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Sex Differentials In Mortality Among Israeli Jews In International Perspective

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Detailed examination of levels and trends in age-specific male and female mortality in different subgroups of Israeli and Diaspora Jews provides the basis for two hypotheses regarding the origins of small sex differentials among Israeli Jews. The first hypothesis links low male mortality to health protective behaviour of Israeli Jewish males, the second hypothesis places the source of elevated mortality of Israeli Jewish females in the migrant origin of this population.

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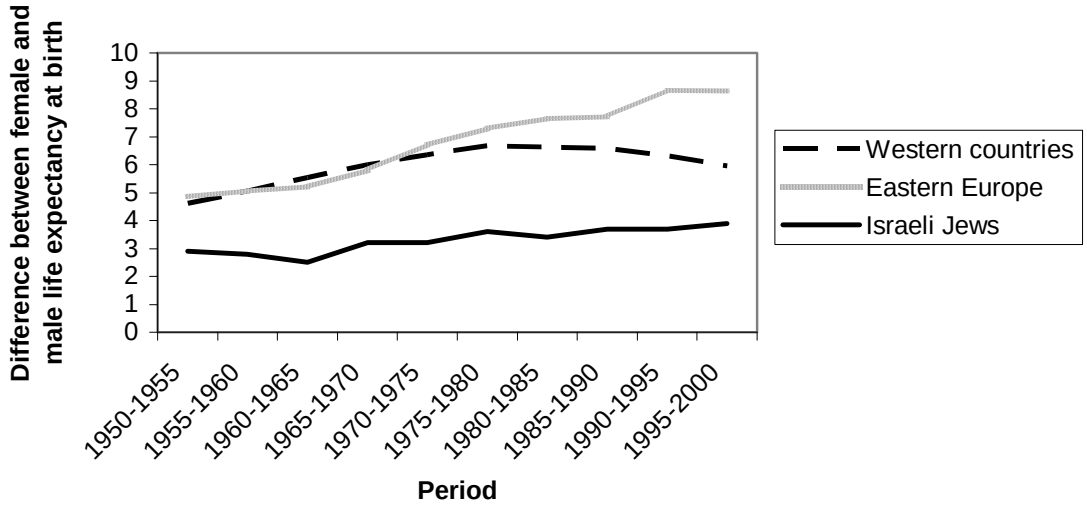
1. Introduction

The developed world experienced significant increases in sex differentials in mortality between the end of the 19th century and the last quarter of the 20th century. In Western world sex differentials in mortality, calculated as the difference between female and male life expectancies at birth, grew from an average of 2.4 years in the 1900s to 4.8 years in the 1950s and 6.2 years in the 1990s. The widening started at different times in different countries (United Nations 1988a, 1988b) and the sex differentials peaked approximately in the early 1980s at 6.6 years. This development was followed by a decrease (Trovato and Lalu 1996, Pampel 2002, 2005, Trovato and Heyen 2006). Although most developed countries of Western Europe and America then underwent a downward trend in the size of sex differentials, in Eastern Europe the gap between male and female life expectancy at birth continued to increase (United Nations 2004). These developments are illustrated by Figure 1:

Figure 1. Sex differentials in mortality, developed countries and Israeli Jews, 1950s-1990s



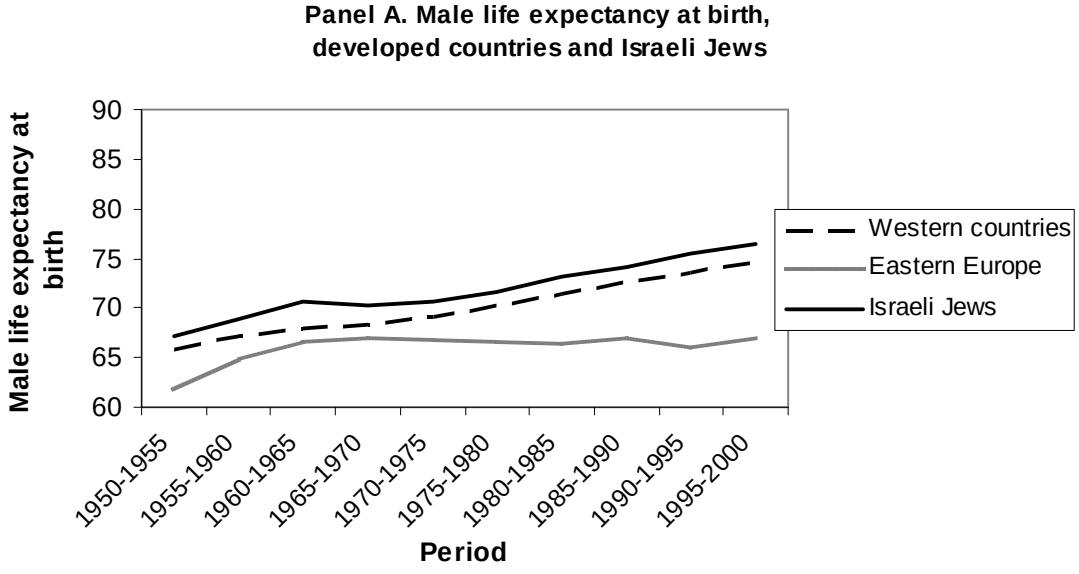
Source. United Nations (2004); Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* 2005).

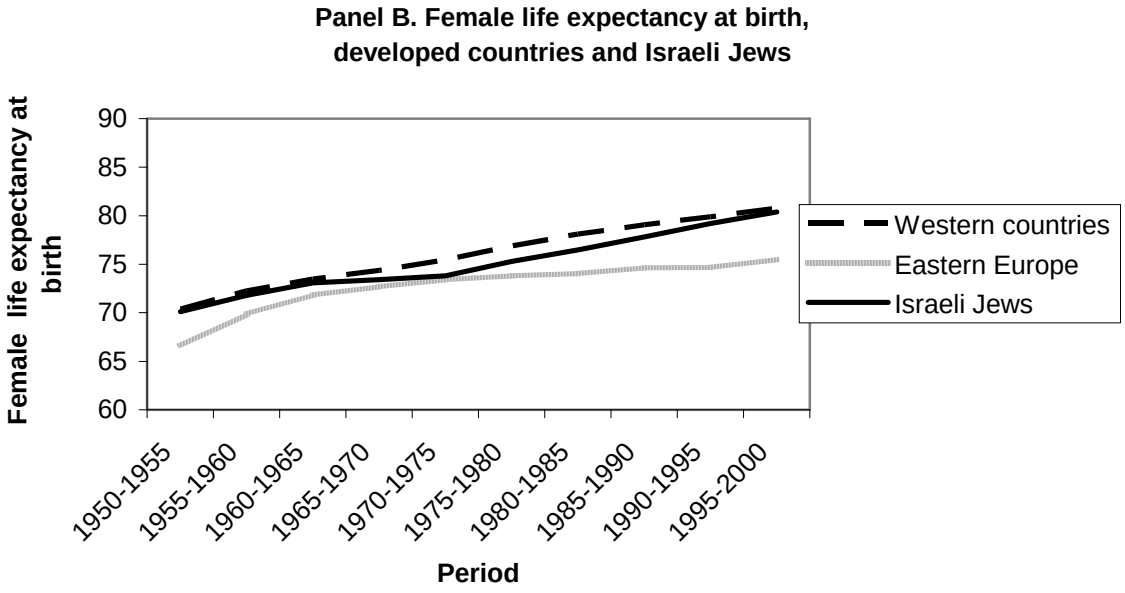
Note. 'Western countries' is a collective term that incorporates countries of Western, Northern, Southern and Central Europe, North America, Australia and New Zealand (19 countries in total). Eastern Europe includes Bulgaria, Czech Republic, East Germany, Hungary, Poland, Slovakia, Ukraine, Romania, and Russian Federation. Unweighted averages are presented for both groups.

Figure 1 also shows how different the level and the trend in sex differentials in mortality were among Israeli Jews in comparison to elsewhere in developed world. Since the establishment of Israel sex differentials in the life expectancy at birth exhibited by Jews have been very low in comparison to other countries. Sex differentials in the mortality of the Jewish population of Israel were at about 2.9 years in the 1950s, 3.5 years in the 1970s, and 3.8 years in the 1990s, i.e. they grew slightly and very slowly over time. Curiously, the differential between female and male life expectancy among Israeli Jews declined somewhat during the 1960s, while it was widening elsewhere. In fact, the experience of Israel in respect of sex differentials in mortality resembled more the experience of the developing world, despite the country being at the same level as in the developed countries when judged by various indices of development (life expectancy, GDP per capita, literacy), and values found in historical European societies (United Nations 1988a).

Figure 2 (panels A and B) presents sex-specific trends in mortality:

Figure 2. Male and female life expectancy at birth, developed countries and Israeli Jews, 1950s-1990s





Source. United Nations (2004); Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, 2005).

Note. See Note to Figure 1.

A number of important observations may be made. First of all, Israeli Jewish male life expectancy at birth rose from 67.2 years in the early 1950s to 76.5 years in the end of the 1990s while Israeli Jewish female life expectancy at birth rose from 70.1 years to 80.4 years. The magnitude of change (a gain of about 9 years for males and 10 years for females) was similar to the gains observed in Western countries. Both among Israeli Jews and in Western countries the gains were much larger than in Eastern Europe where between the middle and the end of the 20th century male life expectancy rose by about 5 years and female life expectancy-by 9 years.

Second, the life expectancy of Israeli Jewish males and females declined somewhat or stagnated remarkably during the 1960s. Some stagnation was registered in Western European countries and America at the same time but on a smaller scale. Apart from this peculiarity, Israeli Jews seem to belong to the so-called Western European mortality regime characterised by a more or less continuous decrease in total mortality since the 1970s, a trend attributed mainly to the development of medical science and related public health measures (essentially, improved treatment and prevention of cardiovascular diseases and cancer). The stagnation and increase in mortality in

Eastern Europe since the 1960s (Figure 2) seems to be related to a significant gap between these countries and Western Europe in the treatment and prevention of chronic diseases (Vallin and Mesle 2001, 2004, Nolte et al. 2004) which in the 1990s was exacerbated by a sociopolitical crisis.

Finally, the somewhat anomalous level and development of sex differentials in the mortality of Israeli Jews when compared to Western countries seems to be the result of relatively low male and relatively high female mortality. Male mortality of Israeli Jews remained low, indeed the lowest within the given comparative context, through the entire period under examination. The mortality of Israeli Jewish females remained elevated, however, the disadvantage was not as prominent in the 1950s and 1990s as it was in the 1960s-1980s. Mortality of both sexes among Israeli Jews remained lower than in Eastern Europe.

The role of both sexes among Israeli Jews in creation of relatively small sex differentials in mortality in this population can be further investigated through decomposition of the difference between sex differentials in Western countries and Israeli Jews into female and male contributions, as shown in Table 1.

Table 1. Sex-specific contributions to the difference in sex differentials between Western countries and Israeli Jews, 1950-2000

		1950-1955	1970-1975	1995-2000
Sex differential in mortality in Western countries (1)	(a)	4.6	6.4	6.0
Sex differential in mortality among Israeli Jews (1)	(b)	2.9	3.2	3.9
Difference in sex differentials	(a-b)	1.7	3.2	2.1
Thereof:				
due to difference between life expectancy of Western females and Israeli Jewish females (2) (3)	(c)	0.3	1.7	0.4
due to difference between life expectancy of Western males and Israeli Jewish males (2) (3)	(d)	-1.4	-1.5	-1.7

Source. United Nations (2004); Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* 2005).

Note. (1) Calculated as difference between female and male life expectancy at birth. (2) Calculated as difference between sex-specific life expectancy in Western countries and among Israeli Jews. (3) The method of derivation of sex-specific contributions is as follows. Let $e^{m,I}$ and $e^{f,I}$ denote male and female

life expectancy at birth among Israeli Jews and $e^{m,W}$ and $e^{f,W}$ –corresponding figures in Western countries. Let d^I and d^W be sex differentials in mortality among Israeli Jews and in Western countries: $d^I = e^{f,I} - e^{m,I}$ and $d^W = e^{f,W} - e^{m,W}$. Then $d^W - d^I = (e^{f,W} - e^{m,W}) - (e^{f,I} - e^{m,I}) = (e^{f,W} - e^{f,I}) - (e^{m,W} - e^{m,I})$.

It is easy to see that a large part of the difference in sex differentials between Western countries and Israeli Jews in the 1950s and the 1990s is due to the difference between male life expectancy of the two populations. At times in-between contributions of both sexes to difference are roughly equal. Male mortality advantage is a stronger and more permanent characteristic of Israeli Jewish mortality than female mortality disadvantage.

Previous research pointed out the general similarity between Israel and Western countries in patterns of total and cause-specific mortality during the second half of the 20th century with sharp decline both in infectious and chronic diseases and the most significant contributions to the decrease made by ages 45 years and over and ages 0-4 years (Bachi 1974, Goldbourt and Kark 1982, Uemura and Pisa 1988, Thom and Epstein 1994, Thom et al. 1985, Beiran et al. 1991, Ore et al.1991, Shuval 1992, Davies 1996, Koton et al. 2001, Wilf-Miron et al. 2001, Amitai et al. 2005, Gerber et al. 2005). Socioeconomic and educational differences, as well as differences related to the timing of migration and country of birth, remained the main focus of the existing studies on Israeli Jewish mortality. Jews of European origin and Jews of non-European origin among the Jewish migrants in Israel were shown to have different mortality levels, with the latter group consistently showing higher overall mortality as well as higher mortality from cerebrovascular disease, certain types of heart disease and other diseases (Cohen 1971, Peritz et al. 1973, Goldbourt and Kark 1982, Peritz 1986, Eisenbach 1994, Friedlander et al. 1995, Manor et al. 1999, 2000, 2004). Survival advantage of the Jewish population of European origin persisted through the entire Israeli history, however the gap between this group and the Jews of non-European origin narrowed with time. It was shown by Manor et al. (1999, 2000, 2004) that during the 1980s and 1990s the enduring gap in socioeconomic conditions of these two groups played a more important role in maintaining the gap in their survival outcomes than cultural differences between them, as suggested by Ore et al. (1991). The particular stress of mortality studies on socioeconomic and ethnic aspects of the mortality differentials is explained by the fact that Israeli Jewish society is extremely

heterogeneous in terms of places of birth of its members, with patterns of socioeconomic stratification from its very early days existing along the lines of ethnic diversity.

Although biological factors may be implicated in the phenomenon of greater female longevity, it appears that differential social roles and modes of behaviour of females and males are principally responsible for differences in mortality between two sexes (Waldron 1976, 1983, 1993, 2000, Nathanson 1984, 1995, Nathanson and Lopez 1987, Pampel 2001, 2002, 2003, 2005, Kalben 2002, Luy 2003, Gjonca et al. 2005, Waldron et al. 2005, Trovato and Heyen 2006). In transition to modernity, chronic mortality and particularly mortality from cardiovascular diseases, in relation to which males display strong survival disadvantage, became a more prominent component of total mortality. At the same time, certain female-specific or relatively sex-neutral types of mortality (i.e. maternal mortality and infectious diseases, respectively) were eliminated (Preston 1976, Lopez 1983, Nathanson 1984, United Nations 1988a, Gage 1994, Nikiforov and Mamaev 1998). Later modernity (20th century) also presented new health risks-occupational hazards, stress, overnutrition, individualization, as well as the appearance of new health damaging habits such as smoking. The new 'burden' of mortality was unequally shared by females and males thereby further increasing sex differentials in mortality (Preston 1976, Lopez 1983, Nikiforov and Mamaev 1998). Prevalent patterns of socialization towards sex roles ensured that females tended less than males towards the adoption of hazardous lifestyles, their patterns of labour market participation protected them against many adverse effects of industrialization and their greater attention to health matters made them more efficient users of health services (Waldron 1976, Lopez 1983, Nathanson 1984, 1995, Nikiforov and Mamaev 1998, Waldron et al. 2005). In the second half of the 20th century there was an increase in the proportion of females adopting lifestyles more similar to those of males. This mainly applied to smoking and drinking and labour force participation but might have had a wider meaning as well simply because of the potentially wide implications of the underlying process of the changes (female emancipation). The first results of these processes were already felt in the 1950s when in certain countries a decrease in male to female ratios of death rates from external causes was registered (Waldron et al. 2005), but its full implications were apparent only during the mid-1970s when females started showing less favourable trends in

heart disease and lung cancer (Waldron 1993, Lopez 1995, Trovato and Lalu 1998, Trovato and Heyen 2006). This is when the summary measures of mortality in Western European and Anglophone countries first indicated the reversal of the increase in sex differentials. In Western countries smoking proved to be a single factor with the greatest contribution to sex differentials in mortality. The largely delayed impact of smoking on various aspects of health (Ravenholt 1990, Peto et al. 1992, 1994, Doll et al. 2004) exhibited itself first in male mortality at ages 45 years and over and, following the spread of smoking among females, also in female mortality at these ages. Therefore, smoking contributed first to the widening and, subsequently, to the narrowing of sex differentials in mortality (Retherford 1975, Waldron 1986, 1991, Lopez et al. 1994, Valkonen and Van Poppel 1997, Preston and Wang 2005, Pampel 2002, 2003, 2005, Bongaarts 2006).

The unusually small difference between female and male life expectancy among Israeli Jews has been commented on in previous research, however, it has been given considerably less attention than socioeconomic and ethnic mortality differences inside Israel. It was probably first noted in the mid-1970s (Peritz et al. 1973, Kark 1976). Two studies were devoted specifically to the issue of sex differentials in Israeli Jewish mortality (Kark 1976, Leviatan and Cohen 1990), with the emphasis on subpopulations within Israeli society and specific causes of death. Specifically, in the 1950s and 1960s Israeli Jews of non-European origin were shown to have smaller sex differentials in mortality when compared to European Jews (Peritz et al. 1973, Kark 1976). However, both Israeli Jews of European origin and Israeli-born, too, possessed sex differentials in mortality which were smaller than in selected European countries (Kark 1976). Leviatan and Cohen (1990) showed that in the 1970s sex differentials in mortality in Israeli Kibbutzim, Jewish agricultural settlements with peculiar similarity of female and male lifestyles, had somewhat larger sex differentials in mortality when compared to the total of Israeli Jews. This is an unexpected finding given that the social settings with similarities of female and male lifestyles, such as, for example, societies of monks and nuns display smaller sex differentials in mortality than in larger society (Madigan 1957, Luy 2003). Nevertheless, even in Kibbutzim sex differentials in mortality were still significantly smaller than in Western countries (Leviatan and Cohen 1990). The phenomenon of small sex differentials in mortality was covered by country reports on Israel to the World Health Organization (World

Health Organization, *Highlights on Health in Israel* 1996, World Health Organization, *Highlights on Health in Israel 2004* 2006) indicating its multicausal nature. It was mentioned by a report on health inequalities and health system in Israel published by the Adva Institute (Swirski et al. 1998)[1] and by Shuval (1992) in a study of various social dimensions of health and disease in Israel. Sicron (2004) in a recent work on Israeli demography suggested that the size of the sex differential in mortality in Israel is unusually low considering the country's level of economic development. Peculiar features of Israel's positioning in terms of sex differentials in mortality have been demonstrated by international studies of sex differentials (Preston 1976, United Nations Population Division 1983, United Nations 1988b, Trovato and Lalu 1996). Two studies conducted by the United Nations (United Nations Population Division 1983, United Nations 1988b) indicated that Israel fitted well into the Middle Eastern pattern of small sex differentials in mortality. Again, this is an unexpected finding given that in the Middle Eastern societies the pattern is attributed to sex-specific bias in the distribution of material resources and health care (Tabutin 1992, Yount 2001)- these phenomena have not been documented among Israeli Jews.

