

# Infant mortality in Israel during 1950–2000: rates, causes, demographic characteristics and trends

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## Summary

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We evaluated the trends and risk factors in infant mortality in Israel over five decades (1950–2000), based on data obtained from the official notifications of live births, and death certificates. Until the 1960s the main cause of infant mortality was infectious disease; this was replaced by congenital anomalies in Moslems and Druzes, and preterm birth in Jews and Christians. In 2000, there were 746 infant deaths, and the national infant mortality rate (IMR) was 5.4 per 1000 live births (Jews 3.9; [95% CI 3.5, 4.3]; Moslems 9.2 [8.3, 10.3]; Christians 3.6 [1.4, 5.8]; Druzes 6.3 [3.6, 9.0]). Between 1955 and 2000 the overall IMR declined sevenfold (absolute declines of 56.8, 56.3, 45.0 and 28.3 per 1000 live births, in Moslems, Druzes, Christians and Jews, respectively). The reduction in IMRs between 1990 and 2000 in all religious groups (>45%) exceeded the goal set by the World Summit for Children in 1990 of 33%. In 2000, the main risk factors were birthweight <1500 g [relative risk (RR) = 69], major congenital malformations (RR = 22.0 [18.8, 25.7], and multiple births (RR of 9.3 and 4.2 in triplets and twins respectively). We conclude that the marked decline in IMRs in Israel over five decades reflects a major improvement in population health. Today, infant mortality in Israel represents a unique combination of high rate of congenital malformations among Moslems, where consanguineous marriages are common, and medical termination of pregnancy of malformed fetuses are infrequent; and relatively high IMRs from preterm birth in Jews, associated with high rates of assisted reproduction.

## Introduction

The infant mortality rate (IMR) is widely accepted as an index of general community health.<sup>1</sup> As such, IMRs are used internationally to compare standards of health and health care in different countries. The first goal set forth by the World Summit for Children, assembled at the United Nations in 1990, was a reduction of the infant and under-5 child mortality rate by one-third in 10 years.<sup>2</sup>

In Israel, as in other countries, trends in infant mortality of the various population groups are studied in order to monitor changes in the health status of infants and their mothers, inequalities in health and the quality of health services. They are also used to determine factors in the physical and social environment that

influence the health of mothers and children and to identify high-risk groups who require special health care services and interventions.

The present report describes the national IMRs in Israel and the specific IMRs of the four main religious sub-groups since 1950. We analyse causes, trends and risk factors for infant mortality and identify a plan of action for a further reduction in IMRs.

## Methods

For calculation of IMRs, the case definition of infant mortality is dependent on the definition of live birth. The definition of a live birth, adopted by the World Health Assembly is: 'the complete expulsion or extrac-

tion from the mother of a product of conception, irrespective of the duration of pregnancy, which, after the separation, breathes or shows any other evidence of life, such as beating heart, pulsation of the umbilical cord or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached.<sup>3</sup>

The WHO definition of IMR is: probability of dying between birth and exactly one year of age expressed per 1000 live births.<sup>4</sup> In this report, IMRs were calculated by cohorts: i.e. the number of infants dying between birth and exactly one year of age in a given calendar year per 1000 live births in that year. The difference between IMRs calculated by these two methods is negligible since almost two-thirds of deaths occur within one month of birth, and the variation in the number of deliveries between two consecutive cohorts is small. Data on infant mortality are collected and analysed by the Central Bureau of Statistics and by the Department of Mother, Child and Adolescent Health, in the Ministry of Health. Data are based on the National Population Register, on the official notifications of live births and on death certificates.

Demographic data, such as religion, maternal age, birthweight and the type of delivery (singleton or multiple births), are registered in the official notifications of births. The composition of newborns in Israel in the year 2000 ( $n = 136\,390$ ) by religion was: Jews 67.4%, Moslems 26.2%, Christians 2.0%, Druzes 1.99%, no defined religion 2.4%. The Druze community in Israel is officially recognised as a separate religious entity with its own courts and spiritual leadership. Their culture is Arab and their language Arabic but they are not within mainstream Arab nationalism. Worldwide there are probably about one million Druzes, with 104 000 in Israel. To assess whether cultural and socio-economic differences between the various religious groups in Israel may be significant health determinants, with regard to infant mortality, the specific IMRs for these four religion subgroups were calculated and compared.

