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## Mortality in France by *département*

Knowledge of the level, structure and trends of mortality at a finer scale than that of the country as a whole is necessary both for the scholarly purpose of better understanding the factors behind the variations and inequalities observed, and for reasons of public health, in order to decide where resources are most needed and to determine what type of intervention to apply and to which parts of the territory. This paper is part of a longstanding demographic tradition (Blayo, 1970; Caselli and Egidi, 1986a and 1986b; Daguët, 2005 and 2006; Meslé and Vallin, 1998; Nizard and Prioux, 1975; Noin, 1973; Salem et al., 2000; Caselli and Vallin, 2002; Leclerc et al., 2010). Its purpose is to describe the variations in mortality between France's *départements*, their evolution over the last thirty years and their structural characteristics.<sup>(1)</sup> Specifically, the aim is to answer three questions:

- What is the current geography of overall mortality in metropolitan France and how has it changed over the last thirty years?
- Do differences in life expectancy between *départements* correspond to specific age patterns of mortality?
- What causes of death explain the geographical variations in mortality?

This analysis is based on the annual life tables by sex and *département* in metropolitan France<sup>(2)</sup> for the period 1976-2008. The tables were constructed and transmitted by the regional, local and urban statistics department (Division des Statistiques régionales, locales et urbaines) of the National Institute for Statistics and Economic Studies (Institut national de la statistique et des études économiques, INSEE).<sup>(3)</sup>

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(1) See Appendix A.1 for a map of French *départements* and regions.

(2) Life tables are not available for the French overseas territories for this period.

(3) INSEE calculates the annual life tables from death statistics and population estimates based on population censuses.

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To reduce the effect of random annual fluctuations due to small populations in some *départements*, we worked with three-year life tables using the arithmetic mean for a given indicator over three successive years. For simplicity, the text refers to the middle year of each three-year period. For example, life expectancy at birth in 2007 refers to the arithmetic mean of life expectancy at birth from 2006 to 2008.

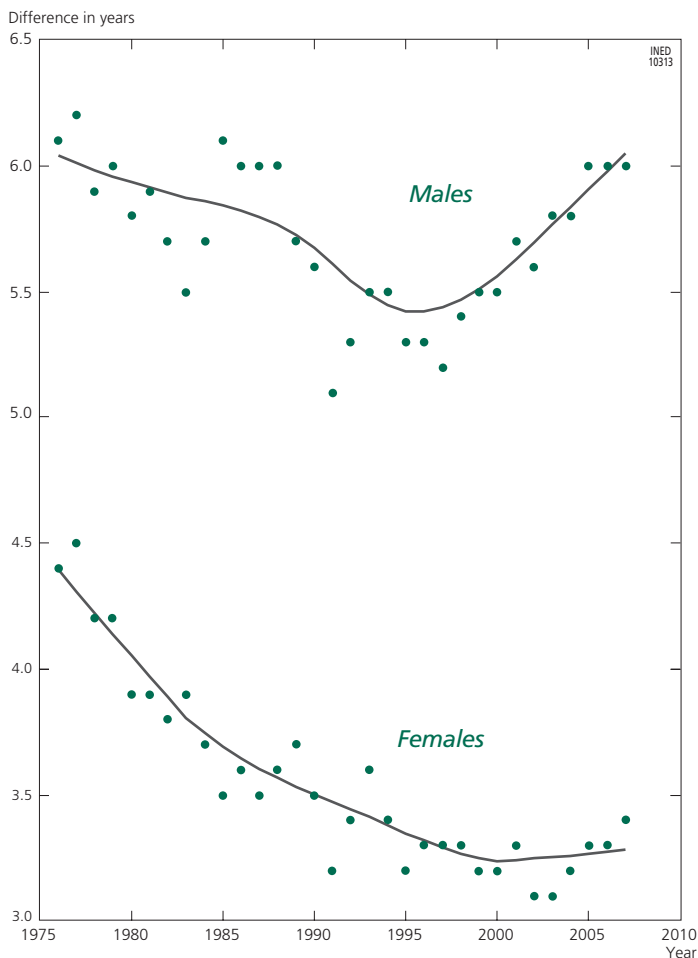
### I. Little change in the geography of life expectancy over the last thirty years

In 2007, life expectancy at birth in metropolitan France was 77.2 years for men and 84.3 years for women, i.e. 8.1 and 7.0 years more than in 1977. These average figures conceal major geographical variations. In 2007, the difference between the life expectancies of the two *départements* at the top and bottom of the range (Hauts-de-Seine and Pas-de-Calais) was 6.0 years for men and 3.4 years for women, compared with 5.9 and 4.2 years in 1977 (Appendix Table A.2). Overall, geographical inequalities in mortality seem to have persisted for men, where they are more marked, but to have declined for women. In fact, both fell steadily – until the early 1990s for men and the early 2000s for women – and then increased noticeably for men and very slightly for women (Figure 1). At its narrowest, the gap in life expectancy at birth between the highest and lowest ranked *départements* was 5.1 years for men (in 1991) and 3.1 years for women (in 2002 and 2003).

Figures 2 and 3 show life expectancy at birth by sex in metropolitan France in 1977 (1976-1978) and 2007 (2006-2008). The *départements* are divided into five groups along the distribution scale. The middle group is around the mean (plus or minus half a standard deviation) and the other groups are bounded by one or two standard deviations on either side. It should be borne in mind that the range within groups on these maps is much smaller in absolute terms for women than for men, with a gap between the extremes of the top and bottom groups of 2.75 years in 1977 and 2.25 years in 2007 for women, versus 4.45 and 3.50 years for men. All the values are represented on these maps, but because of the small number of deaths in some sparsely populated *départements*, any relative excess or deficit of mortality seen in these *départements* may be due to chance and may not reflect the actual state of health of the local population.

The maps show the persistence of geographical variations in life expectancy at birth, the general indicator of mortality. In 1977, the most disadvantaged *départements* were located in two geographical areas. The first was a crescent stretching from Alsace to the Nord-Pas-de-Calais region for both sexes, and as far as some *départements* in Normandy for men (Seine-Maritime and Calvados) including Lorraine (except Vosges for women), the north of the Champagne-Ardenne region and Picardy (except Oise for men). The second disadvantaged area, for men especially, extended across Brittany and the Loire-Atlantique

Figure 1. Difference between highest and lowest life expectancy at birth recorded in the French *départements*, males and females



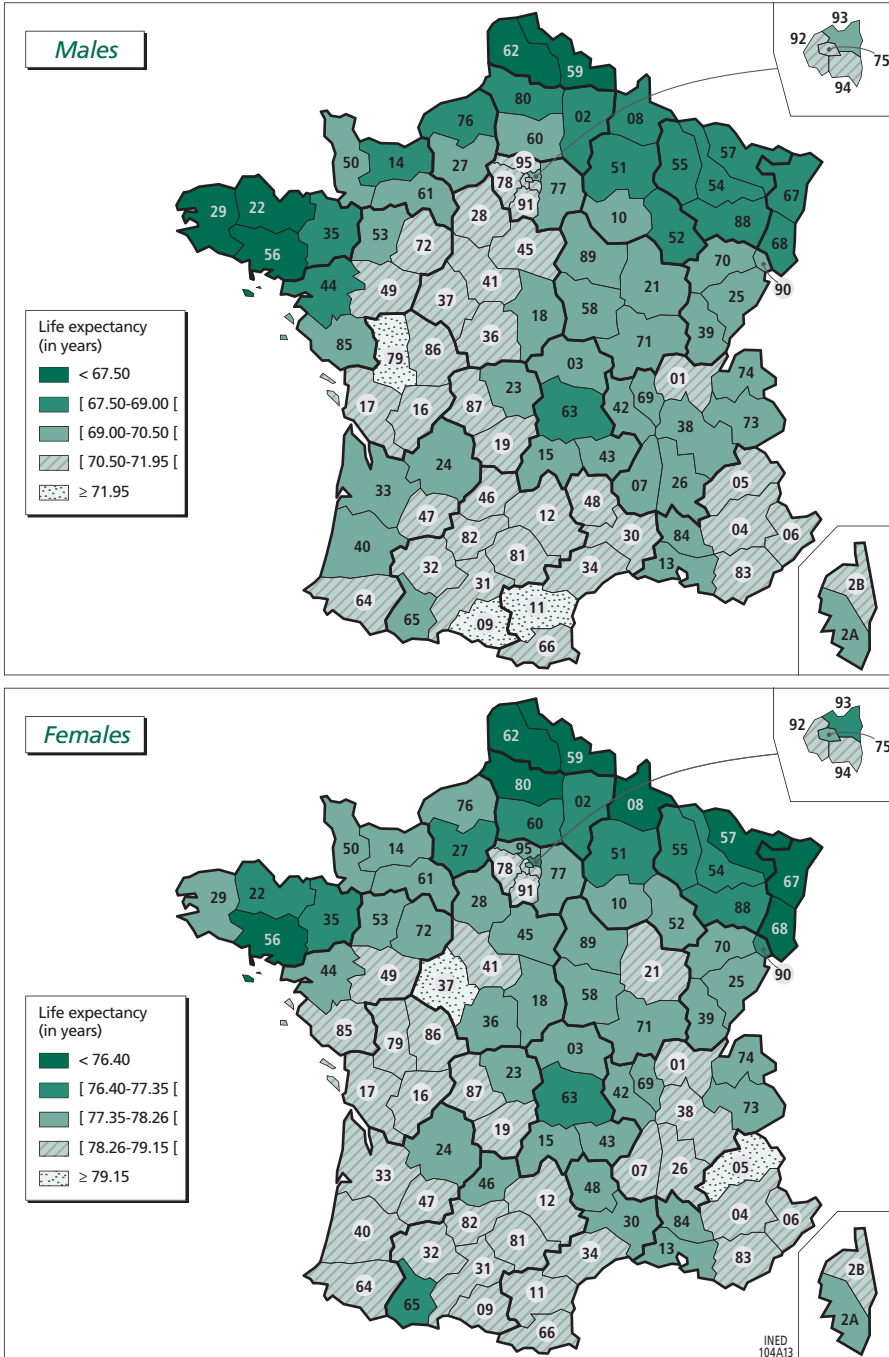
**Note:** The curves are the regression lines obtained by locally weighted scatterplot smoothing (LOWESS), i.e. by considering a window centred successively on each observation year and including a constant proportion of points, in this case, half the total points on the figure.

**Source:** INSEE, Division des statistiques régionales, locales et urbaines, three-year life tables.

*département*. For women this area only comprised the three easternmost *départements* of Brittany. In 2007, these two areas of relatively high mortality are still visible, although less so for Brittany, Alsace and Lorraine for men, and Champagne-Ardenne for women. The most striking change is the expansion of the area along France's northern frontier, especially for men. It pushes down towards the centre of the country from Champagne-Ardenne to the north of Limousin.

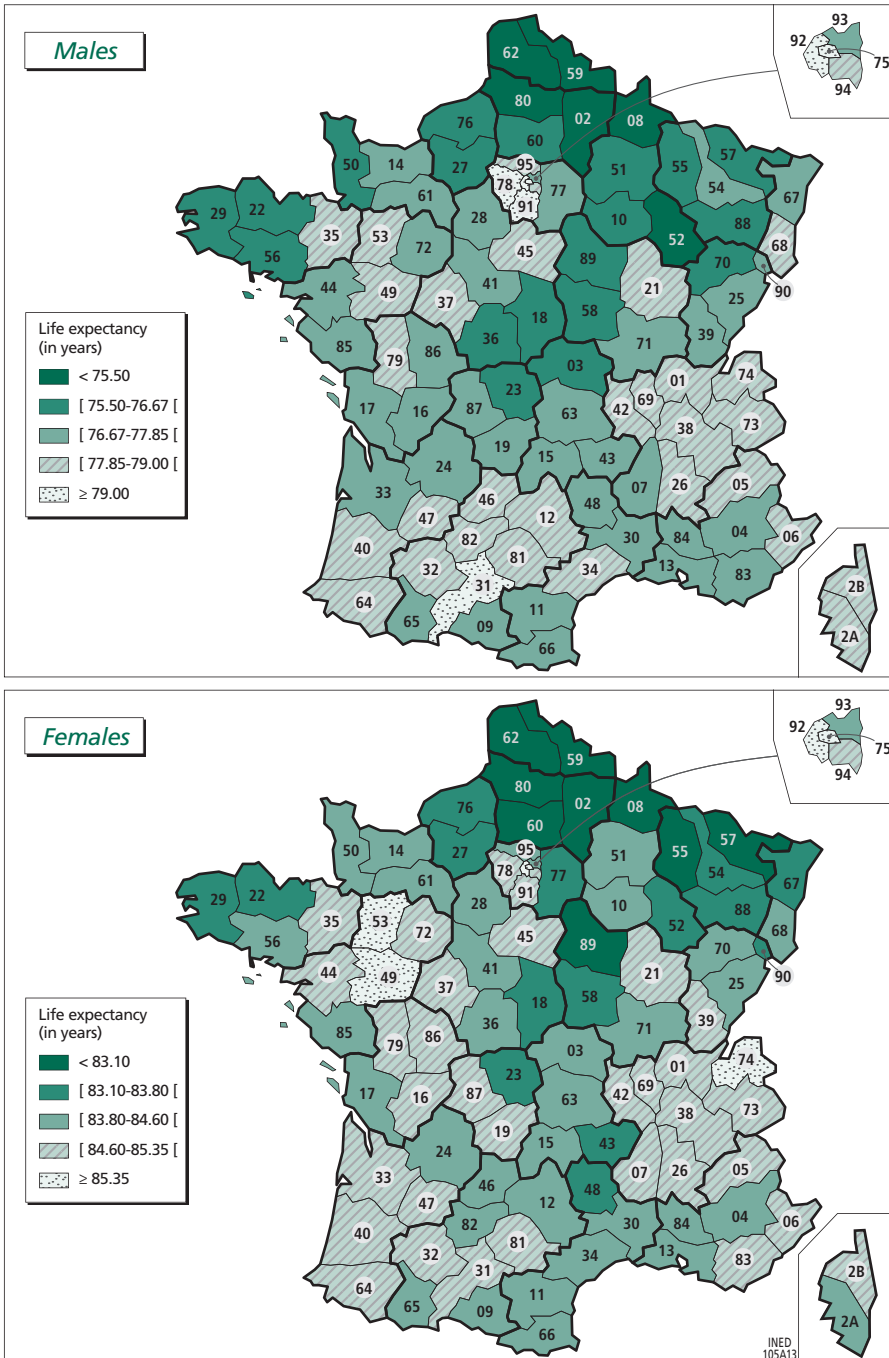
The geography of the *départements* with high life expectancy at birth has also changed. In 1977, they were to be found overwhelmingly in an area running

Figure 2. Male and female life expectancy at birth by *département*, 1976-1978



Source: INSEE, Division des statistiques régionales, locales et urbaines.

Figure 3. Male and female life expectancy at birth by département, 2006-2008



Source: INSEE, Division des statistiques régionales, locales et urbaines.

from Île-de-France to the south-west and south-east. For men, this area comprised Île-de-France except Seine-Saint-Denis, the *départements* along the regional borders of Pays de la Loire and Centre, Poitou-Charentes, part of Limousin, Midi-Pyrénées and Languedoc-Roussillon. For women, it was broken by Sarthe and Loir-et-Cher, but stretched down to Aquitaine. The other area of low mortality covered the four *départements* in the south-east corner of France, plus Haute-Corse, and, for women, part of the Rhône-Alpes region. By 2007, this second area had shifted north, centring more on Rhône-Alpes than Provence-Alpes-Côte d'Azur, while the first area of high life expectancy at birth had broken into three distinct islands around Île-de-France, Pays de la Loire (especially for women) and, for men, a group of *départements* from the Atlantic coast to Hérault, except for those along the Spanish frontier, and, for women, covering Aquitaine (except Dordogne) and some of the *départements* in Midi-Pyrénées.

