POPULATION HEALTH

Trends in the gap in life expectancy between Arabs and Jews in Israel between 1975 and 2004

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Objectives
To examine trends in the Arab–Jew life expectancy gap in Israel during 1975–2004 and to determine the contribution of age groups and causes of death to changes in the gap.

Methods
Data on life expectancy and mortality rates by cause of death, for Arabs and Jews, were obtained from the Israel Central Bureau of Statistics. Standard life table techniques were used for decomposition analysis to explore the contribution to changes in the life expectancy gap.

Results
While life expectancy of Arabs was lower than Jews during 1975–2004, there was a decline in this gap during 1975–98. However, during the following years the gap increased and the difference in 2004 was 3.2 years for men and 4 years for women. During 2000–04, the main causes of death contributing to the gap in life expectancy were chronic diseases, mainly heart disease and diabetes. Heart disease mortality contributed mostly to the overall life expectancy gap for males and females, accounting for 0.89 and 1.17 years, respectively. The age group 465 years contributed most to the gap (1.33 years among males, and 2.42 years among females).

Conclusions
Following a period of reduction, the gap in life expectancy at birth between Arabs and Jews in Israel has started to widen. These findings indicate the need for increased attention to primary prevention and disease management in the Arab population. Reducing social and individual risk factors for major causes of death should be a national priority.

Keywords
Life expectancy, gap, Arabs, Jews, causes of death, decomposition analysis

Introduction
Life expectancy is one of the major health indicators of community health and a sensitive measure for health disparities. In most countries, it has increased markedly during the 20th century, although differences remain substantial both internationally and within populations.1 In a comparison of life expectancy at birth in 2006, among 193 member
countries of the World Health Organization (WHO), the highest life expectancy for men was found in San Marino (80.0 years), whereas Japan had the highest life expectancy for women (86.0 years). Sierra Leone had the lowest male life expectancy (37.0 years), whereas Swaziland had the lowest female life expectancy (37.0 years). Israel was ranked 7th for men and 12th for women.

Differences in life expectancy can be attributed to many individual and environmental factors, and have been associated consistently with per capita income. In the Arabian peninsula, due to the improvement in socio-economic conditions and a gradual improvement in health status, life expectancy at birth has increased markedly. For example, the health of Kuwaitis has improved considerably in the past 20 years, owing to economic and social transformations that have ameliorated the problems of nutrition, sanitation, personal hygiene, housing and social conditions in general and health services, and life expectancy is now comparable with developed countries.

Marked differences in life expectancy are also observed between sub-populations within the same country. In the USA, in 2003, life expectancy at birth was 80.5 years in White females as compared with 76.1 years in Black females, and 75.4 years among White males as compared with 69.2 years among Black males. In Australia, life expectancy among the indigenous population is substantially lower compared with the non-indigenous population, with differences ranging between 15.7 and 17.6 years in 1996–2000. Some direct factors that could influence life expectancy include patterns of mortality, distribution of diseases, and features of the health system that may influence access to health-care services.

In Israel there are two main population groups, and, at the end of 2006, Jews comprised 80% of the population and Arabs nearly 20% of the population. Israeli Arab citizens have lived within the state of Israel since its establishment in 1948. During the past three decades, the Arab population in Israel has been undergoing socio-demographic changes, with improvement in several major health indicators. For example, infant mortality rates fell from 41.3 per 1000 live births in 1975 to 8.4 per 1000 live births in 2005. Total fertility rates have decreased substantially from 8.5 in 1975 to 4.0 in 2005. The patterns of leading causes of death have shifted largely from infectious diseases to chronic illnesses. Despite the improvement in various health indicators, life expectancy remains higher among Jews than Arabs. The aims of the current study were to examine the trends in the gap in life expectancy between Arabs and Jews in Israel over the past 30 years and to explore potential causes of the observed trends.

Methods

Study design

A descriptive and analytic study was conducted on national mortality and life expectancy data during 1975–2004.