Trends of IMRs over the years are reported separately for all four religious groups. However one should stress the fact that Moslems, Druzes and most Christians are considered by themselves and the Israeli Central Bureau of Statistics as Arabs. They share the same Arabic language and basically the same social values. For the purpose of comparison and due to the relatively small numbers of the population of Christians and Druzes and people who consider themselves

as without religion and national identity, the other demographic variables are reported for Jews and the other religious groups combined as a single category (Arabs).

In Israel, over 99% of the deliveries in the Jewish population have been in hospital since the 1950s. However, in the Arab population the rate of deliveries in hospital was low in the 1950s and 1960s, and increased to 90% only in 1970 by providing social security incentives.<sup>5</sup> This rate has been >99% since the 1980s. Thus, data of IMRs and the cause of death in the Arab population before 1970 are less accurate and are incomplete. Major congenital malformations found on physical examination or other investigations carried out on newborns before discharge from the nursery, are reported to the Department of Mother, Child and Adolescent Health at the Ministry of Health from all 29 neonatal departments in Israeli hospitals. The completeness of these reports is about 85%. Mortality rates were computed arithmetically. Differences in specific IMRs between groups are reported as crude rates or percentages.

## Results

### *Rates and general trends during five decades*

In general, IMRs have been declining steadily over the past decades in all the four religious sub-populations (Fig. 1). The national IMR in the year 2000 was 5.4 per 1000 live births; Jews 3.9 [95% CI 3.5, 4.3]; Moslems 9.2 [8.3, 10.3]; Christians 3.6 [1.4, 5.8]; Druzes 6.3 [3.6, 9.0]. Rates in Moslems were approximately twofold higher than in Jews over the years. However, the difference in IMRs between Jews and Moslems has decreased considerably from 33.7 per 1000 live births in 1955 to 5.2 per 1000 live births in the year 2000.

A comparison of IMRs in 1955 and 2000 shows that the greatest absolute decline in the infant mortality was in the Moslem and Druze population, where infant mortality has declined by 56.8 and 56.3 per 1000 live births over the 45-year period respectively. Infant mortality declined by 45.0 per 1000 among Christians and by 28.3 per 1000 among Jews.

### *Causes of death*

The IMRs by main causes of death are described for Jews (Fig. 2) and Arabs (Fig. 3). Due to the incomplete data among Arabs during the 1950s, data in this pop-

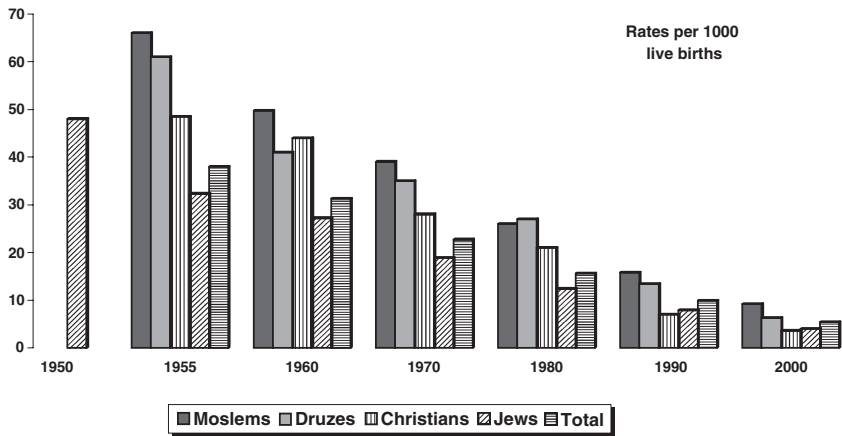


Figure 1. Infant mortality rates by religious groups in Israel during 1950–2000.

ulation are provided only for the years 1963–2000. Over these periods there has been a general decline in IMRs from all causes among both Jews and Arabs. There was a marked decline in IMR from infection over the years. Infectious diseases were the most common cause of infant mortality in Jews during the early 1950s and 1960s and in Arabs through the early 1960s and during 1969–71. In the year 2000, the IMRs from infections were only 0.12 [0.05, 0.19] and 0.36 [0.18, 0.55] per 1000 live births in Jews and Arabs respectively. In the year

2000, the major causes of infant mortality were preterm birth (IMR: 2.1 [1.8, 2.4] and 2.5 [2.0, 3.0] per 1000 live births in Jews and Arabs respectively), and congenital malformations (IMR: 0.9 [0.7, 1.1] and 3.4 [2.9, 4.0] per 1000 live births in Jews and Arabs respectively).

