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Major causes of deaths between 1901 and 1990 in Geneva, Switzerland

Summary

This is the first analysis of the evolution of major causes of death in the canton of Geneva during the twentieth century. Data was abstracted from handwritten archives of the Federal Office for Statistics. Life expectancy has increased during the century for men and women. There has been a steady decline of the epidemic of tuberculosis during this century. Other epidemics, such as coronary heart disease or lung cancer in males, started during the twentieth century but seem to have already reached a peak. A third group of epidemics such as AIDS or lung cancer in women are still increasing. In the future, surveillance of causes of death should be supplemented with surveillance of exposure to risk factors for these diseases.

Since the seminal work of William Farr[1] and of Marc D'Espines[2], surveillance of causes of death has been a major source of information on the health of populations. It has allowed epidemiologists to track the evolution of epidemics across decades and even centuries and has generated clues for potential causal relationships between correlated changes in exposure and in mortality.

Evolution of causes of death in Switzerland during the 20th century has been previously described by Gubéran[3–5]. Similar work has been performed for England[6,7] and for France[8]. However, this is the first analysis of causes of death throughout this century in the canton of Geneva, Switzerland[9]. We describe here changes in mortality from 1901 to 1990 from all causes and from specific causes such as tuberculosis, ischemic heart disease, lung cancer, breast cancer, motor vehicle accidents, suicides and AIDS.

Material and methods

Causes of death

Causes of death for each Swiss canton are available from death certificates systematically collected by the Swiss Office Fédéral de la Statistique. Before 1986, primary causes of death were recorded in a tabulated format by age and sex. These tabulations are handwritten from 1901 to 1968. Since 1969, death certificate information has been computerized. From 1901 to 1990, six different classifications of diseases have been used, for the periods 1901–1920[10], 1921–1930[11], 1931–1941[12], 1942–1950[13], 1951–1968[14], 1969–1990[15]. The changes of nomenclatures and codes for the causes of death studied in the present paper have been described in detail elsewhere[9].

Denominators of mortality rates

The denominators of mortality rates were based on census information for the resident population of Canton Geneva from 1901 to 1990[16]. A census is performed every ten years. The yearly population was extrapolated assuming that the change in numbers between two censuses was linear, using the slope of a linear regression. The overall population always grew between two censuses, but there were periods in which the size of specific age groups declined. Census data is available in tabulated format with fixed 10-year age groups between 1901 and 1925, 5-year age groups between 1926 and 1968[17]. It has been computerized since 1969. Before 1969, age 0 is not separated from age 1.

Statistical analysis

Rates were standardized for age using as reference the standard

European population[18]. They were computed for 5-year periods from 1901–1905 to 1961–1965. Because a new international classification of disease was introduced in 1969, the calendar time periods were grouped as follows: 1966–1968, 1969–1975, 1976–1980, 1981–1985, 1986–1990. Overall mortality was analyzed using all available data, but cause-specific mortality rates was limited to deaths occurring before age 80.

Results

Figures 1 to 6 persent the changes in sex-specific standardized mortality rates for all causes, tuberculosis, coronary heart disease, lung and breast cancer, suicide, and motor vehicle accidents.

There has been a constant decline of mortality rates from all causes since the beginning of the century, which corresponds to a lengthening of life expectancy in men and women (Fig.1). The peak in mortality around 1918 may be related to the influenza pandemic that caused 988 deaths in Geneva between 1918 and 1920, that is, about 30% of the total mortality. The ratio of mortality of men to women was 1.3 in 1901–1905 and 1.7 in 1986–1990, indicating that the decline in mortality rates has been stronger for females than for males.

Tuberculosis was the most important cause of death in 1901 (Fig. 2). No other single cause of death during this century reached rates as high as those of tuberculosis among males for the 1901–1905 period (350/100,000/yr). Today the mortality rate from tuberculosis is virtually zero. The rapid fall of tuberculosis rates plateaued in 1916–1920 for women, and 1931–1935 and in 1941–1945 for both sexes.

