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Abstract

Objective—In recent decades, in most European countries young adult mortality has risen, or at best has remained stable. The aim of this study was to describe trends in mortality attributable to the principal causes of death: AIDS, drug overdose, suicide and motor vehicle traffic accidents, among adults aged between 15 and 34 years in three European cities (Barcelona, Bologna and Munich), over the period 1986 to 1995.

Methods—The population studied consisted of all deaths that occurred between 1986 and 1995 among residents of Barcelona, Bologna and Munich aged from 15 to 34 years. Information about deaths was obtained from mortality registers. The study variables were sex, age, the underlying cause of death and year of death. Causes of death studied were: drug overdose, AIDS, suicide and motor vehicle traffic accidents. Age standardised mortality rates (direct adjustment) were obtained in all three cities for the age range 15–34. To investigate trends in mortality over the study period Poisson regression models were fitted, obtaining the average relative risk (RR) associated with a one year increment.

Results—Young adult mortality increased among men in Barcelona and Bologna (RR per year: 1.04, 95% confidence intervals (95%CI): 1.03, 1.06 in Barcelona and RR:1.03, 95%CI:1.01, 1.06 in Bologna) and among women in Barcelona (RR:1.02, 95%CI: 1.01, 1.04), with a change in the pattern of the main causes of death attributable to the increase in AIDS and drug overdose mortality. In Munich, the pattern did not change as much, suicides being the main cause of death during the 10 years studied, although they have been decreasing since 1988 (RR:0.92, 95%CI:0.88, 0.96 for men and 0.81, 95%CI: 0.75–0.87 for women).

Conclusion—The increase in AIDS mortality observed in the three European cities in the mid–80s and mid–90s has yielded to substantial changes in the pattern of the main causes of death at young ages in Barcelona and Bologna. Munich presented a more stable pattern, with suicide as the main cause of death.

In recent decades, adult mortality rates have declined in the majority of European Union countries, mainly because of the reduction in deaths from cardiovascular and cerebrovascular diseases.1 However, this generalised decline is not homogeneous in all age groups, as among young adults the death rates have risen, or at best have remained stable.2–7

The main causes of death among young adults in most European countries are AIDS, drug overdose, suicide and traffic accidents, all causes related with life styles and risk behaviours, and therefore avoidable.7 8 9 The only differential feature from one country to another is the magnitude of the rates and the order in which they appear in the ranking of the main causes.

Thus, since the appearance of AIDS, mortality attributable to this cause has increased more rapidly in the countries of southern Europe9–11 and is currently higher than in the northern and central European countries.12 This higher rate is mainly explained by the higher percentage of injecting drug users. In some countries this transmission group accounts for over 60% of AIDS cases diagnosed.9 10 Conversely, in the case of suicide, the northern and central European countries show higher rates.13–15 These differences could be explained, once again, by social factors (religion, unemployment, divorce) and psychological factors (mental or physical illness, alcoholism).16

Some causes of death tend to concentrate in urban areas, such as AIDS and drug abuse,4 17–19 and therefore it is important to analyse mortality trends in cities of different locations within Europe. Thus, the aim of this study was to describe trends in mortality attributable to the principal causes of death, AIDS, drug overdose, suicide and motor vehicle traffic accidents, among adults aged between 15 and 34 years in three European cities (Barcelona, Bologna and Munich), over the period from 1986 to 1995.

Methods

THE CITIES STUDIED

Barcelona is the second largest city in Spain and it is located in the north east of the country. Its population has decreased from 1 701 812 inhabitants in 1986 to 1 508 805 in 1996, with an increasingly aging population, resulting from higher life expectancy and decreasing fertility rates. The majority of its population works in the service sector. Unemployment rates in the province of Barcelona have been relatively high, fluctuating between 14% and 25%.
### Table 1  Death cases and standardised mortality rates, by year, in the 15–34 years age group, in Barcelona, Bologna and Munich by sex, 1986–1995

<table>
<thead>
<tr>
<th>Year</th>
<th>Barcelona</th>
<th>Bologna</th>
<th>Munich</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td></td>
<td>Death cases</td>
<td>Standardised mortality rate × 10^6</td>
<td>Death cases</td>
</tr>
<tr>
<td>1986</td>
<td>245</td>
<td>3.2</td>
<td>99.1</td>
</tr>
<tr>
<td>1987</td>
<td>259</td>
<td>3.3</td>
<td>104.7</td>
</tr>
<tr>
<td>1988</td>
<td>381</td>
<td>5.0</td>
<td>154.4</td>
</tr>
<tr>
<td>1989</td>
<td>405</td>
<td>5.0</td>
<td>164.3</td>
</tr>
<tr>
<td>1990</td>
<td>413</td>
<td>4.7</td>
<td>168.0</td>
</tr>
<tr>
<td>1991</td>
<td>413</td>
<td>4.8</td>
<td>167.9</td>
</tr>
<tr>
<td>1992</td>
<td>458</td>
<td>5.4</td>
<td>185.9</td>
</tr>
<tr>
<td>1993</td>
<td>458</td>
<td>5.5</td>
<td>186.2</td>
</tr>
<tr>
<td>1994</td>
<td>410</td>
<td>5.0</td>
<td>167.2</td>
</tr>
<tr>
<td>1995</td>
<td>404</td>
<td>4.8</td>
<td>166.0</td>
</tr>
</tbody>
</table>