**Age at death**

About half (44.6%) of all infant deaths in the year 2000 were in the first week of life (early neonatal period)

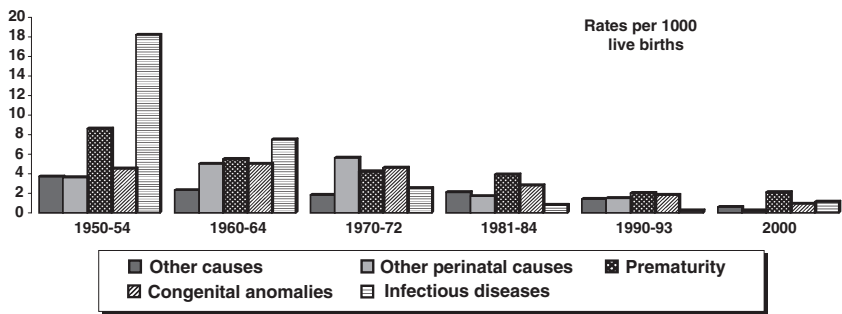


Figure 2. Trends in infant mortality rates among Jews in Israel by main cause of death, 1950–2000.

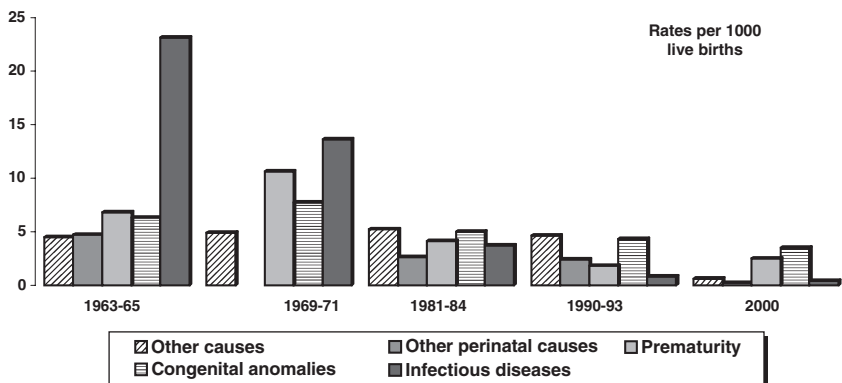


Figure 3. Trends in Infant mortality rates among Arabs in Israel by main cause of death, 1963–2000.

**Table 1.** Infant mortality rates by age at death, maternal age and education in Jews and Arabs, for the year 2000 (rates [95% CI] per 1000 live births)

	Jews	Arabs	RR Arabs/Jews
Early neonatal (0–7 days)	1.9 [1.6, 2.2]	3.5 [2.9, 4.0]	1.8 [1.4, 2.2]
Late neonatal (8–28 days)	0.8 [0.6, 1.0]	1.5 [1.1, 1.9]	1.9 [1.4, 2.7]
Post-neonatal (29–365 days)	1.2 [1.0–1.4]	3.7 [3.1, 4.3]	3.1 [2.4, 3.9]
All IMR (0–365 days)	3.9 [3.5–4.3]	8.7 [7.8, 9.6]	2.2 [1.9, 2.6]
Mother's age (years)			
<21	16.0 [9.4, 22.7]	20.0 [15.0, 25.6]	1.3 [0.8, 2.0]
21–25	5.2 [4.1, 6.3]	9.4 [7.8, 11.1]	1.8 [1.4, 2.4]
26–30	4.0 [3.3, 4.7]	7.4 [5.9, 8.9]	1.8 [1.4, 2.4]
31–35	2.9 [2.2, 3.5]	6.9 [5.1, 8.8]	2.4 [1.7, 3.4]
36–40	3.9 [2.8, 5.0]	7.7 [4.9, 10.5]	2.0 [1.2, 3.1]
>40	3.0 [1.2, 4.7]	7.0 [1.4, 12.6]	2.3 [0.9, 6.3]
Mother's years of schooling <sup>a</sup>			
0–8	8.3 [2.2, 14.4]	11.1 [8.9, 13.3]	1.3 [0.6, 2.9]
9–12	4.3 [3.5–5.9]	7.9 [6.7, 9.1]	1.9 [1.5, 2.3]
>12	3.0 [1.8–3.9]	5.5 [3.4, 7.5]	1.8 [1.4, 2.3]

RR, relative risk; IMR, infant mortality rate.