Ischemic heart disease (IHD) has been identified as a specific cause of death since 1921 (Fig.3). The epidemic of IHD grew rapidly

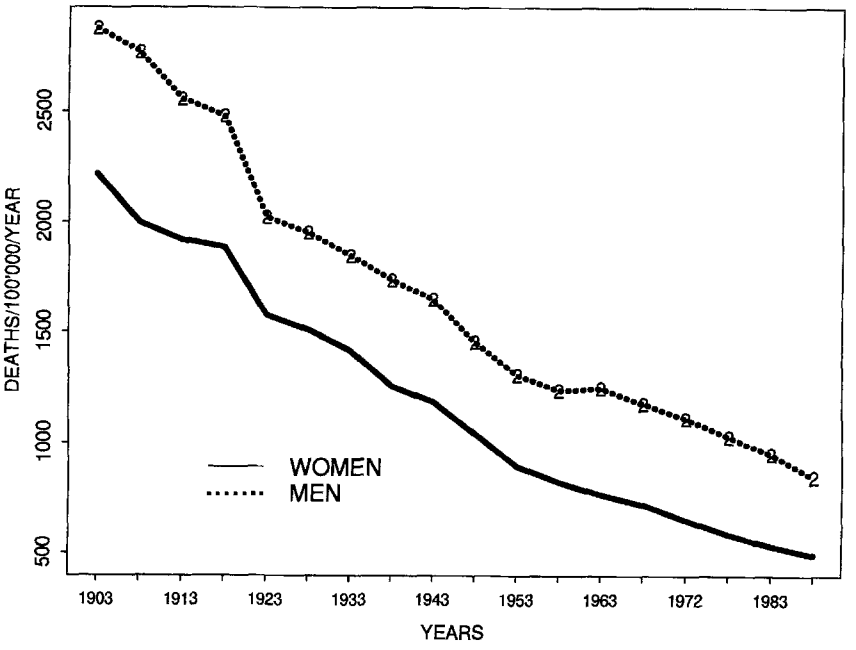

Figure 1. *Age-standardized mortality rates from all causes, by sex. Geneva, Switzerland, 1901–1990.*

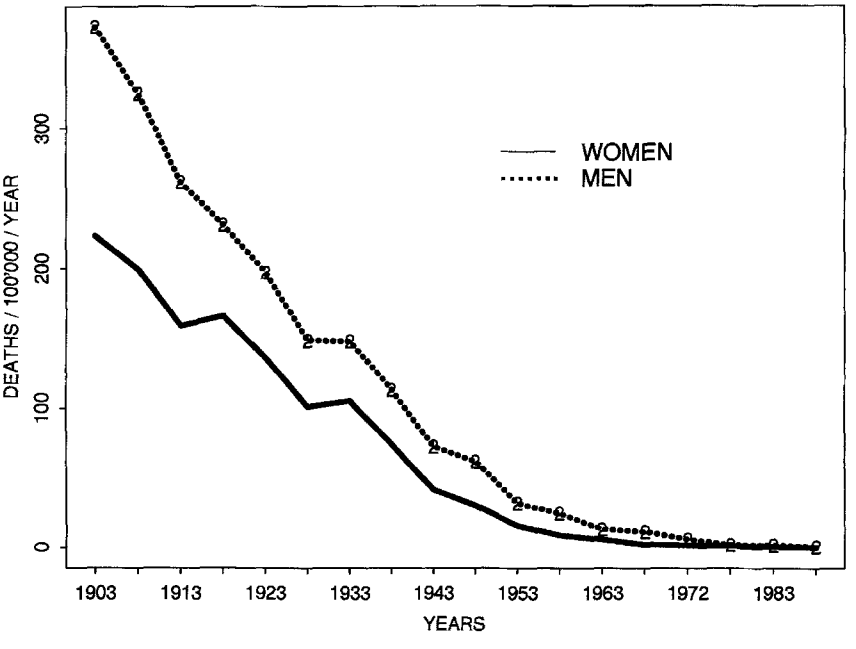

Figure 2. *Age-standardized mortality rates from tuberculosis before age 80, by sex. Geneva, Switzerland, 1901–1990.*

