married (AHR = 1.337; 99%CI = 1.285, 1.392).

When examining the role of the socioeconomic variables in predicting mortality after adjusting for gender and age, mortality rates were found to be higher for people with low (AHR = 2,277; 99%CI = 2.162, 2.397) and intermediate (AHR = 1.362; 99%CI = 1.303, 1.424) levels of education compared to those with a high level of education. Likewise, higher mortality rates were found among low-income (AHR = 2.758; 99%CI = 2.618, 2.904) and middle-income (AHR = 1.975; 99%CI = 1.878, 2.077) earners compared to high-income earners (Table 2).

*Multivariable models to evaluation the relationship between immigration and mortality*

The multivariable Cox model to evaluation the relationship between immigration and mortality among all 218,187 participants in the study population included the base variables: immigration, gender, age, income level and marital status (Model 1, Table 3). A higher mortality rate was found among immigrants compared to non-immigrants (HR = 1.297; 99%CI = 1.248, 1.348). Similarly, in this and all of the models described below, higher mortality rates were found for men compared to women, for married compared to unmarried people and for low- and middle-income earners compared to high-income earners.

Model 2 included the base variables as well as their interactions: gender X immigration, gender X income and immigration X income. These interactions were found to be significant; when they were added to the model the relationship between immigration and mortality was reversed (HR = 0.529; 99%CI = 0.469, 0.597).

Model 3 also included the interaction gender X immigration X income in addition to the base variables and the interactions in Model 2. This interaction was highly significant for low-income earners in comparison to high-income earners (p<0.001) and close to significant for middle-income earners (p=0.118). When this interaction was added to the model, the significance of the relationship between immigration and mortality weakened (HR = 0.660; 99%CI = 0.535, 0.815), but the direction of the relationship was maintained (Table 3).

*Analysis of the relationship between immigration and mortality when classifying by gender and income level*

The multivariable Cox model to evaluation the relationship between immigration and mortality included the variables: immigration, age and marital status. This model was run separately for each gender, and then for each combination of gender and income level.

Among 110,520 males, a higher mortality rate was found for immigrants compared to non-immigrants (HR = 1.474; 99%CI = 1.407, 1.545). A weaker relationship with similar directionality was found among 107,667 women (HR = 1.167, 99%CI = 1.102, 1.236).

Running this model for each combination of gender and income level revealed differences in the strength and directionality of the relationship between immigration and mortality by income level.

Running this model separately for each income level found that among 27,563 men with low incomes the mortality rate was higher among immigrants compared to non-immigrants (HR = 2.941; 99%CI = 2.704, 3.199). In contrast, the opposite directionality for this relationship was found among 45,683 men with high incomes (HR = 0.714; 99%CI = 2.704, 3.199). No relationship between immigration and mortality was found for 37,094 men with middle incomes (HR = 0.1.039; 99%CI = 0.963, 1.121) (Table 4).

Running this model separately for each income level found that among 32,220 women with low incomes the mortality rate was higher among immigrants compared to non-immigrants (HR = 1.756; 99%CI = 1.641, 1.909). In contrast, the opposite directionality for this relationship was found among 50,595 women with middle incomes (HR = 0.846; 99%CI = 0.772, 0.927). A stronger relationship with similar directionality was found for 24,852 women with high incomes (HR = 0.738; 99%CI = 0.596, 0.913) (Table 4).

In summary, when examining the relationship between immigration and mortality in the total population it was found that immigration is a risk factor for mortality among both genders, but more so among men. When classifying the cohort by gender and income level it was found that among men and women with low incomes immigration is a risk factor for mortality. The opposite directionality of the relationship was found among men with high incomes and among women with middle and high incomes.

**Discussion**

Similarly to previous analyses [1] we found that this immigrant population is more educated, earns less, and includes a higher proportion of women and a lower proportion of married women than the non-immigrant population. This can be related to the particularly large differences in life expectancy between genders in the USSR in the 1990s [3, 10]. Similarly to other studies, the current study also found that having high income [11-15], being more educated [16-18] and being married [19] were related to better health outcomes.

When examining the relationship between immigration and mortality in a novel way, by comparing the immigrant group to a control group with similar genetic characteristics in a country that encourages immigration, we found support for the ‘sick immigrant’ phenomenon. Nevertheless, in the high-income subgroup we found the opposing ‘healthy immigrant’ phenomenon.

*The relationship between immigration and mortality in the total study population*

When examining the relationship between immigration and mortality in the total study population we found a trend opposite to that expected between immigration and mortality. Support for the ‘sick immigrant’ phenomenon in this immigrant group can be found in a study that examined the relationship between immigration and state of health in European countries and Israel, and demonstrated, as expected, a health advantage for immigrants in European countries in comparison to the local populations, while among those who immigrated from the USSR to Israel in the 1990s the opposite relationship was demonstrated [4].

