Chapter 7
Health Crises and Cohort Mortality

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Two sorts of relationships can exist between trends in a population's health and trends in the mortality of successive birth cohorts. Firstly, in a period of long-term health improvements, the different cohorts see gradual benefits from this progress; but each new cohort benefits from it more, since it enjoys it sooner and therefore for a longer part of its life. This results from a general decline in mortality as health improves, viewed in terms of cohort. We wondered what happens, from one cohort to another, in a country that is in the contrasting situation of having experienced a decline in health over a long period – like Ukraine. What impact had the deterioration observed since 1965 on cohort mortality? But conversely, we also wondered whether the particular history of certain cohorts, notably those most severely affected by the Great Famine of the 1930s or by the Second World War, leads to these cohorts being distinguished nowadays by poorer health and higher mortality from younger or older cohorts.

7.1 The Outcome of Thirty Years' Deterioration in Health for Birth Cohorts in Ukraine

At the time this chapter was written, the only available data on Ukrainian mortality by year of age and calendar year dated from 1959 onwards.[1] Therefore successive cohorts can be followed only through sections of their lives over about 30 years, and

[1] Editors' Note: it is only very recently that we have been able to gain access to detailed data enabling us to calculate complete life tables for the years before 1959. We could not correct all the chapters to reflect these new data without excessively delaying publication of the book. This was particularly true for this chapter, which relies on fairly long, complex calculations.

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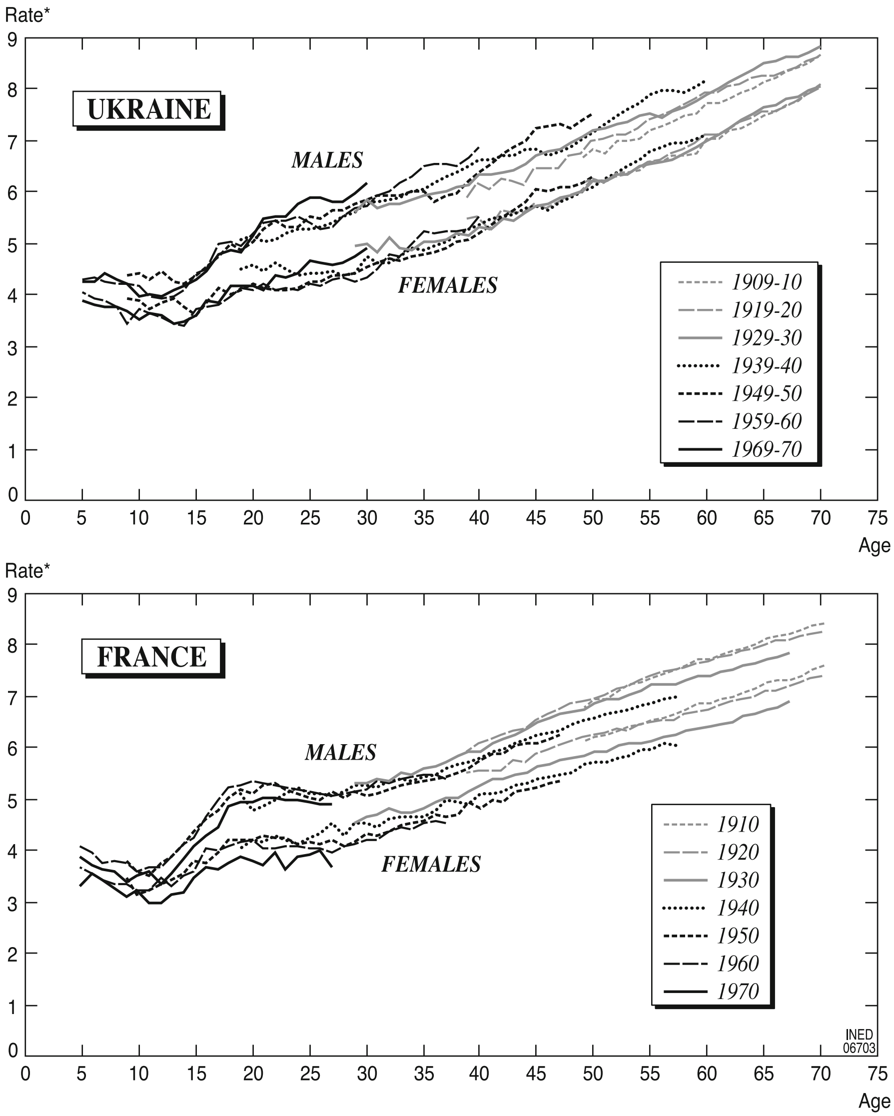