*Percentage of the 15–34 age group mortality over all deaths in each year.

### Table 2  Percentage of deaths by cause in the 15–34 years age group and number of death cases (n) in Barcelona, Bologna and Munich by sex, 1986 and 1995

<table>
<thead>
<tr>
<th>Year</th>
<th>Barcelona</th>
<th>Bologna</th>
<th>Munich</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>1986</td>
<td>132</td>
<td>1.8</td>
<td>54.0</td>
</tr>
<tr>
<td>1987</td>
<td>143</td>
<td>1.8</td>
<td>59.0</td>
</tr>
<tr>
<td>1988</td>
<td>152</td>
<td>1.8</td>
<td>62.4</td>
</tr>
<tr>
<td>1989</td>
<td>178</td>
<td>2.0</td>
<td>72.6</td>
</tr>
<tr>
<td>1990</td>
<td>150</td>
<td>2.0</td>
<td>64.6</td>
</tr>
<tr>
<td>1991</td>
<td>147</td>
<td>1.8</td>
<td>60.1</td>
</tr>
<tr>
<td>1992</td>
<td>133</td>
<td>1.6</td>
<td>54.5</td>
</tr>
<tr>
<td>1993</td>
<td>162</td>
<td>2.0</td>
<td>66.1</td>
</tr>
</tbody>
</table>

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Bologna is situated in the north of Italy, with a population of 437,203 inhabitants in 1985 and 386,491 in 1995. It has also been the majority of its population working in the service sector. Unemployment was lower than in Barcelona (3.4% in 1985 and 6.1% in 1995).

Munich is the third largest city in Germany, and is located in the south east of the country. It is the capital of Bavaria. The population was 1,281,645 inhabitants in 1986 and 386,491 in 1995 (20% being foreigners). The area of Munich has the second highest number of working people in Germany and is the leading centre for high tech and media industries. Unemployment rates in Munich have been fluctuating between 3.9% and 7%.

### SOURCES OF INFORMATION

The population studied consisted of all deaths that occurred between 1986 and 1995 among residents of Barcelona, Bologna and Munich aged from 15 to 34 years. Information about deaths was obtained from death certificates; mortality registers were local in Barcelona and Bologna and were maintained by the municipal administration. In Munich this information was obtained from the regional register of mortality. Population data were obtained from municipal censuses of the three cities: in Barcelona municipal censuses were available for 1981, 1986 and 1991 and intercensal populations were obtained for the other years through the method based in the geometric curve, in Bologna and Munich the municipal census is updated every year.

### VARIABLES

The study variables were sex, age, underlying cause of death and year of death. The underlying cause of death was coded using the International Classification of Diseases, 9th revision (ICD-9). Causes of death studied were the main causes of death in the 15–34 years age group of Barcelona: drug overdose (ICD-9 codes: Barcelona E850-E858 as accidental drug poisoning; Bologna 304.0 and 304.9, and Munich 304 as drug dependence), AIDS (ICD-9 codes: Barcelona 279.5, Bologna 279.1 and Munich 042–044), suicide (ICD-9 codes: E950-E959 in all three cities) and motor vehicle traffic accidents (ICD-9 codes: E810-E829 in all three cities). Barcelona uses different coding for drug use because of forensic traditions, and AIDS codes were different because, as a new disease, different ICD-9 codes were used in each country.

### DATA ANALYSIS

Age standardised mortality rates (direct adjustment) in all three cities for the age range 15–34 were computed. The Standard European population proposed by the World Health Organisation was used as the reference population for adjustment, as well as the three cities’ population censuses as the rate denominators.

To investigate trends in mortality over the study period Poisson regression models were fitted, obtaining the average relative risks (RR) associated with a one year increment. Separate models for each sex were built. Mortality was the dependent variable, and age group (15–19, 20–24, 25–29 and 30–34 years) and year of death the independent ones. As motor vehicle traffic accident mortality in Barcelona and suicide mortality in Munich showed a sharp change in 1988, the Poisson regression models were fitted using data from that year onwards.