It can be concluded that although previous research provided important insights into the features of Israel's narrow sex differential in mortality, ultimately, the phenomenon of small sex differentials in mortality exhibited by Israeli Jews is not well understood. Lack of progress in the explanation of the Israeli Jewish pattern of sex differentials in mortality could be partly explained by the fact that the issue has not been tackled *systematically* and, especially, it has not been systematically investigated within the context of international data. The tendency of the research on Jewish mortality conducted in Israel to focus mostly on 'trends and differences within the Jewish community' has been noted in the late 1970s by Peritz and Tamir (1979, p. 416). Not much has changed since then. A panoramic picture of developments in Jewish mortality in Israel with a focus on the evolution of sex differentials and with the Western world as a comparative framework has not yet been presented.

At the same time another strand of research comparing Jews to non-Jews, rather than subgroups within Jews, developed in the context of the research of Diaspora Jewish

[1] The Adva Institute is an Israel-based independent research facility, monitoring developments in the socioeconomic sphere in Israel, with a particular stress on issues of equal distribution of resources.

communities. This strand relied on scarce resources, as mortality of Jews outside Israel is not well documented. However, despite data limitations, it generated interesting empirical findings and elaborated a few hypotheses explaining the differences between mortality schedules of Jews and non Jews. Identification of the so-called 'Jewish pattern of mortality' is its probably most valuable empirical contribution. 'Jewish pattern of mortality' is a pattern observed among Jews of North America before the 1960s and characterised by a combination of lower mortality of both sexes at ages below 55 among Jews in relation to their host societies, and higher mortality after this age (Spiegelman 1948, Fauman and Mayer 1969, Needleman 1988, Goldstein 1996). Approximately after the 1960s the 'Jewish pattern of mortality' dissolved and was replaced by low mortality of both sexes and at all ages (Rosenwaike 1990, Shatenstein and Kark 1995, Goldstein 1996, Haberman and Schmool 2005). Relatively small sex differentials are a recurrent finding in the literature on Jewish Diaspora mortality within the context of the developed world, specifically in the United States of America, Canada, Great Britain and Russia (Shatenstein and Kark 1995, Goldstein 1996, Shkolnikov et al. 2004, Haberman and Schmool 2005).

It is in this context that the explanations for mortality differentials between Jews and non-Jews have been elaborated. In general, presence of relatively health protective attitudes and lifestyles among Jews has been proposed as an explanation of low mortality in Jewish populations (Schmelz 1971, Glassner and Berg 1980, Condran and Kramarow 1991, Shatenstein and Kark 1995, Goldstein 1996, Shkolnikov et al. 2004). There are indications that this feature is shared by Jews in Israel (Shuval 1992). The underlying reasons for instances of elevated mortality among Jews are not well understood and genetic factors (Shkolnikov et al. 2004), 'sex-gene-environment interactions' (Shatenstein and Kark 1995, p. 735), selection (Spiegelman 1948) and migrant origin of Jewish populations (Goldstein 1996) are all mentioned at times as a possible explanations.

In general, however, the relationship between the Diaspora Jewish pattern of mortality in either early or late form and Israeli Jewish mortality is far from being clear. Some scholars implied the existence of a 'Jewish' pattern of sex differentials in mortality relying largely on such commonalities of Diaspora and Israeli Jews as small sex

differentials and relatively low male mortality (Shkolnikov et al. 2004). Others emphasized the local contextual factors in shaping mortality patterns of Diaspora Jewish communities pointing out certain dissimilarities of mortality experiences of Diaspora and Israeli Jews, chiefly the absence of elevated female mortality in Diaspora Jewish communities (Shatenstein and Kark 1995).

This paper aims at filling a gap in the understanding of Israeli Jewish mortality by (1) systematically documenting the characteristics of sex differentials among Israeli Jews using developed world as a comparator, and (2) clarifying similarities and differences between mortality of Israeli Jews and Diaspora Jewish communities in their relation to the non-Jewish mortality. Specifically, it asks:

1. What are the roles of males and females in creating and sustaining the observed phenomenon of small sex differentials in mortality among Israeli Jews?
2. What age groups are responsible for this phenomenon?
3. Are there differences between the subgroups of Israeli Jewish population in relation to sex differentials in mortality?
4. How do sex differentials in mortality exhibited by Israeli Jews compare to those observed in selected Jewish Diaspora communities?

An attempt to answer these questions leads to the identification of a special age and sex pattern of mortality in Jewish population of Israel, which has not been analysed previously. Characteristics of this pattern are discussed in light of the existing literature on the determinants of sex differentials in mortality across the world and Jewish mortality, hypotheses are set, and directions for future research are identified.

The rest of this paper is structured as follows. First, we present data used in this paper and discuss issues pertaining to measurement of sex differentials in mortality and measures used. Second, we explore age and sex characteristics of female and male mortality and sex differentials in mortality of Israeli Jews as a total and in subgroups of this population at different times, using different comparator populations. Third, we look at sex differentials in mortality of selected Diaspora Jewish communities.

Finally, we formulate hypotheses aiming at explaining the phenomenon of small sex differentials in mortality among Israeli Jews.

2. Data and method

2.1. Data

The mortality and population data for Western countries come from the World Health Organization Statistical Information System (World Health Organization 2006). The data for Eastern European countries come from the Human Mortality Database (2007). Both sources provide information on deaths by sex and age, as well as population estimates in a corresponding format. The mortality data and population estimates of Israeli Jews are taken from the annual publications of the Central Bureau of Statistics (Central Bureau of Statistics, Israel, *Statistical Abstract of Israel*, various years) and from the special datafile prepared by the Central Bureau of Statistics, Israel.

We use some additional sources of mortality and population data within the context of the research of Diaspora Jewish mortality. Some of these data, such as Berkeley Mortality Database (2006) and Canadian Human Mortality Database (2007), are publicly available. Other types of data were communicated to us privately by researchers and /or research units of data collecting institutions. More information on these data will be given in the section presenting Jewish mortality in the Diaspora.

2.2. Method

2.2.1. Measures of sex differentials in mortality

A widely used measure of the *overall* sex differential in mortality is the absolute difference between female and male life expectancies at birth. Differences between female and male life expectancies at ages 45 and 65 years are alternative measures when the focus is on adult mortality. Such measures are used for their straightforward meaning for demographers as well as lay people, and many studies have implemented them (Lopez 1983, United Nations 1988a, 1988b, Trovato and Lalu 1996, Trovato and Heyen 2006). It has been shown that meaningful decomposition of age-specific

and cause-specific contributions can be performed in relation to sex differentials calculated as a difference between life expectancies (Retherford 1975, Arriaga 1984, Pollard 1982, 1988, United Nations 1988a, Das Gupta 1993, Trovato and Lalu 1998, Andreev et al. 2002, Vaupel and Canudas-Romo 2002, Trovato 2005, Trovato and Heyen 2006, Beltran-Sanchez and Preston 2007). Certain studies focusing on causes of death favour the measures of male and female age-standardised crude death rates, because of the simple manner in which they aggregate causes of death (Preston 1976, Lopez 1983, Elo and Drevenstedt 2005). However, using summary measures is somewhat limiting as they conceal differences in behaviour of different age groups. Changes in the values of such measures may reflect a complex mixture of social processes and structural forces (see Glei and Horiuchi (2007) for just one example).

Sex differentials in mortality at the level of *separate* age groups are normally analysed with the help of the ratios of male to female death rates and partial expectations of life, with the former being a measure of patterns of sex differentials at the level of five-year age intervals (United Nations 1988a, 1988b, Waldron 1993, Vallin and Mesle 2001, Kruger and Nesse 2004, Gjonca et al. 2005), and the latter being a method of summarizing sex differentials over broad – for example 20-year – age groups (Trovato and Lalu 1998). Male and female age-standardised death rates over broad age groups are also used for cause of death specific analysis (Elo and Drevenstedt 2005). Certain studies also employ absolute differences between male and female death rates (Retherford 1975, Pollard 1983).

However, even in relation to age-specific measures, there is no single, clearly preferable technique. The choice of an appropriate measure in studies of sex differentials in mortality has been often driven by the purpose of the analysis. Research into sex differentials in mortality has a long history, however, a single set of criteria or recommendations as to when and how to choose a particular measure for analysis has not, to date, been developed. Sheps (1958, 1959) maintained that the choice of measure (relative versus absolute) should depend on a model that is assumed to underlie observations as different measures have different meanings depending on the model (whether dependence, i.e. the presence of shared risks, between the groups is assumed). Specifically, Sheps (1958, p. 1212) perceives males and females as two independent groups, and suggested that any measure (absolute

difference, ratios of survival rates or ratios of mortality rates) can be used provided differences between their meanings are understood. Both ratios of death rates and absolute differences between the rates have a clear intuitive appeal (in terms of multiplication of the risk for ratios, or added deaths for absolute measures). In addition, ratios of death rates are perceived by Sheps (1958, 1959) as scale-neutral. On the other hand, ratios of death rates lack a clear relationship with survival rates and the absolute differences are not scale-neutral. Keyfitz (1985) applied the model of dependency of two populations (as previously defined by Sheps 1958, 1959) to the relationship between males and females, showing how the understanding of sex differentials in mortality can benefit from such analysis: using ratios of survival rates enables to 'net out' effects that are separate for females and males. Pollard (1983) advocates using absolute differences between male and female death rates to show how absolute differences are interrelated with differences at the level of life expectancies; no similar link exists between the ratios of death rates and the life expectancies. Similar statements are also contained and augmented in more recent studies (Bobak 2003, Elo and Dravenstedt 2005).

There is a long- standing tradition of the study of sex differentials in mortality with the help of the ratios of male to female mortality rates (in five-year age groups), in relation to both total and cause-specific mortality. There are even systems of patterning of sex differentials in mortality based on ratios of male to female death rates (Lopez 1983, United Nations Population Division 1983, United Nations 1988a, 1988b, Waldron 1993, Zhang et al. 1995, Kruger and Nesse 2004, Gjonca et al. 2005). The existence of such a tradition is, of course, not in itself evidence that this particular technique is the correct one or even clearly preferable to others. Its persistence is probably related to the fact that ratios of rates are scale-neutral, a property which facilitates international comparisons[2]. Another tradition that seeks to make the connection between age-specific sex differentials and summary measures is the decomposition by age of the contribution to the differential between the sexes in life expectancy. A number of methods are available for this purpose, all of which generate very similar results. Principal methods of decomposition were recently summarized

[2] For another strong argument of this advantage outside of the area of sex differentials in mortality see Low and Low (2006).

by Murthy (2005). Major studies of patterning of sex differentials in mortality (Lopez et al. 1983, United Nations 1988a, 1988b) employed a number of measures of sex differentials in mortality focusing on their differential meanings.

One argument that can be made against measures of sex differentials in mortality in general is that comparing sex differentials in mortality across societies is meaningless unless sex-specific mortality schedules are analysed simultaneously. This is because similar patterns of sex differentials could be created by different levels of sex-specific mortality. Widening of sex differentials in mortality, for example, can stem from a rise in male mortality coupled with the stagnation or decline in female mortality; it can also result from a decline in mortality of both sexes where the decline in males is slower than that in females. Ultimately, sex differentials are an outcome of sex-specific processes (Trovato and Lalu 1998). Studies that combine analysis of sex-specific mortality with analysis of sex differentials in mortality seem to be the most illuminating on the subject (Waldron 1993, Waldron 2000, Vallin and Mesle 2001).

2.2.2. Measures employed in this paper

The basic element of the analyses in this paper is the age-specific death rate. In some parts of this paper age- and sex-specific rates are used, in other parts- additional measures are calculated from them. Since sex differentials are essentially a result of interaction of sex-specific mortality schedules (Trovato and Lalu 1998), comparisons of sex-specific trends and levels are employed extensively throughout this study. Given that (1) there is no ideal measure of mortality sex differentials in mortality, (2) different measures possess different qualities and (3) different measures provide different insights, it has been decided to use more than one measure to present sex differentials in mortality wherever possible, and integrate and compare impressions rendered by these measures. We pursue the same strategy in relation to sex-specific comparisons, i.e. comparison of female/male mortality among Israeli Jews to female/male mortality in comparator countries.

The basic approach of the analysis is the examination of the levels of Israeli Jewish mortality and sex differentials in mortality relative to those observed in different sets of countries at various points in time. We compare age- and sex- specific death rates

of Israeli Jews to a set of 18 Western countries (Australia, Austria, Belgium, Canada, England and Wales, Finland, France, Italy, Greece, Denmark, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United States of America) and also to a set of Eastern European countries (Bulgaria, Czech Republic, East Germany, Hungary, Slovakia)[3]. The choice of countries was motivated by a desire to create a single comparator reflective of a wide range of mortality experiences of the West and Eastern Europe, respectively. In all comparisons we use the unweighted averages of sex and age-specific death rates for the comparator countries and avoid potentially overwhelming country-specific comparisons.

Let $m^{m,J}$ and $m^{f,J}$ denote the age-specific death rates of Israeli Jewish males and females, respectively. Let $m^{m,C}$ and $m^{f,C}$ denote the male and female age-specific death rates in comparator countries. Using this notation, Table 2 gives a summary of the principal measures used for the analysis in this paper.

[3] We do not use data for the republics of the former Soviet Union due to their questionable quality especially for the earliest periods covered by this analysis (1950s). For further discussion of data quality issues in this setting, detailed data protocols from the Human Mortality Database can be consulted at http://www.mortality.org/.

Table 2. Measures of mortality employed in this paper

Type of measure	Notation	Interpretation/Comments
Ratios of death rates		
1. Sex-specific ratios	$m^{m,J} / m^{m,C}$, $m^{f,J} / m^{f,C}$	Ratios of rates of Israeli Jews to those observed in comparator countries
2. Male to female ratios	$m^{m,J} / m^{f,J}$ $m^{m,C} / m^{f,C}$	Ratios of male to female deaths rates for Israeli Jews and in comparator countries
Absolute difference between death rates	$m^{m,J} - m^{f,J}$, $m^{m,C} - m^{f,C}$	Absolute differences between male and female death rates among Israeli Jews and in comparator countries. This measure is used only for comparison of mortality schedules of two sexes.
Age contributions to difference in life expectancy at birth	$_n\Delta_x = [(e_x^f - e_x^m)(\frac{l_x^f + l_x^m}{2})] - [(e_{x+n}^f - e_{x+n}^m)(\frac{l_{x+n}^f + l_{x+n}^m}{2})]$ For the first age group (before age 1): $_1\Delta_0 = (e_0^f - e_0^m) - [(e_1^f - e_1^m)(\frac{l_1^f + l_1^m}{2})]$ For the last age group: (assuming age 85 years and over as an open age group): $_\infty\Delta_{85+} = (e_{85}^f - e_{85}^m)(\frac{l_{85}^f + l_{85}^m}{2})$ (1)	Contribution of an age group to the sex differential in mortality measured using the difference between female and male life expectancy at birth. The same formula applies to the comparison between Jews and comparator countries: in this case superscripts *f* and *m* should be replaced by *J* and *C*.

Note. (1) e and l are defined using conventional life table notation.

The method of decomposition of age contributions to the difference between life expectancies used in this paper is the United Nations method of decomposition

(United Nations 1988a, p. 105)[4]. This choice has been motivated by the computational simplicity of the method.

3. Age and sex structure of sex differentials in mortality among Israeli Jews and elsewhere in developed world

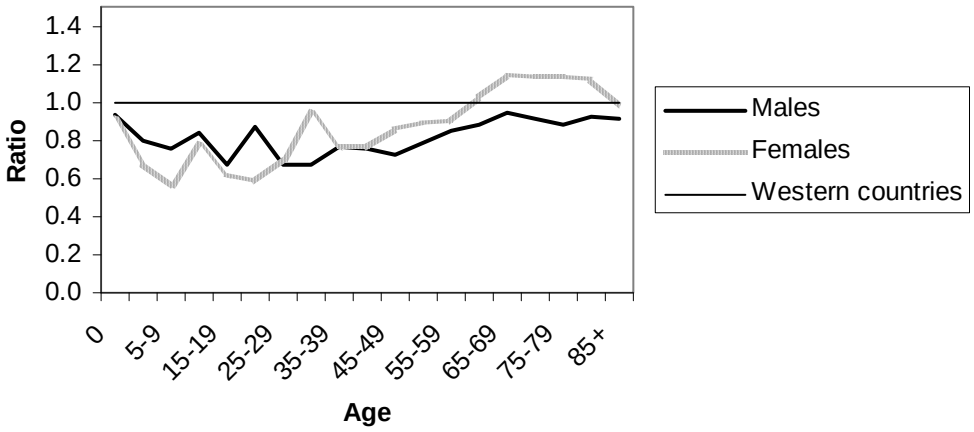
Israeli Jews versus Western countries

In the late 1990s life expectancy at birth of Israeli Jewish males was 1.7 years higher than among males of Western countries (76.7 years versus 75.0 years, respectively). At the same time female life expectancy at birth among Israeli Jews was slightly lower than life expectancy of females in Western countries (80.8 years versus 80.9 years, respectively).

Figures 3 and 4 present ratios of death rates of Israeli Jews to death rates observed in Western countries in the 1990s and age contributions to the difference in life expectancy at birth between two populations in the 1990s, respectively. In the late 1990s for ages 0-64 years the mortality of Israeli Jews, both females and males, is almost always lower than the mean of Western countries: ratios of rates of Israeli Jews to the rates in comparator countries are smaller than unity and the age-specific contributions to difference in life expectancy between two populations are positive.