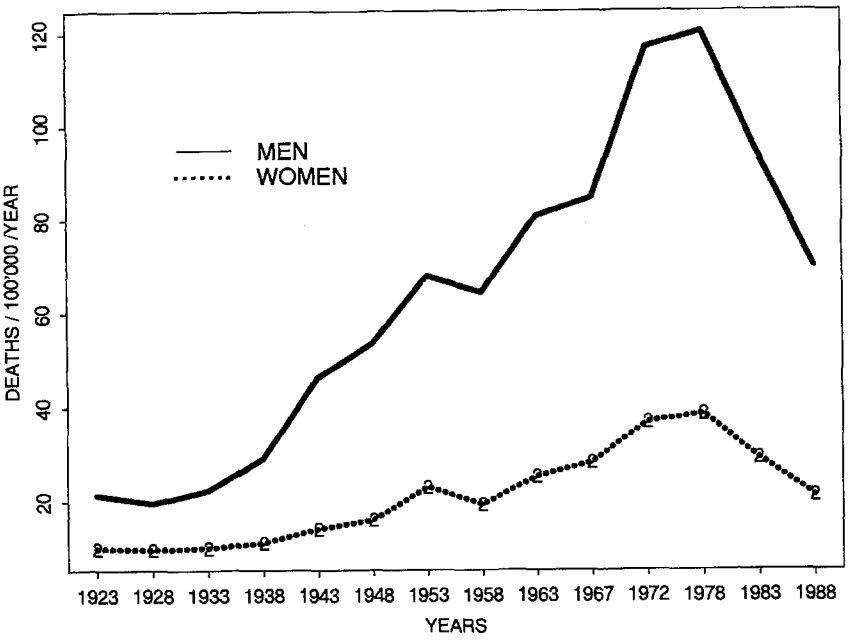

Figure 3. *Age-standardized mortality rates from ischemic heart before age 80, by sex. Geneva, Switzerland, 1921–1990.*

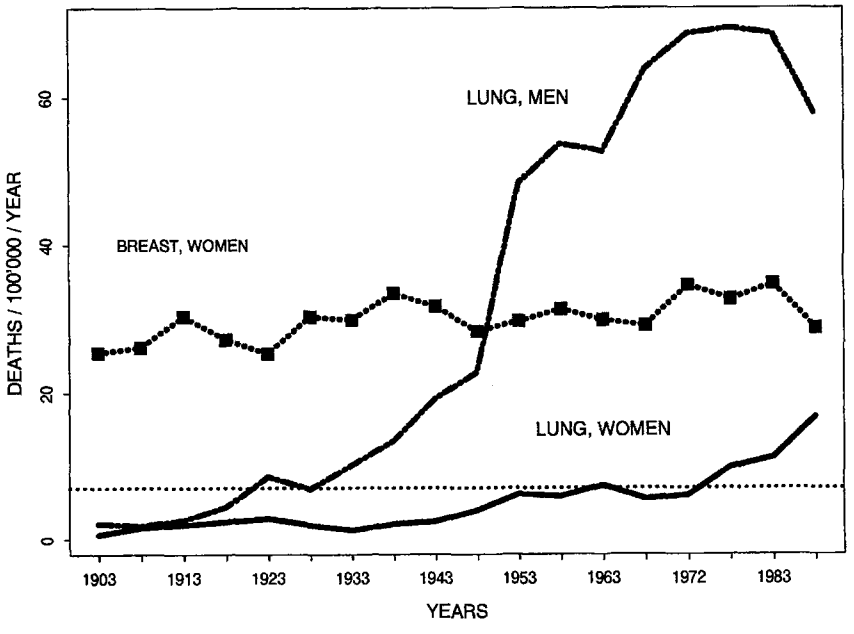

Figure 4. *Age-standardized mortality rates from lung cancer and breast cancer before age 80, by sex. Geneva, Switzerland, 1901–1990. The dashed line indicates the average mortality rate in non-smokers (7/100,000/year).*

during the century, but reached its maximum at the end of the 1970s. Since then it has started to decline. In males, the mortality rate from lung cancer per 100,000 and per year was 2.2 in 1901–1905 and 57.3 in 1986–1990 (Fig. 4). In females, the rates were 0.6 and 16.6, respectively. These rates have been greater than the rate observed among non smokers (7/100,000/yr[18]), in males since about 1930 and in females since about 1975. Mortality rates have been declining in men since 1981–1985 but are still rising among females. In contrast to the sharp rise of the epidemic of lung cancer, breast cancer mortality has been increasing slowly throughout the century (Fig. 4).

Deaths from suicide have always been more frequent in males, but the sex difference has become attenuated in recent years, mostly because of a decline of the mortality rate in males (Fig. 5). A small epidemic of suicide in both sexes seems to have occurred during the seventies.

