Trends in Mortality From Cerebrovascular Disease in France From 1968 to 1978
With Reference to Cardiovascular and All Causes of Death

Bernard Doyon, MD, PhD, CR INSERM, Ghyslaine Serrano, MD, and Jean-Pierre Marc-Vergnes, MD, PhD, DR INSERM

Cerebrovascular disease mortality in France during the period 1968–1978 was compared with cardiovascular and all other causes of death. Our study demonstrated a 25% decline in the age-adjusted cerebrovascular disease mortality rates in both sexes and particularly in the middle-aged groups. This decline is greater than that of the general causes of mortality, which was on the order of 20%. It parallels the decline in congestive heart failure mortality but differs from that of ischemic heart disease. Nevertheless, despite the increase in the proportion of elderly people in the population, the total number of deaths from cerebrovascular diseases has remained almost unchanged, although the deaths occur at a higher age than previously. If this trend is confirmed, cerebrovascular diseases will remain one of the more frequent causes of death in the elderly and thus a social problem of crucial importance. (Stroke 1988;19:330–334)

In the course of the last 20 years a major decrease has been observed in cerebrovascular mortality in many industrialized countries. However, this tendency was not found everywhere. Furthermore, it has been recently suggested that overall cerebrovascular mortality might be partially or largely artifactual. Up to the present, studies on this subject in France have been few or did not include comparison with other causes of death. The objective of our investigation is to describe the changes in cerebrovascular mortality in France as revealed by death certificates over a recent time period. Cerebrovascular mortality was studied in relation to general mortality and other cardiovascular causes of death. Total deaths and crude rates were taken into account as well as adjusted and specific rates.

Subjects and Methods
The data are derived from publications of the Institut National de la Santé et de la Recherche Médicale. For France, these publications group the statistics on the certified underlying causes of death in accordance with the classification of the World Health Organization and the demographic data of the Institut National de la Statistique et des Etudes Economiques (INSEE).

We chose the period 1968–1978 because terms of the International Classification of Diseases (ICD, eighth revision) were uniformly used. Moreover, the availability of two censuses of the French population during this period renders the demographic data especially dependable. We chose four years: 1968, 1971, 1975, and 1978; 1968 and 1975 were the two census years. In addition, 1978 corresponds to the end of the ICD, eighth revision period. The year 1971 was included in the study to correspond to the 1968 census year in the same way that 1978 is related to the 1975 census year. The population data for 1971 and 1978 are official INSEE estimations.

Temporal trends in cerebrovascular mortality are of greater interest if they are compared with those in general mortality and mortality from cardiovascular diseases. For this reason, we studied the general (all-cause) mortality and the mortality associated with cardiovascular disease as a whole (VASC), ICD code 390–458, as well as the mortality associated with cardiovascular disease classified into principal disease subgroups: cerebrovascular disease (CVD), ICD code 430–438; other forms of cardiopathy, ICD code 420–429 corresponding essentially to congestive heart failure (CHF); and ischemic heart disease (IHD), ICD code 410–414. We did not further investigate the mortality in CVD sub-subgroups since it has been demonstrated recently that such data are unreliable.

Since CVD is predominantly a disease of elderly persons, the reliability of the statistics was gauged by means of the following categories: poorly defined causes (PDC), ICD code 780–796 (794 excluded); senility without mention of psychosis (SEN), ICD code 794; and undeclared causes.

We present separately the number of deaths and the crude rates that have demographic and economic interest and the age-adjusted rates (the reference population is the overall French population in 1975). The age-specific rates are given from the age of 45 years, first, because the absolute number of deaths due to CVD is very low before 45 and, second, because young patients are a rather heterogeneous group even if the pathology taken into consideration is restricted to cerebral infarction.

Results
From 1968 through 1978, the French male population increased from 24,314,580 to 26,095,557 (7.3%)
and the female population increased from 25,599,670 to 27,178,125 (6.2%). Figure 1 shows the progressive increase in the percentage of persons > 64 years old in the French population. The relative increase from 1968 through 1978 in the proportion of elderly persons is 17% for men and 11% for women. Nevertheless, the proportion of elderly women remains far greater than that of elderly men, reflecting the particular structure of the French population due to World War I as well as to the higher mortality of males.

Table 1 shows the number of deaths and the crude rates for all-cause and CVD mortality during the period under consideration. Crude rate is the annual number of deaths: population ratio without any standardization but calculated for each sex. Despite the aging of the population, the number of deaths from CVD appears to have reached a maximum in 1975, with a slight fall commencing afterwards. The crude rates, therefore, show a decline in mortality from CVD in the period 1968–1978 estimated at 14% in men and 7% in women. Nevertheless, the proportion of elderly women remains far greater than that of elderly men, reflecting the particular structure of the French population due to World War I as well as to the higher mortality of males.

