

Trends in Youth Mortality in Israel, 1984–1995

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Abstract

Background: Investigation of causes of death can help inform intervention policy aimed at reducing preventable mortality.

Objectives: To assess mortality causes and trends over time and identify target groups with excessive mortality rates among Israeli youth aged 10–24, in order to formulate an intervention policy for prevention of adolescent mortality.

Methods: Mortality data for Israeli residents aged 10–24 were extracted from the Central Bureau of Statistics computerized death certificate file for the period 1984–95. Trends were evaluated by cause of death and demographic characteristics.

Results: The crude mortality rate among Israeli youth aged 10–24, during 1993–1995, was 39.6 per 100,000. Rates were 2.7 times higher among males, increased with age, and reached a peak among 18–21 year olds. Rates were 1.4 times higher among Arabs than among Jews. The sharp increase in mortality among Jewish males of military service age (18–21 years) was due mainly to motor vehicle crashes and suicide. Although overall mortality decreased by 9.4% from 1984–86 to 1993–95, the gap between the subgroups increased. MVC-related mortality increased over time by 100% among Arab males. The rate of completed suicide among Jewish males increased by 110%. Although injury-related mortality is lower in Israel compared with the U.S., similar demographic differentials and trends were found in both countries.

Conclusions: Suicide among Jewish males of military service age, as well as MVC fatalities among Arab males, present a growing public health issue. Intervention strategies should therefore be targeted towards these subgroups in order to minimize the rates of preventable death.

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Adolescents are regarded as a relatively healthy population, demonstrating low rates of disability and chronic diseases and shorter average hospital lengths of stay [1–3]. However, the decrease in mortality among this age group during recent

decades, especially among males, has been less prominent when compared with the decrease in the general population [4]. Injury-related mortality, both intentional (suicide and homicide) and unintentional (accidents), was the leading cause of death among 15–24 year old U.S. youth during 1995, and accounted for 72 deaths per 100,000 or 76% of all deaths [5]. Injuries accounted for 57% of all deaths among 15–24 year old British and Welsh youth during 1997 and for 67% of all deaths among 15–24 year old French youth during 1996 [6]. In Israel, injuries were responsible for 51% of mortality among 10–19 year olds during 1981–86 [7]. From 1950 to 1993, the decline in youth mortality from unintentional injuries in the U.S. was nearly offset by the increase in mortality from intentional causes [4].

Israeli society is composed of two major population groups – Jews and Arabs. The latter group includes Moslems, Druze and Christian Arabs as well as other small minority groups. The two groups differ significantly in culture, health-related habits, and socioeconomic characteristics. The Arab minority, representing 20% of the total population, is characterized by larger families, lower per capita income, and a larger proportion living in rural areas [8]. Adolescence can be perceived as a unique experience for Jewish Israel adolescents, because the great majority of the Jewish males and about half the number of the Jewish females serve in the Israel Defense Forces for an average of 3 years after reaching the age of 18. Among Arab Israelis, only a small number of Druze and Bedouin youth serve in the army.

Few studies have examined adolescent mortality in Israel [7,9]. The purpose of this study is to describe and analyze youth mortality in Israel during 1993–1995, and to examine mortality trends over time in order to identify target groups with excessive, preventable mortality.

Materials and Methods

Data on adolescent mortality in Israel for the periods studied were extracted from the computerized file of individual death notifications, developed by the Central Bureau of Statistics [10]. Data were examined by gender, population group (Jews, Arabs), and age group (10–14, 15–17, 18–21 and 22–24 years). Age categories were planned to isolate the period of compulsory military service (age 18–21). Data were compared according to

* Deceased

MVC = motor vehicle crash

Table 1. Mortality among Israeli youth, aged 10–24, by cause of death category and population group, 1993–95 (rate/100,000)

	Total			Jews			Arabs and Others		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
All	39.6	56.8	21.6	36.6	53.2	19.2	50.0	69.2	29.9
Injuries	22.9	36.4	8.8	21.9	34.3	9.0	26.1	43.6	8.0
Disease	12.7	14.4	11.0	10.6	12.6	8.6	20.0	20.9	19.1
Ill-Defined	3.8	5.7	1.7	3.8	6.2	1.4	3.5	4.3	2.7
Adverse effects*	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.2

* Adverse effects of therapeutic use of medical substances, misadventures and complication of care.

four time periods: 1984–86, 1987–89, 1990–92 and 1993–95. In each period, annual data were combined to reduce the bias caused by unstable rates resulting from a small number of cases in any single year. The distribution of the Israeli population by age, gender and population group, used as denominators for the rates, was extracted from the Annual Statistical Abstracts [11–14]. The average number of 10–24 year old Israeli adolescents, residents of the State of Israel, was 1,149,000, 1,230,000, 1,335,000, and 1,472,133 during 1984–86, 1987–89, 1990–92 and 1993–95, respectively. Of these, 77% were Jews.