Fig. 7.1 Age-specific mortality rates of Ukrainian and French cohorts 10 years apart. * The mortality rate *m* is represented by Ln(100,000**m*)

these sections obviously occur at different ages in different cohorts. So there is fairly limited scope for comparisons between cohorts at the same age. However, for the age bands that they have in common, it is possible to observe the gaps between cohorts, using a single figure showing age-specific mortality rates in successive cohorts (upper panel of Fig. 7.1).

To make the Figure more readable, only one cohort in ten has been shown; this places further restrictions on the comparison but makes it easier to reveal the differences. In order to compare this picture of cohort mortality in Ukraine to the situation observed in France, we have also strictly limited the French data represented to the same age brackets[2] (lower panel of Fig. 7.1) as those that were available for Ukraine.

In France, from one 10-year period to the next, successive cohorts have experienced lower and lower mortality at the same age. So, in the whole of the age band that they have in common (ages 30–55), the 1940 cohort consistently lies below the 1930 cohort. The same goes for the 1930 cohort compared to the 1920 cohort (ages 50–65) – and so on. This obviously relates to the fact that the most recent cohorts were younger when they started to benefit from various health improvements, while the older cohorts experienced these only at a later age. And in the oldest age groups, the phenomenon is much more pronounced among females because, by the time they reach these ages, they have benefited more from health improvements than males have. In contrast, among the young, the situation is much less regular; for certain cohorts, the reverse is even true, especially among males, because road accidents dominate youth-age mortality, and so the latter rose with the increase in such accidents during the 1960s and 1970s.

In Ukraine, for all those aged over 15, mortality increased among males and stagnated among females over the course of the 30 years under consideration. Among Ukrainian males of the same age, mortality increases from one cohort to another, which is the reverse of the phenomenon that typifies the French adult cohorts. All the female Ukrainian cohorts seem to experience about the same mortality.

Thus, Ukraine's long period of deterioration in health led to new cohorts of males being subjected to increasingly high levels of mortality; at the same time, it prevented the younger female cohorts from improving their situation by comparison with that of their older sisters.

In the context of these general trends, Fig. 7.1 also traces the large fluctuation linked to the anti-alcohol campaign and to the swing away from it, with the latter exacerbated by the economic crisis. Here we can see very clearly that this is a typical example of how the impact of circumstantial phenomena increases with age, as one cohort's trajectory succeeds another.

[2]However, it should be noted that, for France, the mortality rates are available by cohort in the strict sense – i.e. they are calculated by year of birth and year of age (relating to two calendar years) – while, for Ukraine, rates are available only by year of age and calendar year (relating to two neighbouring cohorts). Because of this, the Ukraine figure represents the average situations of pairs of adjacent cohorts, while the France figure identifies cohorts strictly. This may pose problems if two successive cohorts are born at a time when there has been an abrupt change in the birth rate – for example, with the appearance of a birth deficit linked to the general mobilization for the First World War (Caselli et al. 2001, pp. 105–109).