Target population

The target population comprised the two main Israeli subgroup populations: Jews and Arabs. It should be noted that the Israeli Arab population included in the present study do not refer to Palestinians living in the West Bank and Gaza Strip, whose health indicators differ substantially.

Data sources

Data on life expectancy, infant mortality and cause-specific mortality were obtained from the Israel Central Bureau of Statistics (ICBS). Death notification forms in Israel are sent by health-care facilities to the district health offices and are forwarded to the ICBS for coding. First, the forms are reviewed and corrected through feedback channels with the registration offices and health-care facilities, and then the cause of death is coded. Up to 1994, causes of death were coded according to the International Classification of Diseases, 9th edition (ICD-9), thereafter they were coded according to ICD-10. In this study, heart disease included the codes 100–109, 111, 113, 120–151, 390–398, 402, 404, 410–429; cancer included C00–C97, 140–208, 238.6, 273.3, 289.8; stroke included I60–69, G45, 430–438; diabetes included E10–E14, 250; external injuries included V01–99, W00–99, X00–84, Y00–Y86, 800–999; and infectious diseases included the codes A00–A32, A34–A99, B00–B99, 1–134,136–139.

Statistical analysis

Trends in the gap in life expectancy at birth, at the ages of 20 and 65 years, between 1975 and 2004 were described by sex and population groups. The differences in infant mortality rates (per 1000 live births) between Arabs and Jews were calculated in males and females between 1975 and 2005. Cause-specific age-adjusted mortality rates were calculated per 100 000 for males and females, by population group over 23 years (1980–2003). Mid-year population estimates were obtained from the ICBS and served as denominators. The population of the Israel 1983 census was used as the standard population for age-adjusted rates. The trends in the difference in cause-specific patterns of mortality between Arabs and Jews were calculated over this period.

To measure the contribution of age-specific mortality changes to the change in the Arab–Jew life expectancy gap, we used the decomposition method developed by Arriaga. For all causes combined, the first method estimates the contribution of mortality
differences in a specific age group to the total difference in life expectancy at birth. By using this method, the total difference in life expectancy between the two subpopulations, Jews and Arabs, is decomposed into smaller differences pertaining to the specific contribution of each age group. The second method, an extension of the first one, estimates contribution of differences in cause-specific death rates to the total difference in life expectancy.  

The specific contribution of differences in mortality rates to life expectancy from cause \( i \) at ages \( x \) to \( x+n \), \( n\Delta x, i \), can be estimated as:

\[
n\Delta x, i = \frac{n\Delta x \times \left[ \frac{m_{x,i}(A) - \frac{n}{p} M_{x,i}(J)}{m_{x}(A) - \frac{n}{p} M_{x}(J)} \right]}{nM_{x,i}(A) - \frac{n}{p} M_{x}(A)}
\]

where \( m_{x,i}(A) \) represents the Arab age-standardized death rate from cause \( i \) at ages \( x \) to \( x+n \) and \( m_{x}(A) \) represents Arabs age-standardized death rate from all-causes combined at the same ages. Similarly, \( m_{x,i}(J) \) and \( m_{x}(J) \) represent the age-standardized death rates from cause \( i \) and from all causes combined, respectively, among Jews at ages \( x \) to \( x+n \). \( n\Delta x \) represents the gap in life expectancy from all causes at ages \( x \) to \( x+n \), which was estimated in the first decomposition.

Results

Life expectancy at birth in Israel increased substantially during the period 1975–2004 among both males and females, Arabs and Jews. During the whole period life expectancy of the Arab population was lower than that of the Jewish population (Figure 1). Since 1998, life expectancy in the Arab population has reached a plateau compared with a continuous rise in the Jewish population, resulting in an increase in the gap in life expectancy between the two populations (Figure 1).

The gap in life expectancy at birth

In 1975–79, the gap in life expectancy at birth between Arabs and Jews was 2.5 and 3.3 years for males and females, respectively. This gap was reduced during the 1980s among both sexes. However, it increased between 1990 and 2004, and reached 3.3 and 3.7 years in males and females, respectively, in 2000–04 (Figure 2).