The database included civilian as well as non-civilian injuries, excluding those associated with the Lebanon War. Deaths associated with the Palestinian uprising (the Intifada) and with military actions in South Lebanon were included. Deaths caused by motor vehicle crashes are sometimes mistakenly assigned to other categories, particularly when the victim was hospitalized for an extended period prior to death. In order to correct for this under-reporting of MVCs, the personal identity numbers of MVC fatalities recorded on police data are routinely compared with the Central Bureau of Statistics mortality file.

Statistical analysis

Comparison of any two specific rates was conducted under the assumption that the number of deaths in each subgroup displays the characteristics of a Poisson distribution. All analyses were done using SAS software on a Sun workstation.

Cause of death

Cause of death was coded according to the International Classification of Diseases, 9th Revision, Clinical Modification [15]. The ICD-9 groups were condensed into four major categories:

- **Injuries** (E800–E869; E880–E929; E950–E999). These were further divided into unintentional (E800–E869; E880–E929), intentional (E950–E978; E990–E999), and undetermined whether intentional or unintentional (E980–E989).
- **Diseases** (001–779).
- **Adverse effects** of therapeutic use of medical and biological substances (E930–E949) and medical or surgical misadventures and complications of care (E870–E879). These were grouped separately because they are considered to be of a different nature than the other categories.
- **Symptoms, signs and ill-defined conditions** (780–799). This catch-all category is difficult to attribute to either injury or disease and is therefore presented separately.

Results

Mortality from all causes

Overall mortality among Israeli youth aged 10–24 during 1993–95 was 39.6 per 100,000 [Table 1]. Rates were 2.7 times higher among males than among females ($P < 0.01$). Mortality rates sharply increased with age, reached a peak among 18–21 year olds (4.2 times the rate among 10–14 year olds) and then slightly decreased. Overall mortality rates were 1.4 times higher among Arabs than among Jews ($P < 0.01$). The subgroup exhibiting the highest mortality rates was that of Arab males (69.2/100,000). Injuries were the major cause of death, accounting for 58% of deaths among the total study population. Injuries were responsible for a larger proportion of mortality among Jews than among Arabs: 60% and 52%, respectively. The relative proportion of disease was significantly higher among Arabs than among Jews (40% and 29%, respectively).

Injury-related mortality was 4.2 times higher among males as compared to females: 36.4 and 8.8 per 100,000, respectively ($P < 0.01$). The age effect on mortality was more prominent in injury-related than in disease-related mortality [Figure 1]. The age effect on injury-related mortality among males displays similar trends in both population groups: Jews exhibit the sharpest increase in mortality from ages 15–17 to 18–21 (rate ratio = 3.8). Rates increased with age, reaching a peak among 18–21 year olds in all subgroups, excluding Arab females. The age effect on disease-related mortality was significant for Jewish males and females ($P < 0.01$). The majority of injuries (59%) were related to unintentional causes (accidents). Intentional causes (suicide, homicide, legal and military actions) were responsible for 36% of the injury-related deaths. Injuries, undetermined whether intentional or unintentional, were responsible for an additional 5%. The relative proportion of unintentional deaths decreased with age, from 68% among 10–14 year olds to 58% among 22–24 year olds, while the proportion of intentional deaths increased with age, from 20% to 38%, respectively. Within the intentional category, 70% were attributed to suicide.

Selected cause-of-death categories

Unintentional injuries

- **MVC:** The mortality rate from MVC was 10.6/100,000 or 27% of all deaths. Rates were 3.7 times higher among males than among females ($P < 0.01$). This rate increased considerably from age 10–14 to age 18–21 (rate ratio 8.3, $P < 0.01$),

after which it plateaued. Rates were 34% higher among Arabs than among Jews ($P < 0.01$).

- **Drowning:** The second leading cause among unintentional injuries was drowning, which accounted for 1.0 deaths per 100,000. Rates were highest among Arab males (1.7/100,000; $P < 0.01$).