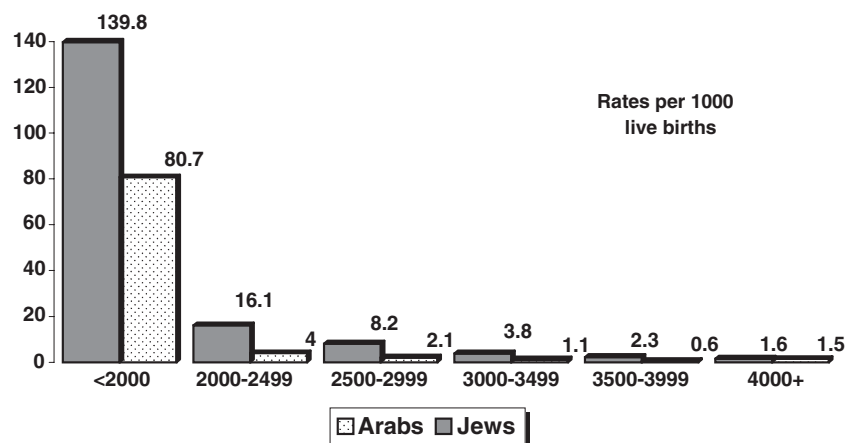
<sup>a</sup>Missing data on mother's school years in 34 448 cases.

and 63% were within the first 28 days of life (neonatal mortality). The proportion of deaths in the early neonatal period was larger among Jews than among Arabs (49.2% vs. 39.8%). Post-neonatal mortality rates (deaths occurring between 28 and 365 days) accounted for 30.9% of all infant deaths among Jews and 42.9% among Arabs. However, the difference in post-neonatal mortality rates between Jews and Arabs is especially striking: 1.2 [1.0, 1.4] and 3.7 [3.1, 4.3] per 1000 live births in Jews and Arabs respectively (Table 1). Mortality at this age is primarily related to congenital malformations.

### Risk factors for infant mortality in the year 2000

#### Birthweight

Infant mortality rates rise steeply for infants with birthweight < 2500 g for both Jews and Arabs, and slightly for infants with birthweight > 4000 g, in Jews (Fig. 4). The specific IMRs of infants with birthweight < 1500 g are not shown. In the year 2000, the IMRs in infants with birthweight < 1000 g were 422 and 600 per 1000 in Jews and Arabs respectively. The IMRs in infants with birthweight of 1000–1499 g were 37.8 and



**Figure 4.** Infant mortality rates in Jews and Arabs by birthweight in Israel, year 2000.

75.5 per 1000 live births in Jews and Arabs respectively. Overall, in the very-low-birthweight (VLBW) category (<1500 g), which comprises 1.24% of all neonates, there were 344 deaths out of 1690 live births (IMR of 204 per 1000 live births). By contrast, there were 398 infant deaths among the 134 700 live births with a birthweight of  $\geq 1500$  g (IMR of 2.95 per 1000 live births). Thus the relative risk (RR) for infant death for those with VLBW compared with infants with a birthweight of 1500 g and over was 69. Overall, the principal causes of death for infants with this birthweight are related to preterm birth. In 2000, preterm birth accounted for 53% of infant deaths among Jews and 29% among Arabs.

The lowest IMR was found for Jewish infants with birthweight of 3500–3999 g: 0.6 [0.3, 0.9] per 1000 live births. The rate was slightly higher (1.1 [0.8, 1.5] per 1000) for infants with birthweight of 3000–3499 g.

### Congenital malformations

In the year 2000, we have received notifications of major congenital malformations in 2740 infants (2.0% of all newborns). There were 232 deaths among those infants (8.5%), compared with 515 deaths among 133 650 infants where there were no reported major congenital malformations (0.39%). The RR for infant mortality in newborns with major congenital malformations, compared with those without reported major malformations, was 22.0 [18.8, 25.7].

There were large differences in the IMRs resulting from major congenital malformations between Jews and Arabs (0.9 [0.7, 1.1] and 3.4 [2.9, 4.0] per 1000 live births respectively, a RR of 3.8 [2.9, 5.0] in Arabs). Overall, congenital malformations accounted for most of the difference between IMRs in Jews and Arabs (3.9 and 8.7 per 1000 live births respectively).