The gap in life expectancy at age 20 years

During 1975–89, the gap in life expectancy at age 20 years between Arab and Jewish men was <1 year, and was between 1.4 and 1.3 years in females (Figure 3). Since 1990, this gap increased consistently, and in 2000–04 it reached 2.6 and 3.1 years in males and females, respectively (Figure 3).

The gap in life expectancy at age 65 years

In 1975–99, life expectancy at age 65 years was in favour of Arab men. However, in 2000–04, this was reversed (Figure 4). Among women the difference between Arabs and Jews was 0.5 year in 1975–79 and it has progressively increased since the early 1990s with a sharp rise in 2000–04 (Figure 4).

![Figure 1](image1.png)

Figure 1 Life expectancy at birth in Israel by sex and population group (Arabs and Jews), 1975–2004. Source: CBS, pp. 212–13
Infant mortality rates
During 1975–94, the differences in infant mortality rates between Arabs and Jews decreased substantially and have remained constant since then (Figure 5).

Leading causes of death
Age-adjusted mortality rates of the leading causes of death between 1980 and 2004 are presented in Table 1. Among males, mortality rates of stroke and heart disease declined during 1980–2004 in Arabs and Jews. However, the decline in heart disease mortality was greater in Jewish than Arab men. The age-adjusted mortality rates of diabetes increased in Arab and Jewish men. This increase was greater in the Arab men during 1980–99. Since 2000, the mortality rates of diabetes have declined in Jews but continued to increase in Arabs. For cancer (all sites), the average mortality rates have declined in Arab and Jewish men since 1995, but this decline was greater among Jewish men. For lung cancer in males, the mortality rates during 1980–2004 increased among Arab men and have not changed among Jewish men. Mortality rates of lung cancer are currently higher in Arab males than Jewish males (data not shown). For deaths due to external causes, the average rates among Jewish men declined substantially during 1990–2004. However, among Arabs, these rates were stable until 1999 and have declined only since 2000 (Table 1).

For females the trends in mortality rates of heart disease, stroke, cancer (all sites), external causes and diabetes were similar to that observed in males. Infectious diseases mortality rates declined in the two populations in both sexes during 1985–99. However, since 2000, an increase has been observed in the Arab population compared with a continuous decline among the Jewish population (Table 1).

The gap in the leading causes of death between Arabs and Jews
Figure 6 shows the trends in the gap of the major causes of death between Arabs and Jews in Israel in 1980–2004. Among males, the positive gap in mortality rates between Jews and Arabs increased substantially in this period for heart disease and diabetes; however, the negative gap for cancer decreased and was eventually replaced by a positive gap in 2000–04 (Figure 6). Since 1999, for specific cancers such as lung cancer, the gap has increased substantially.
Among females, the positive gap in mortality rates between Jews and Arabs increased substantially during 1980–2004 for diabetes, whereas the gap in heart disease mortality that remains the biggest among all causes, has decreased since 1990. However, the negative gap for cancer decreased (Figure 6). For specific cancers like breast cancer, the gap in mortality rates has been reduced even further since 1999.

The contributions of the leading causes of death and age groups to the Arab–Jewish life expectancy gap, based on the decomposition analysis

Table 2 shows the distribution of the major causes of death contributing to the Arab–Jewish life expectancy gap in 1980–84, 1990–94 and 2000–04. Among males, death due to stroke contributed mostly to the 2.53-year overall gap in 1980–84 (0.58 year, 22% of the gap) followed by chronic obstructive pulmonary disease (COPD) (0.28 year, 22% of the gap). In 1990–94 heart disease contributed most to the 1.31-year overall gap (0.6 year, 31% of the gap) followed by COPD (0.4 year, 27%) and stroke (0.37 year, 12%). Some of the increase in the gap in life expectancy was offset by cancer, which is lower in Arab than in Jewish males. It is estimated that cancer decreased the gap between males by 0.84 year in 1980–84, 0.79 year in 1990–94 and 0.48 year in 2000–04.