Similar results were obtained from surveys conducted in Israel, which revealed that these immigrants estimate their state of health as being worse and had a higher rate of hospitalization compared to the local Jewish population [5]. However, this finding is not in line with the results of a different study [3] that was conducted on this population and demonstrated a certain life expectancy advantage among female immigrants compared to non-immigrants. We note that the control group in that study included all Israeli citizens including Arab Israeli citizens who have a higher mortality rate than the Jewish population [20] while in the current study we chose to include only Jews of Eastern European origin.

When comparing the mortality rate of these immigrants to the mortality rate of non-immigrants we must remember that they came from countries in which life expectancy is lower than in Western countries [3, 10, 21]; Israel has one of the highest life expectancies in the Western world.

Nevertheless, we must remember that the ‘healthy immigrant’ phenomenon has been demonstrated in the Western world also among immigrants from developing countries in which life expectancy is relatively low [4, 6]. Furthermore, in line with previous studies [6], we could have expected that in Israel, as a multicultural country that absorbs immigration with good health and welfare systems, immigrants would have a particularly high advantage.

We note that during the 1990s the immigration options for Soviet Jews were concentrated mainly in the USA and Israel. Immigration to the USA during that period was conditional on obtaining a visa and having family connections. Those who were unable to pass the American selection applied to Israel. A study on Jews who immigrated to the USA from the USSR in the 1990s reported a higher level of disability within this population than within the white population in the USA [22]. This finding was explained by early life conditions including poor nutrition during childhood and infectious diseases that may have long-term consequences, alongside social and psychological pressures related to the Soviet economic crisis.

Besides the explanations with respect to early living conditions and pressures related to the Soviet economic crisis we would like to raise a number of possible explanations for the unique ‘sick immigrant’ phenomenon among Soviet immigrants to Israel during 1990–1995. First, these immigrants immigrated under the authority of the Law of Return [2] that enables any Jewish family member to immigrate to Israel without the customary filtering and health examinations practiced in other Western countries that were suggested as a potential explanation for the ‘healthy immigrant’ phenomenon in these countries [4]. Second, the high level of health in Israel and the broad health services provided within the framework of the National Health Insurance Law [8] to every immigrant may serve as a catalyst for immigration among sick people who need these health services and are more inclined to die. Third, biases in the registration of entries to and exits from the country, which have been raised in the literature as a potential explanation for the ‘healthy immigrant’ phenomenon in Western countries [6-7] seem less reasonable in Israel and its boundaries. Fourth, correct health behavior among immigrants, which is considered to be one of the explanations for the ‘healthy immigrant’ phenomenon [4, 6-7], is not relevant with respect to this immigration population that consumes more alcohol than the general Israeli population [23-24] and has poorer health behavior than that prevailing in Israel [21]. Fifth, the genetic advantage attributed to immigrants, which serves as one of the explanations for the ‘healthy immigrant’ phenomenon [4, 6-7], is not relevant for this study as we chose to focus on a control group that is supposed to have a similar genetic base.

*Classifying the cohort by income level*

When examining the relationship between immigration and mortality, while classifying the cohort by income level, we found that immigration protects against mortality for high-income earners and is a risk factor for mortality for low-income earners. The ‘sick immigrant’ phenomenon among low-income earners in contrast to the ‘healthy immigrant’ phenomenon among high-income earners can be explained in several ways. First, we suggest that immigrants with high income potential made an educated decision to immigrate while examining other potential options and it could be expected that the strong and healthy people who estimated that they could manage the transition stages better are the ones who immigrated [6-7]. In contrast, among immigrants with low income potential, immigration to Israel could have been considered an opportunity, and it could be hypothesized that the decision to immigrate was more sweeping, leading to a situation where the weak also immigrated; this is evident in the mortality differences within the immigrant group.

Second, we suggest that the bias of returning immigration or the ‘salmon effect’ – that describes a situation in which immigrants tend to return to their mother countries when their health deteriorates before their death [4, 6-7] – will happen more among high-income owners who can allow themselves to immigrate back and leave Israel despite the health services they receive through the National Health Insurance Law [8]. Third, with respect to the fact that these immigrants have poorer health habits [21, 23-24] than those prevailing in Israel, we suggest that those who achieved a high income are the ones with more points of contact with Israeli society, which could have exposed them to other, better health habits. Fourth, we suggest that those who achieved a high income have less language barriers, more health literacy skills and are less inclined to the mental stress that characterizes immigrants.