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Figure 2 shows the age-adjusted mortality rate for all causes, VASC, and for the three principal disease subgroups CVD, CHF, and IHD. A clear excess in mortality of men is observed both for all-cause mortality and for mortality due to the specific causes considered here. All-cause mortality has declined considerably during this period: 16% for men, 22% for women. The aging of the population thus masks a far-reaching and significant decline in mortality in France. For VASC, the rates fell by 17% for men and 20% for women, a decline that is largely parallel to that of all-cause mortality. However, these statistics mask major divergences that appear when the disease subgroups are examined separately. With regard to CVD, the decline is quite remarkable since it reaches 25% in the period considered without a major difference between the two sexes. The mortality from CHF follows a similar pattern, but it is even more accentuated since the decline reaches 32% for men and 36% for women. For these two causes the decline in mortality is thus clearly more substantial than that of all-cause mortality. By contrast, the mortality from IHD appears to increase slightly during this period (9% for the two sexes) to a point at which it exceeds mortality from CHF in men, an increase that attained

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th></th>
<th></th>
<th>Women</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All causes</td>
<td>Cerebrovascular disease</td>
<td>All causes</td>
<td>Cerebrovascular disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>Rate</td>
<td>No.</td>
<td>Rate</td>
<td>No.</td>
<td>Rate</td>
</tr>
<tr>
<td>1968</td>
<td>283,974</td>
<td>1,167.9</td>
<td>31,913</td>
<td>131.3</td>
<td>266,518</td>
<td>1,041.1</td>
</tr>
<tr>
<td>1971</td>
<td>283,996</td>
<td>1,133.7</td>
<td>33,595</td>
<td>134.1</td>
<td>267,518</td>
<td>1,021.2</td>
</tr>
<tr>
<td>1975</td>
<td>291,108</td>
<td>1,127.5</td>
<td>33,211</td>
<td>128.6</td>
<td>269,245</td>
<td>1,001.4</td>
</tr>
<tr>
<td>1978</td>
<td>286,218</td>
<td>1,096.8</td>
<td>29,492</td>
<td>113.0</td>
<td>260,698</td>
<td>959.2</td>
</tr>
</tbody>
</table>

Rate, deaths/100,000 people/yr.
its maximum in 1975. Taking into account the importance of these disease subgroups in total deaths, one can confirm that the decline in all-cause mortality registered in this period is largely due to a decrease in the mortality from VASC in general and from CVD in particular.

The influence of sex and age is demonstrated in Tables 2 and 3, which present the age-specific rates in particular.

Table 2. Trends in Age-specific Mortality From All Causes and Cardiovascular Disease, France, 1968–1978

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>Rate 1968</th>
<th>Rate 1978</th>
<th>% change</th>
<th>Rate 1968</th>
<th>Rate 1978</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>45–54</td>
<td>811</td>
<td>810</td>
<td>-0.1</td>
<td>389</td>
<td>334</td>
<td>-14.1</td>
</tr>
<tr>
<td>55–64</td>
<td>2,049</td>
<td>1,690</td>
<td>-17.5</td>
<td>878</td>
<td>681</td>
<td>-22.4</td>
</tr>
<tr>
<td>65–74</td>
<td>4,725</td>
<td>3,976</td>
<td>-15.9</td>
<td>2,347</td>
<td>1,808</td>
<td>-23.0</td>
</tr>
<tr>
<td>75–84</td>
<td>11,140</td>
<td>9,302</td>
<td>-16.5</td>
<td>7,341</td>
<td>5,822</td>
<td>-20.7</td>
</tr>
<tr>
<td>&gt;85</td>
<td>27,355</td>
<td>21,582</td>
<td>-21.1</td>
<td>21,566</td>
<td>16,968</td>
<td>-21.3</td>
</tr>
</tbody>
</table>
| Rate, deaths/100,000 people/yr.

Table 3. Trends in Age-specific Mortality From Cerebrovascular Disease, Congestive Heart Failure, and Ischemic Heart Disease, France, 1968–1978