Intentional injuries

- **Suicide:** The suicide rate among Israeli youth was 4.6/100,000 or 12% of overall mortality. The male-to-female ratio was 4:1. Rates increased consistently with age, from 0.6/100,000 among 10–14 year olds to 8.7/100,000 among 22–24 year olds ($P < 0.01$). Rates among Jews were 2.8 times higher than among Arabs ($p < 0.01$). The subgroup with the highest suicide mortality rates was 18–21 year old Jewish males (18.0/100,000). These rates were 50% higher than that of Arab males of the same age.
- **Homicide:** The homicide rate was 1.9/100,000 or 5% of overall mortality. Rates were 5.2 times higher among males than among females ($P < 0.01$). The subgroup with the highest rate was 22–24 year old Arab males (11.4/100,000).
- **Military-related mortality:** This category accounted for 1.7 deaths per 100,000 in the total research population. As might be expected, rates were highest among 18–21 year old Jewish males (4.5 deaths per 100,000). Rates among Jewish females and among Arabs of both genders were far lower.

Injuries-undetermined whether intentional or unintentional

This category accounted for 1.2 deaths per 100,000. Rates were highest among Arab males.

Disease-related mortality

Benign and malignant neoplasms were the major disease-related cause of death, accounting for 11% of overall mortality (4.5/100,000). Rates increased with age and were 23% higher among Jews than among Arabs ($P < 0.01$). Neurological, cardiovascular, metabolic and blood diseases all showed higher rates among Arabs.

Symptoms, signs and ill-defined conditions

This group accounted for 3.8 deaths per 100,000 or 9% of total mortality. Rates were three and a half times higher among males than among females and were identical among Arabs and Jews.

Although Jewish females serve in the military, their participation rate is far lower than that of males, and they rarely serve in operational units.

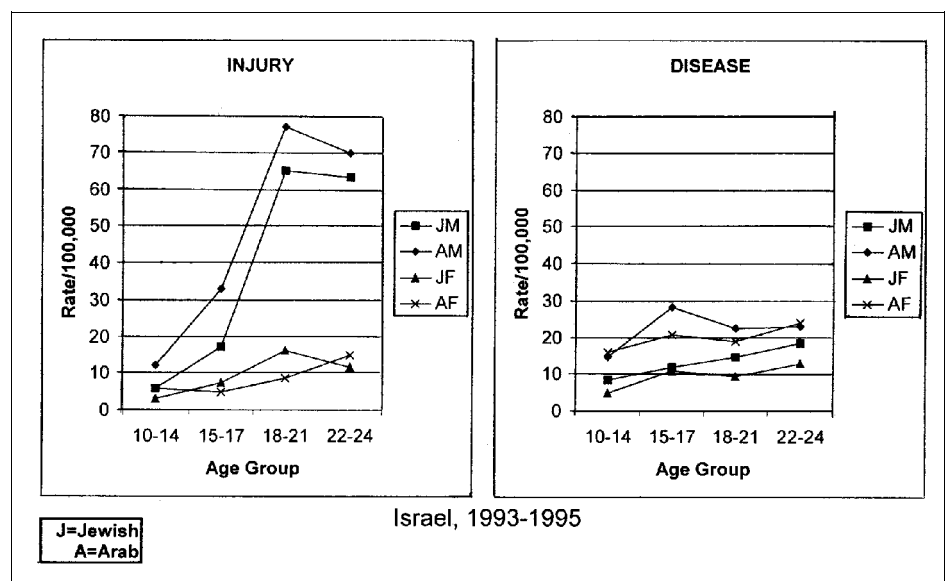


Figure 1. Mortality by age, gender and population group, Israel 1993–95

Trends in mortality

Cause-specific rates showed a consistent decrease from 1984–86 to 1990–92 for almost all cause-of-death categories. The 1993–95 period deviates from this trend, and demonstrates a slight increase in the majority of injury-related causes (e.g., MVC, suicide, homicide) and in some of the disease-related causes (e.g., malignancies). Overall mortality nevertheless decreased by 9.4% throughout the period studied [Table 2].

Decrease over time was greater among Jews than among Arabs (10.7% and 5.3%, respectively). Disease-related mortality exhibited a larger decline (–18%) than did injury-related mortality (–5%). Arab females represent the only subgroup that demonstrated an increase in disease-related mortality over time. Despite the general decrease in unintentional mortality, MVCs showed a 20% increase over time.