Table 3 shows the contribution of age groups to the Arab–Jewish gap in 1975–79, 1990–94 and 2000–04. The age group that most affected the gap in 1975–79 was 0–4 years in both males (1.47 years) and females (1.67 years). Over time, the Arab–Jewish gap has become more concentrated at older ages. The impact of the age group 5–65 years increased from –0.28 year (–10.9%) in 1975–79 to 1.33 years (40.8%) in 2000–04 among males, and from 0.4 year (12%) to 2.42 years (64%) among females.

Discussion

In this study we examined the changes in the gap in life expectancy during 1975–2004 between Arabs and Jews in Israel and potential explanations for these changes. While life expectancy of Arabs was lower than Jews during 1975–2004, there was a decline in this gap from 1975 to 1998. However, during the following years the gap increased and the differences in 2004 were 3.2 years for men and 4 years for women. The gap in life expectancy between Arabs and Jews also increased at the ages of 20 and 65 years. During 2000–04, the main causes of death...
Contributing to the gap in life expectancy at birth were chronic diseases, mainly heart disease and diabetes. Heart disease mortality contributed mostly to the overall life expectancy gap for males and females, accounting for 0.89 and 1.17 years, respectively. The age group 45–65 years contributed most to the gap (1.33 years among males and 2.42 years among females).

The narrowing gap in infant mortality between Arabs and Jews between 1975 and 1994 explained much of the decrease in the gap in life expectancy at birth between the two populations. Since 1995, this difference has remained constant and it appears that the difference in life expectancy between the two populations moved from pronounced disparities in age-specific mortality rates at ages 0–10 years and at ages 45–70 years. The decomposition analysis applied in this study reveals that the leading age groups contributing to the Arab–Jewish gap has shifted over the time and, in 2000–04, the age group ≥65 years made the largest contribution to the gap for both males and females.

In a study carried out in North Africa, it was found that life expectancy at birth was 50–52 years in 1970 but rose to 64–70 years in 1993, a change that was attributed to the decline in infant mortality rates.

**Leading causes of death**

In the present study, the increasing gap in the mortality rates for the main leading causes of death adjusted for age between Arabs and Jews explains much of the trends in the gap in life expectancy between the two populations. This is similar to the USA where the main causes of death also contributed to the Black–White life-expectancy gap between 1983 and 2003. Amongst males, the largest contributor to
the gap was homicide in 1983 and 1993, but by 2003
heart disease became the leading cause, followed by
homicide, human immunodeficiency virus and peri-
natal deaths.24 For females, heart disease made the
largest contribution to the overall life expectancy
gap; other important causes included diabetes,
stroke and perinatal death.24

In males, the gap in heart disease, cancer and dia-
betes mortality rates between Arabs and Jews
increased during 1980–2004.25 During this period,
for all causes of death, the age-adjusted rates of all
main causes of deaths in Israeli Arabs have been
higher than in Jews, except for malignant neo-
plasms.25 The lower cancer mortality rates among
Arabs has helped to reduce the life expectancy gap
between the two groups. In the past few years, mor-
tality due to cancer has declined more rapidly among
Jews, rendering the differences between the two
populations less significant. If these trends continue,
they are expected to influence the future gap in life
expectancy. Specifically, we expect cancer to become a
weaker suppressor of the gap than it was in the past
and thus the gap is expected to become even wider.
The life-expectancy gap between Arabs and Jews
has become more evident at older ages. The contribu-
tion of the age group 5–65 years increased and has
become the largest among both males and females in
2000–04. For Israeli Arabs the rate of ischaemic heart
disease adjusted for age was around 1.2 times higher
than for Jews in 2004.26

Differences in the leading causes of death between
Arabs and Jews are influenced by changes in
socio-economic status, primary preventive measures
such as vaccinations and behavioural factors (diet,
smoking, obesity, physical exercise, etc.), treatment
of chronic diseases (compliance), availability, accessi-
bility and use of health services, and some genetic
factors. These can partly explain the increasing gap
in life expectancy between Arabs and Jews. The
prevalence of cigarette smoking has been higher in