[4] Note that the original formulation of the contribution of the first age group in United Nations (1988a, p. 105) is erroneous. The correct version of the formula is presented here.

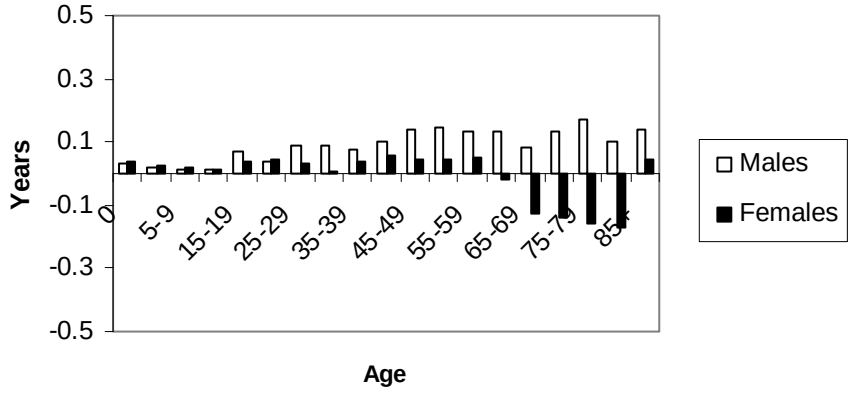
Figure 3. Ratios of death rates of Israeli Jews to Western countries, by sex, 1997-1999



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Note. Death rates for Israeli Jews and Western countries can be found in Appendix 1.

Figure 4. Age-specific contributions to the difference in life expectancy at birth between Israeli Jews and Western countries, by sex, 1997-1999



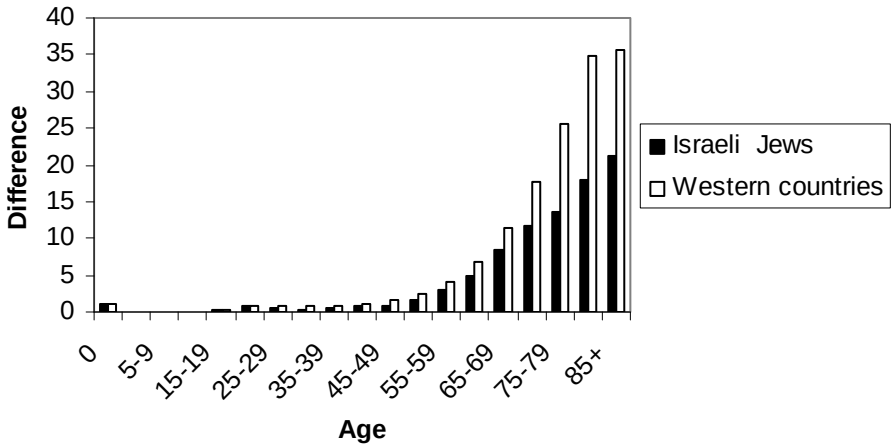
Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

After age 65 years, however, a clear pattern arises in which female mortality among Israeli Jews has a significantly less favourable positioning in relation to the average female mortality in Western countries than does mortality among Israeli Jewish males in relation to the average male mortality in these countries. In fact, at ages 65-84 years

the ratios of Israeli Jewish female death rates to death rates among females of Western countries exceed 1.1 and the contributions of these ages to difference in life expectancy is negative. Israeli Jewish males at these ages, on the other had, retain a somewhat advantageous positioning in relation to their counterparts in Western countries, with positive contributions to difference in life expectancy and ratios of their death rates to male death rates in Western countries being decisively below 1.0.

Differences between Israeli Jews and Western countries in terms of sex differentials in mortality are described in Figures 5-7, with the help of various measures.

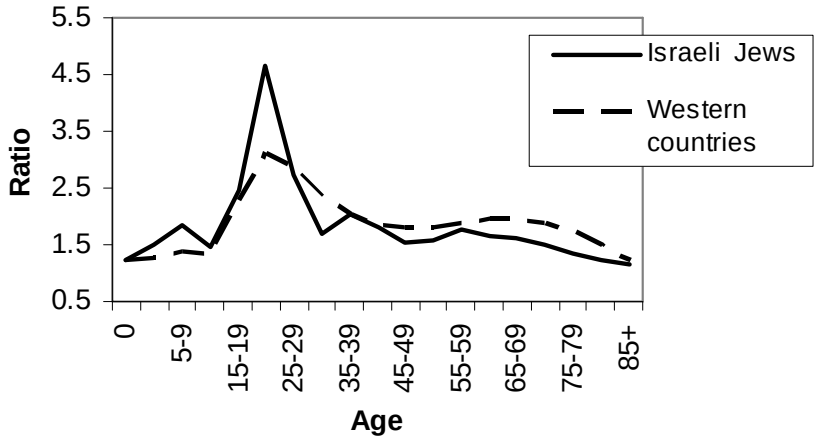
Figure 5. Absolute differences between male and female death rates per 1000 among Israeli Jews and in Western countries, 1997-1999



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

In terms of absolute measures Israeli Jews show lower values of the differentials across all age groups. The gap between them and Western countries, however, is especially wide for ages 65 years and over.

Figure 6. Ratios of male to female death rates among Israeli Jews and in Western countries, 1997-1999

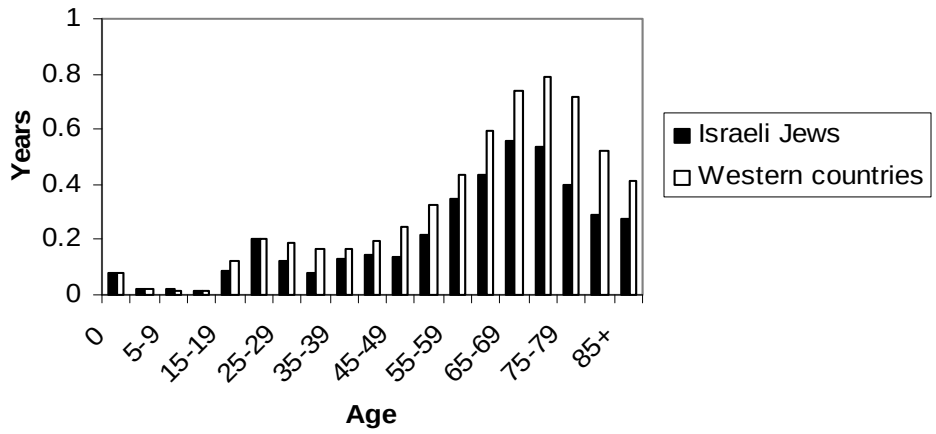


Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Figure 6 shows that both in Israel and in developed countries the highest ratios of male to female death rates are found in the age groups 15-29 years and 45-69, i.e. Israeli Jews possess a bimodal curve of ratios of male to female death rates which is a typical shape for Western countries (United Nations 1988a). There is no clear pattern in which sex differentials of Israeli Jews deviate from those observed in Western countries before age 25 years. For ages 25 years and over, on the other hand, values of ratios of male to female death rates among Israeli Jews are lower than in Western countries indicating smaller male mortality disadvantage among Israeli Jews. The gap is especially large for ages 65-84 years: among Israeli Jews ratios of male to female death rates are in a range of 1.2-1.6 while in Western countries they are in a range of 1.5-2.0.

Finally, the results of the decomposition of the difference between female and male life expectancy at birth into the contributions of different age groups are presented in Figure 7.

Figure 7. Age-specific contributions to the difference between female and male life expectancy at birth among Israeli Jews and in Western countries, 1997-1999



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Note. Difference between female and male life expectancy at birth among Israeli Jews is 4.1 years and it is 5.9 years in Western countries. Proportions of age-specific contributions to total difference in life expectancy between sexes are presented in Appendix 2.

Although the structure of relative age group contributions to the difference between female and male life expectancy is largely similar in the two populations (see also Appendix 2 where proportions of age-specific contributions to sex differentials in mortality are given) the actual sizes of the contributions are very different. Israeli Jews display a smaller size of age-specific contributions for all ages above 15 years. The absolute gap between their age-specific contributions and those found in Western countries is especially large for ages 65-84 years[5]. Age groups 65 years and over contribute 2.1 years to the difference in life expectancy at birth between the two sexes among Israeli Jews and 3.2 years in Western countries. The corresponding figures for ages 15-64 years are 2.1 years and 2.8 years.

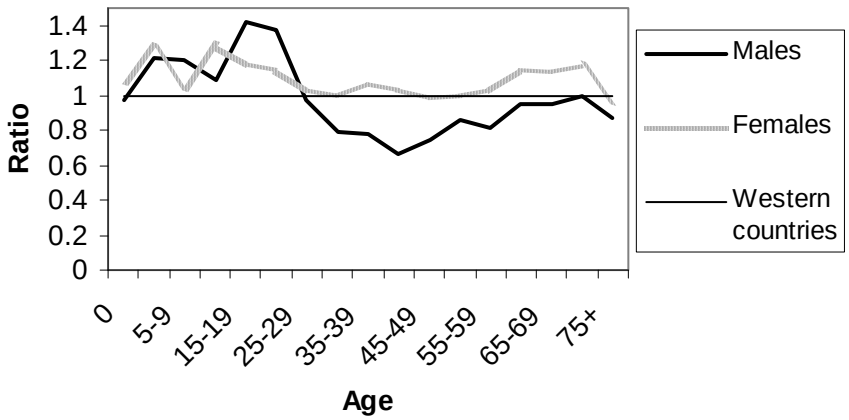
So far we have seen that in the late 1990s small sex differentials in mortality observed among Israeli Jews are maintained by all adult ages. Both females and males contribute to the pattern but in different ways for different age groups. For ages 65

[5] This can be expected since the contribution of a given age group to life expectancy at birth is a function of the number of deaths occurring in this age group and of the person-years of life saved per each death averted. In modern populations most deaths occur at old ages, and these are also most significant contributors to differences between populations in life expectancy at birth.

years and over females exhibit elevated mortality and males-somewhat reduced mortality. For ages 25-64 years small sex differentials result from low mortality of both sexes. But was this also the case in the past?

Examination of historical data facilitates an understanding of the evolution of the currently observed pattern. In the early 1950s life expectancy at birth of Israeli Jewish males was 1.1 years higher than among males of Western countries (67.4 years versus 66.3 years, respectively), and female life expectancy at birth among Israeli Jews was 0.8 years lower than life expectancy of females in Western countries (70.3 years versus 71.1 years, respectively). Figures 8-12 compare sex-specific mortality schedules and sex differentials among Israeli Jews to those found in Western countries in the early 1950s, a period following the first wave of mass migration wave into Israel. Importantly, at this time a majority of the Israeli Jewish population consisted of new migrants from countries of Eastern and Central Europe.

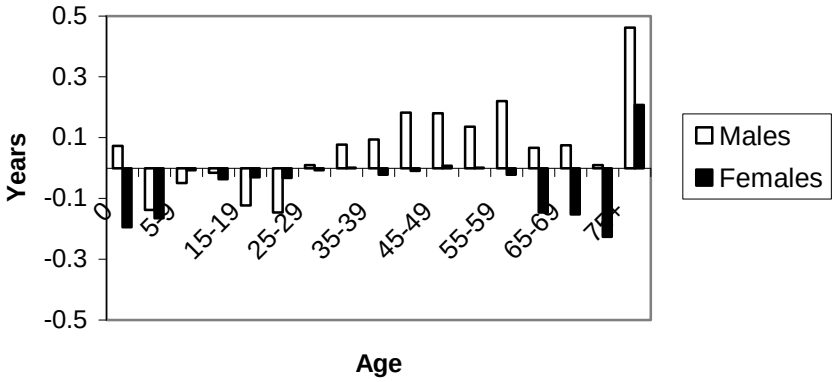
Figure 8. Ratios of death rates of Israeli Jews to Western countries, by sex, 1951-1953



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006).

Note. Death rates for Israeli Jews and Western countries can be found in Appendix 3.

Figure 4.9. Age-specific contributions to the difference in life expectancy at birth between Israeli Jews and Western countries, by sex, 1951-1953



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006).

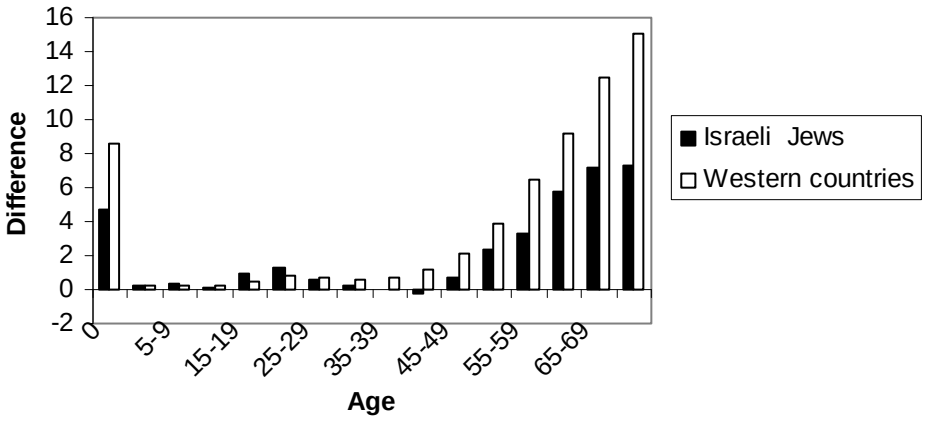
In general, a previously observed combination of relatively low male and relatively high female mortality exists among Israeli Jews approximately at ages 60 years and over also in the 1950s, apart from the oldest age group. The ratios of Israeli Jewish female death rates to female rates of Western countries are above 1.1 for ages 60-74 years; the contributions of these age groups to difference in life expectancy between the two populations are negative. Israeli Jewish males, on the other hand, display ratios of rates that are slightly lower than unity and positive contributions to difference in life expectancy between themselves and male populations of Western countries.

Curiously, Israeli Jewish males and females display differentiated positioning in relation to their counterparts in Western countries also at ages 25-59 years. In these age groups, however, female disadvantage is not as pronounced as it is at older ages; in fact, female mortality among Israeli Jews is nearly equal to that observed among females of Western countries. Male advantage, on the other hand, is more pronounced. As opposed to the late 1990s, however, in the early 1950s both Israeli Jewish females and males displayed relatively high mortality at ages younger than 25 years, for females and males alike and without clearly differentiated pattern for the two sexes. In general, the occurrence of relatively high mortality in this population in

the early 1950s is not entirely surprising given that (1) this population originates from countries with higher mortality than in Western countries, and (2) its mortality is measured a relatively short time after immigration to Israel.

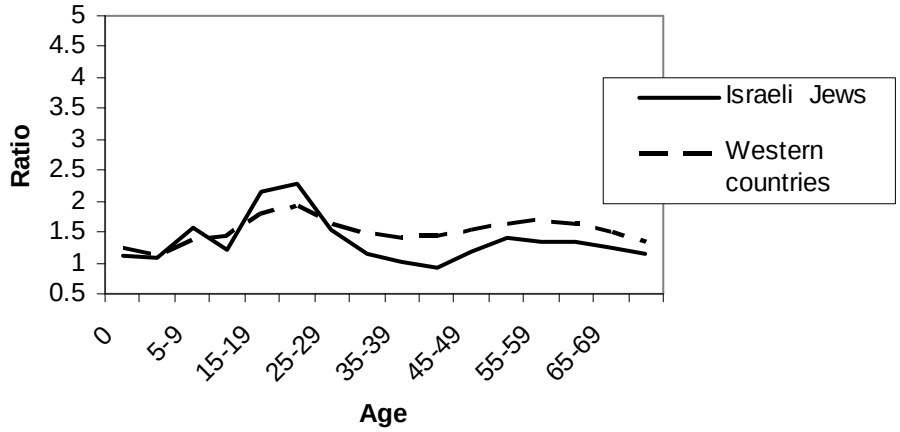
The previously identified pattern of relatively small sex differentials in mortality is conspicuous among Israeli Jews also in the early 1950 (Figures 10-12). The pattern of small sex differentials in the 1950s covers all adult age groups among Israeli Jews (25 years and over). At ages 35-44 years female mortality among Israeli Jews is either equal to or even somewhat higher than among males. Importantly, as in the 1990s, the pattern of low sex differentials is very strong at ages 60/65 years and over. All measures of sex differentials in mortality convey the same impression in this respect.

Figure 10. Absolute differences between male and female death rates per 1000 among Israeli Jews and in Western countries, 1951-1953



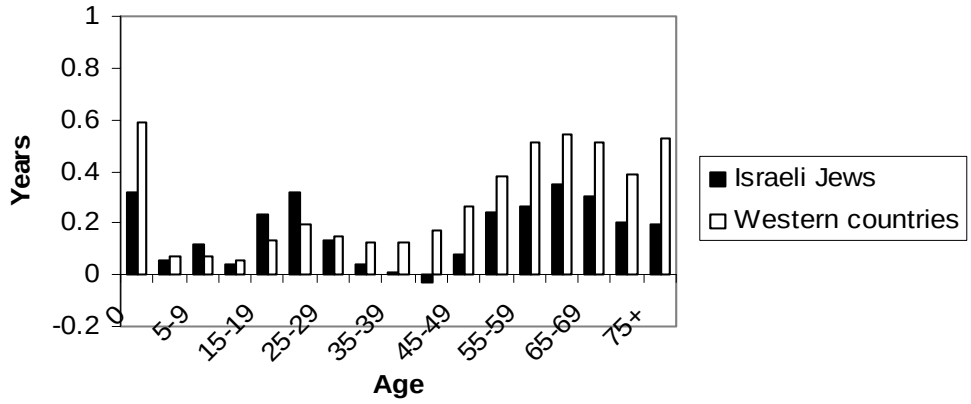
Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006).

Figure 11. Ratios of male to female death rates among Israeli Jews and in Western countries, 1951-1953



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006).

Figure 12. Age-specific contributions to the difference between female and male life expectancy at birth among Israeli Jews and in Western countries, 1951-1953



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006).