### Results

The percentage of deaths in the 15–34 age group over all deaths was higher in men than in women, being over 3% in men in Barcelona.
and Munich, around 3% in men in Bologna and between 1% and 2% in women in the three cities (table 1).

Table 2 shows the percentage of deaths attributable to the main causes of death in the age group 15–34 over all deaths in this age group in 1986 and 1995. The percentage attributable to AIDS has increased in the three cities, but mainly in Barcelona and Bologna, representing in 1995 more than 30% of deaths in this age group. The percentage attributable to drug overdose has increased in Barcelona and Munich, being around 15% in 1995. Consequently, the percentages of deaths attributable to motor vehicle traffic accidents and suicide have decreased in the three cities.

Standardised death rates in the 15–34 year age group for the years 1986 to 1995 for the three cities are presented in table 1. Barcelona and Bologna showed similar rates, both higher than in Munich, and higher in men than in women. In the study period, total mortality increased in Barcelona in men (RR per year: 1.04, 95% confidence intervals (95%CI): 1.03, 1.06) and women (RR:1.02, 95%CI: 1.01, 1.04), and in Bologna in men (RR:1.03, 95%CI:1.01, 1.06) (table 3).

Figure 1 depicts the trends in cause specific mortality in each city. It may be observed that the pattern changed during the study period in Barcelona and in Bologna. The main cause of death in 1986 was motor vehicle traffic accidents while in 1995 it was AIDS, with a large increase in the latter cause of death.
The main causes of death among young adults in most European countries are AIDS, drug overdose, suicide and traffic accidents, all causes related with life styles and risk behaviours, and therefore avoidable.

The aim of this study was to describe trends in mortality among adults aged between 15 and 34 years in three European cities (Barcelona, Bologna and Munich), over the period 1986 to 1995.

The study has shown the increase in young adult mortality among men and women in Barcelona and among men in Bologna, the pattern of the main causes of death changing because of the increase in AIDS and drug overdose mortality. In Munich, the pattern did not change as much, suicides being the main cause of death during the 10 years studied.

Greater efforts should be devoted at the European level to monitor trends in health outcomes and determinants in major cities, favouring more systematic and harmonised procedures to analyse and disseminate comparable results.

Discussion

This is the first study looking at trends in mortality among three large European cities, each one reflecting the differential impact of the main causes of death in the young adult population. The study has shown the increase in young adult mortality among men and women in Barcelona and among men in Bologna, the pattern of the main causes of death changing because of the increase in AIDS and drug overdose mortality.

By the end of the study period, AIDS had become the leading cause of death in adults aged from 15–34 years in Barcelona and Bologna, and had also increased in Munich. These trends are related with AIDS incidence; Spain and Italy, as other southern European countries, have had consistently higher traffic related mortality than northern and central European countries, a situation largely related with a stronger increase in motorisation in the former countries, together with higher mean speeds and a lower use of protective devices, although road conditions and health care infrastructures could also account for some of the observed differences.

It should be noted that one of the limitations of this study may be the underreporting of the causes of death studied, which may underestimate the cause specific mortality. Nevertheless, total mortality in the age group studied and trends in the same city are not
affected by this underreporting. In a study on improvement of the quality and comparability of causes of death statistics inside the European Union, suicide, accidental deaths and drug related deaths were focused as causes of death requiring special attention.69

Moreover, although slightly different coding criteria for causes of death were used in each city, there is no evidence that for the case of AIDS and drug overdose deaths this may have had a substantial influence in data comparability. Although we are aware this study has included mortality data until 1995, a period after which AIDS incidence rates have tended to decrease in most Western European countries, the period covered is valid to document the major changes in mortality profiles having occurred in certain European areas in the period from mid-80s to mid-90s.

This study has shown trends in young adult mortality in three large European cities and especially in AIDS, drug overdose, motor vehicle traffic accidents and suicide. AIDS increased in the three cities, changing the pattern of the main causes of death in Barcelona and Bologna. Munich presented a stable pattern, suicide being the main cause of death. It is worth mentioning that these causes of death are all avoidable causes, which should be a priority target for public health action at the local level.

As large urban areas are an appropriate setting to detect sentinel health events, we believe that greater efforts should be devoted at the European level to monitor trends in health outcomes and determinants in major cities, favouring more systematic and harmonised procedures to analyse and disseminate comparable results. Such efforts would contribute to improve the quality of public health policies and programme evaluations at local level.

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The methods and materials of demography, economics, health indicators and analysis of information on drug-related deaths are described in the references cited in the text. The results are presented in tables and graphs, and a summary of the findings is given in the discussion. The paper is intended for a general audience interested in public health and epidemiology.

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