Table 2 Causes of death contributing to the Arab–Jewish life expectancy gap at birth in 1980–84, 1990–94 and 2000–04 by sex

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Life expectancy gap, years (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart diseases</td>
<td>0.28 (12) 0.84 (42) 0.89 (27)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.03 (1) 0.14 (7) 0.58 (18)</td>
</tr>
<tr>
<td>COPD</td>
<td>0.52 (22) 0.41 (21) 0.37 (11)</td>
</tr>
<tr>
<td>External injuries</td>
<td>0.12 (5) 0.23 (12) 0.30 (9)</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.53 (22) 0.28 (14) 0.18 (6)</td>
</tr>
<tr>
<td>Cancer (all site)</td>
<td>−0.64 (−27) −0.55 (−28) 0.17 (5)</td>
</tr>
<tr>
<td>Infectious diseases</td>
<td>0.14 (6) 0.01 (1) 0.11 (3)</td>
</tr>
<tr>
<td>Kidney disease</td>
<td>0.04 (1) −0.05 (−2) 0.11 (3)</td>
</tr>
<tr>
<td>Congenital anomalies</td>
<td>0.14 (6) 0.17 (9) 0.11 (3)</td>
</tr>
<tr>
<td>Perinatal causes</td>
<td>0.11 (5) 0.07 (4) 0.04 (1)</td>
</tr>
<tr>
<td>Chronic liver disease</td>
<td>0.03 (1) 0.05 (3) 0.01 (0)</td>
</tr>
<tr>
<td>Other causes</td>
<td>1.07 (46) 0.38 (17) 0.39 (14)</td>
</tr>
<tr>
<td>Total</td>
<td>2.37 (100) 1.98 (100) 3.26 (100)</td>
</tr>
</tbody>
</table>

Table 3 Contribution of age groups to the Arab–Jewish life expectancy gap in 1975–79, 1990–94 and 2000–04 by sex

<table>
<thead>
<tr>
<th>Age group</th>
<th>Life expectancy gap, years (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–0</td>
<td>1.47 (57.5) 0.63 (31.6) 0.52 (16)</td>
</tr>
<tr>
<td>5–19</td>
<td>0.24 (9.5) 0.16 (8.0) 0.19 (5.7)</td>
</tr>
<tr>
<td>20–44</td>
<td>0.47 (18.4) 0.26 (13.3) 0.25 (7.7)</td>
</tr>
<tr>
<td>45–64</td>
<td>0.65 (25.5) 1.1 (55.5) 0.97 (29.8)</td>
</tr>
<tr>
<td>&gt;65</td>
<td>−0.28 (−10.9) −0.17 (−8.4) 1.33 (40.8)</td>
</tr>
<tr>
<td>Total</td>
<td>2.55 (100) 1.98 (100) 3.26 (100)</td>
</tr>
</tbody>
</table>
Conclusions

The leading age group currently contributing to the Arab–Jewish gap in life expectancy is ≥65 years. The main causes of death contributing to the increasing gap in life expectancy for males are heart disease, diabetes, COPD and external injuries, and for females, heart disease, diabetes and stroke, and a decrease in the favourable gap for cancer mortality. Our results suggest that the trends in the Arab–Jewish life expectancy gap can be explained by different trends in the causes of death from chronic diseases and external injuries. These may be partly a result of changes in general social and economic circumstances and impact directly and indirectly on the recent increasing gap in life expectancy between Arabs and Jews. Reducing social and individual risk factors for major causes of death, particularly in the Arab population, should be a national priority.

Conflict of interest: The contents of this paper are the responsibility of the authors alone, and do not necessarily reflect the views of the Israel Ministry of Health.

Limitations and strengths of the study

The gap in mortality from heart disease and stroke between male Arabs and Jews may be due to differences in morbidity and case-fatality between the two diseases. These factors could not be evaluated with the data currently available. Coding of causes of death is unlikely to be responsible for changes in the life-expectancy gap, since they are expected to affect both populations equally. It could slightly affect the causes we found to be responsible for the gap.