There are two peaks of mortality from motor vehicle accidents, one between the two world wars and the second after world war II (Fig. 6). Despite the increased usage of motor vehicles, the epidemic growth stopped around 1960.

Figure 7 shows that the absolute number of deaths from AIDS in Geneva has increased rapidly since 1984, especially among males.

Table 1 summarizes the absolute impact of these seven epidemics in terms of number of deaths below age 80 due to each cause from 1901 to 1990. Tuberculosis stands out as the greatest killer of the century, since 8,848 men (9.3% of all deaths) and 7,279 women (8.7% of all deaths) died from this disease The second most important cause of death is ischemic heart disease in males (5,530 deaths) and breast cancer in females (3,555 deaths). It is unlikely that either of these two causes will beat the record of

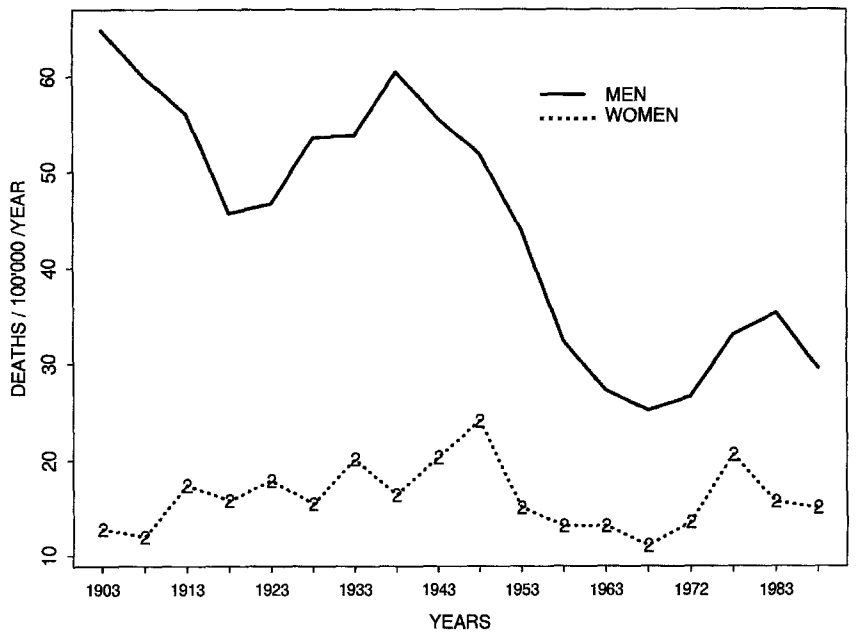

Figure 5. *Age-standardized mortality rates from suicide before age 80, by sex. Geneva, Switzerland, 1901–1990.*

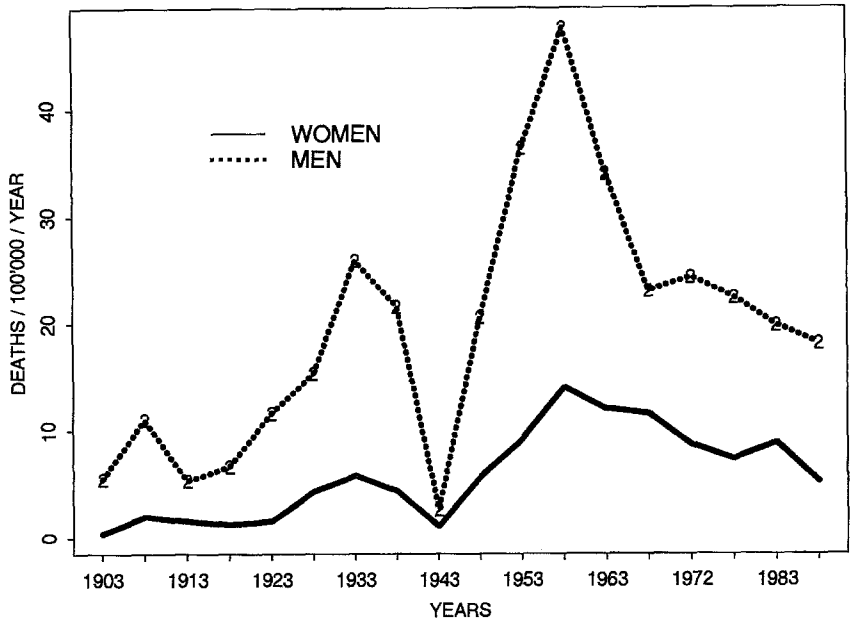

Figure 6. *Age-standardized mortality rates from motor vehicle accidents before age 80, by sex. Geneva, Switzerland, 1901–1990.*

tuberculosis by the end of the century. It is noteworthy that overall, suicide has killed more males than lung cancer.