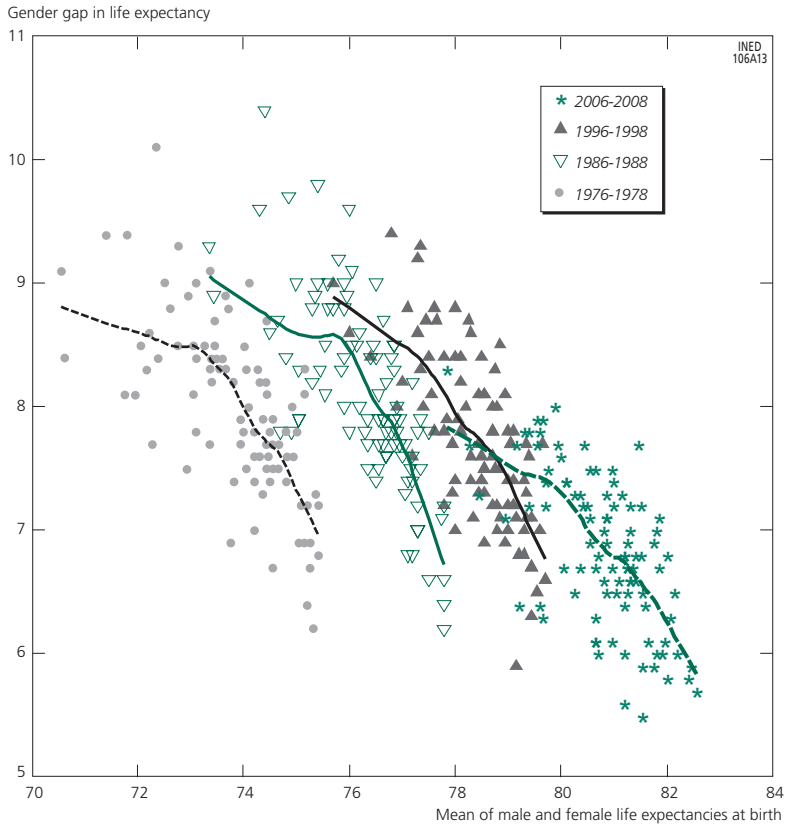
Generally speaking, the advances made from 1976-1978 to 2006-2008 were greatest where life expectancy at birth was initially low (but not lowest). The correlation is statistically significant for both sexes but more marked for men. That the standard deviation barely moved between the two dates, from 1.4 to 1.1 for men and 0.9 to 0.8 for women, is due to a few *départements* at either end of the distribution.

## II. The gender gap in life expectancy has narrowed in all *départements*

There is a close correlation between male and female life expectancy at birth. Those *départements* where life expectancy is low for men are in general those where it is also low for women. For example, the lowest ranking *départements* for life expectancy (Pas-de-Calais, Nord and Aisne) and the highest (Paris and Hauts-de-Seine) are the same for both sexes.

Figure 4 shows the correlation between the gender gap in life expectancy and the mean of male and female life expectancies. It demonstrates that the higher the mortality, the wider the gender gap. This finding is not new (Vallin, 1990; Meslé and Vallin, 1998) and is reflected in the local regression lines for the four clouds of points corresponding to the four periods considered. However, the correlation is not linear, as can be seen by the changing gradients of each regression line. The narrowing of the gender gap in life expectancy associated with each additional year of life expectancy is greater in those *départements* where life expectancy at birth is highest: in this group, life expectancy varies mainly for men, whereas in the *départements* with lowest life expectancy, the differences between *départements* are similar for men and women. This effect was very pronounced in the life tables for 1976-1978 and 1986-1988 but has lessened over time: the gradient change is much less marked for the 1996-1998 cloud of points and almost entirely disappears for the most recent period. Analysis of life expectancy trends for each sex shows that this reflects greater progress

Figure 4. Correlation between the gender gap in life expectancy and the mean of male and female life expectancies at birth, 1976-1978, 1986-1988, 1996-1998 and 2006-2008



**Note:** The curves are the regression lines obtained by locally weighted scatterplot smoothing (LOWESS), i.e. by considering a window centred successively on each observation year and including a constant proportion of points, in this case, half the total points on the figure.

**Source:** INSEE, Division des statistiques régionales, locales et urbaines, life tables.

for women with respect to men in the *départements* with low life expectancy at birth than in the others, a finding consistent with the fact that geographical inequalities in mortality have shrunk since the 1970s for women but not for men.

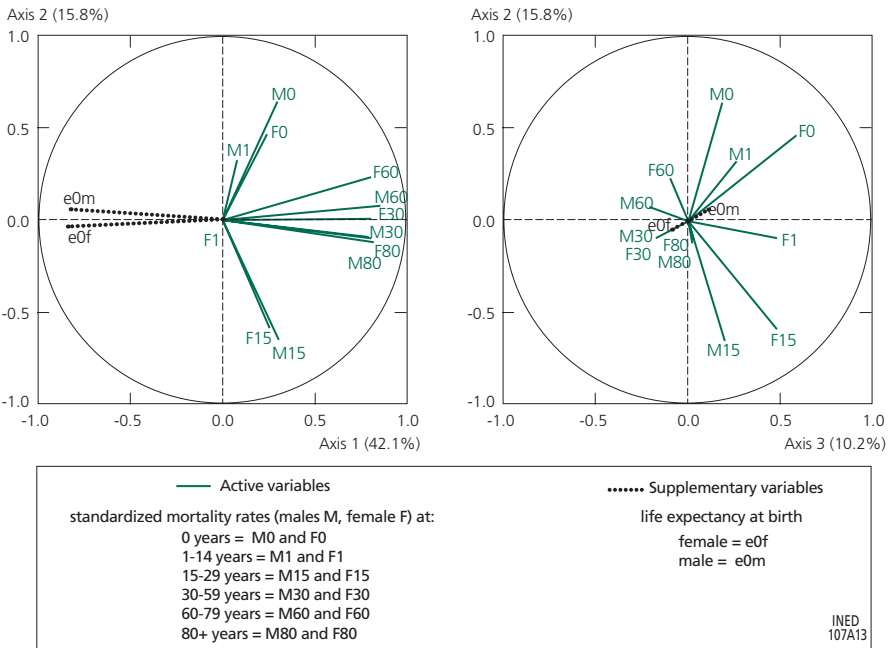
In Pas-de-Calais, Nord, Aisne, Somme, Meuse, Moselle and Oise in 2006-2008, the correlation between the gender gap in life expectancy and overall mortality is as strong as elsewhere, but at each level of life expectancy the gender gap is smaller than in other *départements* with similar life expectancies: whereas male life expectancy is similar in the northern *départements* and in those of Brittany, female life expectancy is lower in the former than the latter. This finding suggests that the factors behind geographical inequalities of mortality in the north of France affect both sexes equally and that, compared with women in other areas of excess mortality, those in the north have a particular disadvantage in terms of life expectancy at birth.

### III. Impact of adult mortality on geographical variations in life expectancy

To understand the reasons behind geographical variations in mortality, principal component analysis (PCA)<sup>(4)</sup> can be used to determine the various age patterns of mortality in French *départements*. The analysis was applied to the standardized mortality rates<sup>(5)</sup> for major age groups (0, 1-14, 15-29, 30-59, 60-79, 80+) in 2006-2008 in each of the 96 *départements* of metropolitan France.<sup>(6)</sup>

The graphical presentation of the PCA results shows correlations between mortality rates at various ages (Figure 5). The proximity of the points in the

**Figure 5. Principal component analysis on mortality rates by sex and age in the French *départements*. Factor map of active and supplementary variables on axes 1 and 2 and on axes 2 and 3**



**Note:** The percentages in brackets show the proportion of inertia for each axis. The life expectancies are supplementary variables of the analysis and do not contribute to the axes.

**Source:** INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by *département*.

(4) Our analyses were implemented using the R package *FactoMineR* (Husson et al., 2009), which uses the Pearson coefficient as similarity index.

(5) The standardized rates were calculated for each sex and age group using the population of metropolitan France, both sexes, on 1 July 2007 as reference structure.

(6) In this type of analysis the values used can be "standardized" (by centring the variables so that the mean becomes zero, and dividing by the standard deviation). We chose not to do this, since we did not wish to give the same weight to the lowest rates (childhood and young adult mortality) as to the highest (older adults), which now have a much greater impact on life expectancy at birth.

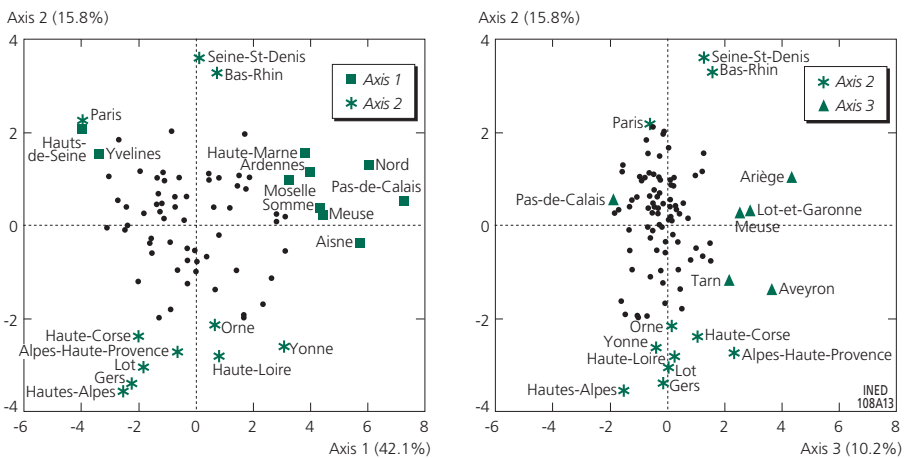


factors space reflects a high positive correlation between the corresponding mortality rates. Life expectancy at birth is represented as a supplementary variable and does not contribute to the principal components. Its presence is useful because, as explained below, it shows the impact of various age groups on the variability between *départements* of life expectancy at birth.

The first three PCA axes express 68% of total inertia. Note that the closeness of the female and male rates by age on the first two PCA axes indicates that age-group impact on geographical variations in mortality is similar for both sexes.

Axis 1 alone accounts for more than 40% of total territorial variability. All the mortality rates above age 30 contribute to this axis. They are positioned opposite life expectancy at birth, showing the high correlation between the two types of indicator: the higher the mortality above age 30 in a *département*, the lower life expectancy at birth and vice versa. In practice, mortality before age 30 has become so low in France that it no longer has any noticeable effect on life expectancy. It therefore does not affect territorial variations in overall mortality either. Axis 1 thus represents the intensity of mortality. It shows very clearly the difference between the *départements* in the Paris region (especially Paris, Hauts-de-Seine and Yvelines), where life expectancy at birth is high (at least 79.5 years for men, 85 years for women) and the northern *départements* (especially Pas-de-Calais, Nord and Aisne) where it is low (below 75 years for men, 81.2 years for women) (Figure 6).

**Figure 6. Principal component analysis on mortality rates by sex and age in the French *départements*.**  
Factor map of the *départements* on axes 1 and 2 and on axes 2 and 3



**Note:** The *départements* contributing most to each axis are identified by name and by a distinctive symbol (a green square, a green star and a green triangle for those contributing to the first, second and third axes, respectively). The four *départements* contributing significantly to two of the first three PCA axes are Paris (axes 1 and 2), Pas-de-Calais and Meuse (axes 1 and 3) and Alpes-de-Haute-Provence (axes 2 and 3).

**Source:** INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by *département*.

While mortality rates before age 30 contribute little or nothing to PCA axis 1, they are practically the sole contributors to axes 2 and 3, which, unlike axis 1, correlate only slightly with life expectancy at birth. Taking all the *départements* together, whatever their overall mortality levels, marked differences can be seen in the structure of young people's mortality, which is due to low correlations between mortality rates at 0, 1-14 and 15-29 years, by contrast with the high correlations seen for mortality after age 30. PCA axis 2 distinguishes between those *départements* where child mortality is high and those where adolescent and young adult mortality is particularly high relative to life expectancy at birth (although these mortality levels may not necessarily be higher than for France as a whole). The former group of *départements* includes Hautes-Alpes, Gers, Lot, Haute-Loire, Alpes-de-Haute-Provence, Yonne, Haute-Corse and Orne, while the latter is well represented by Seine-Saint-Denis, Bas-Rhin and Paris.

Axis 3 of the factorial plane adds some nuance to the contrast between child mortality on the one hand, and adolescent and young adult mortality on the other, by simply comparing the *départements* with high under-30 mortality and those with low under-30 mortality (particularly for women), relative to adult mortality. This axis also contrasts, though less markedly, the *départements* with high and low male 60-79 mortality, since high mortality at this age tends to be associated with low mortality for young people of both sexes and vice versa. The *départements* that contribute most to axis 3 are Ariège, Aveyron, Lot-et-Garonne, Meuse, Alpes-de-Haute-Provence and Tarn, where young women's mortality is particularly high relative to that of young men, and Pas-de-Calais, where, conversely, under-30 mortality is particularly low with respect to the high level of overall mortality in that *département*.

Table 1 summarizes the PCA findings by distinguishing five age patterns of mortality defined, first, by overall mortality (life expectancy at birth and over-30 mortality) and, second, by level and structure of under-30 mortality.

#### IV. Territorial variations in mortality by cause of death

In order to examine the medical causes of death for each of the major age groups identified above, we combined INSEE's life tables with data on deaths by cause, sex and age supplied by INSERM,<sup>(7)</sup> and calculated mortality rates by sex, age group, cause of death and *département* in 2006-2008 (Appendix Table A.4). The codes of the International Classification of Diseases used by INSERM were combined into 26 categories, further collated under five major headings (Appendix Table A.5). These headings are those already used in INED's annual report on the demographic situation. To facilitate comparison,

(7) Specifically, CépiDC at INSERM.

Table 1. Typical *départements* for five age patterns of mortality, metropolitan France, 2006-2008

Relative mortality				
Under age 15 (both sexes)		High under age 30 (both sexes)	Under age 30 (both sexes)	
Low	High		Low or moderate	High
Ages 15-29 (both sexes)			Ages 60-79 (both sexes)	
High	Low		High	Low
Gers	Bas-Rhin	Alpes-de-Haute-Provence	Aisne	Meuse
Haute-Corse	Hauts-de-Seine	Ariège	Ardennes	
Haute-Loire	Paris	Aveyron	Nord	
Hautes-Alpes	Seine-Saint-Denis	Lot-et-Garonne	Moselle	
Lot		Meuse	Pas-de-Calais	
Orne		Tarn	Somme	
Yonne				

**Note:** The most typical *départements* for each pattern were identified from their positions on each of the first three PCA axes.

**Source:** INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by *département*.

deaths from ill-defined or unspecified causes were proportionally redistributed for each sex in each age group and *département*.

It must be borne in mind that in any analysis of mortality in the French *départements* by sex, age group and cause of death, the numbers are almost always too small for any observed differences to be statistically significant. This holds especially for the 1-14 age group, since death has become a particularly rare event for children beyond the first few months of life. For this reason, the 1-14 and 15-29 age groups are combined. However, caution should be exercised in interpreting the findings given here and they must be seen as indicative rather than definitive.

Table 2 shows the contribution of each category of causes of death to variations in mortality between *départements* for each age group, both sexes combined, and standardized mortality rates for the same age groups and causes (whole of France).