The analysis of male mortality reveals different trends among the two population groups: Unintentional deaths among Jews

Table 2. Mortality change over time among 10–24 year-olds, by cause-of-death category and year

	1984–86	1987–89	1990–92	1993–95	% change*
Overall	43.7	41.4	39.2	39.6	–9.4%
All injuries	24.1	23.2	21.0	22.9	–5%
Unintentional	16.1	15.1	13.3	13.5	–16%
Intentional	6.2	6.3	6.3	8.2	32%
Undetermined	1.8	1.8	1.4	1.2	–33%
All diseases	15.5	14.3	12.1	12.7	–18%
Malignancies	5.5	5.0	4.1	4.5	–18%
Other diseases**	10.0	9.3	8.0	8.2	–18%
Ill-defined	3.4	3.3	5.6	3.8	11.8%
Complications	0.8	0.6	0.5	0.2	–75%

* 1984–86 to 1993–95

** This group is composed of small subgroups that usually display similar trends.

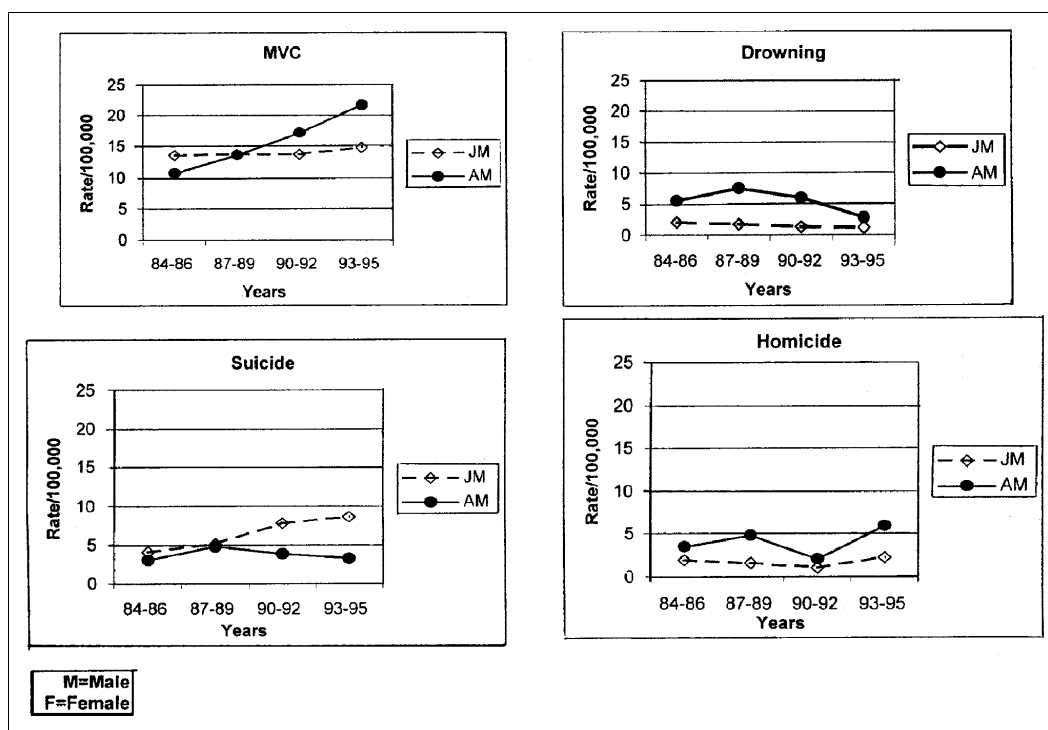


Figure 2. Mortality among males by cause of death and population group: change over time

decreased, from 25.1 deaths per 100,000 in 1984–86 to 18.4/100,000 in 1993–95, while over the same period it increased among Arabs, from 27.4 deaths per 100,000 to 30.6/100,000. These opposing trends widened the gap between the two groups. MVC mortality among Arab males doubled over time, compared with a 10% increase among Jewish males [Figure 2]. Drowning fatalities among Arab males decreased by 50%. In contrast, suicide rates gradually increased over time among Jewish males, from 4.1/100,000 to 8.6/100,000 (+110%) and the homicide rate increased by 67% among Arab males.

Discussion

Analysis of cause-specific mortality among Israeli youth enables identification of the subgroups at risk. Different patterns can be seen for injury and disease: males of both population groups have excessively high injury-related death, whereas both male and female Arabs are characterized by higher disease-related mortality. Overall mortality in the study group was half of the U.S. rate (72.6/100,000 among 10–24 year olds in 1993–95) [16]. This gap is explained by the higher rate of injury-related deaths [17] among U.S. youth. Excess male mortality was demonstrated in many countries, where male-to-female rate ratio among 15–24 year olds was 2.6, 2.8, 2.5 and 2.7 in Israel, U.S., England and Wales, and France, respectively [5,6]. Overall mortality in Israel decreased by 9.4% from 1984–86 through 1993–95. During the years 1984–95, mortality among U.S. youth decreased by 5.3% only [16]. In Europe, the trend in mortality among 15–24 year old youth was different between

countries. For example, between 1984 and 1995, it decreased by 4.0% and 27.7% among youth in the UK and France, respectively [6]. Motor vehicle crashes, suicide and neoplasms were the three major causes of death among Israeli youth, whereas leading causes of death among American youth (15–24 year olds) in 1995 were MVCs, homicide and suicide [5]. In Israel, as in most other western countries, homicide fatalities among youth are very low compared with the equivalent age group in the U.S. [18].