### Singleton and multiple births

The rate of multiple births in Israel has been steadily increasing from 1.94% of all births in the years 1977–80,<sup>6</sup> to 3.36% during the years 1990–93,<sup>7</sup> 3.69% in 1993–96,<sup>8</sup> and 4.82% in the year 2000 (5.3% and 3.58% in Jews and Arabs respectively).

In the year 2000, IMR was 4.6 per 1000 singleton live births, compared with 20.8 per 1000 live births in multiple births (19.2 and 42.9 per 1000 live births in twin births and in triplets or quadruplets respectively). Compared with singletons, the RR for infant mortality

was 4.5 in multiple births (RR of 4.2 in twins, and 9.3 in triplets or quadruplets).

### Maternal age

Among both Jews and Arabs, IMRs were highest for infants of mothers <21 years of age, and lowest for infants of mothers in the age of 31–35 years (Table 1). The RR for infant mortality between these two age groups was 5.6 [3.5, 9.0] in Jews, and 2.9 [2.0, 4.3] in non-Jews.

### Maternal education

In each population group, IMRs decrease with increasing years of education of the mother (Table 1). In 2000, the IMR among infants born to mothers with 0–8 years of schooling was 2.8 [1.3, 6.0] and 2.0 [1.3, 3.1] times higher than that of infants born to mothers with >12 years of education in Jews and non-Jews respectively.

### Discussion

IMRs in Israel over 50 years show a dramatic decline in the whole population, and in all the four major religious groups. Data on IMRs are presented for Jews from 1950 and for the other three religion groups from 1955. Due to the fact that in the Jewish population over 99% of the deliveries were in hospital from the beginning of the 1950s, the completeness and accuracy of the data are likely to be satisfactory. However, in the Arab population the rate of deliveries in hospital reached 90% only in 1970<sup>5</sup> and reached >99% during the 1980s and thereafter. Thus, data on IMRs and the causes of death in the Arab population before 1970 are probably less accurate. Nevertheless, the reduction in IMRs, in all four religious groups, is steady and at similar rates since 1955. The reduction in the national IMR between 1990 and 2000 was 45%. Reduction of the specific IMR in all religious groups ranged between 41% in Moslems and 51% in Jews. These reductions markedly exceeded the goal set by the World Summit for Children in 1990 of 33% reduction in 10 years.<sup>2</sup> Although the gap in IMR between Jews and Moslems has decreased considerably over the years, the relative difference in IMR between Arabs and Jews remained quite stable over the decades (about twofold) and calls for action.

A recent report, entitled *We the Children – end decade review of the follow-up to the World Summit for Children*, prepared for the UN General Assembly special

session on children – states that only 63 countries have achieved this goal. In over 100 countries there was only a one-fifth reduction.<sup>9</sup>

Differences in IMRs between population groups in Israel were previously reported for the years 1977–80,<sup>10</sup> and were still high in the year 2000 (Jews 3.9; Moslems 9.2; Christians 3.6; and Druzes 6.3 per 1000 live births). Such differences between ethnic population groups are not uncommon. In the US, IMRs in 1999 in Black non-Hispanic and White non-Hispanic were 14.1 and 5.8 per 1000 respectively.<sup>11</sup> In England, perinatal mortality rate in infants of Pakistani origin was 1.86 times higher than in those whose mothers were born in the UK.<sup>12</sup> In Malmo and Sweden, perinatal mortality was 4.3 times higher in infants of sub-Saharan origin than in those whose mothers were of Swedish origin.<sup>13</sup> Recently, a study from Turkey reported a two- to threefold higher perinatal mortality rate in a population with low socio-economic status, predominantly rural and semi-urban than in a population in an economically more developed region.<sup>14</sup>

Over the years there were marked changes in the main causes of death in Israel. In the 1950s the main cause of infant mortality was infectious disease. Infant mortality from this cause decreased both in Jews and Arabs to very small proportions, due to a significant improvement in preventive and curative health care services alongside improvements in environmental and socio-economic conditions. In Israel, 100% of the population has supply of improved drinking water, and 92–96% of one-year-old children are fully immunised against DTP, polio, MMR, HBV and HIB. Israel was the first country in the world to implement a national programme for immunisation for hepatitis A virus.<sup>15</sup>