This classification by income level for examining the relationship between immigration and mortality may be found in a similar study conducted in Finland in which lower mortality rates were found among immigrants at all income levels. Greater differences were found among immigrants with low socioeconomic status. In other words, a more widespread ‘healthy immigrant’ phenomenon was found among those with low socioeconomic status. These findings, which contradict the findings from the current study, were explained by poor health behavior among non-immigrants with low socioeconomic status, the ‘salmon effect’ that occurs more among low-income earners who cannot allow themselves to receive health treatment in Finland, and other selection biases [25]. These characteristics of immigration in Finland are not relevant to this group of immigrants from the USSR to Israel, who have poorer health behavior than the local population [21, 23-24], while Israel’s National Health Insurance Law, which provides a comprehensive health services basket to all immigrants, will prevent a situation of the ‘salmon effect’ among a low-income population inclined to die.

*Gender differences in the relationship between immigration and mortality*

When examining the relationship between immigration and mortality within the total study population we found that immigration is a risk factor for mortality among both genders, but more so among males, in contrast to previous studies conducted in other Western countries in which the opposite relationship was found, i.e. a higher mortality advantage among male immigrants [6].

The difference between genders in the relationship between immigration and mortality in the total study population may be explained by the exceptional differences in life expectancy between genders in the USSR in 1990s [3, 10, 24]; this created a situation in which the difference in life expectancy for males between the USSR and Israel in the 1990s was greater than for women. This difference was explained partly by the poorer health habits of males [3, 10]. This point may also explain the gender difference regarding the strength of the relationship between immigration and mortality at low income. We could raise the hypothesis that male immigrants of low socioeconomic status come from a place in which men with poorer health habitats will be less inclined to health-promoting behavior. Moreover, the gender difference in the strength of the relationship when classifying the cohort by income level can be linked to the findings of previous studies in which a stronger relationship between income and mortality was demonstrated for males [12, 14] than for females.

*Strengths and limita­tions of the study*

The main strength of this study lies in the fact that we had apparently widespread real-time population data; however, we do not have the tools to determine the reliability of these and other variables including income data obtained from the Taxation Authority. Furthermore, the income data in this study are individual income data, excluding partner income, which may harm the quality of the study’s results. On the other hand, we must remember that the marital status of the individual was included in each of the models.

A further bias related to income data may stem from the fact that income from dividends, social insurance or any other income that is not from wages or self-employed work, was not included in the ‘Income’ variable in this study. However, we could assume that most of the population does not receive a significant income from dividends and that support from social insurance is received according to individual income level and age.

In order to compare groups with similar genetic characteristics, our control group comprised immigrants and children of immigrants who came from Eastern Europe countries and former Soviet states. In contrast, we must remember that the former Soviet states are not homogeneous, and are diverse with respect to health level and health behavior characteristics; this may affect the quality of the study results and maybe there is justification for classifying them.

We chose to omit from the study population immigrants who came from the region of the Chernobyl disaster [9], which is considered to have potential long-term health outcomes. This act was intended to prevent a situation of bias stemming from the consequences of this disaster. In contrast, a previous study conducted in Israel did not find higher mortality or morbidity rates among immigrants from these regions [26] and perhaps they could have been included in the current study.

*Consequences for the future*

Decision makers in Israel, as an immigrant-absorbing country, should invest in, and give particular attention to, immigrants of low socioeconomic status whose health outcomes according to this study are worse than those of non-immigrants. The results of this study emphasize the need to examine the relationships between immigration and health outcomes using social stratification. This stratification is also necessary due to ever-growing immigration around the world.

**References**

1. Central Bureau of Statistics. Immigrant Population from the Former USSR - Demographic Trends 1990-2001. 2006. www.cbs.gov.il. Accessed 9 July 2019.

2. Knesset Israel. Law of Return. Israeli parliament. 1950. https://www.knesset.gov.il/laws/special/heb/chok\_hashvut.htm. Accessed 9 July 2019.

3. Ott JJ, Paltiel AM, Becher H. Noncommunicable disease mortality and life expectancy in immigrants to Israel from the former Soviet Union: country of origin compared with host country. Bull World Health Organ. 2009;87:20-29. https://doi.org/10.1590/S0042-96862009000100010

4. Constant AF, García-Muñoz T, Neuman S, Neuman T. A “‘healthy immigrant effect’” or a “ ‘sick immigrant effect’”? Selection and policies matter. Eur J Heal Econ. 2018;19. https://doi.org/10.1007/s10198-017-0870-1

5. Konstantinov V. Patterns of Integration into Israeli Society among Immigrants from the Former Soviet Union over the Past Two Decades. Jerusalem: Myers-JDC-Brookdale Institute; 2015. www.jdc.org.il/brookdale. Accessed 5 July 2019.