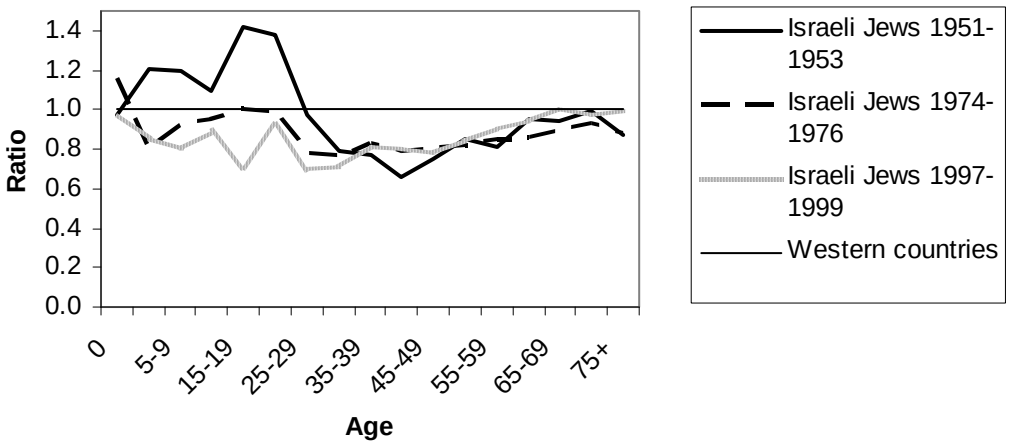
Note. Difference between female and male life expectancy at birth among Israeli Jews is 2.9 years and it is 4.8 years in Western countries. Proportions of age-specific contributions to total difference in life expectancy between sexes are presented in Appendix 4.

Small sex differentials are therefore a strong feature of Israeli Jewish adult mortality. The phenomenon is seen in all adult age groups, at all times and regardless of the level of mortality. Additional evidence to stability of this pattern can be gained from

the exploration of the data from the mid-1970s, a mid-point of the time span examined in this study (Appendix 5). Higher female and lower male mortality at all times generate small sex differentials in this population at ages 60/65 years and over. At younger ages variable combinations of sex-specific mortality schedules are observed, however, all of them result in small sex differentials in mortality.

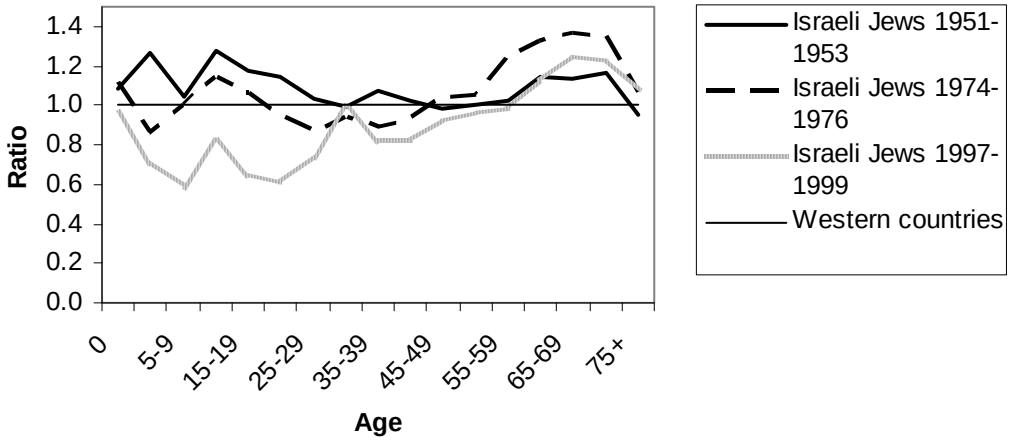
To further illustrate this last point we plot the curves expressing the relationships of sex-specific schedules of Israeli Jews to those observed in Western countries at a few points in time in Figures 13 and 14.

Figure 13. Ratios of death rates of Israeli Jewish males to males of Western countries,1950s-1990s



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Figure 14. Ratios of death rates of Israeli Jewish females to females of Western countries, 1950s-1990s



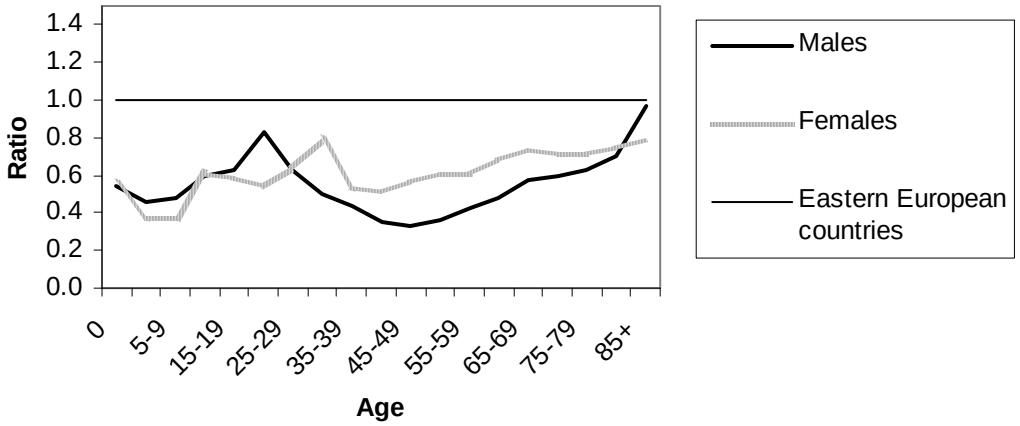
Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Mortality of Israeli Jewish males is lower than in Western countries at all points in time for all ages above 25 years, and it is especially low at ages 25-59 years-a typical zone of premature mortality. The phenomenon of elevated mortality at ages below 25 years disappears in Israeli Jewish males sometime between the 1950s and 1970s. Mortality of Israeli Jewish females at ages 60 years and over appears to be elevated at all points in time. However, there is clear evidence of the evolving pattern of low female mortality at all ages below 60 years. In both sexes, therefore, younger age groups among Israeli Jews are more dynamic than older age groups in how they compare to mortality schedules of Western countries. The shift from relatively high to low, or from relatively low to even lower mortality is limited, for both sexes, to younger age groups.

Israeli Jews versus Eastern European countries

Israeli Jewish mortality is routinely compared to mortality of Western countries. To our knowledge, it has not been systematically compared to the Eastern European mortality schedules. This is unfortunate given that Jewish population of Israel evolved as a result of the migration of Jews from Eastern Europe. Such comparisons can bring valuable insights, and are made in Figures 15 and 16.

Figure 15. Ratios of death rates of Israeli Jews to Eastern European countries, by sex, 1997-1999



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); Human Mortality Database (2007); special datafile prepared by the Central Bureau of Statistics, Israel.

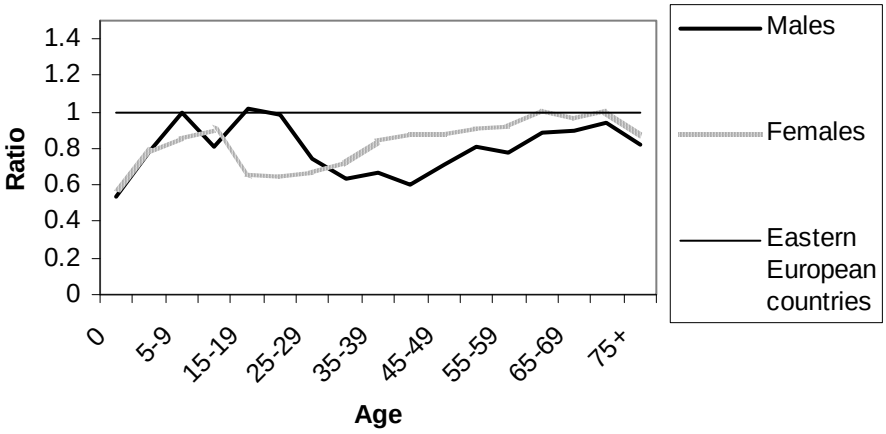
Note. Death rates for Israeli Jews and Western countries can be found in Appendix 6.

In the late 1990s both male and female mortality among Israeli Jews are significantly lower than in Eastern Europe. Infant, childhood and especially typical premature mortality (mortality for ages 30-64 years) among Israeli Jews are approximately one third to one half that observed at the same period in populations of Eastern Europe. In general, since the 1950s Eastern European mortality has remained higher than in the West largely due to the differences between the two regions in the quality of medical care, the level of health awareness and perhaps also inferior socioeconomic conditions (Vallin and Mesle 2001, 2004, Nolte et al. 2002, 2004, McKee and Nolte 2004). These were exacerbated by the socioeconomic crisis that developed in Eastern Europe following the transition to market economies. Examination of the life expectancy at birth showed that Israeli Jews belong to the Western mortality regime, and age-specific comparisons represent an additional confirmation of this.

Next, we compare Israeli Jewish mortality to the mortality schedules of Eastern Europe before a clear divergence between Eastern Europe and Western countries took place, i.e. before the 1960s (Figure 16). This is a period when a very significant proportion of Israeli Jewish population consisted of new immigrants, predominantly from the countries of Eastern and Central Europe. In the Censuses of 1948 and 1961

those born in Europe represented about 55% and 35%, respectively, of the total Jewish population and a much higher proportion among the adult ages (Central Bureau of Statistics, *Statistical Abstract of Israel*, various years).

Figure 16. Ratios of death rates of Israeli Jews to Eastern European countries, by sex, 1951-1953



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); Human Mortality Database (2007).

Note. Death rates for Israeli Jews and Western countries can be found in Appendix 7.

Israeli Jews displayed lower mortality than in the populations of Eastern European countries already in the 1950s for most age groups, but especially for infant mortality and the young adult ages, for both sexes. The exception is Israeli Jewish females aged 60-74 years. This group shows mortality very similar to that of females of Eastern Europe. This is a significant finding that might be part of the explanation of the pattern of sex differentials in mortality of Israeli Jews. Not much is known about the mortality of Jewish populations in the Diaspora but, given that these populations originate from countries with relatively high mortality, the expectation that shortly after immigration to Israel somewhat elevated mortality could be seen among Israeli Jews is not an unreasonable one. In fact, resemblance of mortality levels of new immigrants to Israel to those found in their countries of origin is often emphasised in literature on Israeli Jewish mortality (Peritz et al. 1973, Shuval 1992, Davies 1996, Hacohen 2003). Figure 16 shows that this is especially true of adult ages, i.e. ages suffering from mortality from chronic conditions which express the accumulated effects of life conditions at earlier stages of life course. It is also shown that Israeli

Jewish females 'live up' to this expectation, but this is not the case with Israeli Jewish males. An attempt to explain this phenomenon will be made in the subsequent sections.

To summarize, relatively small sex differentials in mortality among Israeli Jews are a phenomenon for which both males and females appear to be responsible. It is sustained by ages 25 years and over through the entire period under examination. This is confirmed using different measures of sex differentials in mortality, and sex-specific comparisons. At ages 60/65 years and over Israeli Jewish males display relatively low mortality while the mortality of Israeli Jewish females is relatively high when compared to Western countries. This pattern, too, is observed at all points in time. In fact, during the 1950s mortality of Israeli Jewish females in this age group resembles female mortality observed in Eastern European populations. Both younger males and younger females among Israeli Jews display low mortality at least as early as the 1970s, however, this is not the case in the 1950s. Regardless of the level of mortality, mortality schedules of young adults also contribute to relatively small sex differentials. However, given the smaller importance of these ages for life expectancy they are less significant from the point of view of overall measure of the sex differential in mortality. Importantly, no consistent pattern of differentiated positioning of male and female mortality (or small sex differentials in mortality) was observed for either infant and childhood ages, a phenomenon attributed to sex-specific discriminatory practices in relation to access to health facilities and material resources within the context of the South Asian, Middle Eastern and historical European societies where the social status of females is typically lower than that of males (United Nations 1988b, Tabutin and Willems 1995, Harris 1998, Yount 2001).

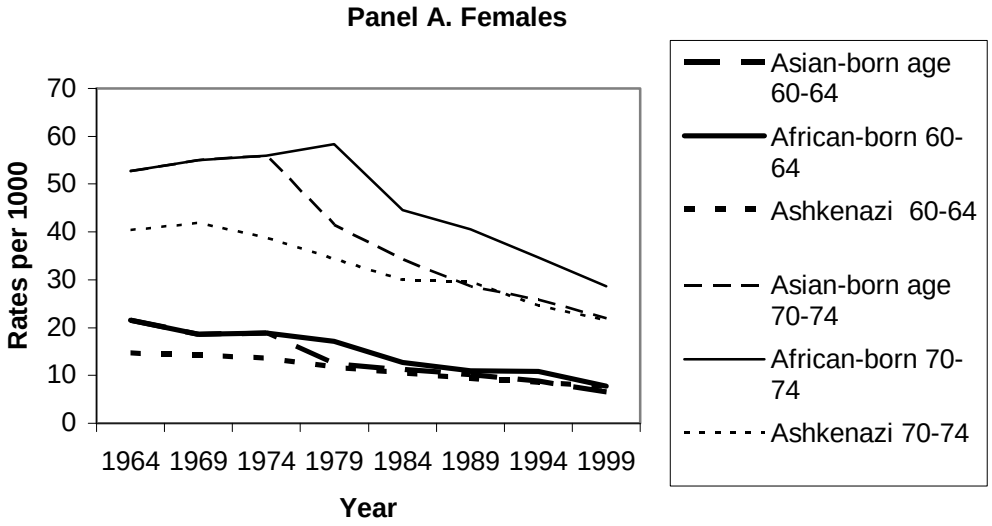
4. Sex differentials in mortality within subgroups of Israeli Jewish population

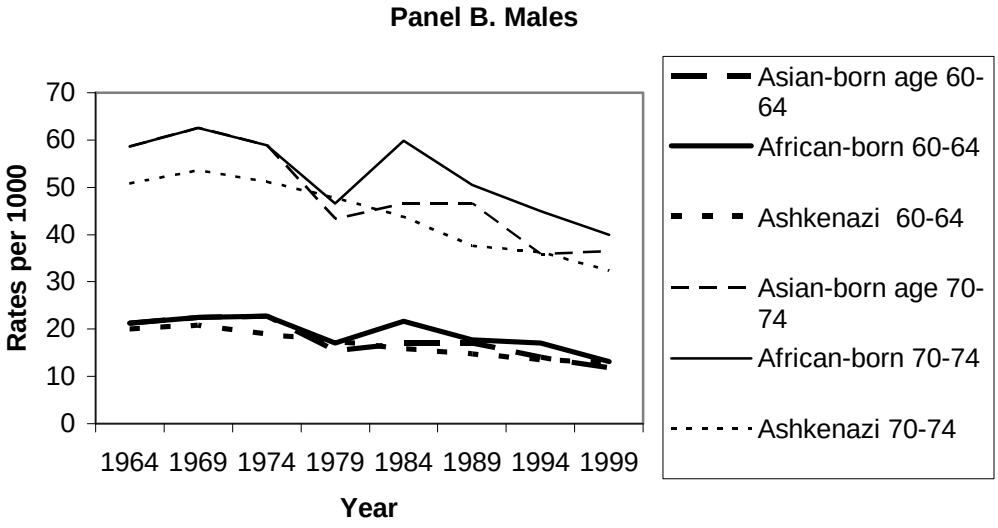
A feature of principal importance in relationships between European and non-European migrants within Israeli society is the fact that the socioeconomic hierarchy in Israel from its very early days developed along the lines of the place of birth (Semyonov and Lewin-Epstein 2004), with European (Ashkenazi) Jews placed at the top, and non-European (Sephardi) at the bottom of the ladder of economic and political power, social prestige etc. This situation originated in the inferior educational

skills of Sephardi immigrants to Israel, however, institutional discrimination cannot be entirely dismissed.

The most relevant aspect of this relationship from the point of view of mortality research is a significant and lasting gap in mortality between the two subpopulations, which is well documented in the demographic literature (see Peritz et al. 1973, Eisenbach 1994, Friedlander et al. 1995, Manor et al. 1999, 2000,). Israeli official statistics make it possible to distinguish between Ashkenazi and Sephardi foreign-born populations starting from the very early days, however, death rates by five-year age groups are only available starting from the mid-1960s. Differences between the two for selected age groups are illustrated in Figure 17.

Figure 17. Death rates of Ashkenazi and Sephardi foreign-born Jews in Israel, by sex, 1964-1999





Note. Before 1979 African- and Asian-born cannot be separated.

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years).

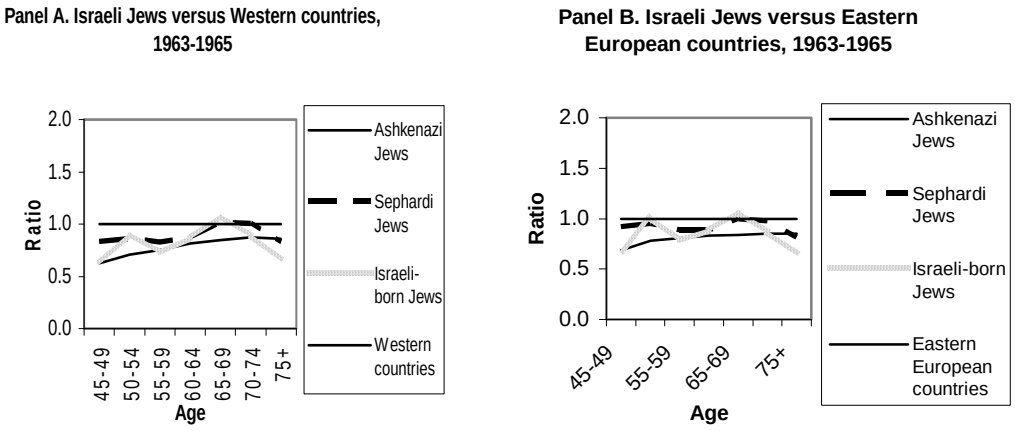
As Figure 17 shows, there was a significant degree of convergence in mortality between Ashkenazi and Sephardi Jews in Israel, especially in younger age groups. At ages 55-70 years differences between groups became insignificant around the mid-1980s.The gap between them never closed completely at the most advanced ages (70 years and over).

