tion, magnitude of pricing differential, and food types targeted, warrant further empirical evaluation. Such strategies have policy implications with respect to taxation and price supports for foods of differing fat content. □

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A Persistent Rise in Mortality among Injection Drug Users in Rome, 1980 through 1992

Marina Davoli, MD, MSc, Carlo A. Perucci, MD, Elisabetta Rapiti, MD, MPH, Anna Maria Bargagli, BSc, Daniela D'Ippoliti, BSc, Francesco Forastiere, MD, MSc, PhD, and Damiano Abeni, MD, MPH

ABSTRACT

Objectives. The purpose of the study was to analyze overall and cause-specific mortality among injection drug users in Rome.

Methods. A cohort of 4200 injection drug users was enrolled in drug treatment centers from 1980 through 1988 and followed up until December 1992.

Results. The age-adjusted mortality rate from all causes increased from 7.8/1000 person-years in 1985/86 to 27.7/1000 in 1991/92. The rise was mainly attributable to acquired immunodeficiency syndrome (AIDS), but mortality from overdose and other causes increased as well. The cumulative risk of death by the age of 40 was 29.3%.

Conclusions. The impact of AIDS deaths appears to be additional to a persistent increase of mortality for all other causes. (*Am J Public Health.* 1997;87:851–853)

Introduction

There is established evidence that injection drug users are at increased risk of death from several causes.[1] In a cohort study of injection drug users in Rome, we documented a large excess in mortality for all causes in the period 1980 through 1988, with a decrease in total mortality from 1980 to 1985 and a rise afterward.[2] The main cause of death was overdose. Acquired immunodeficiency syndrome (AIDS) accounted for 7.1% of all deaths, whereas in a cohort of drug injectors enrolled and followed up from 1984 to 1987 in New York City, AIDS accounted for 40% of all deaths.[3] Since the highest incidence of human immunodeficiency virus (HIV) infection among injection drug users occurred in Italy in 1986 and 1987,[4–6] we extended the follow-up of the same cohort to investigate whether the rise in mortality observed since 1985 was continuing and whether such an increase could be attributed to AIDS or to other causes as well.

Methods

The population under study and the methods have been described in detail previously.[2] Briefly, all injection drug users attending, from 1980 to 1988, the three largest drug treatment centers in Rome were enrolled and followed up as of December 31, 1992. Vital status was ascertained through the registry office of

The authors are with the Department of Epidemiology, Lazio Region, Rome, Italy.

Requests for reprints should be sent to Carlo A. Perucci, MD, Osservatorio Epidemiologico Regione Lazio, Via S. Costanza, 53, 00198 Rome, Italy.

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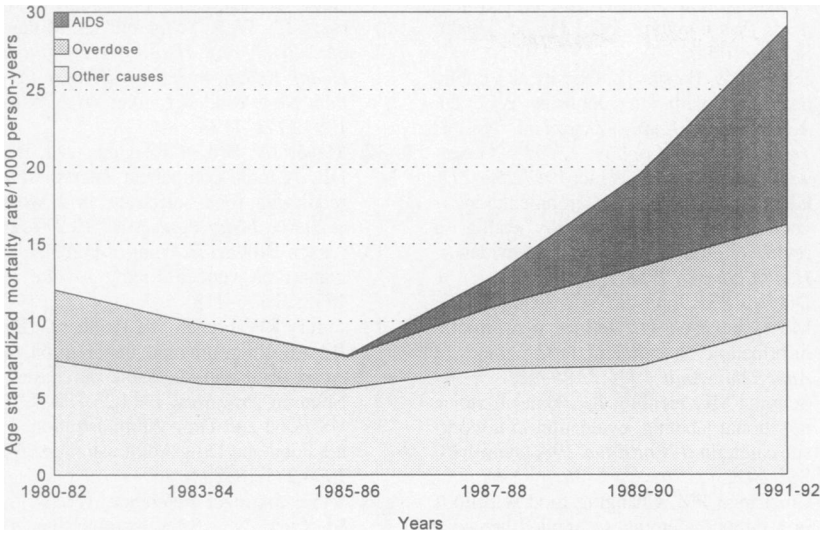

FIGURE 1—Mortality among injection drug users (male and female) in Rome, 1980 through 1992.

the last municipality of residence and underlying cause of death was obtained through record linkage with the national mortality file. The ascertainment of vital status was possible for 95% of the cohort.

Age-standardized mortality rates were computed to analyze temporal trends,along with chi-square test for trend; the direct method and the age distribution of the total study population as standard were used. Standardized mortality ratios and their 95% confidence intervals were used to compare the mortality experience of injection drug users with that of the national population. Losses to follow-up were considered alive at the end of the study period to compute person-years at risk.

The cumulative risk of death from all causes according to age was estimated by means of the Kaplan-Meier product limit method, along with 95% confidence intervals.[7]

Results

Of the total 4200 injection drug users originally enrolled in the cohort, 3955 were alive at the end of 1988. During the following 4 years, 1989 through 1992, we observed 387 deaths; the corresponding all-cause mortality rate was 25.6/1000 person-years. The age-adjusted mortality rate reached a minimum of 7.8/1000 person-years in 1985/86 (Figure 1) and rose to 27.7/1000 in 1991/92. The major cause of death was overdose until 1987/88; thereafter AIDS became the first cause of death, with rates ranging from 1.9/1000 in 1987/88 to 12.8/1000 in 1991/92. Mortality from causes other than AIDS and overdose increased steadily from 5.7/1000 in 1985/86 to 9.7 in 1991/92 (P for trend $< .001$).