Discussion

The mortality trends shown for Canton Geneva are consistent with those previously published for the Swiss population[3–5] or for other industrialized countries[6–8]. The originality of the present paper lies in the fact that the analysis encompasses 90 years, going back all the way to the early years of death certificate registration. At a Swiss level, it is also the first canton-specific analysis of the non-computerized, partly handwritten archives of the Office fédéral de la statistique.

The decline in overall mortality shown in Figure 1 is mostly due to the drastic reduction in childhood mortality: in 1901–1925, 20% of all boys and girls died before age 10, whereas very few do so nowadays[9]. The corresponding increase in life expectancy is also partly explained by the vanishing epidemics of fatal tuberculosis and, more recently, by the decline of ischemic heart disease, lung cancer in men, suicides and motor vehicle accidents. However, two epidemics are still on the rise: lung cancer in females, and AIDS. Causes of these trends have been extensively discussed by others[3–9].

As a single disease, tuberculosis has been the most important killer of the century. However, it should be stressed that average mortality figures lay relatively more emphasis on deaths occurring at older ages. For example, the absolute number of deaths from AIDS accounts for only a very small proportion of all deaths, but it is a major cause – or the major cause – of death in the age group 20 to 30 years. Each death from AIDS is therefore responsible for the loss of many more potential years of life

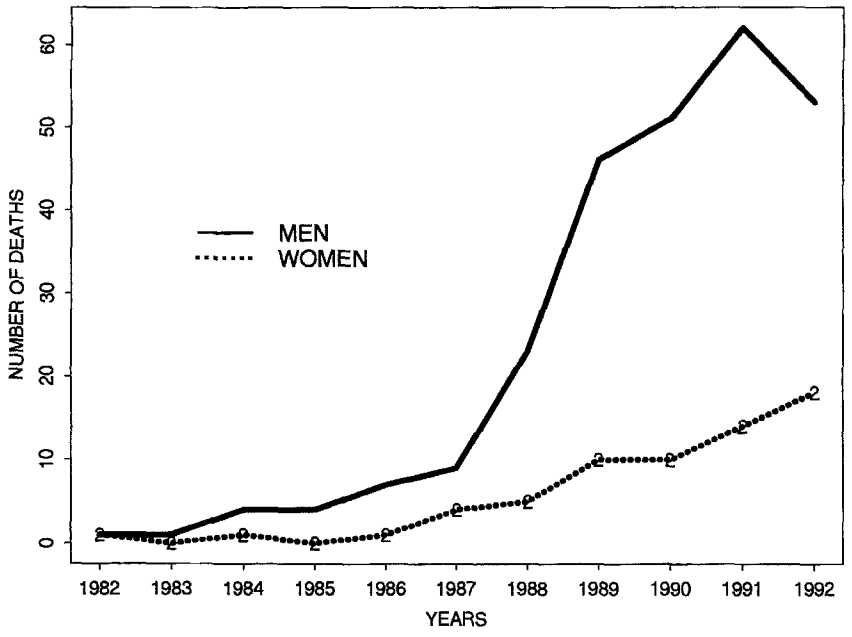

Figure 7. *Number of deaths from AIDS, by sex. Geneva, Switzerland, 1984–1992.*

Causes of death	Males		Females	
	n	%	n	%
Tuberculosis	8,848	9.3	7,279	8.7
Ischemic heart disease*	5,530	5.8	2,667	3.2
Lung cancer	3,649	3.8	764	0.9
Breast cancer	22	–	3,555	4.3
Suicide	3,805	–	1,911	–
Motor vehicle accidents	2,036	2.1	755	0.9

* A specific cause of death only since 1921.

Table 1. *Number of deaths from selected causes in Geneva residents less than 80 years old between 1901 and 1990, by sex.*

than a death from ischemic heart disease or from lung cancer. Another limitation of mortality rates is that they are influenced by both the incidence and survival rates for a disease. The incidence of a particular disease can grow but its mortality rate nevertheless decline if survival is longer as a result of treatment. For this reason, mortality rates underestimate the real importance of the epidemic of breast cancer.