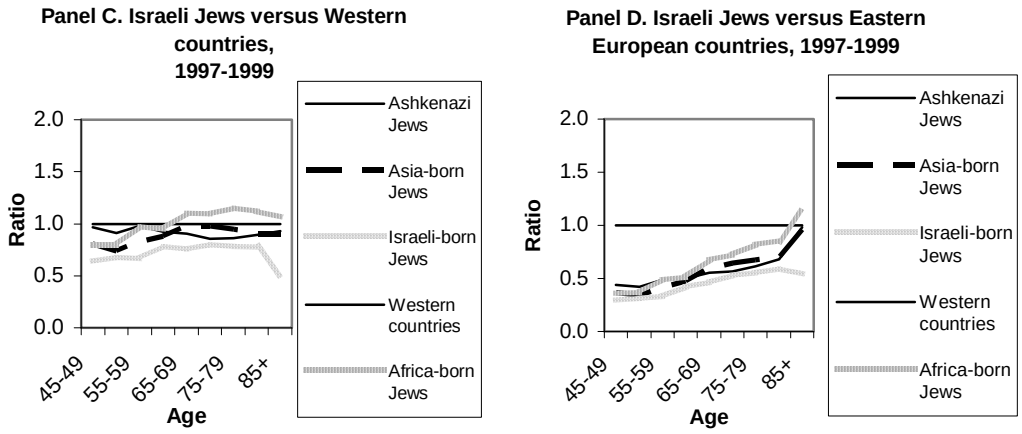
At the times of their immigration Sephardi Jews were characterised by mortality conditions close to those prevalent in their countries of origin (Peritz et al. 1973, Shuval 1992, Davies 1996, Hacohen 2003). Continuing mortality disadvantage could stem from the lasting influence of early life conditions (Elo and Preston 1992, Galobardes et al. 2004) and/or from their socioeconomic status. Israeli demographers emphasized the role of socioeconomic status on the mortality of Sephardi population. Although certain studies suggested the presence of factors that could not be reduced to socioeconomic differences (Eisenbach 1994, Friedlander et al. 1995), it has been shown that socioeconomic factors were responsible for elevated Sefardi mortality in later times (Manor et al. 1999, 2000) and certainly among the second generation. No studies, to our knowledge, have assessed the significance of early life conditions in either foreign-born group among Israeli Jews *in isolation* from its socioeconomic status.

Given the existence of the two more or less distinct socio-cultural groups among Jews which are also different in their economic placement and mortality schedules, it would make sense to ask just how these groups contribute to Israel's positioning in terms of sex differentials in mortality. It was suggested in some of the previous studies (Kark 1976, Peritz et al. 1973) that the Sephardi population displays lower ratios of male to female death rates than the Ashkenazi population. Mortality of Israeli-born Jews, who have remained a minority among the population aged 45 years and over, has not been investigated so far in great detail. Publication of their mortality figures in the Israeli official sources was also less consistent than in relation to the foreign-born Jews, perhaps partly due to a small numbers of deaths in this group. In the 1950s and 1960s mortality of this group was lower than among the foreign-born (Peritz et al. 1973), in the 1970s mortality of this group was largely similar to the Ashkenazi Jews, and in the 1990s Israeli-born Jews became again a group with the lowest mortality (Appendices 8 and 9).

It is worth examining the relationship of the mortality schedules of Ashkenazi and Sephardi foreign-born Jews, and of Israeli-born Jews, to the corresponding schedules of the comparator countries separately. This is done in Figures 18 and 19. We focus here on ages 45 years and over because the number of deaths at younger ages in each subgroup is small and the rates become potentially unstable.

Figure 18. Ratios of death rates of subgroups among Israeli Jews to Western countries and Eastern European countries, 1960s and 1990s-Males





Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* various years); Human Mortality Database (2007); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Note. Death rates for subgroups among Israeli Jews and Western and Eastern European countries can be found in Appendices 8 and 10.

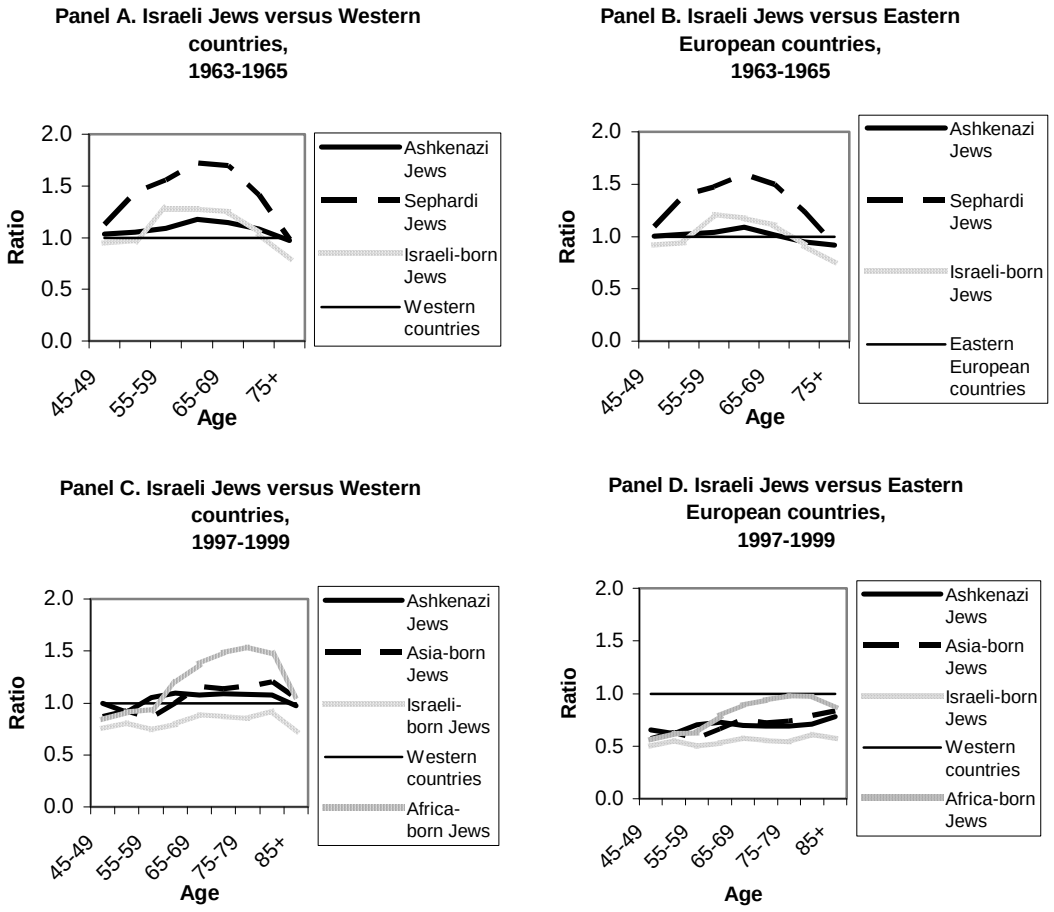
The data from the 1960s and 1970s (Figure 18, see also Appendix 8) indicates that Ashkenazi Jewish males, as can probably be expected, display a more advantageous positioning in relation to their counterparts in Western countries (ratios of 0.62-0.87), in comparison to the Sephardi males. However, Sephardi males are not at a pronounced mortality disadvantage either. In fact, among Sephardi Jews aged 45-59 years mortality is lower than among the male populations of the West (ratios of 0.83-0.87), and for ages 60 years and over it is nearly equal to that of the males in the West. Mortality of Israeli-born males is lower than mortality of Western males for nearly all age groups (ratios of 0.62-0.90 for most age groups). Comparison of Israeli Jews to Eastern European males in the mid-1960s invites similar conclusions.

The situation is somewhat different when the data for the 1990s is examined. In the 1990s the official statistics provide separate estimates of mortality for Sephardi populations born in Asia and in Africa. In this period, Ashkenazi male mortality and mortality of Sephardi males born in Asia are nearly equal to that of the males in the West (ratios of 0.81-0.98), while the mortality of the male Sephardi population born in Africa is substantially higher than for the males of the West for ages above 65 years (ratios of 1.06-0.15), but lower for ages 45-54 years (ratios of 0.79-0.94). Mortality among Israeli-born males is quite consistently lower than male mortality in the West

(ratios of 0.64-0.80). In all subgroups male mortality of Israeli Jews is significantly lower than in Eastern Europe (the only exception is age group 85 years and over; this finding is most likely to be explained by different composition of ages within this group in Israeli Jews and in Eastern European countries).

While the presence of mortality differentials in Israeli Jewish society is well documented, the fact that among males subgroups with low socioeconomic status compare favourably to the levels of male mortality in the West, especially in relation to premature mortality, is not well known. The only group of Israeli Jewish males whose mortality remarkably exceeds that of Western males is African-born Jews aged 65 years and over. All other groups have mortality equal to or lower than that of Western males.

Figure 19. Ratios of death rates of subgroups among Israeli Jews to Western countries, 1960s and 1990s -Females



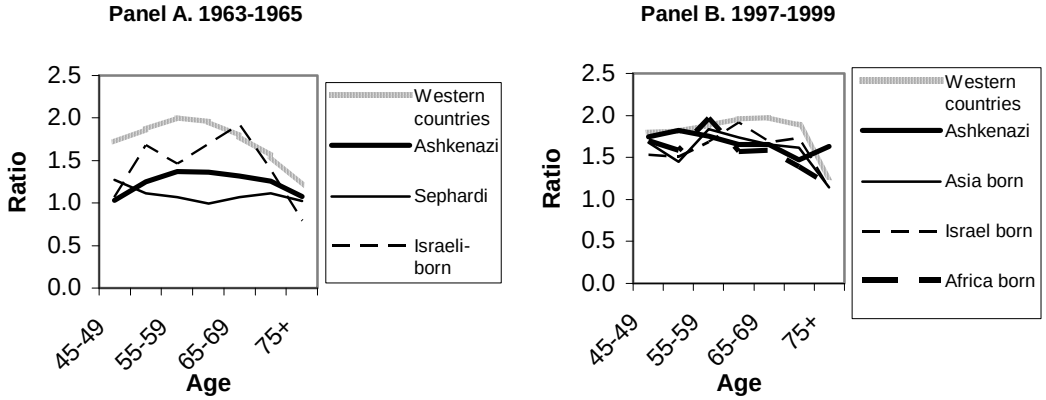
Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); Human Mortality Database (2007); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Note. Death rates for subgroups among Israeli Jews and Western and Eastern European countries can be found in Appendices 9 and 11.

The situation is different for females: it appears that Ashkenazi female mortality is remarkably higher than among their female counterparts in the West, it is observed for most age groups at all points in time, and it is especially strong for ages 60-74 years in the 1960s and 1970s (Figure 9, see also Appendix 9), and 60-84 years in the 1990s. With few exceptions, ratios for this subgroup are in a range of 1.04-1.15. Mortality of Ashkenazi females is quite similar to mortality observed in the 1960s among Eastern European females, and it is much lower in the 1990s. Mortality of Sephardi females is very high relative to female mortality in the West, especially in the 1960s and the 1970s: several of the age-specific ratios of their rates to those of female in the West are between 1.5 and 2.0. A similar pattern is observed in their relation to Eastern European females in the 1960s. The pattern of elevated mortality among Sephardi females is less strong in the 1990s, when ages 45-59 years show somewhat lower mortality than among the females in the West (ratios 0.75-1.00), however, it remains strong among the Sephardi females aged 60 years and over, especially among females born in Africa. In all subgroups of Israeli females, including those born in Africa, mortality is lower than among females of Eastern Europe. Interestingly, Israeli-born females aged 55-69 years show higher mortality than their counterparts in the West at earlier points in time (1960s and 1970s) but younger ages in this group actually display lower mortality. In the 1990s, all age groups among Israeli-born females show lower mortality than in the West. Israeli-born is the *only* subgroup in which relatively low female mortality is observed in comparison to Western countries.

Figure 20 present sex differentials in mortality for each subgroup among Israeli Jews using of the ratios of male to female death rates.

Figure 20. Ratios of male to female death rates for subgroups among Israeli Jews and in Western countries, 1960s and 1990s



Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Both in the 1960s and 1990s all subgroups within the Israeli Jewish population display lower ratios of male to female death rates than in the West. Sephardi Jews possess the smallest sex differentials in mortality in the 1960s (it is close to unity), and Israeli-born Jews display the highest levels at this time, Ashkenazi Jews are located in between these two groups. In the 1990s, the described relationships were preserved by the ages 60 years and over, but less strongly; and no clear relationship existed at younger ages.

Various combinations of male and female mortality are responsible for the low ratios. Male Ashkenazi Jews and Sephardi Jews born in Asia have death rates that are relatively low or close to those in the West, but elevated female death rates. For Sephardi Jews born in Africa it is a combination high male mortality with elevated female mortality for all ages in the 1960s and 1970s and for ages 60 years and over in the 1990s. For Israeli-born Jews it is a combination of low male mortality with either high (1960s and 1970s for ages 55 years and over) or low female mortality (ages 45-54 years in the 1960s and 1970s and all ages in the 1990s).

To further explore the role of compositional forces behind the positioning of Israeli Jews in relation to Western countries in terms of sex differentials between female and

male life expectancy we calculate life expectancy at birth for females and males, using death rates for *foreign-born Ashkenazi and foreign-born Sephardi Jews, and for Israeli-born Jews* at ages 45 years and over only. Death rates for the younger ages remain unchanged. This exercise answers the question of what would happen to sex-specific life expectancy of Israeli Jews if Jewish mortality at ages 45 years an over was following the schedule of foreign-born Ashkenazi/Sephardi/ or Israeli-born *only*, rather than the mix of these communities in the population as a whole. On the basis of these simulated values new values of sex differentials were calculated. Table 3 presents the new values in comparison to the mean value of the differential between female and male life expectancy for Western countries.

Table 3. Original and simulated differences between female and male life expectancy at birth, Israeli Jews, 1960s-1990s

	1963-1965	1974-1976	1997-1999
Israeli Jews			
original values	2.6	3.6	4.1
Ashkenazi only			
at ages 45 years and over	2.9	4.0	4.4
Sephardi only			
at ages 45 years and over	1.7	2.7	
Africa-born			3.9
Asia-born			4.1
Israeli-born only			
at ages 45 years and over	3.4	3.1	4.1
Western countries	5.8	6.6	6.2

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); United Nations (2004).

It is quite clear from Figure 20 and from Table 3 that there are compositional forces behind Israel's relative positioning in terms of sex differentials in mortality: Sephardi Jews demonstrate lower values of sex differentials than do Ashkenazi Jews. Values of sex differentials of Israeli-born Jews are in-between those of Ashkenazi and Sephardi Jews in the 1970s and 1990s, and they are somewhat higher than among Ashkenazi in the 1960s. Had the Israeli population above age 45 years consisted of Sephardi Jews only its overall sex differential in mortality would be, in the 1960s and 1970s, in the

range of 1.7-2.7 years of life expectancy; whilst had it consisted of Ashkenazi Jews or Israeli-born Jews only these values would be in the range of 2.9-4.0 years. The difference between the subgroups is less prominent during the late 1990s. Therefore, it is possible that the presence of the Sephardi population drives down the original value of sex differentials among Israeli Jews, but even if the Israeli population consisted of Ashkenazi Jews or Israeli-born Jews only, its sex differential would still be relatively small. It is also worth remembering that (1) Ashkenazi Jews represent a majority among the foreign-born Jews at ages 45 and over: depending on age group the proportion of Ashkenazi Jews was at all times roughly in the range of 50%-75% and (2) foreign-born dominate Israeli Jewish mortality at ages 45 year and over at all times (Central Bureau of Statistics, Israel, *Statistical Abstract of Israel*, various years).

To summarize, this analysis has revealed that all subgroups among Israeli Jews exhibit small sex differentials in mortality. Compositional effects in relation to sex differentials in mortality among Israeli Jews exist, however, they are not responsible for the overall small value of the differentials, i.e. small sex differentials in this population are not due to the impact of one particular group. The dominant combination generating small sex differentials among Israeli Jews is that of low male and high female mortality. However, other combinations (high male-high female and low male-low female mortality) exist as well. It is worth noting that sex differentials in mortality of a socioeconomically disadvantaged group (Sephardi Jews, and especially Jews born in Africa) appear to be the smallest in comparison to other subgroups among Israeli Jews. This is an unusual feature as this is not the case in the rest of the developed world where subgroups with low socioeconomic status reveal larger sex differentials in mortality than subgroups with high status. This finding is common to such diverse social settings as Russia (Shkolnikov et al. 2004), France (Vallin 1995), United States of America (Rogers et al. 2000, Elo and Drevenstedt 2005), United Kingdom (Office for National Statistics 2007), and it has been suggested that males of lower social classes exhibit a greater tendency to engage in health destructive behaviours than other males while the difference between females of different classes are not so large in this respect (Nathanson and Lopez 1987, Vallin 1995, Evandrou and Falkingham 2002, Mackenbach et al. 2004, Shkolnikov et al. 2004).

5. Mortality and sex differentials in mortality among Diaspora Jews

In this section we present the available data on mortality and sex differentials in mortality from the Jewish Diaspora communities. Information on Jewish mortality in the Diaspora is scarce. Various state systems of demographic data collection, both Census and vital registration systems, do not necessarily register information on religious/ethnic affiliation for Jews or in general (Ritterbrand et al. 1988, DellaPergola 2002a, 2002b, Southworth 2005). Alternatively, state systems might collect data on religion/ethnicity in the Census but not through their systems of vital registration. This results in insufficient information for calculation of death rates. Under the circumstances where state systems of data collection provide insufficient (partial) information for calculation of death rates, Jewish community systems of data collection sometimes 'fill in' the lacking data. In this respect, for example, in the absence of religion/ethnicity on death certificates, the existence of a special Jewish burial ritual is a major facilitating factor for collecting information on Jewish deaths.

The main reasons for this dearth of data are perhaps the existence of political sensitivities towards and/or absence of strong traditions of collection of data on Jewish religion and ethnicity. In certain countries with large Jewish communities, for example, the United States of America and the United Kingdom, there are public sentiments against collection of data on religion in general. These sometimes exists side by side with the fear of potential misuse of administrative sources within Jewish communities; this fear is based on a memory of such misuse in various countries of Europe under German occupation during the Second World War (Ritterband et al. 1988, Graham et al. 2007, Graham and Waterman 2005, see also Seltzer 1998 on misuse of statistical sources)[6].