The contributions of the various broad causes to the variability of mortality between *départements* do not necessarily correspond to their contributions to overall mortality (Table 2, final column): while cancers are the main cause of death in France, they are only the third cause of variability between *départements*. Cardiovascular diseases make the largest contribution and account for one-third of the variability between *départements* for all ages. This is due primarily to their impact at ages 80 and above, where they account for 47% of total variance. They also account for 28% of total variance at ages 60-79 but only 16% at 30-59. In these last two groups, cancers dominate, accounting for one-third of total variance, compared with one-quarter for all ages and only 8% at ages 80 and above. "Other diseases" also have a large impact, explaining 23% to 30% of variability between *départements* for all ages, except in the first year of life, where their contribution

**Table 2. Variability between *départements* of mortality rates by broad cause of death and age group, and standardized rates, both sexes, metropolitan France, 2006-2008**

Cause of death	Age group					All ages	Standardized rate (per 100,000)
	0	1-29	30-59	60-7	80+		
Cardiovascular diseases	0.3	1.0	16.3	27.6	46.8	33.3	259
Other diseases	93.6	10.4	29.9	23.2	27.1	26.3	190
Cancers	1.0	3.4	34.0	34.2	7.6	22.2	278
Infectious diseases	3.4	2.8	2.8	11.1	14.0	10.5	75
External causes	1.8	82.4	17.0	3.9	4.5	7.7	65
All causes	100.0	100.0	100.0	100.0	100.0	100.0	866
Standardized rate per 100,000	369	31	284	1 655	9 245	866	

**Note:** Ill-defined or unspecified causes of death are distributed proportionately by *département*, sex and age group. For each age group, the proportion of variability in mortality due to broad cause of death *i* is estimated by the ratio  $C(x_i) / \text{Var}(x)$  where  
 $\text{Var}(x)$  = variance in all-cause mortality;  $C(x_i) = \text{Var}(x_i) + \sum_{j \neq i} \text{Covar}(x_i, x_j)$ ;  
 $\text{Covar}(x_i, x_j)$  = Covariance between mortality rate  $x_i$  by cause *i* and rate  $x_j$  by cause *j*.  
**Sources:** INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by *département*; INSERM, CépiDC, annual statistics of deaths by medical cause.

is overwhelming (94% of total variance), due primarily to perinatal diseases and congenital anomalies, and in the 1-29 age group, where it is minimal and deaths from external causes predominate (82% of total variance). Deaths from external causes also explain 17% of total variance at ages 30-59, but their contribution is negligible after age 60, at only 4%. Among the other causes, infectious diseases only become significant above age 60 (11% of variance at ages 60-79 and 14% at age 80 and above). We examine below in greater detail for each age group the contributions of the various causes to the geographical inequalities in mortality between *départements*, for both sexes under age 30 and for each sex above that age (see also Appendix Table A.4).

**Particular vulnerability during the perinatal period**

Infant mortality is now extremely low throughout France, so that the rates calculated for each *département* exhibit high random annual fluctuations. The difference between these rates and those for metropolitan France as a whole for both sexes is significant at the 5% level in only six *départements*. Mortality is lower than the national average in four of them and higher in two, Bas-Rhin and Seine-Saint-Denis. At the 1% level, the rate only differs from the national average in three *départements*: lower in Bouches-du-Rhône and Haute-Corse, and higher in Seine-Saint-Denis. Even in Bas-Rhin and Seine-Saint-Denis, the infant mortality rate is only 5.1 per 1,000 and 4.8 per 1,000, respectively, (compared with the national average of 3.7 per 1,000), lower than the rate

observed for the same period (and even for 2011-2012) in many high-income Western countries (such as Austria, Luxembourg and the United States) (Mazuy et al., 2013). This finding contrasts with earlier studies, which reported the persistence of major geographical inequalities in infant mortality in the mid-1970s, with rates between 10 per 1,000 and 17 per 1,000 (Caselli and Egidi, 1986b). This reduction in inequality reflects the successful work of maternal and child health services throughout France over the last 30 years, especially in northern France, where infant mortality was particularly high until the late 1960s (Nizard and Prioux, 1975).

The pathologies responsible for infant mortality are highly specific and, as mentioned above, the main causes of overall mortality are inappropriate for describing mortality in the first months of life: 94% of variability between *départements* at this age is attributable to “other diseases”, which is not very informative. The following pathologies can therefore be distinguished for infant mortality: infectious diseases (including acute respiratory infections, pneumonia and influenza), conditions originating in the perinatal period, congenital anomalies, deaths from external causes (mainly accidents at this age), sudden infant death syndrome, and all other causes.<sup>(8)</sup> These categories were selected because they have all been the main cause of infant death or one of the main causes at some time during the last 50 years (Barbieri, 1998).

Nationally, 75% of infant mortality is attributable to only two of the five categories defined above, namely conditions originating in the perinatal period and congenital anomalies. Excluding the residual category, the next most frequent causes of death are sudden infant death syndrome, accidents and infectious diseases. Even though mortality is higher for boys (at 4.1 deaths per 1,000 births, compared with 3.2 for girls), the structure is the same for both sexes, so we make no distinction in the analysis below, which aims to identify typical patterns of mortality by cause. To reduce the effect of random variations, we only examine the *départements* (28 in total) where the infant mortality rate differs significantly from the national average<sup>(9)</sup> and those where at least 30 deaths per year were recorded on average in 2006-2008.

Mortality from conditions originating in the perinatal period and congenital anomalies accounts for more than half of infant mortality in all the selected *départements*. The proportion ranges from 55% to 85%, however. It is below 70% in Haute-Corse, Maine-et-Loire, Charente-Maritime and Gironde, and above 80% in Haute-Garonne, Paris, Val-de-Marne and Bas-Rhin. The first group of *départements* features a high proportion of deaths either from accidents (particularly in Haute-Corse, where the infant mortality rate from accidents

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(8) These six headings correspond to the following codes of the International Classification of Diseases, Tenth Revision (ICD-10): infectious diseases - A00-A99, B00-B99, J00-J06, J09-J18 and J20-J22; conditions originating in the perinatal period - P00-P99; congenital anomalies - Q00-Q99; accidents - V00-Y99; sudden infant death syndrome - R95; other causes: all other ICD codes.

(9) At a 5% significance level.

is almost twice the French average) or sudden infant death syndrome (such as Maine-et-Loire, where the rate is 40% above the French average).

In Bas-Rhin and Seine-Saint-Denis, however, where the all-cause infant mortality rate is particularly high, it is neither accidents nor sudden infant death syndrome that account for this excess mortality but conditions originating in the perinatal period (with rates more than twice the French average). In Bas-Rhin, the rate of congenital anomalies is extraordinarily high (22 per 100,000, compared with 12 per 100,000 in Seine-Saint-Denis and only 8 in France as a whole). This calls for a specific study to determine whether this rate is actually due to a high prevalence of malformations, or rather to specific diagnostic practices, and to see if this finding is confirmed for other years. In Seine-Saint-Denis, the high infant mortality rate may be due to the high proportion of immigrants in the *département*, since research has shown that in France, a mother's migration status is one of the main explanatory factors of social differences in infant mortality today (Niel, 2011). Since these infant deaths are concentrated during the first few days after birth, the high observed mortality may be due to problems with pregnancy monitoring or more limited access to obstetrical care for immigrant women.

### *The overwhelming impact of deaths from external causes among young adults*

The curve of probabilities of dying reaches its minimum around age 10, and deaths have become so rare after the first few months of life that it is impossible to establish a typology of *départements* according to their pattern of mortality by cause at ages 1-14. Deaths at ages 1-14 and 15-29 were therefore analysed together. Even so, the mortality rate at ages 1-29 for both sexes (strongly influenced by mortality above age 15) only differs significantly from the French average in twelve *départements* (of which five with much higher rates). These *départements* rank similarly for both sexes but female mortality rates are much lower. The *départements* in the Île-de-France region (particularly Paris, Hauts-de-Seine and Val-de-Marne), where the rates are below 30 per 100,000 for males and 16 for females, contrast with Aisne, Orne, Vaucluse and Yonne, where the rates are above 60 and 24 per 100,000, respectively, with Somme slightly below (Table 3).

Deaths from external causes are the main explanation for differences in mortality between *départements* at these ages, accounting for more than 80% of variability (Table 2), although they represent barely more than 50% of overall mortality at ages 1-29. There is a strong correlation between mortality rates from all causes and from external causes (coefficient 0.93). Within this broad category, it is transport accidents and (for the 15-29 group) suicide that predominate. Focusing the analysis of causes of death on the 12 *départements* where the all-cause mortality rate for both sexes differs significantly (at the 5% level) from the French average, other diseases, for men only, show a clear divide between low mortality areas and high mortality areas (above and below

**Table 3. Standardized mortality rate (per 100,000) at ages 1-29 in metropolitan France and ratio between the rates by cause in selected départements and the national average (%), 2006-2008**

Département	Ratio between the standardized rate in each département and rate for metropolitan France as a whole (%)										Standardized rate all causes (per 100,000)
	Cancers	Cardiovascular diseases	Infectious diseases	Alcoholism / Cirrhosis	Mental illness or nervous system disorder	Other diseases	Transport accidents	Suicides	Other external causes	All causes	
<b>Males</b>											
Hauts-de-Seine	107	58	124	28	64	95	34	51	56	60	26.4
Paris	130	95	141	21	70	95	28	43	54	61	26.9
Val-de-Marne	104	76	140	0	71	127	48	32	68	66	29.0
Rhône	149	98	96	37	96	95	57	32	60	72	31.7
Essonne	54	106	50	87	74	83	60	93	74	72	31.9
Val-d'Oise	91	153	166	81	81	108	51	66	71	76	33.6
Yvelines	138	104	49	70	89	97	65	82	69	83	36.4
Somme	135	52	74	182	109	121	147	155	112	130	57.5
Vaucluse	189	79	204	103	115	168	159	106	130	143	63.1
Orne	130	124	160	258	265	153	130	180	86	143	63.2
Yonne	17	195	0	441	168	143	200	152	116	145	63.8
Aisne	115	118	102	321	147	131	152	169	147	146	64.6
France	100	100	100	100	100	100	100	100	100	100	44.1
Rate per cause	5.2	2.0	1.4	0.4	2.8	3.0	13.5	8.0	7.9	44.1	
<b>Females</b>											
Hauts-de-Seine	76	76	100	0	80	82	58	94	73	78	14.2
Paris	49	69	136	0	115	153	39	73	59	79	14.5
Val-de-Marne	116	134	113	0	70	95	34	40	97	83	15.3
Rhône	85	75	194	0	44	92	86	46	115	87	16.0
Essonne	106	147	148	0	60	74	48	84	93	88	16.1
Val-d'Oise	115	78	185	0	125	95	76	54	62	93	17.1
Yvelines	112	120	92	0	125	128	42	57	97	94	17.2
Somme	80	117	122	0	40	223	116	138	86	118	21.6
Vaucluse	72	0	111	0	161	185	258	85	85	131	24.0
Orne	103	0	83	0	115	207	285	62	112	140	25.7
Yonne	193	88	33	0	87	125	215	51	184	142	26.1
Aisne	54	0	143	0	51	233	376	109	87	151	27.7
France	100	100	100	100	100	100	100	100	100	100	18.3
Rate per cause	3.7	1.3	1.1	0.0	1.6	2.8	3.3	2.2	2.3	18.3	
<p><b>Notes:</b> For each sex, the départements are ranked by their all-cause mortality rate at ages 1-29 and the dotted line separates the low mortality ones (above) from the high mortality ones (below). The reference population for the standardized rates is metropolitan France in 2007, both sexes.</p> <p><b>Coverage:</b> The twelve départements where the mortality rate at ages 1-29 differs significantly from that of metropolitan France.</p> <p><b>Sources:</b> INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by département; INSERM, CépiDC, annual statistics of deaths by medical cause.</p>											

the dotted line in Table 3). These diseases are mainly alcoholism and cirrroses, plus mental illness and nervous system disorders. The rates for these diseases are extremely low, even in the most affected *départements* (Aisne, Yonne and Orne) and their contribution to overall mortality and variability between *départements* is negligible at these ages. However, they do reveal the problems that underlie excess mortality in these *départements*. All these causes linked to violent deaths indicate a high prevalence of high-risk behaviour in these population groups, reflecting difficulties of social and economic integration for the young men in these *départements*.

### *Cancers responsible for premature mortality at ages 30-60*

Above age 30, mortality increases and the populations at risk are large, so random fluctuations diminish and coherent geographical areas of high and low mortality appear. As for the previous age groups, we focus our analysis on those *départements* where the all-cause rate differs significantly (at the 5% level) from the national average, but now distinguishing between the sexes. A much higher number of *départements* deviate significantly from the mean: 47 for men and 29 for women (out of 96 *départements* in metropolitan France).

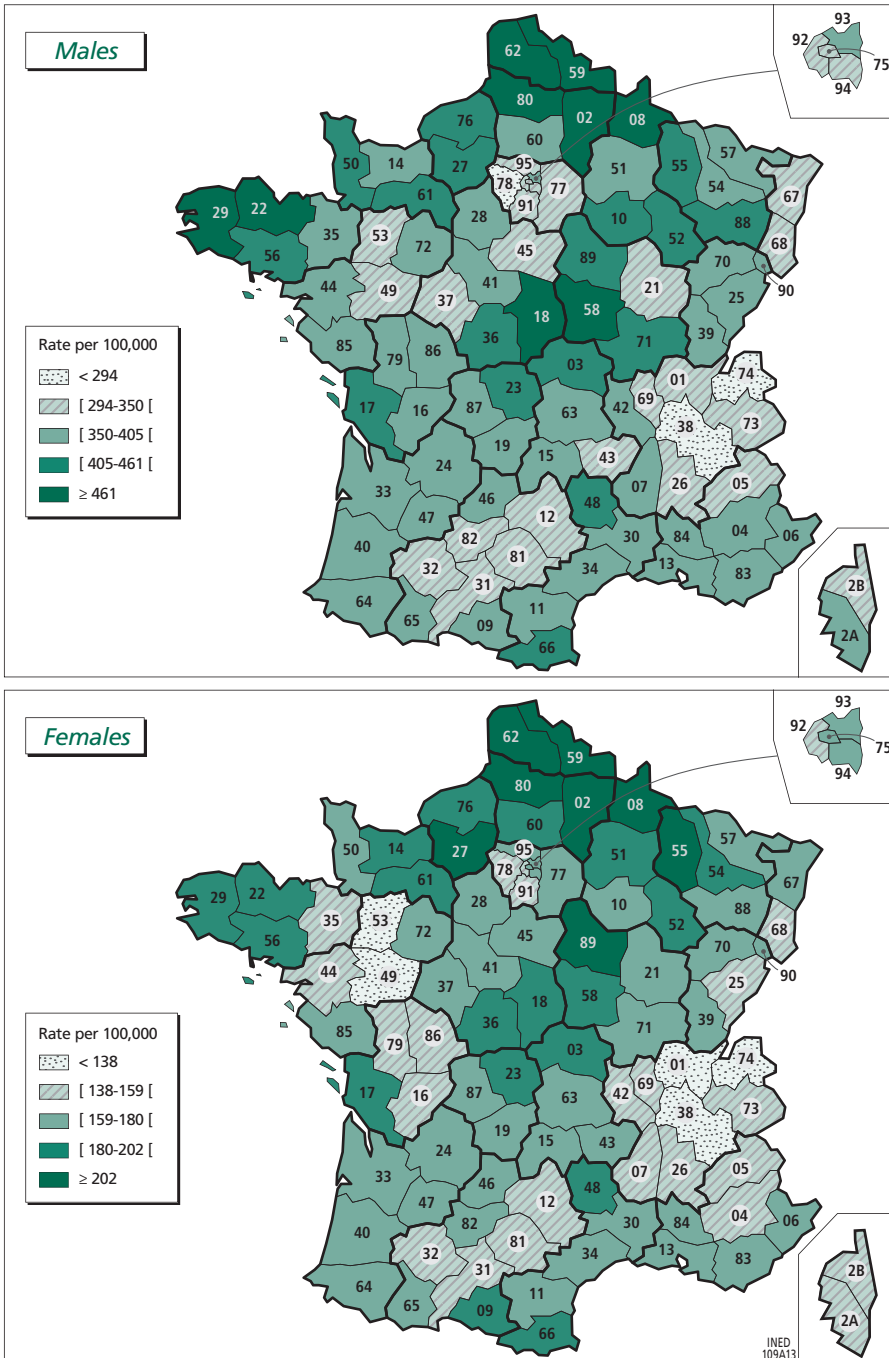
The all-cause mortality rate at ages 30-59 varies by a factor of two between the extremes, from Haute-Savoie (278 per 100,000 for men and 119 for women) to Pas-de-Calais (571 and 236 respectively). The geography of mortality at these ages is similar to that of life expectancy at birth (Figure 7). For both men and women, mortality is high along the Belgian border and in part of Normandy (especially Eure for women). For men in particular, it is also high in Brittany and in an area centred on Cher and Nièvre and stretching into Lorraine. Conversely, mortality is relatively low in Rhône-Alpes and along an axis from Midi-Pyrénées (Gers and Haute-Garonne) almost as far as Rhône-Alpes, with the exception of Lozère which is more disadvantaged. Mortality at these ages is also low in Île-de-France, but less so for women than for men, and in Alsace, for men only. The final area of low mortality, particularly extensive for women, covers Pays de la Loire and part of Poitou-Charentes.