The sharp increase in injury-related mortality in adolescence is a reflection of the risk-taking behaviors typical of middle and late adolescence. These behaviors may fulfill adolescents' evolving needs for autonomy and mastery [15]. Acquisition of driver status also contributes to this age-related increase.

Mortality among Arabs was higher than among Jews and was particularly high in disease. Other studies have also found higher rates of infant mortality and accidental mortality in childhood among Arabs [9,19]. The gap in overall mortality between Arabs and Jews has increased with time (RR = 1.29 and 1.36 in 1984–86 and 1993–95, respectively). A similar though far more prominent trend was found in the U.S., where Afro-American to Caucasian rate ratios increased from 1.2 in 1984–86 to 2.0 in 1993–95 [16]. Mortality among U.S. children and adolescents has also been found inversely related to socioeconomic status [20]. In addition, an increasing disparity in mortality over the years has been noted among 25–64 year olds of different socioeconomic groups in the U.S. [21].

From 1984–86 to 1993–95, MVC-related mortality increased by 100% among Arab males, and by only 10% among Jewish males. This may be explained by a 50% increase in the prevalence of private cars from 1989 to 1994 among the Arab population living in large villages, while rates among the general population increased by 10% only [22]. However, rates of MVC-related mortality during 1993–95 were 34% higher among Arabs, despite the fact that the average number of cars per 1,000 population was significantly higher among Jews. The greater proportion of Arabs living in rural areas, the lack of efficient emergency transport, and poor road conditions may provide some explanation of the high rates. It should be noted

that Arab male predominance in MVC-related mortality is a new phenomenon, indicated only as late as 1987–89. In 1981–86, MVC-related fatalities were higher among 10–19 year old Jews than among Arabs [7]. It seems that improved economic status of the Arab community has led to increased access to motor vehicles without, however, the required planning and implementation of effective strategies for injury prevention.

Both Jews and Arabs exhibited a steep increase in injury-related mortality among 18–21 year old males. Among Jews, the main contributors to this increase were suicide, MVCs and military service-related causes. Preliminary analysis of the information obtained by the military police investigation of firearm deaths indicates that the suicide rate among 18–21 year old Jewish males during 1983–89 was 45% higher than that reported officially. Under-reporting was due to characterization of these deaths as either undetermined or unintentional firearm deaths. Possible explanations for the increased risk of suicide during the age of military service are the emotional stress of service and increased access to guns. More effective identification of teenagers at risk for suicide, prior to enrollment and during service, together with increased teaching of coping skills to adolescents, may reduce the risk of self-inflicted injury.

Among Arabs, the main contributors to the age-related increase in mortality were MVCs, suicide and homicide. The gap in drowning between Arab and Jewish males has almost disappeared, probably the result of the swimming education programs introduced in the schools, accompanied by guidelines for water safety. Also, greater affluence might have lowered the age when swimming lessons were initiated, which has resulted in a greater proportion of Arabs reaching adolescence and having acquired swimming skills.

Neoplasms constitute the leading fatal disease among Israeli youth. Arab females are the only subgroup that failed to demonstrate a decrease in mortality over time. Similarly, overall disease-related mortality increased over time only in this group. These findings deserve further study.

Although overall mortality among Israeli youth has decreased over time, the gap between the subgroups has increased. An increase in unintentional mortality among Arabs as well as completed suicide among Jewish males requires special attention. Nevertheless, there are several limitations to these data: The relatively high proportion of ill-defined death may mask true cause-specific rates and proportions. In addition, the possibility of under-reporting of suicide among Jewish males of military service age prevents accurate estimation of the magnitude of the problem. Appropriate use of E-codes in hospitals, whenever the underlying cause of death is an injury, may increase the reliability of cause-of-death reporting. Furthermore, analysis of mortality by type of residence and socioeconomic status was precluded by an incomplete database. Despite the latter limitation, mortality trends reflect the effect of rapid socioeconomic change, unaccompanied by parallel preventative strategies, on injury-related mortality among minorities.

Conclusion

In an environment of cost containment, it is important to direct resources towards subgroups at risk for potentially preventable death. Suicide among Jewish males of military service age and MVCs among Arab males are emerging as a growing public health issue, which deserves immediate intervention.

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