[6] According to Della Pergola (2002a), there were traditions of mortality data collection in Jewish communities of Europe. Indeed, studies of mortality in the Jewish Diaspora conducted by Hersch (1948) and Schmelz (1971), for example, employ data on Jewish mortality for the end of the 19th and the beginning of the 20th century published by the municipal authorities in many European localities with significant Jewish populations. However, even these data are fragmentary and, in a way, they are less interesting from the point of view of sex differentials: during the first quarter of the century sex differentials everywhere in Europe were rather small. European traditions of data collection on the

Furthermore, even when state systems collect information on Jewish religion and/or ethnicity, definitional differences and the dynamics of inter-ethnic relationships might result in further complications. The main sources of complications are forces of assimilation of Jews into non-Jewish societies and the absence of a single definition of a 'Jew'. Jewish law defines as a Jew a person who was born to a Jewish mother or converted to Judaism in accordance with the Jewish law. Although the Israeli system of demographic data collection consistently follows this definition, this cannot be expected of the systems in countries other than Israel. Additionally, when it comes to the operation of state systems of demographic data collection in countries other than Israel the reporting of Jewish ethnicity or religion in population censuses depends largely on the good will of the respondent. Assimilation of Jews into non-Jewish societies both culturally and through intermarriage might result in the unwillingness of certain persons, born and educated within Jewish communities, to identify themselves as Jews in the census or through ritual. This applies with even greater strength to the offsprings of intermarriages. On the other hand, forces of assimilation and intermarriage create a segment of population which would not be recognized as Jews by the Jewish law but that would identify themselves as Jews. The precise dynamics of these processes and the extent to which they balance each other vary from country to country and, naturally, depend on a degree of assimilation of a given Jewish community, on one hand, and on various political factors that make affiliation with Jewish community more or less desirable.

Finally, there are some problems that the estimates of Jewish mortality share with other types of mortality estimates in subgroups of population (occupational, educational, and ethnic): (1) they often provide only small numbers of events/person-years; (2) in most cases estimates of Jewish mortality are based on unlinked data, i.e. data originating from independent sources, such as, for example, current registration and Census, being potentially prone to numerator-denominator incompatibility.

Jews as well as Jewish communities themselves ceased to exist with the destruction of European Jewry. Within the Diaspora, a re-distribution of Jews among the countries of the Western world took place following the Second World War. By the mid-20th century the majority of the Diaspora Jews resided in countries without long traditions of data collection on Jews.

To our knowledge, there is not a single community in the Jewish Diaspora for which mortality time series can be constructed on a national level. However, there are a number of 'snapshot' life tables and subsets of mortality rates for different national or subnational communities. These are summarized in Table 4. Included in the table are published studies presenting age-specific rates for Jews in five or ten year intervals, compared to the non-Jews of the respective populations, for which reasonably detailed documentation of data collection procedures could be obtained. Further information on data collection and interpretations relating to data quality can be found within the sources cited in Table 4 as well as in other publications (see, for example, Goldstein 1964, Mayer 1967, Goldscheider and Goldstein 1988, Torczyner and Brotman 1995, Tolts 1997, Bogoyavlenskiy et al. 2000, Shahar 2004, Graham and Waterman 2005).

We performed some independent checks on the data included in the sources cited in Table 4. These checks included: a review of the sources on the denominators and numerators of rates to ensure compatibility; recalculation of the death rates on the basis of new and improved information on deaths/ population counts or on the basis of the adjustment for the known sources of undercount; examination of mortality trends, where available, to ensure the absence of gross abnormalities of mortality routes; examination of age and sex structures of populations. All data included in the table were found to be of satisfactory quality. We only included data coming from the relatively large Jewish communities (national or city-level coverage): the smallest community included was that of Rhode Island (15, 500), the largest was that of England and Wales (260,000). The smallest allowed number of deaths in each age group was set at 10. In cases where the actual number of deaths was unknown (i.e. only death rates could be obtained from the original sources), the presentation was restricted to ages 45 years and over. Also, definitional problems (identification as a Jew), too, are less severe in relation to populations aged 45 years and over. Finally, only the sources presenting the data on total mortality were included.

All comparisons of sex-specific mortality and sex differentials among Jews to those of the host populations were performed using both absolute and relative measures[7].

[7] Strictly speaking, the comparisons are of Jews to the total mortality of a given society; however, Jews constitute a very small proportion of the total population in all cases.

Table 4. Mortality of Diaspora Jews: summary of findings

Country/study	Year	Data sources (1)	Coverage	Age group	Mortality when compared to host societies (2)		
					Males (3)	Females (3)	Sex differential (4)
England and Wales							
Haberman and Schmool (2005)	2001	D: Census N: centralised community initiative	national	45+	low [0.5-0.7]	low [0.6-0.9]	small Jews [0.8-1.5], non-Jews [1.5-1.7]
Russian Federation							
Shkolnikov et al. (2004)	1994	D: Census; N: vital registration	local	45+	low [0.2-0.7]	low [0.4-1.0]	small Jews [1.2-1.8], non-Jews [1.5-3.5]
Canada							
Needleman (1988)	1931	D: Census; N: local authority or /and experts initiative	local	45+	45-49: low; 50+: high [0.9] [1.2-1.7]	45-49: low; 50+: high [0.9] [1.1-1.7]	same Jews [1.0-1.2], non-Jews [1.0-1.1]
Spiegelman (1948)	1941	D: Census; N: local authority or /and experts initiative	local	45+	45-54: low; 55+: high [0.8-0.9] [1.0-1.10]	45-49: low; 50+: high [0.9] [1.1-1.3]	small Jews [1.1-1.2], non-Jews [1.3-1.4]
Needleman (1988)	1941	D: Census; N: local authority or /and experts initiative	local	45+	45-54: low; 55+: high [0.9-1.0] [1.2-1.4]	45-54: low; 55+: high [0.8-0.9] [1.0-1.4]	same Jews [1.2-1.4], non-Jews [1.1-1.3]
Needleman (1988)	1951	D: Census; N: local authority or /and experts initiative	local	45+	45-54: low; 55+: high [0.8-0.9] [1.1-1.3]	45-54: low; 55+: high [0.8-0.9] [1.0-1.2]	same Jews [1.3-1.6], non-Jews [1.1-1.5]
Needleman (1988)	1961	D: Census; N: local authority or /and experts initiative	local	45+	low [0.7-0.9]	45-54: low; 55+: high [0.9-1.0] [1.0-1.1]	small Jews [1.0-1.6], non-Jews [1.2-1.8]
Needleman (1988)	1969	D: Census; N: local authority or /and experts initiative	local	45+	low [0.6-0.9]	45-69: low; 70+: high [0.7-0.9] [1.1]	small Jews [1.1-1.8], non-Jews [1.8-2.0]
Shatenstein and Kark (1995)	1986	D: Census; N: local authority or /and experts initiative	local	45+	low [0.5-0.7]	low [0.7-1.0]	small Jews [1.0-1.9], non-Jews [1.9-2.1]
United States of America							
Fauman and Mayer (1969)	1963	D&N: community and experts' initiatives	local	45+	45-59: low; 60+: high [0.8-1.0] [1.0-1.6]	45-49: low; 50+: high [1.0] [1.0-1.9]	small Jews [1.3-2.1], non-Jews [1.6-2.2]
Goldstein (1996)	1963	D&N: community and experts' initiatives	local	55+	55-64: low; 65+: high [0.7] [1.1]	high [1.1-1.4]	almost always small Jews [1.3-1.4], non-Jews [1.3-2.0]
Rosenwaike (1990)	1980	D&N: administrative datafile-Medicare	national-special case	65+	65-79: low; 80+: same [0.8-0.9]	65-79: low; 80+: same [0.8-1.0]	small Jews [1.7-1.9], non-Jews [1.8-2.0]
Goldstein (1996)	1987	D&N: community and experts' initiatives	local	65+	65-84: low; 85+: high [0.7-0.8]	65-74: same; 75+: high [1.0] [1.2]	small Jews [1.1-1.5], non-Jews [1.7-1.9]

Note. (1) Abbreviations: D-denominators, N-numerators; (2) Age-specific mortality data for non-Jews could be found in the original sources except for the following cases: the Russian Federation, Moscow-data were received directly from V. Shkolnikov; Canada-data on mortality in provinces of Quebec and Ontario were obtained from the Canadian Human Mortality Database (2007); the United States of America (1963)-data on mortality of White Americans for comparison with the Jewish rates in Fauman and Mayer (1969) were obtained from Berkeley Mortality Database (2006). Age-specific mortality data for Jews came from the original sources apart from the Russian Federation, Moscow-data were received directly from V. Shkolnikov and Canada, Montreal – Jewish death rates were recalculated using population figures from Census 1991 provided by Charles Shahar, the Department of Community Planning, Federation Combined Jewish appeal (CJA), Montreal, Canada; (3) Ratios of Jewish to non-Jewish death rates appear in brackets (for ages up to 80); (4) Ratios of male to female death rates appear in brackets (for ages up to 80).

The former Soviet Union is the only example of a country with a long tradition of Census collection of data on ethnicity enabling identification of Jews and corresponding state system of vital registration. The United Kingdom, Canada and United States of America are three master-examples of the interaction of state and community data collection. The United Kingdom did not collect data on religion in the Census until 2001. It also does not collect such data on death certificates**,** but the Jewish communal institutions collects data on deaths on a national level. In Canada, data on religion and ethnicity is routinely collected in the Census but not on death certificates. The collection of data on Jewish deaths is not centralised. In the past, also certain local authorities kept registers of Jewish deaths. At present, there is no registration of Jewish deaths by local authorities but there are some scholarly attempts to use the data on deaths produced by the Jewish burial institutions. The United States of America does not collect data on religion in the Census or on death certificates, and a number of researchers are responsible for the estimates of Jewish population on the basis of local surveys/censuses initiated and carried out by research units of Jewish communal bodies. Local mortality data from Jewish burial institutions are also collected by Jewish communal bodies or researchers, however, as in Canada, it is not a centralised enterprise.

Table 4 shows what has become known as the Jewish pattern of mortality, and also its dissolution. The major characteristics of this pattern, identified by researchers in the context of North American Jewish Diaspora communities before the 1970s, were relatively low mortality at young ages and relatively high mortality at old ages, for both sexes (Spiegelman 1948, Fauman and Mayer 1969, Needleman 1988, Rosenwaike 1990, Goldstein 1996). In more recent studies (approximately since the 1970s) signs of dissolution of this pattern were noticed, and a shift to a low level of mortality across young and old ages in males and females was documented in the Jewish Diaspora (Rosenwaike 1990, Shatenstein and Kark 1995, Goldstein 1996, Haberman and Schmool 2005). A reduced impact of smoking and drinking, communal cohesiveness, religious observance, increased health awareness, high socioeconomic status and possible genetic influences were cited as reasons for relatively low Jewish mortality and overnutrition, the possibility of survival of the less 'fit' to older ages as a result of low mortality at younger ages, migrant origin, and, again, certain genetic factors-as reasons for relatively high Jewish mortality, when

these occurred (Spiegelman 1948, Schmelz 1971, Condran and Kramarow 1991, Shatenstein and Kark 1995, Goldstein 1996, Shkolnikov et al. 2004).

Three facts, however, were not given close attention in the literature on Jewish Diaspora mortality:

1. In nearly all instances, sex differentials in mortality observed among Jews are smaller than in the host populations. Moreover, small sex differentials in mortality across all adult ages existed both within the so-called Jewish pattern of mortality and after its dissolution in all Diaspora Jewish communities. This phenomenon exists under very different social, economic and political conditions, and under different levels of mortality. It is observed in the former Soviet Union as well as in Jewish communities of North America and England and Wales, among younger and older ages, at all points in time since the 1950s.
2. The Jewish pattern of mortality was never observed among Israeli Jews (as suggested by earlier analyses in this paper), however Israeli Jews shared with the Diaspora Jews the feature of invariably small sex differentials in mortality. Therefore, while the absolute and the relative levels of mortality vary across Jewish communities and in time, small sex differentials remained the core characteristic of the Jewish mortality perhaps for the large part of the 20th century.
3. The movement towards the relatively low mortality among the Diaspora Jews occurred earlier among the young age groups than among the old. It also occurred earlier in males than in females. This pattern of shift towards lower mortality somewhat resembles the development observed among Israeli Jews, however, as opposed to the North American and perhaps also the British Jews, among Israeli Jews relatively low mortality never became a universal phenomenon at old ages: it remained limited to males.

In the mid-1990s in Moscow Jewish mortality of both sexes and all ages was lower than among the total population. In that Moscow Jews resemble Jews of the three Anglophone countries. However, one must remember that this last comparison was carried out at a peak of mortality crisis in the Russian Federation, a crisis which

differentially affected members of various socioeconomic and educational groups (Shkolnikov et al. 1998). Jews, being a group of higher socioeconomic status within this particular context could be less affected than the rest. This might suggest that the comparison belonging to the mid-1990 is not a 'typical' one for the Russian Jews. For a more typical picture one might want to examine data on Jewish mortality belonging to the pre-crisis years. Such data exist (Interstate Statistical Committee of the Commonwealth of Independent States 1995, Piskunov 1996) but are not included here due to its doubtful quality.

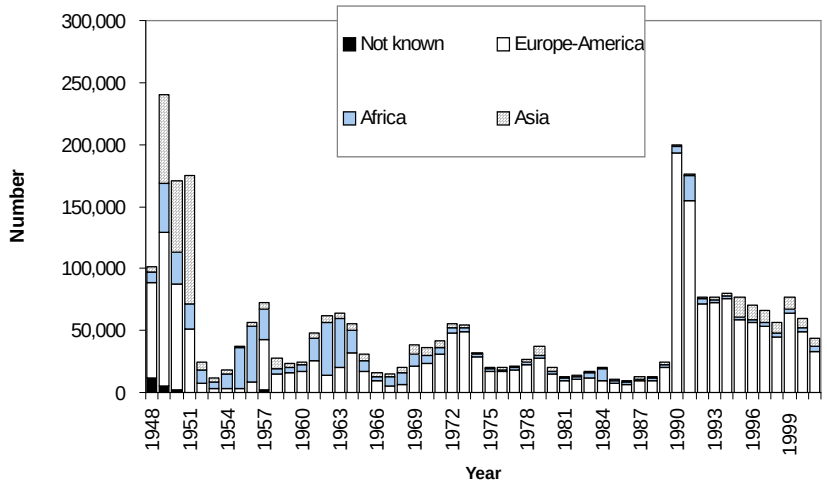
The following section of this paper proposes two complementary hypotheses explaining the origin and the nature of small sex differentials in mortality among Jews.

6. Israeli Jewish pattern of mortality and sex differentials in mortality: explanations considered

What are the forces generating the observed pattern of sex differentials in mortality among Israeli Jews? We hypothesize that the phenomenon is an outcome of two factors: the migrant origin of Israeli Jews and health protective behaviour characteristics of males in this population. These factors 'pull' Israeli Jewish mortality in two opposite directions; the extent to which they balance each other is different for males and females, and it is different for young and old age groups. These hypotheses, if true, may explain both the persistent nature of small sex differentials in mortality among Jews and variability of the levels of mortality.

Firstly, we will briefly review what is known about the origin and evolution of the Israeli Jewish population. This population derived from large migration waves from Eastern Europe and the Middle East largely in the second half of the 20th century, a process illustrated by Figure 21.

Figure 21. Immigration to Israel by continent of birth, 1948-2001

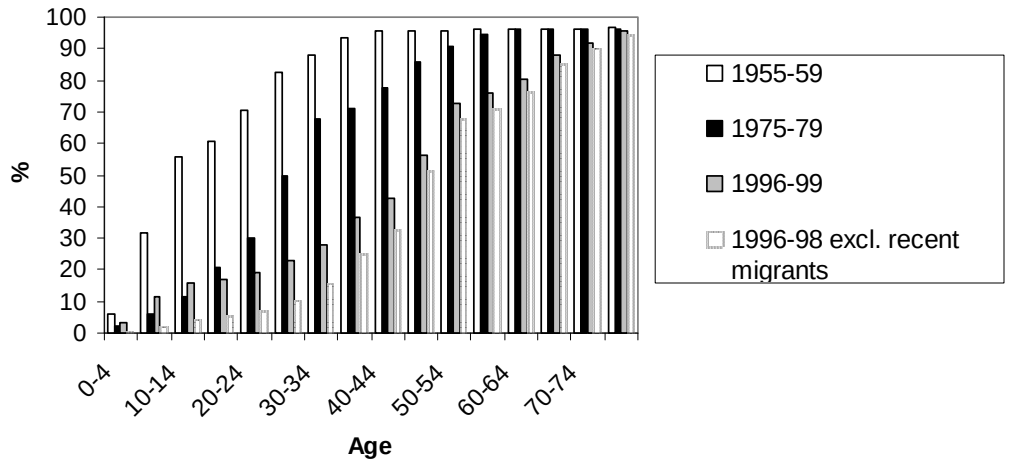


Source. Adapted from Central Bureau of Statistics, Israel (2000)

Migration into Israel developed in the form of waves, with the most significant waves during the first two decades and the last decade of the period under examination. The earliest wave of 1949-51 brought migrants from Europe (mainly Poland and Romania) and the Middle East (Iraq, Turkey, Iran, Yemen); the smaller wave of 1954-57 came mainly from North Africa, the 1961-1964 wave consisted of further migrants from North Africa but also migrants from Eastern Europe; finally, the wave of the 1990s was mainly composed of migrants from the countries of the former Soviet Union. It is worth noting that the impact of migration in relative terms was utterly unprecedented when examined against the migration experiences of other major migrant receiving societies, such as the United States of America and Canada. In Israel migration rates per 1000 residents were above 100 in the early 1950s and the early 1990s and in the range of 12-40 during the 1960s. Therefore, the 1950s and 1960s were the major formative period for the Israeli Jewish population. The Jewish population of Israel was 671,000 in mid-1948 and about 687,000 immigrants joined this population between then and the end of 1951 (Central Bureau of Statistics, Israel, *Statistical Abstract of Israel*, 2007). To summarize, one can conclude that Israeli population was initially shaped but also, during the first two decades of its existence, repeatedly 'hit' by migrant groups from societies with relatively high mortality.

Although the relative importance of migration has diminished somewhat over the years, it had a lasting impact on the population structure. Precisely because migration stopped playing a formative role in population after the first initial waves, the foreign-born populations started aging. In the 1950s all ages are represented among the migrants. In a number of years, however, this migrant population 'lost' its infants simply because the newborns from the very first year of the migrants' presence in the receiving country are not migrants any longer. Further on in time this process will affect other ages, and eventually the first generation of migrants will be represented by advanced ages only while young ages will consist mainly of the locally born. This process is illustrated by Figure 22.

Figure 22. Proportion of foreign-born among Israeli Jews, by age, 1950s-1990s



Source. Central Bureau of Statistics, Israel (*Immigration to Israel, 1999*).

Figure 22 suggests that at all times old age mortality in Israel is dominated by the foreign-born populations. At ages 60 years and over, for example, the proportion of Israeli-born has never exceeded 20%, and even for ages 45-59 years it has never exceeded 45%. To demonstrate that the large proportion of migrants at old ages is not a result of the most recent migration wave additional calculations excluding immigrants from the 1990s were performed. The results of this calculation do not affect the conclusions.