Most deaths at ages 30-59 are due to cancers, particularly among women, where this cause accounts for 50% of the all-cause rate (versus 38% for men). Just over one-third of the territorial variability in mortality at ages 30-59 is also due to cancers, equal to other diseases for women (versus one-quarter for men). Cardiovascular diseases account for 15% of the variance among men and 17% among women, and deaths from external causes 19% and 10%, respectively.

Analysis of variability using more detailed causes of death is highly instructive. When the various types of cancer are separated out, the main cause of geographical inequality in mortality at these ages is lung cancer for men (10% of all-cause variance). For women, lung cancer (5% of variance) comes second to breast cancer (8%). Alcohol-related diseases (alcoholism and cirrhosis of the liver) account for most of the contribution of “other diseases” to territorial



Figure 7. Mortality rate per 100,000 at ages 30-59 by département and sex, 2006-2008



Source: INSEE, Division des statistiques régionales, locales et urbaines

variations in mortality at ages 30-59 (17% for both men and women). Of all external causes, suicide accounts for the greatest proportion of variability (13% of total variance for men out of 19% for all deaths from external causes, and 6% for women out of 10%). Transport accidents are of negligible importance at these ages (1% of territorial variability for each sex).

Table 4 shows the standardized rates of mortality by cause at ages 30-59 in the ten *départements* at either end of the distribution for each sex (among all those where the rate differs significantly from the national average)<sup>(10)</sup> and the ratio between their rate and that of metropolitan France as a whole. The results confirm the major trends described in the previous paragraph and are highly consistent: rates by cause are almost all below average in the *départements* with low overall mortality and higher in those with high mortality, especially for men, with the sole exception of transport accidents. However, some causes do appear to be of particular importance in explaining the excess mortality observed in the northern *départements*. For men, these are cancers, particularly lung cancer, cardiovascular diseases, suicide and, above all, alcohol-related diseases and the residual “other diseases”. For women, lung cancer and deaths from external causes are less systematically correlated with overall mortality, while cardiovascular diseases, mental and nervous system disorders, “other diseases” and, above all, as for men, alcoholism and cirrhosis of the liver establish a clear divide between high- and low-mortality *départements*. This highlights the impact of individual behaviour on mortality (particularly smoking and alcohol consumption) and the geographical variations in behaviour that were emerging in the previous age group. A study by Alfred Nizard and France Prioux (1975) showed the effect of individual behaviour, especially alcoholism, on geographical variations in mortality in general, and for men in this age group in particular, back in the 1960s.

### *Cancers among men and cardiovascular diseases among women account for variations between départements at ages 60-79*

Even more than at ages 30-59, the territorial variations in mortality at ages 60-79 closely overlap with those of life expectancy at birth, and the correlation between these indicators peaks in this age group. This correlation is particularly high for men. The high mortality observed at ages 60-79 in the five most disadvantaged *départements* accounts for 40% to 50% of the total difference with respect to the national average in life expectancy at birth for men, and for 22% to 43% for women. The maps look very similar, with clear geographical concentrations (Figure 8). The all-cause rate varies from 1,769 per 100,000 in

(10) Note that although the difference between the all-cause rate in each selected *département* and the rate for the whole of France is statistically significant (5% level), this does not hold for the rates by cause, which only differ significantly from the national average in exceptional cases. Consequently, it is the consistency of mortality patterns by cause in relation to overall mortality that provides general indications, rather than the examination of any particular *département*.

**Table 4. Standardized mortality rate (per 100,000) for the 30-59 age group in metropolitan France and ratio between the rates by cause in selected départements and the national average (%), 2006-2008**

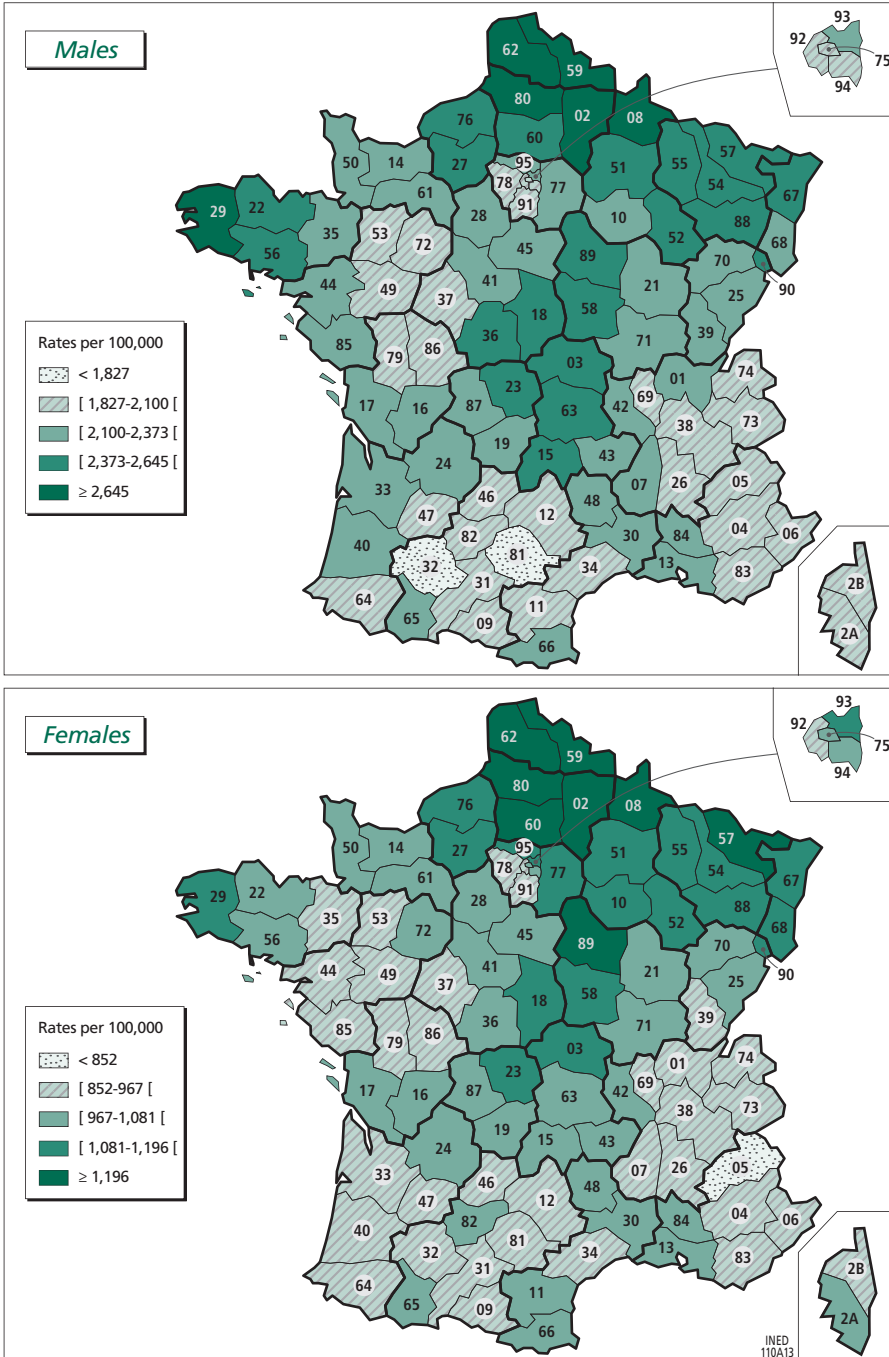
Département	Ratio between standardized rate in each département and rate for metropolitan France as a whole (%)											Standardized rate all causes (per 100,000)
	Lung cancer	Other cancers	Cardiovascular diseases	Infectious diseases	Alcoholism / Cirrhosis	Mental illness or nervous system disorder	Other diseases	Transport accidents	Suicides	Other external causes	All causes	
<b>Males</b>												
Haute-Savoie	71	72	66	62	54	66	57	105	75	105	71	278
Yvelines	72	79	76	73	66	73	69	56	67	61	72	283
Isère	73	70	84	49	56	72	65	105	73	92	73	286
Bas-Rhin	74	79	85	71	77	73	96	63	64	46	75	295
Haute-Garonne	88	81	75	72	46	91	87	87	52	92	76	298
Somme	113	113	131	113	133	113	138	113	121	115	120	469
Aisne	121	102	127	111	132	122	146	148	136	108	120	470
Finistère	126	112	103	102	145	136	120	85	156	142	121	475
Nord	128	140	138	135	182	120	145	61	123	127	136	534
Pas-de-Calais	150	147	138	122	211	108	153	96	149	119	146	571
France	100	100	100	100	100	100	100	100	100	100	100	391
Rate per cause	52	109	63	20	35	15	23	12	37	25	391	
<b>Females</b>												
Haute-Savoie	73	66	64	76	58	63	55	92	93	55	67	119
Mayenne	55	64	93	65	90	91	58	100	117	85	74	132
Isère	87	80	77	53	71	70	64	93	68	58	75	133
Ain	79	83	67	61	49	64	90	111	74	80	77	136
Maine-et-Loire	81	82	73	48	52	98	68	91	95	57	77	137
Somme	52	118	138	104	131	114	145	134	125	136	117	207
Aisne	110	103	160	114	188	130	175	161	92	68	120	213
Ardennes	125	117	150	124	109	142	124	104	125	80	122	215
Nord	79	117	134	121	248	131	165	59	113	126	126	223
Pas-de-Calais	73	127	125	118	309	140	160	84	117	130	134	236
France	100	100	100	100	100	100	100	100	100	100	100	177
Rate per cause	17	77	20	8	11	9	12	3	13	8	177	

**Note:** The départements are ranked by their all-cause mortality rate at ages 30-59 and the dotted line separates the low mortality ones (above) from the high mortality ones (below). The reference population for the standardized rates is metropolitan France in 2007, both sexes.

**Coverage:** For each sex separately, ten extreme départements from among those where the all-cause mortality rate of the 30-59 age group differs significantly from that of metropolitan France.

**Sources:** INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by département; INSERM, CépiDC, annual statistics of deaths by medical cause.

Figure 8. Mortality rate per 100,000 at ages 60-79 by *département* and sex, 2006-2008



Source: INSEE, Division des statistiques régionales, locales et urbaines.

Tarn to 3,172 in Pas-de-Calais for men, and from 832 in Hautes-Alpes to 1,380 in Nord for women.

Three clusters of excess mortality can be seen on the maps, similar to those identified for mortality at ages 30-59, but more clearly delimited. The main cluster, affecting both sexes, is a wide band along the northern borders including all the *départements* in Haute-Normandie, Picardy, Nord-Pas-de-Calais, Champagne-Ardenne, Lorraine and Alsace (except Haut-Rhin for men). It also includes part of Île-de-France (Seine-Saint-Denis and Seine-et-Marne *départements*), and is joined by a second cluster stretching down to the centre of the country (broken by Aube, close to the national male average). The second cluster is concentrated in the *départements* bordering on the Centre, Burgundy and Auvergne regions and is slightly larger for men (with Cantal) than for women. For men the map also shows relative excess mortality in the three westernmost *départements* of Brittany.

Markedly below-average mortality is seen in four clear areas in the south-east, south-west, centre-west and Île-de-France. The first low-mortality area covers almost all the *départements* in Rhône-Alpes, plus Jura for women. For women it also includes the *départements* in Provence-Alpes-Côte d'Azur (except Vaucluse and Bouches-du-Rhône), plus Haute-Corse. For men the area is smaller, and excludes Ardèche, Ain and Jura, but includes Corse-du-Sud. The second low-mortality area for men covers Languedoc-Roussillon and Midi-Pyrénées (except Hautes-Pyrénées and Pyrénées-Orientales), plus Pyrénées-Atlantiques to the west and Lot-et-Garonne to the north. For women, this second area is more broken up and centres on Aquitaine (less Dordogne), excluding Aude and Tarn-et-Garonne. The third low-mortality area centres on the *départements* of Pays de la Loire. It includes for both sexes Mayenne, Maine-et-Loire, Indre-et-Loire, Vienne and Deux-Sèvres. It also includes Sarthe for men, and the three *départements* to the west (Ille-et-Vilaine, Loire-Atlantique and Vendée) for women. The final area of low mortality at ages 60-79 comprises the south-east quarter of Île-de-France, namely Hauts-de-Seine, Yvelines and Essonne, and for men, Paris and Val-de-Marne.

The pattern of causes behind the geographical variations in mortality at ages 60-79 is slightly different for men and women. Cancers continue to account for much of the geographical difference, especially for men, for whom they are still the main cause of variability, accounting for nearly 40% of variance in the all-cause rate, of which one-quarter (10%) from lung cancer alone. Male lung cancer mortality is 20% to 30% above the national average in those *départements* where all-cause mortality is high, and 10% to 25% below it in those with low overall mortality (Table 5). For women, cancers are now only in third position (27% of total variability at these ages, of which only 1% from lung cancer).