<table>
<thead>
<tr>
<th>Age group (yr)</th>
<th>Cerebrovascular disease</th>
<th>Congestive heart failure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>45–54</td>
<td>45</td>
<td>37</td>
</tr>
<tr>
<td>55–64</td>
<td>171</td>
<td>105</td>
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<tr>
<td>65–74</td>
<td>572</td>
<td>406</td>
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<tr>
<td>75–84</td>
<td>1,848</td>
<td>1,362</td>
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<tr>
<td>&gt;85</td>
<td>4,306</td>
<td>3,480</td>
</tr>
</tbody>
</table>
| Rate, deaths/100,000 people/yr.
for the magnitude of the changes we observed over a period as short as 1968–1978. During this period, no major change in medical knowledge or environmental factors appeared that would have likely resulted in a new pattern of diagnosis. In particular, the increase in the number of patients who died in a hospital that occurred in the early 1960s had already been established, and the rapid increase in the number of physicians who began practicing in France after 1975 would have affected medical practice only to a minor extent. The new imaging techniques, such as computed tomography, were not available in France during this period. Furthermore, the improvement in the accuracy of death certificates should actually result in an increase in the number of deaths declared due to CVD. This thesis has already been put forward by Fratiglioni et al, who explained the increase in CVD mortality rates in nations with low rates in the 1950s by improvements in case ascertainment and diagnosis. In France, despite improvement in the accuracy of death certificates, we still observed a decrease in the number of CVD-related deaths. Thus, we consider it to be unlikely that this trend is artifactual.

Other arguments add to the credibility of the trends demonstrated by our study. The dramatic decline in all-cause age-adjusted mortality, on the order of 20%, is absolutely certain. This decrease implies a fall in one or several major causes of death (cancer, accidents and violent deaths, VASC). As the first two causes have not shown a tendency to fall in France during the period studied, this constitutes indirect proof of the fall in VASC. Confirmation of the hypothesis, that the decline in mortality from VASC is largely responsible for the decline in all-cause mortality, might be provided by the observation of a uniform decline in mortality observed for the various disease subgroups of this category. This is the case for CVD and CHF but not for IHD, which showed a slight increase in the period studied, although a decrease appears to be beginning at the end of this period. France is not the only country in which there is a divergence of CVD and IHD. In the study by Fratiglioni et al, only nine of 19 countries show a decrease for both.

The differences in the trends in mortality among the three major disease subgroups of VASC may be explained in part by the respective influence of risk factors, the patterns of which depend on the way of life and thus vary from one country to another. For instance, reducing hypertension is more likely to decrease CVD and CHF than IHD mortality; IHD is especially sensitive to smoking and blood lipid factors. If trends in such risk factors varied a great deal in different countries, the trends in mortality for VASC disease subgroups would likely also differ. The lack of accurate data on the epidemiology of risk factors in France makes further discussion on this point problematic. Concerning the question of CVD mortality, one reassuring factor supporting the validity of our study is the comparability of our results with those registered elsewhere in the world. We agree with a recent review on this subject stating that this decline in CVD mortality is indeed “real and substantial.”
Since there is no evidence that treatment of stroke plays a role in this improvement, some authors have attributed this decline to the implementation of preventive measures based on knowledge of risk factors,\textsuperscript{15,16} the most important of which is doubtless the effective treatment of arterial hypertension. It is necessary to note that the decline in mortality due to CVD had begun before the appearance of many of these treatments.\textsuperscript{15,16} Even if one admits that this factor contributed to the decline, it is not likely that this is the sole explanation.\textsuperscript{17,18} Similar reasoning could be applied to better control of diabetes, treatment of hypercoagulability of blood, and treatment of several cardiac causes of stroke. The suggestion can be offered that these preventive measures have given rise to a decrease in the incidence of CVD described by several authors,\textsuperscript{24-22} even if an increase in the incidence of stroke has been recently reported in Sweden.\textsuperscript{22} All these studies are of circumscribed regions and remain to be confirmed for France. Preventive measures may also act on the severity of stroke and thus on the case-fatality rate.\textsuperscript{22,26} The later occurrence of deaths from CVD demonstrated by our study favors this hypothesis. The improvement observed is much more marked in middle-aged than in elderly persons. Another explanation consists of major modifications in habits of life and diet, although the relation of these factors to the decline in mortality is difficult to demonstrate and remains controversial.\textsuperscript{15} None of the explanations advanced is satisfactory in itself. It is not even sure that consideration of all the factors envisioned up to the present will be sufficient. As pointed out by Kannel and Thom, "there are general health-promoting factors at work."

It must be emphasized that the number of deaths from CVD remained fairly constant during the period under consideration since the aging of the population largely masked the dramatic improvement in the age-adjusted and age-specific mortality rates. This explains why many physicians doubt the reality of this improvement since they do not observe a decrease in the number of patients with CVD seen in their daily practice. An increase in the incidence of stroke has even been described recently in a country where mortality from stroke decreased regularly.\textsuperscript{21} In fact, CVD is observed in increasingly aged subjects, an increasing proportion of deaths occurring in patients >80 years old. Preventive measures presumably delay the appearance of CVD, acting as a "relative preventive." CVD will doubtless remain one of the main causes of death, although these deaths will occur at higher ages.

In conclusion, we contend that a correct appraisal of CVD mortality rates requires the assessment of the all-cause mortality rates, of the vascular mortality rates, of indexes of reliability such as PDC and SEN mortality rates, and of the crude as well as the adjusted rates.

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References

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