Although the duration of stay of foreign-born populations has increased with time, childhood, adolescence and some part of the adult life of many Israeli Jews have been

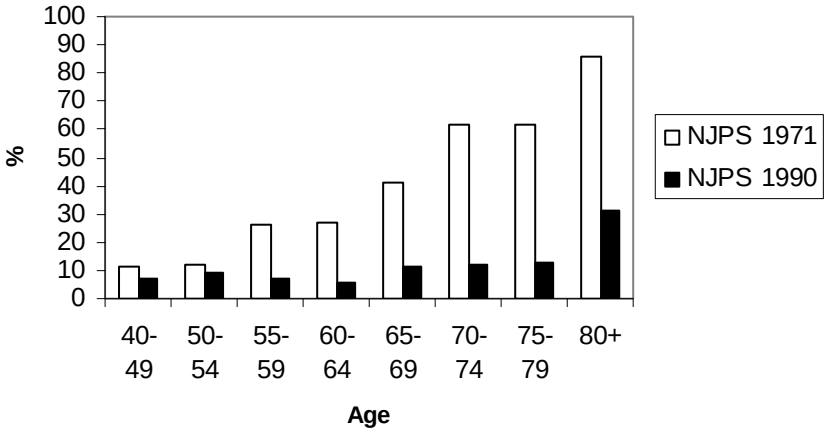
spent under socioeconomic, health and mortality conditions inferior to those characteristic of Western European countries. The Middle Eastern societies from which Sephardi migrants originated presented typical high mortality schedules of the developing world, with life expectancy at birth in the range of 40-46 years (Peritz et al. 1973). Eastern European societies, the source of the majority of Ashkenazi migrants, presented higher mortality than Western Europe and, starting in the 1960s, also divergence from the experience of the Western world, failing to catch up with the cardiovascular revolution in the West (Vallin and Mesle 2004).

Last but not least: in a strikingly different way from other migrant-receiving countries, Israel presents a case where no clear evidence of positive self-selection of migrants or screening on the basis of state of health exists (Hacohen 2003). In fact, in relation to certain migrant groups, the possibility of negative selection was suggested (Peritz et al. 1973, Cohen 2007, Cohen and Haberfeld 2007, Jaffe et al. 2008). This is so because the migration of many Jewish populations to Israel resembled refugee movements (especially during the 1950s) or because Israel presented an easy immigration option for Jews seeking improvement of economic conditions (during the 1990s).

Diaspora Jewish populations of North America and England and Wales also derived to a significant extent from migration of Jews from the countries of Eastern and Central Europe. However, this was a much earlier process in comparison to Israeli Jews. The formative migration waves for Jewish populations of North America and England and Wales occurred between the last quarter of the 19th century and the first quarter of the 20th century (Rosenberg 1947, Lipman 1990, Torczyner and Brotman 1995, Scherzer 2006). Although a considerable proportion of foreign-born populations was preserved by the old age groups among Jews in these countries up until the 1960s (Goldstein 1992, 1996), at later times all age groups became dominated by the locally born. In the United Kingdom in 2001 over 83% of Jews were locally born and another 7% migrated from other Western countries (Graham et al. 2007). In Montreal (Canada) in 2001 66% of Jews were locally born and another 8% were migrants from other Western countries; at ages 65 years and over the corresponding figures were 48% and 8% (Shahar and Magonet 2005). In the United States of America the total proportion of foreign-born in the National Jewish

Population Survey (NJPS) in 1971 was 23%, and it was 9% in the NJPS conducted in 1990 (Sheskin 2001). The proportions of foreign-born among American Jews by age group in the 1970s and 1990s are presented in Figure 23.

Figure 23. Proportion of foreign-born among American Jews, by age, 1970s-1990s



Source. Chenkin (uncertain year); NJPS 1990 datafile accessible through the North American Jewish Data Bank at http://www.jewishdatabank.org.

The proportion of foreign-born among American Jews increases with age, as it is the case with Israeli Jews. In contrast to Israeli Jews, American Jewish foreign-born population becomes a minority at older ages during the 1990s. Neither in the 1970s nor in the 1990s was its proportion as large as the proportion of the foreign-born among Israeli Jews. The only Diaspora Jewish society that did not evolve out of recent migration is Soviet Jews. This population represents a source population for Jewish migration to Israel and elsewhere in the Western world.

We propose that the occurrence of elevated mortality among Israeli Jews is a consequence of the migrant origin of this group. This line of reasoning is supported by the following facts:

1. The movement from elevated to low mortality among young ages parallels the reduction in proportion of foreign-born in this group.
2. Old Israeli Jewish females retain elevated mortality and a high proportion of migrants.

3. Mortality of non-foreign-born (i.e. Israeli-born) females in the 1990s is relatively low when compared to both Western countries and Eastern Europe.
4. Lower mortality is a phenomenon observed for younger age groups (dominated by the locally born populations) in both sexes among the Diaspora Jews of North America. A shift from the relatively high to relatively low mortality for older age groups in these populations follows the reduction in the proportion of the foreign-born Jews. In the population of Russian Jews, the only non-migrant Jewish population among Diaspora Jewish communities reviewed here, mortality of both sexes is relatively low.

The association between migrant status and mortality level, however, is imperfect. Three aspects are particularly prominent in this respect:

1. Mortality of young adults (for example, females) among Israeli Jews in the 1970s was, for many age groups, lower than female mortality in Western countries despite that fact that the proportion of foreign-born was still high in this population. It is possible that migration status has different meanings in relation to young age and old age mortality. Mortality of young adults is not related to natural deterioration of the body and expression of risks accumulated through the life course, and it is more closely related to immediate environment. Hence, it is more responsive to the improvement of socioeconomic conditions and quality of medical care that followed the migration process from Eastern Europe to Israel.
2. It is somewhat difficult to explain the relatively high mortality of Israeli-born females aged 55-74 in the 1960s and 1970s. More information is needed on the present and past socioeconomic conditions of this population. It is worth noting, however, that ages 55-74 years largely represent population born in Palestine under Ottoman rule. Although the system of medical services maintained by the Jewish community of Palestine was superior to the Ottoman and, subsequently, mandatory medical services these times in general were characterised by a low level of socioeconomic development, under-developed medical services, sanitation and wide presence of parasitic and infectious diseases (Bachi 1974, Davies 1996, Waserman and Neumark 1996, Shvarts 1996, 2002). This might represent part of the explanation of the high mortality of Israeli-born Jewish females belonging to the pre-statehood birth cohorts.

3. Old Jewish males retain relatively low mortality despite their predominantly migrant origin. It is remarkable, however, that mortality of this group is relatively not as low as among the younger Israeli Jewish males.

However, to further explain the differentiated positioning of older males and females among Israeli Jews relative to Western countries, and especially the phenomenon of relatively low old age male mortality, one must look elsewhere.

Some factors, especially behavioural ones, affect male mortality more than female. There are various types of risky behaviour that affect health in the short and long term: immoderate drinking, dangerous driving, violence, occupational stress, and smoking. There are multiple indications from the literature in demography, public health and other fields that health protective lifestyles are characteristic of Jewish populations in Israel and elsewhere, and especially of Jewish males (Fishberg 1911, Hersch 1948, Schmelz 1971, Glassner and Berg 1980, Condran and Kramarow 1991, Shuval 1992, Almog 2000). Smoking is an especially important factor. Apart from being a primary cause of lung cancer, it also affects mortality from cancer (other than lung cancer), cardiovascular diseases and respiratory diseases (Ravenholt 1990, Peto et al. 1992, 1994, Doll et al. 2004, Pampel 2005). Results of surveys taken in different social and cultural settings indicate that relative risks of death of smokers versus non-smokers are above 1.3 for most conditions, and significantly higher for lung and aerodigestive cancer and chronic obstructive pulmonary disease (Valkonen and van Poppel 1997, Peto et al. 1992, 1994, Malarcher et al. 2000, Doll et al. 2004, Wen et al. 2004). It has been previously established in the literature that smoking was largely responsible for widening gap in life expectancy between males and females between the 1950s and the 1970s (Valkonen and van Poppel 1997, Bongaarts 2006). It was also shown that in developed world since the 1970s about 30% of male deaths at ages 35-69 years and around 20% of male deaths at ages 70 years and over could be attributed to smoking (Peto et al. 2006).

Levels and trends in mortality from lung cancer can be used as an indicator of the level and route of the smoking epidemic (Lopez et al. 1994), and it has been demonstrated in the past that Israeli Jewish males display an especially low incidence of lung cancer and especially low death rates from lung cancer (Rennert et al. 1988,

1990, Lopez 1995). It is quite possible that a *very significant* part of the mortality advantage of Israeli Jewish males relative to males in other countries is due to the limited impact of smoking in this population in comparison to other male populations. If so, the differentiated positioning of Israeli male and female old age mortality in relation to Western European mortality schedules becomes more comprehensible: female mortality is elevated as it is migrant mortality and male mortality is lowered by a very moderate impact of risky behaviour, and especially smoking. One can also hypothesize that the removal of smoking-related mortality components from the mortality schedules of males in Western European countries and Israeli Jewish males might expose elevated mortality of Jewish males at advanced ages.

7. Discussion

This paper has identified a special pattern of mortality among the Jewish population of Israel. Small sex differentials in mortality at adult ages (25 years and over) is a defining feature of this pattern which seems to persist over its entire history. Small sex differentials in mortality at ages 60/65 years and over are produced by relatively high female and low male mortality compared with populations of Western countries. For young adults small sex differentials in mortality are formed by low mortality of both sexes at least since the 1970s, though in the 1950s they are produced by relatively low male mortality and slightly elevated female mortality. Sex differentials in mortality were small across all subgroups of Jewish population of Israel, including those with low socioeconomic status. Low male mortality was seen in all subgroups of Israeli Jews except African-born male aged 65 years and over. High female mortality was observed in all subgroups apart from Israeli-born females in the 1990s. The phenomenon of small sex differentials in mortality was shared with the Diaspora Jewish communities with available mortality data.

Existence of a special age and sex pattern of mortality is not at all an unusual phenomenon. Such patterns have been documented in the literature. For example, the North American mortality pattern, present in the United States and, although less strongly, also in Canada, is characterised by relatively high death rates up to age 65 and relatively low mortality among the oldest old (Himes 1994, Bourbeau 2002). A Far Eastern mortality pattern is defined by relatively high death rates of old males in

comparison to younger males and females of all ages (Goldman 1980, Gragnolati et al. 1999). Factors such as lifestyle, quality of medical care, selection forces, period/cohort specific patterns of exposure to diseases, and compositional differences are all used to explain those different patterns. Findings presented in this paper add to the literature on patterns of mortality across the world.

Two hypotheses have been proposed to explain small sex differentials in mortality among Israeli Jews. The first linked the occurrence of relatively high mortality in Jewish populations to their migrant origin. Older age groups within the Israeli context represent the first generation of migrants at all points in time. These are people who were born and spent significant parts of their lives under conditions of the regimes of high mortality: countries of Eastern and Central Europe and the Middle East. They may retain some characteristics of their mortality regime for a long time after migration to lower mortality countries. Young age groups among Israeli Jews are dominated by the first generation of migrants in the 1950s but not subsequently. This line of reasoning may explain elevated mortality of elderly Israeli Jewish females as well as the relatively quick movement towards low mortality for both sexes among young adults. The first group retains high mortality because it consists of foreign-born, the second group moves towards low mortality as a result of its being increasingly dominated by the locally born people. It is important to remember while interpreting levels of mortality of Israeli Jews that migration to Israel lacked a clear positive selectivity (either self-selection or screening by a receiving country), characteristic of many large migration waves in different settings.

Additional supporting evidence to this explanatory framework comes from the fact that mortality of Israeli-born Jews, a group whose mortality has not been well studied, is low for both sexes in the 1990s. Finally, essentially the same process is noticeable in Jewish Diaspora communities. In Jewish communities of North America a combination of low mortality for young ages and high mortality at old ages was observed for both sexes prior to the 1960s. This was especially pronounced for females (Spiegelman 1948, Goldstein 1966, Fauman and Mayer 1969, Needleman 1988). After the 1960s, however, the mortality of old aged Jewish populations became either equal or lower than in the host population (Rosenwaike 1990, Shatenstein and Kark 1995), and this process coincided with the increase in proportion of locally born

people. In the United Kingdom, where an absolute majority of Jews in the beginning of the 21st century are locally born or originate from developed countries, both male and female adult mortality are lower than in the host population (Haberman and Schmool 2005). Perhaps, relatively low female mortality in these communities can be interpreted as an indicator of what is likely to happen to Israeli Jewish females as well in the long term.

To explain the absence of elevated mortality for elderly males another set of arguments has been invoked. The relatively modest presence of various types of risk taking behaviour and, especially, low effects of smoking among Israeli Jews were documented in the past (Rennert et al. 1988, 1990, Shuval 1992, Lopez 1995). Given the pervasive impact of smoking on the level of total mortality across the world (Peto et al. 1994, Valkonen and Van Poppel 1997, Pampel 2002, 2003, 2005, Bongaarts 2006) the persistent mortality advantage of Israeli Jewish males relative to male in the comparator populations could be largely attributable to the limited effect of smoking in this population. The questions of impact of smoking in this population and whether or not removing smoking mortality would unmask a certain mortality disadvantage of Israeli Jewish males should be addressed in future research.

To what extent is the preservation of a high level of mortality characteristics of migration processes across the world? Depending on the nature of migration movement, mortality of migrants can be lower or higher than that of host populations. Subsequent convergence of migrants' mortality to the levels of host population is often observed but this is not the only possible scenario (Kaplan 1988, Kliewer 1992, Singh and Siahpush 2002, McKay et al. 2003, Antecol and Beddard 2006). Explanations to the convergence as well as persistent survival advantage or disadvantage of migrant populations draw on interactions of the 'imported' state of health and 'imported' lifestyles and conditions of migrant adjustment to a particular context (perhaps most importantly, their socioeconomic placement, adaptation of new lifestyles, and acculturation stress).

In general, there are indications that either survival advantage or survival disadvantage of migrants in relation to populations of host countries may persist over significant periods of time since migration. Young (1991) showed both reduced and

elevated levels of mortality among migrants from different countries to Australia after 15 years of stay in Australia. This was observed for males and females, with migrants from Southern Europe displaying lower mortality and migrants from India, Ireland and Poland displaying higher mortality. As a rule, the mortality of migrants to Australia was lower than in their countries of origin. Courbage and Khlat (1996) described a mortality pattern characteristic of migrant Moroccan populations in France characterised by relatively low male mortality coupled with relatively high female mortality. This was explained by the presence of positive selection driving migration of males and by the lack of positive selection driving migration of their family members (Courbage and Khlat 1996). Wild and Mckeigue (1997) described elevated mortality among migrants to England and Wales from various source countries, including South Asia, Africa, the Caribbean Commonwealth, Ireland, and Scotland. Razum et al. (1998) reported on a lasting survival advantage of Turkish migrants to Germany in the 1980s and 1990s. Both in the United Kingdom and in Germany the core migrant groups evolved at least more than 10 years before the respective mortality studies were conducted. Within the Israeli context, Goldbourt (2002) reported on (1) the preservation of differential mortality rates from coronary heart disease among Jewish immigrants to Israel for many years after migration and (2) similarity between mortality rates from coronary heart disease of new migrants to those who had spent in Israel up to 20 years, for certain migrant groups. Steinitz et al. (1989) and Parkin et al. (1990) presented broadly similar results in relation to mortality of Jewish migrants to Israel from certain types of cancer.

The interpretations of the small sex differentials in mortality among Jew proposed in this paper have some limitations. The finding of relatively low mortality from behaviourally induced causes is quite common among Jewish males, observed in a wide variety of contexts. On the other hand, the impact of migration on mortality is harder to define and to prove. Changing socioeconomic conditions are a strong confounding factor in this context. Improving socioeconomic well being is a key for reduction in mortality. Both Israel and Diaspora Jewish populations experienced improvement of socioeconomic conditions over the second half of the 20th century. It is possible, for example, that the occurrence of elevated mortality among Israeli Jews during the 1950s was partly a result of relatively low socioeconomic level and difficulties imposed on the local economy by large-scale migration (Peritz et al. 1973,

Hacohen 2003). Jewish populations of the North America were characterised by a significant social and economic mobility. Jews moved to white collar occupations quicker than other migrant populations and their educational level rose more significantly than among the total population (Chiswick 1985, 1995, Goldstein 1996, Chiswick 2001, Scherzer 2006). In the second half of the 20th century educational and occupational status of Jews was higher both in North America and in England and Wales in comparison to the host populations (Torczyner and Brotman 1995, Sheskin 2001, Graham et al. 2007). With the available data, however, we cannot isolate the effects of the improvement in relative socioeconomic status from the compositional effects (generational/migration status) in their impact on mortality. Migration origin produces, in our view, the most coherent explanation to the occurrence of elevated mortality among elderly Jewish females in a variety of contexts. However, the links between changing socioeconomic conditions and the migration origin of Jewish populations should be further investigated.