The major causes of infant death in the year 2000 were congenital malformations in Moslems and Druzes, and preterm births in Jews and Christians. The high IMR in Moslem Arabs is mainly accounted for by major congenital malformations, which are 3.8 times more common than among Jews. This large gap is explained by very high rates of consanguinity in Moslem Arabs in Israel (33–45%) for both social and economic reasons.<sup>16–18</sup> This phenomenon is well established in Moslem countries in the whole Middle East. The rate of major congenital malformations in children of consanguineous parents in Moslems in Israel has been reported as 15% due to inbreeding within extended families in one study<sup>19</sup> and 8.7% among children of first degree cousins in a more recent study.<sup>18</sup> Furthermore, most Moslems oppose termination of

pregnancy, even in the case of a severe malformation in the fetus, on religious grounds. In a recent survey in Israeli Arab women only 36% said they would agree to a termination of pregnancy in the event of a severely affected fetus.<sup>20</sup>

The situation is very different among the small Christian Arab community in Israel (2789 live births and 10 infant deaths in the year 2000, IMR of 3.6 [1.4, 5.8] per 1000, even lower than the IMR in Jews). This community shares many demographic indicators with the Jewish population in terms of improved socio-economic status, lower fertility rate, relatively higher age of marriage and higher education, and lower rates of consanguinity than with Moslem Arabs.

Low birthweight, and especially VLBW, was found to be the strongest risk factor for infant mortality. The rate of multiple births resulting in VLBW in Israel increased steeply during the past two decades, mainly due to a sharp increase in assisted reproductive technology: *in vitro* fertilisation (IVF) and intracytoplasmic sperm injection (ICSI). A comparison of assisted reproductive technology in 48 countries showed that in Israel, the national rates of IVF/ICSI cycles were the highest of all the 48 surveyed countries.<sup>21</sup> The rate of multiple births in Israel in the year 2000 (4.82%; 5.3% and 3.58% in Jews and Arabs respectively) was much higher than that of the US (3.07% in 1999).<sup>11</sup> In infants conceived with use of assisted reproductive technology, the RR for VLBW among singleton infants was 2.6, compared with that in the general US newborn population.<sup>22</sup> Also, the RR for a major congenital malformation after ICSI or IVF was 2, compared with natural conception.<sup>23</sup> The RR for IMR in multiple births compared with singletons in Israel and in the US is comparable (4.5 and 5.3).<sup>11</sup>

Thus, the extensive use of assisted reproductive technology in Israel caused a marked increase in multiple births, reduced birthweight and VLBW, and might have contributed to birth defects. All of these variables are strong risk factors for infant mortality.

The national IMR in Israel is slightly higher than in most of the European Community countries (range 3–6 per 1000 live births), and lower than the rate in the US (7 per 1000 live births).<sup>4</sup> The IMRs among Jews and Christians in Israel are lower than that of most of the European Community countries. By contrast, the IMR among the Arab population in Israel is relatively high, yet markedly lower than most of those reported from Moslem Middle East countries in 2000 (United Arab Emirates –8; Kuwait –10; Oman –12; Qatar –12; Saudi

Arabia –24; Syria –24; Lebanon –32; Jordan –34; Egypt –37; Yemen –85; and Iraq –130 per 1000 live births).<sup>4</sup>

We conclude that marked decline in IMRs in Israel over five decades reflects a major improvement in population health. In 2000, the main risk factors were VLBW, major congenital malformations and multiple births.

Today, infant mortality in Israel represents a unique combination of: high rates of congenital malformations among Moslems, where consanguineous marriages are common and medical termination of pregnancy of malformed fetuses is infrequent; and relatively high IMRs from preterm births in Jews, associated with high rates of assisted reproductive technology. Nevertheless, the national IMR is well within the range of most developed countries, and the specific IMRs for Jews and Christians are comparable with that of the countries with the lowest IMRs in the world. Gaps in IMRs between Moslems and Druzes on the one hand and Jews and Christian on the other hand call for intensification of intervention programmes to reduce infant mortality among Moslems and Druzes. Such interventions are in process, via health education and health promotion emphasising the avoidance of consanguineous marriage, utilisation of genetic counselling and periconceptional consumption of folic acid, to reduce certain birth defects.