Table 1 shows the standardized mortality ratios comparing mortality in the study group with the expected figures derived from the general population of the same age and sex for the two follow-up periods (1980 through 1988 and 1989 through 1992). The standardized mortality ratio from all causes was elevated in both study periods, among both males and females, and was higher during the period 1989 through 1992. AIDS and overdose represent 66.7% of the total deaths among males from 1989 through 1992 and 40.5% during the previous follow-up period; among females, these two causes accounted for 68.1% of total deaths from 1989 through 1992 and 43.6% during the earlier period. Excess mortality was also found for other causes of death. The standardized mortality ratio for cardiovascular diseases was lower in the second study period for both sexes, whereas that for respiratory diseases was higher. The cumulative risk of death from all causes was 12.3% (95% confidence interval [CI] = 10.7, 14.0) by the age of 30, 29.3% (95% CI = 26.8, 31.9) by the age of 40, and 52.8% (95% CI = 45.1, 60.9) by the age of 50.

Discussion

The study shows that mortality among injection drug users in Rome has been increasing in the last years. AIDS accounts for most of the increase, although a persistent rise in baseline mortality for other causes of death was observed.

The temporal pattern observed in Rome was similar to what has been observed in Milan,[8] where on average the rates were higher, probably owing to a higher prevalence of HIV infection among injection drug users in Milan than in Rome.[9]

Compared with the general population, injection drug users show an overall risk of death almost 15 times higher among males and 30 times higher among females. Even when deaths due to overdose and AIDS are excluded, a sixfold excess risk for males and an elevenfold excess risk for females is estimated.

The particularly high standardized mortality ratio during the period 1989 through 1992 is due mainly to deaths from AIDS and overdose. The lower standardized mortality ratio for cardiovascular diseases is attributable to a decrease in the number of deaths classified as "heart failure." This decrease may reflect an improvement in reporting of underlying causes of death over time, as confirmed also by a lower standardized mortality ratio for "ill-defined" causes of death.

The higher standardized mortality ratio for respiratory diseases is due mainly to deaths from bacterial pneumonia. Before 1993 bacterial pneumonia was not an AIDS-defining condition, and such cases would now probably be classified as AIDS cases according to the new definition. However, a specific risk of bacterial pneumonia has already been reported among drug injectors in the United States.[10]

Some caution should be used in generalizing the results to all drug injectors in Rome. Nevertheless, data from surveys on injection drug users conducted in Rome in 1990 and 1992[11,12] indicate that about 80% of the subjects recruited in the street had entered treatment at least once; moreover, the extended period of recruitment increases the likelihood of enrolling drug injectors seeking care at least once during their lifetime history of injection drug use.

In conclusion, despite the relevant epidemiological evidence about preventable risk factors among drug users, we still observe high levels of mortality among drug injectors in Rome: one out of three die by the age of 40, one out of two

TABLE 1—Cause-Specific Mortality among Injection Drug Users in Rome, by Sex and Follow-Up Period

Cause of Death (ICD-9)[a]	1980–1988			1989–1992		
	No. Deaths	SMR	95% CI	No. Deaths	SMR	95% CI
Males						
All causes (000–999)	200	9.3	8.1, 10.7	318	21.2	18.9, 23.7
All malignant neoplasms (140–239)	8	2.7	1.2, 5.3	10	3.8	1.8, 6.9
AIDS (279)	16	...	...	131	...	...
Overdose (304)	65	...	...	81	...	...
Diseases of nervous system (320–389)	2	3.3	0.4, 12.0	2	5.8	0.7, 21.1
Diseases of circulatory system (390–459)	22	8.5	5.3, 12.8	8	3.5	1.5, 6.8
Diseases of respiratory system (460–519)	3	6.2	1.3, 18.1	4	11.9	3.2, 30.5
Diseases of digestive system (520–579)	20	16.5	10.1, 25.6	21	19.9	12.3, 30.5
Injuries and poisoning (800–999)	46	4.0	2.9, 5.3	35	5.9	4.1, 8.2
Ill-defined conditions (780–799)	6	12.1	4.4, 26.2	2	5.4	0.7, 19.5
Other causes	3	...	...	8	...	...
Unknown causes	9	...	...	16	...	...
Females						
All causes (000–999)	39	18.1	12.9, 24.7	69	38.6	30.0, 48.9
All malignant neoplasms (140–239)	1	...	...	3	4.5	0.9, 13.3
AIDS (279)	1	...	...	37	...	...
Overdose (304)	16	...	...	10	...	...
Diseases of nervous system (320–389)	...	...	...	...	...	...
Diseases of circulatory system (390–459)	5	13.5	4.4, 31.6	2	6.0	0.7, 21.8
Diseases of respiratory system (460–519)	3	37.1	7.6, 108.5	5	82.1	26.6, 191.5
Diseases of digestive system (520–579)	3	24.4	5.0, 713	2	18.4	2.2, 66.4
Injuries and poisoning (800–999)	4	6.7	1.8, 17.1	5	15.5	4.9, 35.3
Ill-defined conditions (780–799)	2	45.5	5.5, 164.5	...	...	...
Other causes	2	...	...	4	...	...
Unknown causes	2	...	...	1	...	...

Note. SMR = standardized mortality ratio (not computed for categories with fewer than 2 deaths); CI = confidence interval (two-tailed test).
[a]Code numbers are from the *International Classification of Diseases,* 9th revision (Geneva, Switzerland: World Health Organization; 1975).

by the age of 50. The HIV epidemic has a major influence, but AIDS mortality does not replace other causes of deaths. On the contrary, AIDS adds to the baseline mortality, which is itself increasing. Since the peak incidence of HIV infection among drug injectors occurred in Italy in the years 1986 and 1987, and given the long incubation period of HIV,[13] we have to expect even higher death rates for injection drug users during the coming years. Interventions for drug injectors should still be aimed at preventing not only AIDS and overdose but also a large spectrum of other lethal diseases. □

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