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Appendix 1. Death rates per 1000 of Israeli Jews in comparison to the unweighted mean of Western countries, by sex, 1997-1999

Age group	Males			Females		
	Israeli Jews	Western countries mean	Ratio	Israeli Jews	Western countries mean	Ratio
	a	b	c (a/b)	d	e	f (d/e)
0	5.3	5.7	0.93	4.2	4.7	0.91
1-4	0.3	0.3	0.80	0.2	0.3	0.68
5-9	0.1	0.2	0.76	0.1	0.1	0.57
10-14	0.2	0.2	0.84	0.1	0.1	0.76
15-19	0.5	0.7	0.67	0.2	0.3	0.62
20-24	0.9	1.1	0.87	0.2	0.3	0.59
25-29	0.7	1.1	0.67	0.3	0.4	0.71
30-34	0.9	1.3	0.68	0.5	0.5	0.93
35-39	1.2	1.6	0.76	0.6	0.8	0.77
40-44	1.8	2.4	0.75	1.0	1.3	0.76
45-49	2.6	3.5	0.73	1.7	2.0	0.86
50-54	4.3	5.5	0.79	2.7	3.0	0.89
55-59	7.2	8.6	0.84	4.1	4.6	0.91
60-64	12.3	14.1	0.88	7.4	7.2	1.03
65-69	21.8	23.2	0.94	13.4	11.8	1.14
70-74	34.2	37.7	0.91	22.6	20.0	1.13
75-79	53.6	60.9	0.88	39.9	35.4	1.13
80-84	93.5	101.8	0.92	75.6	67.1	1.13
85+	177.2	194.2	0.91	155.9	158.6	0.98

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* various years);

World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel**.**

Appendix 2. Age-specific contributions to the difference between female and male life expectancy at birth among Israeli Jews and in Western countries, 1997-1999

Age group	Israeli Jews	Western countries	Israeli Jews	Western countries
	Years		*%*	
Total	4.1	5.9	100.0	100.0
0	0.08	0.08	2.0	1.3
1-14	0.06	0.05	1.5	0.9
15-24	0.29	0.32	7.1	5.4
25-34	0.20	0.35	4.9	5.9
35-44	0.28	0.36	6.7	6.1
45-54	0.36	0.57	8.7	9.5
55-64	0.78	1.03	19.0	17.3
65-74	1.10	1.53	26.6	25.7
75-84	0.69	1.23	16.7	20.8
85+	0.28	0.42	6.75	7.0

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* various years);

World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel**.**

Appendix 3. Death rates per 1000 of Israeli Jews in comparison to the unweighted mean of Western countries, by sex, 1951-1953

Age group	Males			Females		
	Israeli Jews	Western countries mean	Ratio	Israeli Jews	Western countries mean	Ratio
	a	b	c (a/b)	d	e	f (d/e)
0	42.0	43.1	0.97	37.3	34.6	1.08
1-4	3.1	2.5	1.21	2.9	2.3	1.27
5-9	1.0	0.8	1.20	0.6	0.6	1.04
10-14	0.7	0.7	1.09	0.6	0.5	1.28
15-19	1.7	1.2	1.42	0.8	0.7	1.18
20-24	2.3	1.7	1.38	1.0	0.9	1.15
25-29	1.7	1.8	0.97	1.1	1.1	1.03
30-34	1.6	2.0	0.79	1.4	1.4	0.99
35-39	2.0	2.6	0.77	2.0	1.9	1.07
40-44	2.6	3.9	0.66	2.7	2.7	1.03
45-49	4.6	6.2	0.75	3.9	4.0	0.98
50-54	8.5	10.0	0.86	6.1	6.1	1.00
55-59	12.7	15.7	0.81	9.5	9.2	1.03
60-64	22.9	24.2	0.95	17.2	15.0	1.15
65-69	35.3	37.3	0.95	28.1	24.9	1.13
70-74	58.0	58.4	0.99	50.7	43.4	1.17
75+	113.5	129.6	0.88	108.5	113.4	0.96

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006).

Appendix 4. Age-specific contributions to the difference between female and male life expectancy at birth among Israeli Jews and in developed countries, 1951-1953

Age group	Israeli Jews	Western countries	Israeli Jews	Western countries
	Years		*%*	
Total	2.9	4.8	100.0	100.0
0	0.32	0.59	11.2	12.2
1-14	0.20	0.20	7.1	4.1
15-24	0.55	0.33	19.2	6.8
25-34	0.17	0.27	6.0	5.6
35-44	-0.02	0.30	-0.7	6.3
45-54	0.33	0.65	11.4	13.4
55-64	0.61	1.06	21.4	21.9
65-74	0.51	0.90	17.7	18.7
75+	0.19	0.53	6.7	11.0

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* various years); World Health Organization (2006).

Appendix 5. Death rates per 1000 of Israeli Jews in comparison to the unweighted mean of Western countries, by sex, 1974-1976

Age group	Males			Females		
	Israeli Jews	Western countries mean	Ratio	Israeli Jews	Western countries mean	Ratio
	a	b	c (a/b)	d	e	f (d/e)
0	20.8	18.0	1.16	15.4	13.8	1.11
1-4	0.7	0.8	0.80	0.6	0.7	0.86
5-9	0.4	0.4	0.92	0.3	0.3	1.00
10-14	0.4	0.4	0.96	0.3	0.3	1.14
15-19	1.2	1.2	1.01	0.5	0.4	1.07
20-24	1.4	1.5	0.99	0.5	0.5	0.95
25-29	1.0	1.3	0.78	0.5	0.6	0.88
30-34	1.1	1.5	0.77	0.7	0.8	0.94
35-39	1.7	2.1	0.84	1.0	1.1	0.89
40-44	2.6	3.3	0.79	1.7	1.8	0.93
45-49	4.5	5.5	0.81	3.0	2.9	1.05
50-54	7.3	8.9	0.82	4.7	4.5	1.05
55-59	11.8	14.0	0.85	8.5	6.8	1.26
60-64	19.3	22.5	0.86	14.2	10.7	1.33
65-69	32.0	35.8	0.89	24.1	17.5	1.37
70-74	52.3	56.4	0.93	41.6	30.9	1.35
75-79	81.6	87.7	0.93	68.3	56.3	1.21
80+	146.7	168.6	0.87	146.1	134.3	1.09

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); World Health Organization (2006).

Appendix 6. Death rates per 1000 of Israeli Jews in comparison to the unweighted mean of Eastern European countries, by sex, 1997-1999

Age group	Males			Females		
	Israeli Jews	Eastern European countries mean	Ratio	Israeli Jews	Eastern European countries mean	Ratio
	a	b	c (a/b)	d	e	f (d/e)
0	5.3	9.7	0.55	4.2	7.7	0.55
1-4	0.3	0.6	0.45	0.2	0.5	0.37
5-9	0.1	0.3	0.48	0.1	0.2	0.37
10-14	0.2	0.3	0.59	0.1	0.2	0.61
15-19	0.5	0.8	0.63	0.2	0.3	0.58
20-24	0.9	1.1	0.83	0.2	0.4	0.54
25-29	0.7	1.2	0.63	0.3	0.4	0.64
30-34	0.9	1.7	0.50	0.5	0.6	0.78
35-39	1.2	2.8	0.44	0.6	1.1	0.54
40-44	1.8	5.0	0.35	1.0	1.9	0.51
45-49	2.6	7.7	0.33	1.7	3.0	0.57
50-54	4.3	11.8	0.36	2.7	4.4	0.61
55-59	7.2	17.1	0.42	4.1	6.8	0.60
60-64	12.3	26.0	0.47	7.4	10.8	0.68
65-69	21.8	37.9	0.58	13.4	18.2	0.74
70-74	34.2	57.1	0.60	22.6	31.6	0.71
75-79	53.6	85.5	0.63	39.9	55.7	0.72
80-84	93.5	133.6	0.70	75.6	101.8	0.74
85+	177.2	182.9	0.97	155.9	197.4	0.79

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years); Human Mortality Database (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Appendix 7. Death rates per 1000 of Israeli Jews in comparison to the unweighted mean of Eastern European countries, by sex, 1951-1953

Age group	Males			Females		
	Israeli Jews	Eastern European countries mean	Ratio	Israeli Jews	Eastern European countries mean	Ratio
	a	b	c (a/b)	d	e	f (d/e)
0	42.0	78.6	0.53	37.3	63.8	0.59
1-4	3.1	3.9	0.79	2.9	3.7	0.78
5-9	1.0	1.0	1.00	0.6	0.8	0.85
10-14	0.7	0.9	0.81	0.6	0.7	0.89
15-19	1.7	1.6	1.02	0.8	1.2	0.66
20-24	2.3	2.4	0.98	1.0	1.6	0.64
25-29	1.7	2.4	0.74	1.1	1.7	0.67
30-34	1.6	2.6	0.63	1.4	1.9	0.72
35-39	2.0	3.1	0.66	2.0	2.4	0.84
40-44	2.6	4.2	0.60	2.7	3.1	0.88
45-49	4.6	6.4	0.72	3.9	4.5	0.88
50-54	8.5	10.5	0.81	6.1	6.7	0.91
55-59	12.7	16.4	0.78	9.5	10.3	0.92
60-64	22.9	25.9	0.89	17.2	17.1	1.00
65-69	35.3	39.5	0.89	28.1	29.2	0.97
70-74	58.0	61.7	0.94	50.7	50.5	1.00
75+	113.5	137.7	0.82	108.5	123.2	0.88

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* various years); Human Mortality Database (2007).

Appendix 8. Death rates per 1000 for different subgroups among Israeli Jews in comparison to the unweighted mean of Western countries, 1960s-1990s-Males

	Mid 1960s						
Age	Death rates per 1000				Ratio		
group	WEST	Ashkenazi	Sephardi	Israeli-born	Ashkenazi	Sephardi	Israeli-born
	(a)	(b)	(c)	(d)	(b/a)	(c/a)	(d/a)
45-49	5.6	3.5	4.7	3.5	0.62	0.83	0.62
50-54	9.2	6.5	7.9	8.3	0.70	0.86	0.90
55-59	15.2	11.4	12.6	11.1	0.75	0.83	0.73
60-64	24.5	20.0	21.3	21.2	0.82	0.87	0.87
65-69	37.9	32.1	38.4	40.6	0.85	1.01	1.07
70-74	58.1	50.8	58.6	51.6	0.87	1.01	0.89
75+	127.0	109.5	105.0	83.1	0.86	0.83	0.65
	Mid 1970s						
	Death rates per 1000				Ratio		
	WEST	Ashkenazi	Sephardi	Israeli-born	Ashkenazi	Sephardi	Israeli-born
	(a)	(b)	(c)	(d)	(b/a)	(c/a)	(d/a)
45-49	5.5	4.3	4.6	4.5	0.78	0.83	0.82
50-54	8.9	7.1	7.8	6.4	0.80	0.88	0.72
55-59	14.0	11.4	12.8	11.0	0.81	0.91	0.79
60-64	22.5	18.2	22.8	18.0	0.81	1.01	0.80
65-69	35.8	31.2	34.3	32.7	0.87	0.96	0.91
70-74	56.4	50.7	57.6	44.6	0.90	1.02	0.79
75+	123.4	108.4	110.9	83.3	0.88	0.90	0.68
	Late 1990s								
	Death rates per 1000					Ratio			
	WEST	Ashkenazi	Asia-born	Africa-born	Israeli-born	Ashkenazi	Asia-born	Africa-born	Israeli-born
	(a)	(b)	(c)	(d)	(e)	(b/a)	(c/a)	(d/a)	(e/a)
45-49	3.3	3.4	2.9	2.8	2.3	0.96	0.81	0.79	0.64
50-54	5.1	5.0	4.1	4.4	3.7	0.91	0.74	0.79	0.68
55-59	8.0	8.4	7.2	8.4	5.7	0.98	0.83	0.97	0.66
60-64	13.1	13.0	12.4	13.4	11.0	0.92	0.88	0.95	0.78
65-69	21.7	21.1	22.6	25.6	17.6	0.91	0.97	1.10	0.76
70-74	35.2	32.2	36.8	41.3	30.2	0.85	0.98	1.09	0.80
75-79	57.0	52.3	57.7	70.2	47.5	0.86	0.95	1.15	0.78
80-84	95.7	90.6	92.3	114.2	79.0	0.89	0.91	1.12	0.78
85+	183.2	180.1	175.2	206.6	98.9	0.93	0.90	1.06	0.51

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel,* various years);

World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Appendix 9. Death rates per 1000 for different subgroups among Israeli Jews in comparison to the unweighted mean of Western countries, 1960s-1990s-Females

Age group	Mid 1960s: Death rates per 1000 WEST (a)	Ashkenazi (b)	Sephardi (c)	Israeli-born (d)	Ratio Ashkenazi (b/a)	Sephardi (c/a)	Israeli-born (d/a)
45-49	3.3	3.4	3.7	3.1	1.04	1.13	0.94
50-54	4.9	5.2	7.1	4.8	1.05	1.44	0.97
55-59	7.6	8.3	11.8	9.7	1.09	1.55	1.28
60-64	12.5	14.7	21.5	15.9	1.18	1.72	1.27
65-69	21.2	24.3	35.9	26.5	1.15	1.70	1.25
70-74	37.3	40.4	52.7	38.8	1.08	1.41	1.04
75+	104.8	101.9	102.4	82.0	0.97	0.98	0.78

	Mid 1970s: Death rates per 1000 WEST (a)	Ashkenazi (b)	Sephardi (c)	Israeli-born (d)	Ratio Ashkenazi (b/a)	Sephardi (c/a)	Israeli-born (d/a)
45-49	2.9	3.0	3.3	2.6	1.03	1.13	0.89
50-54	4.5	4.4	5.2	4.4	0.98	1.16	0.98
55-59	6.8	7.8	9.9	8.4	1.15	1.46	1.24
60-64	10.7	13.3	16.8	13.0	1.25	1.57	1.22
65-69	17.5	21.9	30.7	20.5	1.25	1.75	1.17
70-74	30.9	37.1	53.6	38.3	1.20	1.73	1.24
75+	94.5	97.9	110.1	88.3	1.04	1.17	0.93

	Late 1990s: Death rates per 1000 WEST (a)	Ashkenazi (b)	Asia-born (c)	Africa-born (d)	Israeli-born (e)	Ratio Ashkenazi (b/a)	Asia-born (c/a)	Africa-born (d/a)	Israeli-born (e/a)
45-49	1.8	2.0	1.7	1.7	1.5	0.99	0.87	0.84	0.75
50-54	2.8	2.8	2.8	2.8	2.4	0.91	0.93	0.91	0.81
55-59	4.2	4.8	3.9	4.3	3.4	1.05	0.86	0.93	0.74
60-64	6.6	7.9	7.2	8.5	5.7	1.09	1.00	1.18	0.80
65-69	10.7	12.7	13.7	16.2	10.5	1.08	1.16	1.37	0.89
70-74	18.5	21.8	22.8	29.7	17.4	1.09	1.14	1.48	0.87
75-79	33.0	38.4	41.1	54.5	30.2	1.08	1.16	1.54	0.85
80-84	63.0	72.4	80.8	98.8	62.2	1.08	1.20	1.47	0.93
85+	150.0	154.4	164.4	170.1	112.5	0.97	1.04	1.07	0.71

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years);

World Health Organization (2006); special datafile prepared by the Central Bureau of Statistics, Israel.

Appendix 10. Death rates per 1000 for different subgroups among Israeli Jews in comparison to the unweighted mean of Eastern European countries, 1960s and 1990s-Males

	Mid 1960s						
Age	Death rates per 1000				Ratio		
group	Eastern Europe	Ashkenazi	Sephardi	Israeli-born	Ashkenazi	Sephardi	Israeli-born
	(a)	(b)	(c)	(d)	(b/a)	(c/a)	(d/a)
45-49	5.1	3.5	4.7	3.5	0.69	0.92	0.69
50-54	8.3	6.5	7.9	8.3	0.78	0.95	1.00
55-59	14.2	11.4	12.6	11.1	0.80	0.89	0.78
60-64	24.0	20.0	21.3	21.2	0.83	0.89	0.88
65-69	38.4	32.1	38.4	40.6	0.84	1.00	1.06
70-74	59.8	50.8	58.6	51.6	0.85	0.98	0.86
75+	128.8	109.5	105.0	83.1	0.85	0.82	0.65

	Late 1990s								
	Death rates per 1000					Ratio			
	Eastern Europe	Ashkenazi	Asia-born	Africa-born	Israeli-born	Ashkenazi	Asia-born	Africa-born	Israeli-born
	(a)	(b)	(c)	(d)	(e)	(b/a)	(c/a)	(d/a)	(e/a)
45-49	7.7	3.4	2.9	2.8	2.3	0.44	0.37	0.36	0.29
50-54	11.8	5.0	4.1	4.4	3.7	0.42	0.34	0.37	0.31
55-59	17.1	8.4	7.2	8.4	5.7	0.49	0.42	0.49	0.33
60-64	26.0	13.0	12.4	13.4	11.0	0.50	0.48	0.51	0.42
65-69	37.9	21.1	22.6	25.6	17.6	0.56	0.60	0.68	0.46
70-74	57.1	32.2	36.8	41.3	30.2	0.56	0.64	0.72	0.53
75-79	85.5	52.3	57.7	70.2	47.5	0.61	0.67	0.82	0.56
80-84	133.6	90.6	92.3	114.2	79.0	0.68	0.69	0.85	0.59
85+	182.9	180.1	175.2	206.6	98.9	0.98	0.96	1.13	0.54

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years);

Human Mortality Database (2007); special datafile prepared by the Central Bureau of Statistics, Israel.

Appendix 11. Death rates per 1000 for different subgroups among Israeli Jews in comparison to the unweighted mean of Eastern European countries, 1960s and 1990s-Females

	Mid 1960s						
Age	Death rates per 1000				Ratio		
group	Eastern Europe	Ashkenazi	Sephardi	Israeli-born	Ashkenazi	Sephardi	Israeli-born
	(a)	(b)	(c)	(d)	(b/a)	(c/a)	(d/a)
45-49	3.4	3.4	3.7	3.1	1.00	1.09	0.92
50-54	5.1	5.2	7.1	4.8	1.02	1.40	0.94
55-59	8.0	8.3	11.8	9.7	1.04	1.48	1.21
60-64	13.5	14.7	21.5	15.9	1.09	1.59	1.18
65-69	23.9	24.3	35.9	26.5	1.02	1.50	1.11
70-74	42.6	40.4	52.7	38.8	0.95	1.24	0.91
75+	110.7	101.9	102.4	82.0	0.92	0.92	0.74

	Late 1990s								
	Death rates per 1000					Ratio			
	Eastern Europe	Ashkenazi	Asia-born	Africa-born	Israeli-born	Ashkenazi	Asia-born	Africa-born	Israeli-born
	(a)	(b)	(c)	(d)	(e)	(b/a)	(c/a)	(d/a)	(e/a)
45-49	3.0	2.0	1.7	1.7	1.5	0.66	0.57	0.56	0.50
50-54	4.4	2.8	2.8	2.8	2.4	0.62	0.63	0.62	0.55
55-59	6.8	4.8	3.9	4.3	3.4	0.70	0.57	0.62	0.50
60-64	10.8	7.9	7.2	8.5	5.7	0.73	0.66	0.79	0.53
65-69	18.2	12.7	13.7	16.2	10.5	0.70	0.75	0.89	0.57
70-74	31.6	21.8	22.8	29.7	17.4	0.69	0.72	0.94	0.55
75-79	55.7	38.4	41.1	54.5	30.2	0.69	0.74	0.98	0.54
80-84	101.8	72.4	80.8	98.8	62.2	0.71	0.79	0.97	0.61
85+	197.4	154.4	164.4	170.1	112.5	0.78	0.83	0.86	0.57

Source. Central Bureau of Statistics, Israel (*Statistical Abstract of Israel*, various years);

Human Mortality Database (2007); special datafile prepared by the Central Bureau of Statistics, Israel.