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## References

- 1 Reidpath DD, Allotey P. Infant mortality rate as an indicator of population health. *Journal of Epidemiology and Community Health* 2003; **57**:344–346.
- 2 <http://www.unicef.org/wsc/goals.htm>.
- 3 World Health Organization. *Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death*. Volume 1. Geneva: World Health Organization, 1977.
- 4 UNICEF. *The State of the World's Children 2002. Leadership, Official Summary*. New York: UNICEF House, 3 UN Plaza, 2001, p. 81.
- 5 Central Bureau of Statistics. *Late Fetal and Infant Deaths in Israel 1948–1972*. Special Series No. 453. Jerusalem: Central Bureau of Statistics, 1974. [In Hebrew].
- 6 Central Bureau of Statistics. *Socio-demographic Characteristics of Infant Mortality 1977–1980*. Publication No. 871. Jerusalem: Central Bureau of Statistics, 1990.
- 7 Central Bureau of Statistics. *Socio-demographic Characteristics of Infant Mortality 1990–1993*. Publication No. 1070. Jerusalem: Central Bureau of Statistics, 1970.
- 8 Central Bureau of Statistics. *Infant Mortality 1993–96 Socio-demographic Characteristics*. Publication No. 1127. Jerusalem: Central Bureau of Statistics, 2000.
- 9 Rose S. UNICEF report flags failures of 1990 Child Summit goals. *Bulletin of the World Health Organization* 2001; **79**:1171.
- 10 Lusky A, Zadka P, Chetrit A, Barell V. Mortality among Moslems, Christians and Druze infants. *Harefuah* 1992; **122**:349–353. (In Hebrew).
- 11 Mathews TJ, MacDorman MF, Menacker F. Infant mortality statistics from the 1999 period linked birth/infant death data set. *National Vital Statistics Reports* 2002; **50**:1–28.
- 12 Raleigh VS, Botting B, Balarajan R. Perinatal and postneonatal mortality in England and Wales among immigrants from the Indian subcontinent. *Indian Journal of Pediatrics* 1990; **57**:551–562.
- 13 Essen B, Hanson BS, Ostergren PO, Lindquist PG, Gudmundsson S. Increased perinatal mortality among sub-Saharan immigrants in a city population in Sweden. *Acta Obstetrica Scandinavica* 2000; **79**:737–743.
- 14 Erden G for the Turkish Neonatal Society Multicentre Study Group. Perinatal mortality in Turkey. *Paediatric and Perinatal Epidemiology* 2003; **17**:17–21.
- 15 Anis E, Leventhal A, Roitman M, Slater PE. Introduction of routine hepatitis a immunization in Israel – the first in the world. *Harefuah* 2000; **138**:177–180. (Hebrew).
- 16 Jaber L, Shohat M, Halpern GJ. Demographic characteristics of the Israeli Arab community in connection with consanguinity. *Israel Journal of Medical Sciences* 1996; **32**:1286–1269.
- 17 Jaber L, Halpern GJ, Shohat M. Trends in the frequency of consanguineous marriages in the Israeli Arab community. *Clinical Genetics* 2000; **58**:106–110.
- 18 Bromiker R, Glam-Baruch M, Gofin R, Hammerman C, Amitai Y. Association of parental consanguinity with congenital malformations among Arab newborns in Jerusalem. *Clinical Genetics* 2004; **66**:63–66.
- 19 Jaber L, Merlob P, Bu X, Rotter JI, Shohat M. Marked parental consanguinity as a cause for increased major malformations in an Israeli Arab community. *American Journal of Medical Genetics* 1992; **44**:1–6.
- 20 Jaber L, Dolfin T, Halpern GJ, Reish O, Fejgin M. Prenatal diagnosis for detecting congenital malformations: acceptance among Israeli Arab women. *Israel Medical Association Journal* 2000; **2**:346–350.
- 21 Collins J. An international survey of the health economics of IVF and ICSI. *Human Reproductive Update* 2002; **8**:265–277.
- 22 Schieve LA, Meikle SF, Ferre C, Peterson HB, Jeng G, Wilcox LS. Low and very low birth weight in infants conceived with use of assisted reproductive technology. *New England Journal of Medicine* 2002; **346**:731–737.
- 23 Hansen M, Kurinczuk JJ, Bower C, Webb S. The risk of major birth defects after intracytoplasmic sperm injection and in vitro fertilization. *New England Journal of Medicine* 2002; **346**:725–730.