For women, cardiovascular diseases are the largest contributing factor to geographical variations in mortality (32% of total variability, compared with 26% for men), particularly heart disease (8% of variability due to coronary

**Table 5. Standardized mortality rate (per 100,000) for the 60-79 age group in metropolitan France and ratio between the rates by cause in selected *départements* and the national average (%), 2006-2008**

<i>Département</i>	Ratio between standardized rate in each <i>département</i> and rate for metropolitan France as a whole (%)											Standardized rate all causes (per 100,000)
	Lung cancer	Other cancers	Heart diseases	Cerebrovascular diseases	Respiratory system diseases	Other infectious diseases	Alcoholism / Cirrhosis	Mental illness or nervous system disorder	Other diseases	Deaths from external causes	All causes	
<b>Males</b>												
Tarn	73	72	91	87	59	43	46	106	72	79	76	1,769
Gers	77	76	91	74	69	52	40	73	69	112	78	1,797
Paris	89	88	70	78	75	114	60	72	78	53	80	1,843
Alpes-Maritimes	83	80	77	80	82	92	63	89	85	80	81	1,865
Haute-Garonne	92	78	89	84	73	72	47	74	83	77	81	1,870
<hr/>												
Somme	120	107	113	98	130	146	117	122	126	141	116	2,674
Ardennes	134	107	135	141	124	92	107	106	122	104	120	2,767
Aisne	126	112	126	123	143	119	132	121	131	127	122	2,832
Nord	124	126	128	136	173	132	178	117	144	123	132	3,059
Pas-de-Calais	127	128	139	134	216	131	172	122	143	118	137	3,172
France	100	100	100	100	100	100	100	100	100	100	100	2,315
Rate per cause	279	789	399	173	135	41	71	116	190	121	2,315	
<b>Females</b>												
Hautes-Alpes	92	73	87	50	85	119	21	85	77	93	77	832
Haute-Corse	131	78	80	97	55	35	62	85	84	66	81	874
Tarn	78	82	87	102	56	80	33	83	78	77	81	880
Indre-et-Loire	87	90	74	80	73	50	94	77	66	86	81	881
Mayenne	56	94	69	80	40	31	56	95	72	143	83	896
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Moselle	119	103	125	136	137	149	121	114	136	93	117	1,265
Somme	83	121	114	108	132	118	133	93	128	128	117	1,266
Aisne	93	114	142	136	123	181	130	122	157	111	126	1,369
Pas-de-Calais	59	111	153	144	144	139	221	119	149	108	126	1,369
Nord	73	112	138	148	151	138	242	122	151	122	127	1,380
France	100	100	100	100	100	100	100	100	100	100	100	1,084
Rate per cause	53	431	167	85	50	23	23	82	115	54	1,084	
<p><b>Note:</b> The <i>départements</i> are ranked by their all-cause mortality rate at ages 60-79 and the dotted line separates the low mortality ones (above) from the high mortality ones (below). The reference population for the standardized rates is metropolitan France in 2007, both sexes.</p> <p><b>Coverage:</b> for each sex separately, ten extreme <i>départements</i> from among those where the 60-79 age group all-cause mortality rate differs significantly from that of metropolitan France.</p> <p><b>Sources</b> INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by <i>département</i>; INSERM, CépiDC, annual statistics of deaths by medical cause.</p>												

heart disease, the same as for men; 15% to other heart diseases versus 10% for men). For both sexes, there is a sharp contrast between the rates for these causes in *départements* where mortality is high with respect to the whole of France and in those where it is low. This is especially striking for women, for whom the rates are 30% to 50% higher than the national average in the three most disadvantaged *départements*, Aisne, Pas-de-Calais and Nord (Table 5).

Among all other diseases, we note the impact of those related to high alcohol consumption in the two most disadvantaged *départements*: in Nord and Pas-de-Calais, the mortality rate from alcoholism and cirrhosis of the liver is over twice that of France as a whole for women, and 70% higher than the average for men. Taking all *départements* and not just those in Table 5, alcoholism also accounts for a non-negligible share of total variability (6% for men, 5% for women). Diseases of the respiratory system also account for much of the excess mortality in the northern *départements*, which is hardly surprising given that alcoholism and environmental pollution are major risk factors, as well as occupational exposure to certain pathogens. They account for 9% of geographical inequalities in mortality for men and 7% for women, ahead of ischaemic heart disease.

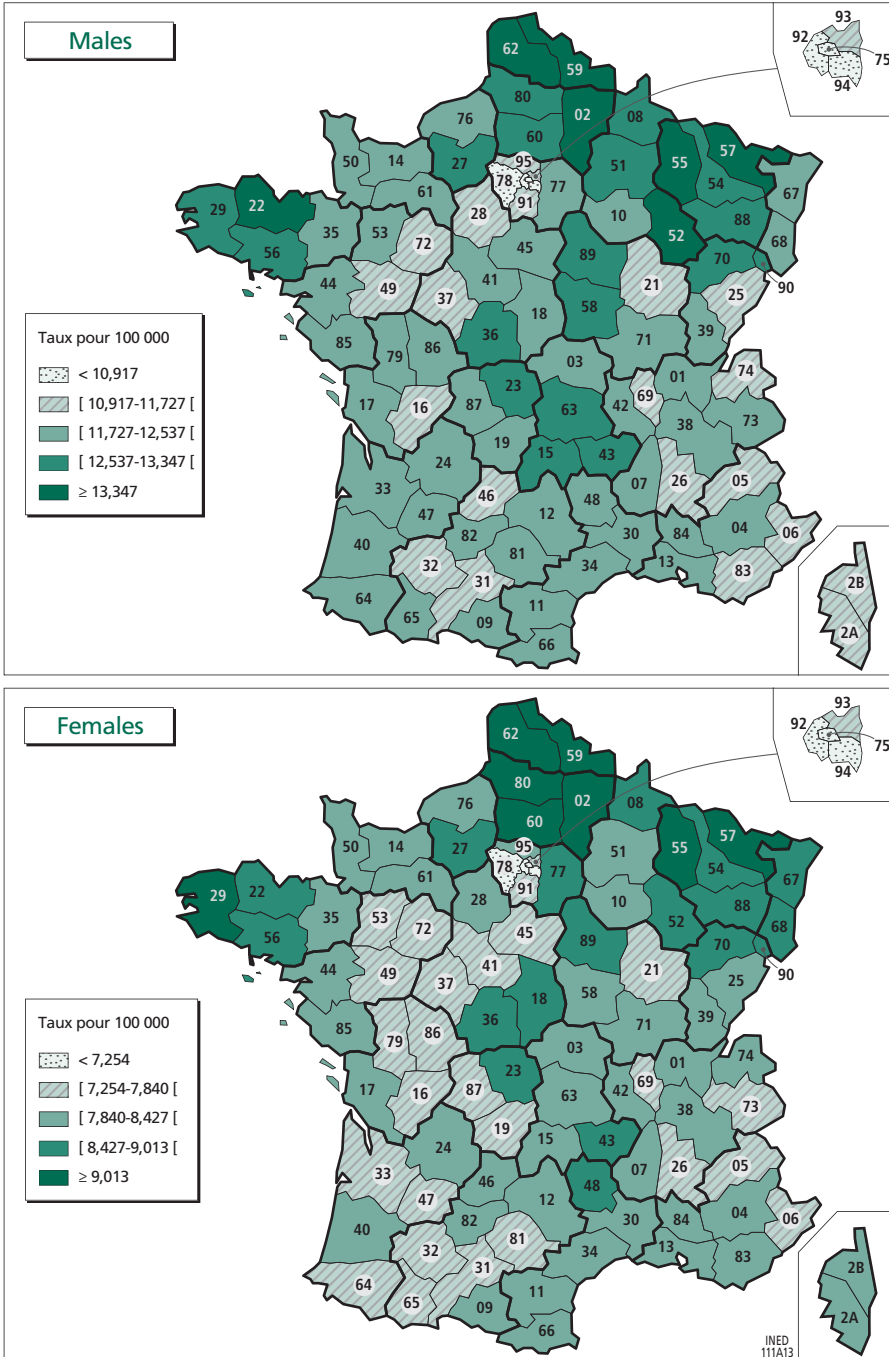
This is the age group for which deaths from external causes contribute least to geographical variability in mortality (less than 5% for each sex), due to their minor contribution to overall mortality. Mortality rates from external causes do, however, correlate well with all-cause mortality rates, and are almost always higher for men in the high-mortality *départements* than in France as a whole (up to 40% higher in Somme).

### *At age 80 and above, all causes contribute to geographical variations in mortality*

The geography of mortality at age 80 and above is similar to that of the previous age group, but the variations between *départements* are much less marked (Figure 9). In fact, the statistical significance tests for the differences between *départements* and France as a whole show that for most of them, the variations cannot be distinguished from random fluctuations, especially for men, whose overall mortality rate only differs from the average in 22 *départements*, compared with 48 for women.

The high-mortality *départements* are found in the three clusters already identified for the other age groups: the three westernmost *départements* in Brittany, the Nord-Pas-de-Calais and Picardy regions with extensions to the east (Ardennes, Marne – men only –, Haute-Marne, all the *départements* in Lorraine and as far as Haute-Saône and Territoire de Belfort), plus, for women, the two *départements* in Alsace. A few other *départements* scattered across the centre of the country also have above-average mortality rates at ages 80 and above, namely, Yonne, Indre, Creuse, Haute-Loire for both sexes, Nièvre, Puy-de-Dôme, Cantal for men, and Lozère for women.

Figure 9. Mortality rate per 100,000 at ages 80 and above by *département* and sex, 2006-2008



Source: INSEE, Division des statistiques régionales, locales et urbaines.



There is one clear low-mortality area: it comprises Paris, Hauts-de-Seine, Val-de-Marne, Yvelines, Essonne, plus, to a lesser extent, particularly for women, a group in the Pays de la Loire and the west of the Centre region. The preventive measures taken after the 2003 heat wave may have played a role here. As the death toll was particularly high in the Paris area, the measures implemented there may have been more effective than elsewhere and contributed to a faster fall in old-age mortality than in the rest of the country (Toulemon and Barbieri, 2008; Rey et al., 2007).

The mortality rate at these ages in the *départements* where it differs significantly from the average, varies from 9,639 per 100,000 in Paris to 14,168 in Pas-de-Calais for men and, in the same *départements*, from 6,443 to 9,646 for women. So the highest female rate is roughly the same as the lowest male rate.

After age 80, cardiovascular diseases (mainly heart disease) loom largest for men and women, and account for nearly half of geographical variability. For women, mental illness and nervous system disorders are another major contributor (14%, compared with 8% for men) and, for men, respiratory diseases (19%, compared with 9% for women). Note that senile dementia and Alzheimer's disease account for a large share of overall female mortality at these ages. Alzheimer's is the second cause of female mortality at age 80 and above, after cardiac arrest (sixth for men, after certain diseases of the circulatory system, such as myocardial infarction, prostate cancer and lung cancer). Although cancer mortality rates are high at this age, the role of cancer in geographical disparity is now negligible, even for lung cancer (only 2% of total geographical variability for men, 1% for women). The contribution of deaths from external causes is barely higher than at ages 60-79 and accounts for less than 5% of geographical differences at ages 80 and above.

All the causes of death given in Table 6 contribute to the situation in the most disadvantaged *départements*, including lung cancer for men and deaths from external causes for both sexes. For suicide, there is a particularly striking contrast between the *départements* of the Paris region and those in the north, with rates varying for men from 8 per 100,000 in Paris (but 72 in Yvelines) to 158 in Aisne (123 in Nord). Variations in this cause are therefore large, even among the best-placed *départements*. For women there is no systematic correlation between overall mortality and suicide rates. For the *départements* in Table 6 and the others, there is a high correlation for both sexes between overall mortality and mortality from cardiovascular diseases, alcohol consumption, infectious diseases (especially those of the respiratory system), mental illness and nervous system disorders.

**Table 6. Standardized mortality rate (per 100,000) for ages 80 and above in metropolitan France and ratio between the rates by cause in selected *départements* and the national average (%), 2006-2008**

<i>Département</i>	Ratio between standardized rate in each <i>département</i> and rate for metropolitan France as a whole (%)											Standardized rate all causes (per 100,000)
	Lung cancer	Other cancers	Cardiovascular diseases	Respiratory system diseases	Other infectious diseases	Alcoholism / Cirrhosis	Mental illness or nervous system disorder	Other diseases	Suicides	Other external causes	All causes	
<b>Males</b>												
Paris	103	90	74	84	114	82	81	86	9	93	83	9,639
Hauts-de-Seine	93	89	81	81	81	55	104	85	37	81	85	9,967
Val-de-Marne	120	94	81	90	109	106	89	97	20	101	90	10,498
Yvelines	91	94	87	85	109	56	98	96	78	105	92	10,700
Alpes-Maritimes	99	95	94	96	97	56	97	98	67	89	95	11,042
Haute-Marne	107	105	118	131	162	120	141	119	51	68	117	13,612
Aisne	123	115	115	118	156	179	115	134	171	92	118	13,825
Nord	124	108	116	166	125	115	103	121	133	106	119	13,866
Meuse	153	104	117	124	148	157	143	113	152	135	120	14,004
Pas-de-Calais	124	110	121	173	119	121	109	115	145	104	121	14,168
France	100	100	100	100	100	100	100	100	100	100	100	11,670
Rate per cause	404	2,511	4,219	1,168	247	52	1,086	1,361	93	530	11,670	
<b>Females</b>												
Paris	170	98	73	96	89	99	73	80	31	96	83	6,443
Hauts-de-Seine	138	93	79	96	98	81	94	84	101	88	87	6,786
Val-de-Marne	150	95	84	104	113	92	87	96	41	98	91	7,127
Essonne	95	101	91	104	127	77	106	103	171	80	98	7,643
Haute-Vienne	76	100	101	78	106	57	107	99	141	88	99	7,714
Somme	93	113	116	156	131	69	116	124	78	120	120	9,332
Nord	85	111	120	135	129	186	112	128	108	122	120	9,342
Aisne	98	115	123	119	147	231	128	133	94	102	123	9,562
Moselle	124	112	128	125	138	111	126	122	63	121	124	9,640
Pas-de-Calais	65	113	128	125	127	143	120	132	160	118	124	9,646
France	100	100	100	100	100	100	100	100	100	100	100	7,804
Rate per cause	85	1,309	3,115	592	165	15	1,053	1,064	16	390	7,804	
<p><b>Note:</b> The <i>départements</i> are ranked by their all-cause mortality rate at ages 80 and above, and the dotted line separates the low mortality ones (above) from the high mortality ones (below). The reference population for the standardized rates is metropolitan France in 2007, both sexes.</p> <p><b>Coverage:</b> for each sex separately, ten extreme <i>départements</i> taken from those where the all-cause mortality rate of persons aged 80 and above differs significantly from that of metropolitan France.</p> <p><b>Sources:</b> INSEE, Division des statistiques régionales, locales et urbaines, annual life tables by <i>département</i>; INSERM, CépiDC, annual statistics of deaths by medical cause.</p>												

## Discussion and conclusion

Large geographical disparities in mortality have persisted in metropolitan France over the last 30 years. Although they have narrowed among women, they have barely changed among men. As in the 1960s, the least advantaged regions are the North, Alsace and Brittany, despite faster than average progress in Brittany (Nizard and Prioux, 1975). Conversely, mortality is lower in Paris, in the south-western *départements* of Île-de-France, in the *départements* of the Rhône-Alpes and Midi-Pyrénées regions (especially for men), and, for women, in northern Poitou-Charentes and Pays de la Loire, a region that has enjoyed rapidly increasing life expectancy at birth over the last 30 years.

Variations in life expectancy at birth between *départements* are closely linked to variations in mortality after age 30 and particularly at ages 60-79, but not systematically to variations in child mortality. For example, infant mortality is high in *départements* of Alsace and Lorraine, but close to average in Nord-Pas-de-Calais and low in Brittany. At ages 30-60, differences in cancer mortality account for most of the geographical variability (particularly lung cancer among men). Alcohol-related diseases and suicides contribute extensively to geographical inequalities in mortality in this and following age groups despite accounting for a low proportion of overall mortality. Variations in suicide mortality and alcohol-related disease rates between *départements* are generally correlated, but with many exceptions. Cancers still contribute to inequalities in mortality at ages 60-80 but, among women, cardiovascular (mainly heart) diseases have the strongest impact. Respiratory diseases have a similar impact for both sexes. At ages 80 and above, cardiovascular (including cerebrovascular) diseases play a major role in geographical variability, accounting for 50% of variation among women and 40% among men. But in the northern *départements* with low life expectancy at birth, alcohol-related mortality and, for men, suicides still contribute to this variability.