Analysis of mortality trends over long historical periods is beset with many methodological problems[19]. The validity of causes of death mentioned on death certificates has certainly improved since 1901, even though it remains imperfect. Multiple revisions of the international classification of diseases have introduced heterogeneity into the statistical series since classification of a given disease may have changed up to 6 times since 1901. For example, some diseases first classified according to their anatomical localization (e.g., kidney) were later classified according to etiology (e.g., atherosclerosis). Also, the proportion of deaths from undefined causes is lower nowadays than earlier in the century. It would require a considerably greater amount of work to reconstruct homogeneous series for each cause of death, as was done in France by Vallin and Meslé[8]. This was however not compulsory for the present study because the sample of causes of death analyzed here consisted of relatively stable nosologic entities. We also avoided analysing types of diseases, such as "cancers" or "cardiovascular diseases", because large categories of diseases would have been more affected by changes in the classification criteria[8].

The length of the historical period encompassed by the present data can be seen as a strength. The qualitative interpretation of the trends is unlikely to be seriously challenged by the methodological limitations associated with the analysis of death certificates. The estimates of number of deaths attributable to each cause are more sensitive to misclassification of disease because of invalid reporting or coding. However, the differences between specific causes were large and should be robust enough to withstand substantial degrees of misclassification.

The major lesson from the present study is that a surveillance system based on systematic reporting of causes of deaths is inadequate as a basis for prevention in present-day Switzerland. The two rising epidemics in terms of mortality rates, lung cancer in females, and AIDS, have known causes but no cure. Mortality trends reflect exposure to the cause 5, 10 or 15 years ago, but are almost totally uninformative about current priorities for prevention[20]. Prediction of emerg-

ing epidemics should be based on the distribution of risk factors in populations. Progress towards monitoring the evolution of these distributions in Swiss populations has been made[21–25], but this work still needs to be coordinated and harmonized in order to supplement the surveillance of disease mortality with surveillance of exposure in the population.

In conclusion, the evolution of causes of deaths shows that most epidemics of rapidly fatal diseases are declining except lung cancer in females, and AIDS. Prevention and evaluation of the impact of preventive campaigns to control these two epidemics would be enhanced if distribution of their risk factors were monitored in the population.

Zusammenfassung

Wichtigste Todesursachen von 1901 bis 1990 in Genf, Schweiz

Erstmals erfolgt hier eine Auswertung des handschriftlichen Archivs des Statistischen Bundesamtes der Todesursachen von Männern und Frauen im Kanton Genf seit Anfang des Jahrhunderts. Die Lebenserwartung ist im Laufe des Jahrhunderts ununterbrochen angestiegen. Die Tuberkuloseepidemie ist in dieser Zeit laufend zurückgegangen. Andere Epidemien, wie z. B. Koronarerkrankungen oder Lungenkrebs beim Mann, die sich seit dem 20. Jahrhundert ausbreiten, scheinen ihren Gipfel in der zweiten Hälfte des Jahrhunderts bereits erreicht zu haben. Eine dritte Gruppe von Epidemien, wie z. B. Aids oder Lungenkrebs bei der Frau, nimmt noch immer zu. In Zukunft sollten Studien über Todesursachen mit Studien über Indikatoren von Risikofaktoren der betreffenden Krankheiten kombiniert werden.

Résumé

Principales causes de décès entre 1901 et 1990 à Genève, Suisse

C'est ici la première fois que sont analysées les archives manuscrites du Bureau fédéral de la statistique sur les causes de décès des hommes et des femmes du canton de Genève depuis le début du siècle. L'espérance de vie s'est accrue de façon presque ininterrompue au cours du siècle. L'épidémie de tuberculose a poursuivi son déclin au cours du siècle. D'autres épidémies, telles que celles de maladie coronarienne ou du cancer du poumon chez l'homme ont débuté au 20ème siècle mais semblent avoir atteint un pic dans la deuxième moitié du siècle. Un troisième groupe d'épidémies, telles que le sida ou le cancer du poumon chez la femme, est en pleine expansion. L'étude des causes de mortalité devrait être combinée à l'avenir avec l'établissement d'indicateurs de l'exposition aux facteurs de risque de ces maladies.

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