6. Shor E, Roelfs D, Vang ZM. The “Hispanic mortality paradox” revisited: Meta-analysis and meta-regression of life-course differentials in Latin American and Caribbean immigrants’ mortality. Soc Sci Med. 2017;186:20-33. https://doi.org/10.1016/J.SOCSCIMED.2017.05.049

7. Wallace M, Kulu H. Low immigrant mortality in England and Wales: A data artefact? Soc Sci Med. 2014;120:100-109. https://doi.org/10.1016/J.SOCSCIMED.2014.08.032

8. Kneset Israel. National Health Insurance Law. Israeli parliament. 1994. https://fs.knesset.gov.il//13/law/13\_lsr\_211132.PDF. Accessed 9 July 2019.

9. WHO | Chernobyl: the true scale of the accident. WHO. 2018. https://www.who.int/mediacentre/news/releases/2005/pr38/en/index1.html. Accessed 5 July 2019.

10. Bobak M, Marmot M. East-West mortality divide and its potential explanations: proposed research agenda. BMJ. 1996;312(7028):421-425. https://doi.org/10.1136/bmj.312.7028.421

11. Pickett KE, Wilkinson RG. Income inequality and health: A causal review. Soc Sci Med. 2015;128:316-26. https://doi.org/10.1016/j.socscimed.2014.12.031

12. Chetty R, Stepner M, Abraham S, et al. The association between income and life expectancy in the United States, 2001-2014: Association Between Income and Life Expectancy in the United States HHS Public Access. JAMA. 2016;315(16):1750-1766. https://doi.org/10.1001/jama.2016.4226

13. Brodish PH, Hakes JK. Quantifying the individual-level association between income and mortality risk in the United States using the National Longitudinal Mortality Study. Soc Sci Med. 2016;170:180-187. https://doi.org/10.1016/J.SOCSCIMED.2016.10.026

14. Mustard CA, Etches J. Gender Differences in Socioeconomic Inequality in Mortality. J Epidemiol Community Health. 2003;57:974-980. https://doi.org/[10.1136/jech.57.12.974](https://dx.doi.org/10.1136%2Fjech.57.12.974).

15. Marmot M. The influence of income on health: Views of an epidemiologist. Health Aff. 2002;21(2):31-46. https://doi.org/10.1377/hlthaff.21.2.31

16. Lleras-Muney A. The relationship between education and adult mortality in the United States. Rev Econ Stud. 2005;72(1):189-221. https://doi.org/10.1111/0034-6527.00329

17. Regidor E, Reques L, Belza MJ, Kunst AE, Mackenbach JP, de la Fuente L. Education and mortality in Spain: a national study supports local findings. Int J Public Health. 2016;61(1):139-145. https://doi.org/10.1007/s00038-015-0762-z

18. Byhoff E, Hamati MC, Power R, Burgard SA, Chopra V. Increasing educational attainment and mortality reduction: A systematic review and taxonomy. BMC Public Health. 2017;17(1). https://doi.org/10.1186/s12889-017-4754-1

19. Tatangelo G, McCabe M, Campbell S, Szoeke C. Gender, marital status and longevity. Maturitas. 2017;100:64-69. https://doi.org/10.1016/J.MATURITAS.2017.03.002

20. Weiss A. The Singer Series annual State of the Nation Report: Society, Economy and Policy in Israel 2017. Jerusalem: Taub Center for Social Policy Studies in Israel; 2017. www.taubcenter.org.il. Accessed 31 July 2019.

21. Rennert G. Implications of Russian immigration on mortality patterns in Israel. Int J Epidemiol. 1994;23(4):751-756. https://doi.org/10.1093/ije/23.4.751

22. Mehta NK, Elo IT. Migrant selection and the health of U.S. immigrants from the former Soviet Union. Demography. 2012;49(2):425-447. https://doi.org/10.1007/s13524-012-0099-7

23. Schiff M, Rahav G, Teichman M. Israel 2000: Immigration and gender differences in alcohol consumption. Am J Addict. 2005;14(3):234-247. https://doi.org/10.1080/10550490590949578

24. Weiss S. Review: Alcohol use and problems among immigrants from the former Soviet Union in Israel. Subst Abus. 2008;29(4):5-17. https://doi.org/10.1080/08897070802418444

25. Patel K, Kouvonen A, Koskinen A, et al. Distinctive role of income in the all-cause mortality among working age migrants and the settled population in Finland: A follow-up study from 2001 to 2014. Scand J Public Health. 2018;46(2):214-220. https://doi.org/10.1177/1403494817726620

26. Slusky DA, Cwikel J, Quastel MR. Chronic diseases and mortality among immigrants to Israel from areas contaminated by the Chernobyl disaster: a follow-up study. Int J Public Health. 2017;62(4):463-469. https://doi.org/10.1007/s00038-017-0941-1