The research literature identifies the impact of economic and social inequalities in France on geographical disparities in mortality and health (Nizard and Prioux, 1975; Caselli and Egidi, 1986b; Salem et al., 2000). Mortality differences between socioeconomic categories (by occupation and educational level), for example, explain the contrast between the Paris region *départements* with large proportions of higher categories (professionals/managers and higher intellectual occupations) and the northern *départements* with their high proportion of unskilled workers (Daguet, 2006). De-industrialization and rising unemployment in the mining areas of Nord-Pas-de-Calais and Picardy certainly favour health-damaging behaviour (especially alcohol and tobacco consumption), as well as suicide, mental illness and nervous system disorders. The excess mortality of manual workers, whose life expectancy increased less in the 1970s and 1980s than that of other social categories, and of the unemployed, is well documented, as is the role of these risk factors among these disadvantaged

population groups (Desplanques, 1984). However, the relationship between economic situation and mortality in French *départements* is a complex one. Although levels of poverty, income inequality and unemployment are indeed high in northern France, they are quite low in Brittany, where life expectancy at birth is almost as low as in the north. In the *départements* along the Mediterranean, by contrast, where levels of disadvantage are also high, lifespans are close to or even above the national average. Socioeconomic disadvantage in the southern *départements* may be outweighed by other factors such as healthier eating habits (the well-known “Mediterranean diet”) that have a positive impact on the two main causes of death in France (cancer and cardiovascular disease).

Selective migration is another potentially important explanatory factor for inequalities in mortality between French *départements*. This operates where there are differences between migrants and non-migrants in terms of health status or behaviours liable to affect health, as is typically the case with economic migration (or migration to enter higher education among the young): those who leave are generally healthier than those who stay, especially in depressed employment areas, and they seldom return to live in their native *départements* (Bentham, 1988; Norman et al., 2005; van Lenthe et al., 2007). Conversely, some migration is related to poor health, especially among older people who move closer to their children as their health declines. Specific research, especially on the northern *départements* and in Brittany, would help capture the relative contributions to observed excess mortality of individual characteristics, local conditions (health services and socioeconomic environment) or population movements between *départements*.

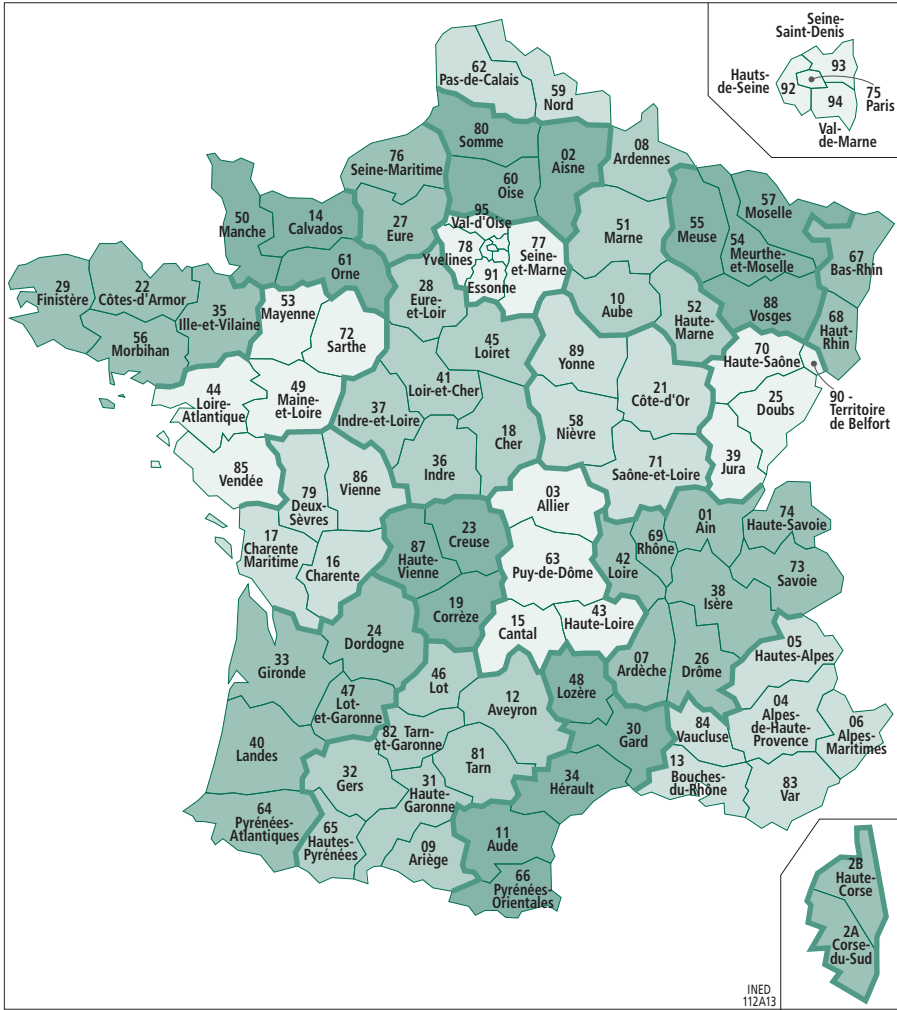
The present study is essentially exploratory in nature, since mortality before age 60 in France has now fallen to such a low level that random fluctuations at *département* level are considerable, particularly when deaths are broken down by cause. Despite our best efforts to present only relatively stable findings, these need to be confirmed by further research and must be interpreted with caution. Continued research on these questions is all the more crucial because, after a period in which inequalities in mortality were seen to narrow somewhat, the trend has reversed since the mid-1990s, particularly for men.

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## APPENDICES

### Appendix A.1. Map of French départements and regions



## Appendix A.1 (cont'd). List of French départements and regions

<b>Alsace Region</b> (67) Bas-Rhin (68) Haut-Rhin	<b>Corse Region (Corsica)</b> (2A) Corse-du-Sud (2B) Haute-Corse	<b>Nord - Pas-de-Calais Region</b> (59) Nord (62) Pas-de-Calais
<b>Aquitaine Region</b> (24) Dordogne (33) Gironde (40) Landes (47) Lot-et-Garonne (64) Pyrénées-Atlantiques	<b>Franche-Comté Region</b> (25) Doubs (39) Jura (70) Haute-Saône (90) Territoire de Belfort	<b>Pays de la Loire Region</b> (44) Loire-Atlantique (49) Maine-et-Loire (53) Mayenne (72) Sarthe (85) Vendée
<b>Auvergne Region</b> (03) Allier (15) Cantal (43) Haute-Loire (63) Puy-de-Dôme	<b>Haute-Normandie Region</b> (27) Eure (76) Seine-Maritime	<b>Picardie Region</b> (02) Aisne (60) Oise (80) Somme
<b>Basse-Normandie Region</b> (14) Calvados (50) Manche (61) Orne	<b>Île-de-France Region</b> (75) Paris (77) Seine-et-Marne (78) Yvelines (91) Essonne (92) Hauts-de-Seine (93) Seine-Saint-Denis (94) Val-de-Marne (95) Val-d'Oise	<b>Poitou-Charentes Region</b> (16) Charente (17) Charente-Maritime (79) Deux-Sèvres (86) Vienne
<b>Bourgogne Region (Burgundy)</b> (21) Côte-d'Or (58) Nièvre (71) Saône-et-Loire (89) Yonne	<b>Languedoc-Roussillon Region</b> (11) Aude (30) Gard (34) Hérault (48) Lozère (66) Pyrénées-Orientales	<b>Provence - Alpes - Côte d'Azur Region</b> (04) Alpes-de-Haute-Provence (05) Hautes-Alpes (06) Alpes-Maritimes (13) Bouches-du-Rhône (83) Var (84) Vaucluse
<b>Bretagne Region (Brittany)</b> (22) Côtes d'Armor (29) Finistère (35) Ille-et-Vilaine (56) Morbihan	<b>Limousin Region</b> (19) Corrèze (23) Creuse (87) Haute-Vienne	<b>Rhône-Alpes Region</b> (01) Ain (07) Ardèche (26) Drôme (38) Isère (42) Loire (69) Rhône (73) Savoie (74) Haute-Savoie
<b>Centre Region</b> (18) Cher (28) Eure-et-Loir (36) Indre (37) Indre-et-Loire (41) Loir-et-Cher (45) Loiret	<b>Lorraine Region</b> (54) Meurthe-et-Moselle (55) Meuse (57) Moselle (88) Vosges	
<b>Champagne-Ardenne Region</b> (08) Ardennes (10) Aube (51) Marne (52) Haute-Marne	<b>Midi-Pyrénées Region</b> (09) Ariège (12) Aveyron (31) Haute-Garonne (32) Gers (46) Lot (65) Hautes-Pyrénées (81) Tarn (82) Tarn-et-Garonne	

Table A.2. Characteristics of overall mortality in the *départements* of metropolitan France, 2006-2008

Département	Life expectancy (years)				Infant mortality rate* (per 1,000)	Survivors at age 60 (per 1,000)	
	At birth		At age 60			Males	Females
	Males	Females	Males	Females			
01 Ain	78.1	84.9	22.1	27.1	2.9	893	952
02 Aisne	74.8	82.1	20.2	25.0	3.4	850	929
03 Allier	76.4	83.8	21.4	26.5	3.4	862	939
04 Alpes-de-Haute-Provence	77.2	84.5	22.3	27.1	2.6	868	944
05 Hautes-Alpes	78.3	85.3	22.6	27.5	0.9	891	949
06 Alpes-Maritimes	78.6	84.7	23.1	27.3	3.7	885	941
07 Ardèche	77.7	84.9	22.2	27.1	2.3	882	949
08 Ardennes	75.3	83.0	20.5	25.8	3.5	854	931
09 Ariège	77.1	84.0	22.4	27.0	5.7	871	934
10 Aube	76.4	83.8	21.5	26.4	3.8	864	940
11 Aude	77.6	84.1	22.5	26.7	2.4	875	940
12 Aveyron	78.8	84.3	22.7	27.0	3.2	899	942
13 Bouches-du-Rhône	77.8	84.4	22.1	26.7	2.3	885	945
14 Calvados	77.0	84.1	21.6	26.6	2.9	873	940
15 Cantal	76.8	84.0	21.3	26.7	2.5	874	941
16 Charente	77.5	84.8	22.3	27.1	3.1	874	949
17 Charente-Maritime	77.3	84.3	22.2	27.0	2.1	870	937
18 Cher	76.0	83.4	21.0	26.1	1.8	857	935
19 Corrèze	77.3	84.7	21.7	27.0	2.1	881	946
2A Corse-du-Sud	78.0	84.4	22.8	26.7	2.3	878	948
2B Haute-Corse	78.4	84.8	22.6	27.2	1.5	893	946
21 Côte-d'Or	78.0	84.6	22.0	27.1	3.2	890	944
22 Côtes d'Armor	75.7	83.6	21.1	26.3	3.2	851	938
23 Creuse	75.6	83.5	20.8	26.1	3.6	855	936
24 Dordogne	77.3	84.0	22.1	26.6	3.6	876	941
25 Doubs	77.8	84.3	22.2	26.6	3.4	882	948
26 Drôme	78.3	84.8	22.6	27.3	3.2	890	944
27 Eure	76.1	83.3	21.0	26.1	3.0	864	932
28 Eure-et-Loir	77.3	84.1	21.8	26.5	3.0	881	943
29 Finistère	75.5	83.3	20.6	26.0	2.5	852	935
30 Gard	77.6	84.3	22.1	26.8	3.0	882	944
31 Haute-Garonne	79.2	85.2	23.0	27.3	2.8	902	952
32 Gers	78.8	84.8	23.1	27.2	2.1	890	946
33 Gironde	77.8	84.8	22.2	27.2	2.7	882	943
34 Hérault	78.0	84.5	22.7	27.0	3.0	877	944
35 Ille-et-Vilaine	78.0	84.6	22.3	26.8	2.6	886	949
36 Indre	75.9	83.9	21.3	26.4	2.3	854	940
37 Indre-et-Loire	78.3	85.2	22.6	27.6	2.6	888	945
38 Isère	78.9	85.0	22.6	27.1	2.8	904	953
39 Jura	77.8	84.6	22.1	27.0	2.7	884	944
40 Landes	77.9	84.6	22.2	27.0	2.8	883	945
41 Loir-et-Cher	77.3	84.4	21.9	26.9	3.2	877	943
42 Loire	77.9	84.6	22.1	26.7	3.0	886	952
43 Haute-Loire	77.6	83.7	21.5	26.4	1.8	890	939
44 Loire-Atlantique	77.2	84.7	21.8	27.1	2.7	874	946
45 Loiret	78.0	84.7	22.1	27.1	2.7	888	944
46 Lot	78.6	84.5	23.0	27.0	1.1	884	941
47 Lot-et-Garonne	78.1	84.7	22.7	27.4	3.4	882	941
48 Lozère	77.0	83.7	22.0	26.5	5.1	867	934



Table A.2 (cont'd). Characteristics of overall mortality  
in the départements of metropolitan France, 2006-2008

Département	Life expectancy (years)				Infant mortality rate* (per 1,000)	Survivors at age 60 (per 1,000)	
	At birth		At age 60			Males	Females
	Males	Females	Males	Females			
49 Maine-et-Loire	78.3	85.4	22.5	27.3	2.4	887	954
50 Manche	76.6	84.3	21.7	26.8	3.4	864	941
51 Marne	76.2	83.8	20.9	26.4	3.8	870	939
52 Haute-Marne	75.4	83.2	20.9	26.0	4.7	852	934
53 Mayenne	78.6	85.4	22.6	27.4	2.9	896	954
54 Meurthe-et-Moselle	76.7	83.4	21.2	26.0	3.4	875	936
55 Meuse	76.0	82.4	20.8	25.6	4.8	867	927
56 Morbihan	76.1	83.8	21.1	26.4	2.1	861	939
57 Moselle	76.4	82.8	20.8	25.3	3.6	878	940
58 Nièvre	75.7	83.5	21.0	26.4	2.7	854	932
59 Nord	74.4	82.1	19.7	25.1	3.2	840	927
60 Oise	76.5	82.8	21.1	25.6	3.4	871	935
61 Orne	76.7	84.0	21.7	26.8	2.4	865	936
62 Pas-de-Calais	73.7	82.0	19.4	25.0	3.3	827	924
63 Puy-de-Dôme	76.9	84.1	21.4	26.6	2.8	874	942
64 Pyrénées-Atlantiques	78.0	84.8	22.3	27.2	3.4	884	945
65 Hautes-Pyrénées	77.4	84.3	21.9	26.9	2.5	879	939
66 Pyrénées-Orientales	76.8	84.3	22.0	26.9	3.6	862	939
67 Bas-Rhin	77.7	83.7	21.4	26.1	5.1	900	944
68 Haut-Rhin	77.9	84.0	21.7	26.2	2.9	898	948
69 Rhône	78.9	85.2	22.7	27.3	3.2	898	952
70 Haute-Saône	76.6	83.9	21.6	26.5	3.1	870	940
71 Saône-et-Loire	76.9	84.4	21.9	26.8	2.6	867	944
72 Sarthe	77.4	84.6	22.3	27.1	3.1	870	942
73 Savoie	78.5	85.2	22.3	27.2	2.1	900	953
74 Haute-Savoie	78.9	85.4	22.6	27.2	2.7	905	958
75 Paris	79.5	85.4	23.5	27.8	3.2	896	945
76 Seine-Maritime	76.0	83.5	21.0	26.3	3.5	861	934
77 Seine-et-Marne	77.6	83.7	21.7	26.0	3.2	891	945
78 Yvelines	79.5	85.3	23.1	27.4	3.2	905	950
79 Deux-Sèvres	77.9	85.1	22.5	27.4	2.9	881	947
80 Somme	75.4	82.5	20.7	25.4	3.5	852	931
81 Tarn	78.8	84.7	23.1	27.4	2.9	889	943
82 Tarn-et-Garonne	78.2	84.2	22.6	26.8	2.2	889	942
83 Var	77.8	84.6	22.5	27.0	3.0	877	943
84 Vaucluse	77.5	84.1	22.1	26.6	3.0	879	942
85 Vendée	77.3	84.4	22.1	26.9	3.1	875	944
86 Vienne	77.6	85.3	22.4	27.4	2.2	874	950
87 Haute-Vienne	77.8	84.7	22.2	27.0	2.4	884	944
88 Vosges	75.7	83.4	21.0	26.0	4.0	860	939
89 Yonne	75.8	83.0	21.0	25.9	1.8	855	932
90 Territoire de Belfort	77.0	83.5	21.3	26.0	3.4	884	943
91 Essonne	79.1	84.9	22.9	27.2	3.3	900	950
92 Hauts-de-Seine	79.7	85.4	23.4	27.6	3.1	902	949
93 Seine-St-Denis	77.5	83.8	21.8	26.5	4.8	886	939
94 Val-de-Marne	78.9	84.9	22.8	27.3	3.1	896	945
95 Val-d'Oise	78.4	84.0	22.2	26.5	3.4	896	943
Metropolitan France	77.4	84.3	21.9	26.8	3.7	874	940

\* Probability of dying before age 1.  
**Coverage:** Metropolitan France.  
**Source:** INSEE, Division des statistiques régionales, locales et urbaines.

Table A.3. Standardized mortality rate\* (per 100,000)  
by sex, département and age group, 2006-2008

Département	Standardized rate per 100,000											
	Males						Females					
	0	1-29	30-59	60-79	80+	All ages	0	1-29	30-59	60-79	80+	All ages
01 Ain	374	50	316	2,142	12,206	1,114	209	21	136	941	7,947	616
02 Aisne	352	65	470	2,832	13,825	1,377	326	24	213	1,369	9,562	801
03 Allier	353	52	434	2,476	11,946	1,205	323	19	180	1,091	8,160	670
04 Alpes-de-Haute-Provence	210	74	395	2,077	12,019	1,132	303	29	152	929	8,006	627
05 Hautes-Alpes	146	66	316	1,989	11,638	1,063	50	21	151	832	7,691	589
06 Alpes-Maritimes	395	43	352	1,864	11,042	1,022	339	21	169	930	7,485	606
07 Ardèche	319	49	360	2,137	12,184	1,129	136	23	148	911	7,994	618
08 Ardennes	412	48	467	2,767	13,263	1,332	290	15	215	1,210	8,799	734
09 Ariège	544	70	378	2,012	11,965	1,115	592	28	181	923	8,099	646
10 Aube	408	59	417	2,363	12,216	1,196	351	19	176	1,098	8,299	677
11 Aude	302	63	377	1,958	12,071	1,105	177	24	177	1,001	8,150	653
12 Aveyron	305	44	302	1,927	12,157	1,066	344	38	150	934	8,054	633
13 Bouches-du-Rhône	259	43	356	2,168	11,905	1,116	204	19	163	1,008	8,043	642
14 Calvados	347	42	402	2,319	12,379	1,184	232	15	185	1,039	8,165	661
15 Cantal	245	41	399	2,433	12,637	1,213	248	30	167	1,008	8,331	662
16 Charente	405	53	385	2,118	11,642	1,111	209	16	154	988	7,636	614
17 Charente-Maritime	172	56	405	2,135	11,942	1,136	259	21	188	970	7,840	637
18 Cher	254	46	462	2,609	12,090	1,243	107	25	197	1,101	8,765	708
19 Corrèze	316	50	366	2,273	12,510	1,170	90	20	164	976	7,829	626
2A Corse-du-Sud	293	68	359	1,966	11,273	1,061	159	19	147	997	8,180	640
2B Haute-Corse	172	64	312	1,999	11,456	1,054	130	28	154	874	8,066	619
21 Côte-d'Or	336	37	343	2,250	11,393	1,097	298	22	159	987	7,552	615
22 Côtes d'Armor	358	63	466	2,427	13,491	1,291	270	19	188	1,080	8,626	694
23 Creuse	447	51	459	2,602	13,162	1,298	268	25	186	1,124	8,733	708
24 Dordogne	409	56	376	2,103	12,362	1,142	311	26	167	1,015	8,267	660
25 Doubs	365	48	359	2,183	11,623	1,108	323	17	151	1,034	8,380	659
26 Drôme	364	50	327	2,046	11,390	1,062	277	27	156	924	7,736	614
27 Eure	376	54	424	2,501	13,210	1,269	224	24	204	1,135	8,722	716
28 Eure-et-Loir	373	52	360	2,345	11,407	1,127	219	15	174	1,072	8,066	657
29 Finistère	278	51	475	2,662	13,243	1,316	230	19	200	1,084	9,075	721
30 Gard	327	51	361	2,162	12,047	1,127	280	19	164	975	8,244	648
31 Haute-Garonne	332	36	298	1,870	11,473	1,019	225	14	144	900	7,645	595
32 Gers	161	66	320	1,797	11,243	1,013	249	22	156	911	7,837	614
33 Gironde	293	37	373	2,141	11,851	1,114	250	19	168	940	7,552	609
34 Hérault	323	52	375	1,967	11,802	1,089	281	20	162	953	7,948	629
35 Ille-et-Vilaine	277	44	353	2,112	11,977	1,109	236	16	150	951	8,390	644
36 Indre	306	61	453	2,462	12,649	1,248	147	20	181	1,044	8,552	680
37 Indre-et-Loire	370	44	342	2,029	11,324	1,059	144	21	165	881	7,304	585
38 Isère	322	43	286	1,976	11,879	1,054	228	19	133	939	7,971	615
39 Jura	300	50	353	2,178	12,156	1,131	247	19	163	918	8,101	631
40 Landes	269	50	358	2,139	11,793	1,109	286	16	164	954	7,951	629
41 Loir-et-Cher	277	49	382	2,264	11,764	1,138	356	17	168	995	7,717	627
42 Loire	334	38	357	2,134	12,144	1,121	269	16	140	1,020	8,036	634
43 Haute-Loire	138	44	343	2,321	13,187	1,198	226	31	174	1,040	8,735	691
44 Loire-Atlantique	239	40	404	2,265	12,119	1,161	312	17	158	946	7,860	621
45 Loiret	311	42	344	2,159	11,752	1,102	222	20	166	968	7,602	616
46 Lot	84	58	351	1,887	11,092	1,029	129	27	173	920	8,042	633
47 Lot-et-Garonne	267	56	356	1,933	12,042	1,087	424	26	163	913	7,527	606
48 Lozère	583	48	408	2,216	12,397	1,175	439	15	199	971	8,807	690

Table A.3 (cont'd). Standardized mortality rate\* (per 100,000) by sex, département and age group, 2006-2008

Département	Standardized rate per 100,000											
	Males						Females					
	0	1-29	30-59	60-79	80+	All ages	0	1-29	30-59	60-79	80+	All ages
49 Maine-et-Loire	292	44	347	2,054	11,268	1,062	182	14	137	907	7,623	591
50 Manche	424	63	412	2,293	12,422	1,194	252	20	177	987	8,156	651
51 Marne	428	49	404	2,550	12,884	1,251	336	16	184	1,134	8,009	671
52 Haute-Marne	606	67	447	2,518	13,612	1,309	325	21	195	1,175	8,720	719
53 Mayenne	345	43	314	1,973	11,867	1,064	224	19	132	896	7,483	583
54 Meurthe-et-Moselle	387	43	392	2,456	12,803	1,224	295	16	194	1,157	8,584	706
55 Meuse	517	53	409	2,553	14,004	1,312	443	31	208	1,177	9,252	756
56 Morbihan	248	54	438	2,507	12,780	1,253	176	25	181	1,044	8,600	685
57 Moselle	429	46	374	2,604	13,455	1,276	279	21	175	1,265	9,640	771
58 Nièvre	285	55	465	2,580	12,622	1,269	256	29	197	1,119	7,955	674
59 Nord	351	38	534	3,059	13,866	1,434	282	19	223	1,380	9,342	794
60 Oise	323	49	404	2,497	12,799	1,237	367	23	190	1,233	9,036	743
61 Orne	237	63	413	2,336	11,798	1,169	232	26	189	1,000	8,069	655
62 Pas-de-Calais	416	50	571	3,172	14,168	1,488	244	19	236	1,369	9,646	812
63 Puy-de-Dôme	333	41	400	2,416	12,688	1,214	217	17	175	1,042	8,224	661
64 Pyrénées-Atlantiques	418	43	356	2,072	11,807	1,097	260	17	162	947	7,636	611
65 Hautes-Pyrénées	241	46	378	2,237	12,481	1,166	271	24	178	1,021	7,647	634
66 Pyrénées-Orientales	438	49	434	2,197	12,098	1,166	273	18	183	970	8,089	646
67 Bas-Rhin	576	37	295	2,427	12,358	1,158	448	18	159	1,103	8,866	700
68 Haut-Rhin	336	39	311	2,308	12,097	1,129	249	18	153	1,105	8,592	682
69 Rhône	351	32	315	2,008	11,089	1,029	282	17	138	929	7,589	596
70 Haute-Saône	370	63	391	2,337	12,953	1,218	243	23	178	1,014	8,694	683
71 Saône-et-Loire	278	54	416	2,276	11,932	1,164	250	20	165	984	8,026	639
72 Sarthe	328	53	404	2,087	11,681	1,115	286	16	173	979	7,602	619
73 Savoie	238	39	308	2,099	11,824	1,079	192	16	139	928	7,752	603
74 Haute-Savoie	364	43	278	1,972	11,572	1,036	163	18	119	897	7,853	595
75 Paris	375	27	327	1,843	9,639	933	265	15	164	978	6,443	558
76 Seine-Maritime	371	45	445	2,561	12,437	1,246	326	21	195	1,105	8,349	689
77 Seine-et-Marne	372	43	331	2,319	12,510	1,162	265	17	162	1,156	8,628	695
78 Yvelines	395	36	283	1,896	10,700	980	246	14	149	952	7,216	585
79 Deux-Sèvres	357	53	359	2,030	12,093	1,108	215	17	156	927	7,402	594
80 Somme	343	57	469	2,674	12,965	1,305	360	22	207	1,266	9,332	770
81 Tarn	229	49	337	1,769	11,746	1,035	348	29	157	880	7,728	608
82 Tarn-et-Garonne	226	56	332	1,991	12,218	1,096	216	24	167	970	8,226	649
83 Var	341	47	382	2,014	11,675	1,091	256	19	168	948	7,951	630
84 Vaucluse	339	63	358	2,141	12,096	1,129	263	26	165	1,011	8,358	662
85 Vendée	311	56	381	2,159	12,074	1,138	302	24	160	963	8,093	639
86 Vienne	295	50	390	2,053	11,772	1,107	141	12	154	912	7,497	592
87 Haute-Vienne	327	47	356	2,142	11,922	1,115	160	14	173	1,006	7,714	627
88 Vosges	556	63	426	2,541	13,033	1,273	238	23	178	1,167	8,658	707
89 Yonne	181	64	455	2,574	12,946	1,282	189	28	202	1,214	8,541	720
90 Territoire de Belfort	314	43	360	2,377	13,164	1,215	372	23	163	1,178	8,624	703
91 Essonne	356	32	309	1,887	11,317	1,017	298	16	147	954	7,643	607
92 Hauts-de-Seine	308	26	308	1,873	9,967	945	309	15	151	965	6,786	568
93 Seine-St-Denis	537	37	350	2,359	11,273	1,115	417	19	177	1,154	7,694	658
94 Val-de-Marne	341	29	325	2,041	10,498	1,008	277	16	164	1,006	7,127	597
95 Val-d'Oise	373	34	322	2,158	11,360	1,071	309	17	168	1,112	8,048	662
Metropolitan France	412	44	391	2,315	11,670	1,145	323	18	177	1,084	7,804	650

\* Reference population: France, both sexes, estimated by INSEE, 1 July 2007.

Coverage: Metropolitan France.

Source: Author's calculations based on annual life tables established by INSEE, Division des statistiques régionales, locales et urbaines, and on deaths by cause communicated by INSERM, CépiDC.

Table A.4. Standardized mortality rate\* (per 100,000)  
by sex, *département* and broad cause of death, 2006-2008

*Males*

<i>Département</i>	Standardized rate per 100,000						
	Cancers	Cardio-vascular diseases	Infectious diseases	Other diseases	External causes	Ill-defined or unspecified causes	All causes
01 Ain	348	303	108	199	90	66	1,114
02 Aisne	422	369	128	267	106	85	1,377
03 Allier	393	352	86	220	94	59	1,205
04 Alpes-de-Haute-Provence	337	309	103	197	112	74	1,132
05 Hautes-Alpes	324	289	104	183	94	69	1,063
06 Alpes-Maritimes	316	274	97	189	76	69	1,022
07 Ardèche	358	309	97	210	93	63	1,129
08 Ardennes	415	393	118	233	92	80	1,332
09 Ariège	323	323	108	196	104	61	1,115
10 Aube	366	332	99	221	86	92	1,196
11 Aude	313	315	100	214	98	65	1,105
12 Aveyron	289	319	103	213	84	57	1,066
13 Bouches-du-Rhône	348	302	105	203	82	76	1,116
14 Calvados	382	321	100	212	83	86	1,184
15 Cantal	355	364	114	239	85	55	1,213
16 Charente	333	292	90	211	94	91	1,111
17 Charente-Maritime	378	297	91	200	103	66	1,136
18 Cher	418	349	95	229	92	60	1,243
19 Corrèze	358	329	101	226	98	57	1,170
2A Corse-du-Sud	328	315	89	156	95	78	1,061
2B Haute-Corse	350	296	78	174	86	69	1,054
21 Côte-d'Or	360	300	95	201	75	66	1,097
22 Côtes d'Armor	389	355	108	235	127	77	1,291
23 Creuse	374	381	110	251	113	70	1,298
24 Dordogne	336	346	82	218	101	57	1,142
25 Doubs	340	317	91	200	96	64	1,108
26 Drôme	329	302	86	198	88	58	1,062
27 Eure	392	364	109	231	101	72	1,269
28 Eure-et-Loir	363	309	88	205	90	72	1,127
29 Finistère	414	357	116	235	118	77	1,316
30 Gard	355	315	101	208	86	62	1,127
31 Haute-Garonne	311	296	88	176	68	80	1,019
32 Gers	283	293	84	191	106	56	1,013
33 Gironde	362	313	94	192	82	70	1,114
34 Hérault	347	301	89	202	93	56	1,089
35 Ille-et-Vilaine	345	321	98	199	93	53	1,109
36 Indre	381	368	96	234	99	70	1,248
37 Indre-et-Loire	340	278	100	186	85	71	1,059
38 Isère	334	304	87	197	83	48	1,054
39 Jura	328	321	106	214	95	66	1,131
40 Landes	336	340	82	199	99	55	1,109
41 Loir-et-Cher	373	285	90	221	99	69	1,138
42 Loire	357	299	114	212	92	47	1,121
43 Haute-Loire	358	332	114	238	98	58	1,198
44 Loire-Atlantique	380	325	92	201	91	71	1,161
45 Loiret	366	301	81	214	85	56	1,102
46 Lot	294	301	89	190	92	63	1,029
47 Lot-et-Garonne	338	313	93	189	98	56	1,087
48 Lozère	351	366	95	219	86	59	1,175

Table A.4 (cont'd). Standardized mortality rate\* (per 100,000)  
by sex, département and broad cause of death, 2006-2008

## Males

Département	Standardized rate per 100,000						
	Cancers	Cardio-vascular diseases	Infectious diseases	Other diseases	External causes	Ill-defined or unspecified causes	All causes
49 Maine-et-Loire	352	288	89	194	86	54	1,062
50 Manche	357	368	95	213	98	63	1,194
51 Marne	389	334	109	238	100	82	1,251
52 Haute-Marne	391	356	140	258	95	69	1,309
53 Mayenne	333	303	94	187	86	62	1,064
54 Meurthe-et-Moselle	397	317	136	220	87	67	1,224
55 Meuse	400	359	124	256	101	72	1,312
56 Morbihan	396	358	106	221	108	64	1,253
57 Moselle	393	345	151	235	76	76	1,276
58 Nièvre	402	385	96	226	94	66	1,269
59 Nord	453	383	162	269	97	70	1,434
60 Oise	389	340	107	212	99	89	1,237
61 Orne	366	332	94	193	103	82	1,169
62 Pas-de-Calais	469	400	175	275	105	65	1,488
63 Puy-de-Dôme	379	344	103	239	95	54	1,214
64 Pyrénées-Atlantiques	337	327	95	188	84	66	1,097
65 Hautes-Pyrénées	343	341	107	198	103	73	1,166
66 Pyrénées-Orientales	365	327	109	215	90	60	1,166
67 Bas-Rhin	370	331	109	218	69	62	1,158
68 Haut-Rhin	359	310	102	225	84	50	1,129
69 Rhône	343	265	91	193	57	80	1,029
70 Haute-Saône	341	361	121	224	107	64	1,218
71 Saône-et-Loire	366	312	98	226	102	60	1,164
72 Sarthe	353	306	88	219	95	53	1,115
73 Savoie	337	305	92	196	88	61	1,079
74 Haute-Savoie	333	289	93	178	85	58	1,036
75 Paris	308	217	89	155	45	120	933
76 Seine-Maritime	411	334	108	243	85	66	1,246
77 Seine-et-Marne	371	302	111	207	73	97	1,162
78 Yvelines	327	260	90	187	69	47	980
79 Deux-Sèvres	344	319	93	189	95	68	1,108
80 Somme	398	333	133	258	107	76	1,305
81 Tarn	303	316	84	194	85	53	1,035
82 Tarn-et-Garonne	320	326	102	192	95	61	1,096
83 Var	350	290	96	189	90	77	1,091
84 Vaucluse	365	292	105	207	95	66	1,129
85 Vendée	375	298	92	198	95	79	1,138
86 Vienne	340	315	95	193	104	60	1,107
87 Haute-Vienne	347	321	91	216	82	59	1,115
88 Vosges	376	331	132	244	116	75	1,273
89 Yonne	386	360	113	236	108	78	1,282
90 Territoire de Belfort	322	362	114	259	120	38	1,215
91 Essonne	326	256	101	199	71	65	1,017
92 Hauts-de-Seine	317	242	85	179	49	73	945
93 Seine-St-Denis	367	288	108	186	54	112	1,115
94 Val-de-Marne	342	251	94	182	49	90	1,008
95 Val-d'Oise	355	263	104	205	67	77	1,071
Metropolitan France	368	311	102	210	86	69	1,145

\* Reference population: France, both sexes, estimated by INSEE, 1 July 2007.

Coverage: Metropolitan France.

Source: Author's calculations based on annual life tables established by INSEE, Division des statistiques régionales, locales et urbaines, and on deaths by cause communicated by INSERM, CépiDc.

Table A.4 (cont'd). Standardized mortality rate\* (per 100,000)  
by sex, *département* and broad cause of death, 2006-2008

*Females*

<i>Département</i>	Standardized rate per 100,000						
	Cancers	Cardio-vascular diseases	Infectious diseases	Other diseases	External causes	Ill-defined or unspecified causes	All causes
01 Ain	161	177	49	150	36	43	616
02 Aisne	198	241	63	202	41	57	801
03 Allier	180	207	44	158	42	39	670
04 Alpes-de-Haute-Provence	161	177	56	149	37	47	627
05 Hautes-Alpes	150	166	49	138	46	40	589
06 Alpes-Maritimes	165	166	48	136	39	51	606
07 Ardèche	166	188	43	141	36	44	618
08 Ardennes	191	233	60	157	39	55	734
09 Ariège	168	208	51	139	42	37	646
10 Aube	169	205	46	162	36	59	677
11 Aude	169	192	48	155	42	48	653
12 Aveyron	158	185	50	157	44	40	633
13 Bouches-du-Rhône	164	184	47	147	41	60	642
14 Calvados	182	195	49	145	34	56	661
15 Cantal	170	219	45	149	42	38	662
16 Charente	161	190	40	132	39	51	614
17 Charente-Maritime	174	186	48	144	42	43	637
18 Cher	180	218	47	179	44	40	708
19 Corrèze	167	197	45	142	40	36	626
2A Corse-du-Sud	174	184	48	132	38	38	615
2B Haute-Corse	177	192	40	139	33	60	640
21 Côte-d'Or	160	195	40	132	44	48	619
22 Côtes d'Armor	166	213	57	152	49	57	694
23 Creuse	188	214	57	162	46	40	708
24 Dordogne	170	211	45	149	43	42	660
25 Doubs	168	201	56	146	43	45	659
26 Drôme	169	182	41	135	43	44	614
27 Eure	183	209	50	181	47	46	716
28 Eure-et-Loir	179	192	46	151	37	52	657
29 Finistère	170	229	57	165	48	51	721
30 Gard	168	193	49	150	40	47	648
31 Haute-Garonne	160	182	42	129	34	49	595
32 Gers	161	187	42	142	40	42	614
33 Gironde	170	185	43	122	36	54	609
34 Hérault	165	190	46	144	39	45	629
35 Ille-et-Vilaine	159	202	57	139	46	41	644
36 Indre	170	213	44	159	41	53	680
37 Indre-et-Loire	170	162	45	126	36	46	585
38 Isère	163	186	46	142	38	40	615
39 Jura	153	192	51	152	43	40	631
40 Landes	173	202	46	137	35	36	629
41 Loir-et-Cher	165	178	46	151	40	47	627
42 Loire	167	188	48	151	43	37	634
43 Haute-Loire	181	201	55	165	45	44	691
44 Loire-Atlantique	162	189	46	133	40	51	621
45 Loiret	176	170	40	149	40	39	616
46 Lot	161	184	44	159	41	44	633
47 Lot-et-Garonne	148	194	44	140	39	42	606
48 Lozère	172	205	44	184	42	44	690

Table A.4 (cont'd). Standardized mortality rate\* (per 100,000)  
by sex, département and broad cause of death, 2006-2008

Females

Département	Standardized rate per 100,000						
	Cancers	Cardio-vascular diseases	Infectious diseases	Other diseases	External causes	Ill-defined or unspecified causes	All causes
49 Maine-et-Loire	166	181	41	127	36	40	591
50 Manche	166	203	48	145	45	44	651
51 Marne	172	191	55	158	41	55	671
52 Haute-Marne	178	211	62	182	41	45	719
53 Mayenne	153	180	43	129	38	40	583
54 Meurthe-et-Moselle	184	209	60	168	42	43	706
55 Meuse	196	219	61	177	48	55	756
56 Morbihan	174	216	55	144	48	47	685
57 Moselle	189	242	64	181	40	55	771
58 Nièvre	182	205	39	162	43	43	674
59 Nord	196	238	67	196	46	51	794
60 Oise	190	221	55	166	45	66	743
61 Orne	175	194	50	141	43	52	655
62 Pas-de-Calais	199	254	64	205	45	46	812
63 Puy-de-Dôme	174	192	50	164	39	42	661
64 Pyrénées-Atlantiques	163	186	48	127	38	48	611
65 Hautes-Pyrénées	167	189	50	139	47	42	634
66 Pyrénées-Orientales	167	199	52	139	41	50	646
67 Bas-Rhin	179	227	55	164	35	41	700
68 Haut-Rhin	170	226	52	164	39	32	682
69 Rhône	164	171	41	140	28	51	596
70 Haute-Saône	155	230	53	156	46	43	683
71 Saône-et-Loire	165	187	44	153	42	46	639
72 Sarthe	165	180	46	150	40	38	619
73 Savoie	164	179	45	140	36	38	603
74 Haute-Savoie	160	174	50	133	37	42	595
75 Paris	176	131	46	105	27	73	558
76 Seine-Maritime	189	201	49	168	37	44	689
77 Seine-et-Marne	184	185	57	155	40	74	695
78 Yvelines	169	159	49	138	33	37	585
79 Deux-Sèvres	161	180	45	123	37	48	594
80 Somme	201	219	70	178	48	54	770
81 Tarn	160	192	39	136	41	40	608
82 Tarn-et-Garonne	181	198	48	137	42	43	649
83 Var	171	173	49	137	39	61	630
84 Vaucluse	178	192	50	151	41	51	662
85 Vendée	174	185	51	133	41	55	639
86 Vienne	162	180	45	130	38	37	592
87 Haute-Vienne	171	193	40	149	35	39	627
88 Vosges	180	218	59	153	44	52	707
89 Yonne	181	215	60	166	44	54	720
90 Territoire de Belfort	179	224	50	176	42	32	703
91 Essonne	169	163	51	141	30	52	607
92 Hauts-de-Seine	167	147	48	126	31	48	568
93 Seine-St-Denis	179	178	52	145	32	72	658
94 Val-de-Marne	176	152	49	131	31	58	597
95 Val-d'Oise	184	175	57	153	32	61	662
Metropolitan France	178	189	49	148	39	47	650

\* Reference population: France, both sexes, estimated by INSEE, 1 July 2007.

Coverage: Metropolitan France.

Source: Author's calculations based on annual life tables established by INSEE, Division des statistiques régionales, locales et urbaines, and on deaths by cause communicated by INSERM, CépiDc.

**Table A.5. Cause-of-death categories and the corresponding codes in the International Classification of Diseases (10<sup>th</sup> revision)**

	ICD 10
<b>Cancer</b>	C00 to D48
Lung cancer	C33 to C34
Stomach cancer	C16
Cancer of the intestine	C18 to C21
Breast cancer	C50
Cancer of the uterus	C53 to C55
Prostate cancer	C61
Other cancers	C00 to C15; C17; C22 to C32; C37 to C49; C51; C52; C56 to C60; C62 to D48
<b>Cardiovascular diseases</b>	I00 to I99
Ischaemic heart diseases	I20 to I25
Other heart diseases	I00 to I15; I26 to I51
Cerebro-vascular diseases	I60 to I69
Other diseases of the circulatory system	I70 to I99
<b>Infectious and parasitic diseases, diseases of the respiratory system</b>	A00 to B99; J00 to J98
Tuberculosis (all forms)	A15 to A19; B90
AIDS	B20 to B24
Influenza	J10 to J11
Other infectious and parasitic diseases of ICD Chapter I	A00 to A09; A20 to B19; B25 to B89; B91 to B99
Other diseases of the respiratory system	J00 to J06; J12 to J98
<b>Other diseases</b>	D50 to D89; E00 to H95; K00 to Q99
Alcoholism and cirrhosis of the liver	F10; K70; K73 to K74
Diabetes	E10 to E14
Other mental disorders and diseases of the nervous system	F00 to F09; F11 to H95
Other diseases of the digestive system	K00 to K67; K71; K72; K75 to K93
Other diseases	D50 to D89; E00 to E07; E15 to E89; L00 to Q99
<b>External causes</b>	V01 to Y89
Transport accidents	V01 to V99
Suicides	X60 to X84
Other deaths from external causes	W00 to X59; X85 to Y89
<b>Unspecified or ill-defined causes of death</b>	R00 to R99
<b>All causes</b>	A00 to R99; V01 to Y89





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**Magali BARBIERI • MORTALITY IN FRANCE BY DÉPARTEMENT**

There have been marked disparities in mortality between metropolitan French *départements* for the past thirty years. They have lessened for women but remain high for men. As in the 1960s, the worst placed regions are the North, Alsace and Brittany. Mortality is lower in Paris, the south-western *départements* of Île-de-France, and Rhône-Alpes and Midi-Pyrénées (mainly for men); the lowest female mortality is found in the north of Poitou-Charentes and in Pays de la Loire. Geographical variations in life expectancy at birth are closely linked to variations in mortality above age 30, especially at ages 60-79, but not systematically with variations in child mortality. At ages 30-60, cancers remain the prime explanation (particularly lung cancer for men), together with alcoholism and suicide, which also impact the higher age groups. Cancers still account for a large share of mortality inequalities at ages 60-80, along with cardiovascular diseases, for women especially. After age 80, these diseases account for 50% of mortality variation between *départements* for women and 40% for men.

**Magali BARBIERI • LA MORTALITÉ DÉPARTEMENTALE EN FRANCE**

Les disparités interdépartementales de mortalité demeurent marquées en France métropolitaine depuis trente ans. Elles ont diminué chez les femmes, mais restent fortes chez les hommes. Comme dans les années 1960, les régions les plus défavorisées sont le Nord, l'Alsace et la Bretagne. La mortalité est au contraire plus faible à Paris et dans les départements situés au sud-ouest de l'Île-de-France ainsi que dans les régions Rhône-Alpes et Midi-Pyrénées (principalement pour les hommes); pour les femmes, la mortalité la moins importante est située dans le nord de la région Poitou-Charentes et les Pays de la Loire. Les variations géographiques d'espérance de vie à la naissance sont étroitement associées aux variations de la mortalité à partir de 30 ans et tout particulièrement à 60-79 ans, mais pas systématiquement à celles de la mortalité des enfants. Entre 30 et 60 ans, les tumeurs demeurent l'explication principale (notamment par cancer du poumon pour les hommes), ainsi que l'alcoolisme et les suicides qui ont également des conséquences sur les groupes d'âges suivants. Les tumeurs continuent de peser sur les inégalités de mortalité entre 60 et 80 ans, et pour les femmes surtout les maladies cardiovasculaires. Après 80 ans, ces maladies expliquent 50 % des variations de mortalité entre départements pour les femmes contre 40 % pour les hommes.

**Magali BARBIERI • LA MORTALIDAD DEPARTAMENTAL EN FRANCIA**

En Francia metropolitana, desde hace treinta años las diferencias de mortalidad entre los departamentos continúan siendo importantes. Aunque han disminuido para las mujeres son todavía fuertes para los hombres. Como en los años sesenta, las regiones más desfavorecidas son el Norte, Alsacia y Breñaña. La mortalidad más débil se encuentra en las regiones Île-de-France, Rhône-Alpes y Midi-Pyrénées (sobre todo para los hombres); para las mujeres, la mortalidad más baja se sitúa en el norte de la región Poitou-Charentes y en la región Pays-de-la-Loire. Las variaciones geográficas de la esperanza de vida al nacimiento están fuertemente asociadas a la mortalidad a partir de 30 años y en particular a la mortalidad de los 60-79 años, pero no estas ligadas sistemáticamente a la mortalidad infantil. Entre 30 y 60 años, los tumores constituyen la explicación principal de las diferencias de mortalidad (en particular, el cáncer de pulmón para los hombres), así como el alcoholismo y los suicidios, que tienen también consecuencias sobre la mortalidad a partir de 60 años. Los tumores continúan siendo un factor de desigualdad importante entre 60 y 80 años, así como las enfermedades cardiovasculares, sobre todo en las mujeres. A partir de 80 años, estas enfermedades explican el 50% de las variaciones de mortalidad entre los departamentos para las mujeres y el 40% para los hombres.

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**Keywords:** mortality by *département*, life expectancy at birth, France, disparities between *départements*, causes of death, geography of mortality.

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