7.2 The Long-Term Effects of Earlier Traumas

Beyond this general phenomenon, is it reasonable to believe that certain aspects of the overall deterioration in health observed since the mid-1960s are, for some cohorts, linked to the long-term effects of an earlier event that had a severe impact on them. This issue is especially relevant here because Ukraine, as we saw in Chaps. 2 and 3, has been through some very serious crises, notably the famine of the 1930s and the Second World War. These crises hit certain age groups harder than others, and so some cohorts experienced greater after-effects, which could have led to their higher mortality rates even in recent decades. Various writers studying a number of other countries have observed that the First World War and other major events had long-term effects on the later survival of the cohorts most affected (Vallin 1973; Horiuchi 1983; Wilmoth et al. 1989; Caselli 1990; Rychtaríková et al. 1994). With regard more specifically to Ukraine, first Barbara Anderson and Brian Silver (1989), then Frans Willekens and Sergei Scherbov (1992) put forward the hypothesis that cohorts born during the Second World War or the 1950s have had abnormally high mortality in recent years. However, the series on which their analyses relied were too short and fragmentary to provide a definitive view on this point.

The most classic approach to answering this type of question is provided by APC[3] methods (Hobcraft et al. 1982; Wilmoth 2001), in the following form:

$$ln(M_{ijk}) = a_i + b_j + c_k + e_{ijk}$$

where:

M_{ijk} is the central death rate for age i, year j and cohort k,
a_i is the age effect,
b_j, the period effect,
c_k, the cohort effect,
e_{ijk}, stochastic error.

Using the least squares method, age, period and cohort effects are estimated as the linear regression coefficients of the logarithms of mortality rates over dummy variables representing years of age, calendar years and years of birth.[4] The age, cohort and period effects are additive and independent, which means that the age effects are the same for all calendar years and the cohort effects are the same for all ages.

[3] For 'Age, Period, Cohort'.

[4] For example, for the year 1970, the corresponding dummy variable is 1 for all the observations in this year and 0 for all the others.

We applied this model to the Ukrainian data for the period 1965–2001[5]; however, we excluded mortality at ages 0–4 and over 65 from consideration, so that we would be basing our judgement only on the most reliable age-specific data.[6] The number of observations obviously varies according to the cohort concerned. The 1899–1900 cohort provides a single mortality rate, the rate at age 64 in 1965. The next cohort appears twice, in 1965 and 1966, at ages 63 and 64 respectively. In this way, the number of observations rises to 37 in the 1934–1935 cohort. Each of the 1934–1935 to 1959–1960 cohorts is the object of 37 observations, sequentially shifted with age. Then the number of cohort observations declines gradually from the 1959–1960 cohort to the 1994–1995 cohort, which in turn provides only a single observation, at age 5.

The age of 5, the year 1965 and the 1919–1920 cohort were taken as reference points. The age-period-cohort effects were measured in terms of deviation from these reference levels. The calculations were carried out using STATA software. The correlation coefficient R^2 between the observed and the estimated rates was very high, in the order of 0.998 for each of the two sexes.

In order to make a comparison with France, the same model was applied to the French data for the same period[7] and the same age ranges.

Figures 7.2–7.4 show the effects of age, period and cohort calculated for each sex in the two countries. The age effects (Fig. 7.2) come as no surprise. Mortality here follows its classic laws, growing more or less exponentially with age from 30 onwards, but also with a downward trend among the very young (ages under 10) and a local elevation around the age of 20. The difference between Ukraine and France lies in the concavity of the French curves in the young adult age groups, which contrasts with an earlier exponential rise in Ukraine.

The period effects (Fig. 7.3) are certainly also the expected ones, showing a very clear contrast between the downward trend in French mortality (which, following a period of stagnation in the 1960s, has been constant since the early 1970s) and long-term deterioration in mortality of Ukrainian males and stagnation in mortality of Ukrainian females. In Ukraine, we can also see very clearly the large fluctuation following the anti-alcohol campaign of 1985 and the political and economic transition in the early 1990s.

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[5] In fact, revealing cohort effects requires great precision in measuring age-specific rates. Although age-specific mortality rates are available from 1959, the years 1959–1964 were excluded from our analysis because of the quality of population estimates for those years. We knew that 1959 census population counts by year of age were so imprecise. This suggests that errors in the age-specific rates may disrupt the cohort analysis, and it was only from the 1964 microcensus onwards that annual age-specific population estimates enabled us to calculate mortality rates that were usable here.

[6] There was a risk that improved registration of deaths at these ages (see Chap. 4) might distort the analysis.

[7] In fact, for France, this period covers the years from 1965 to 1997.

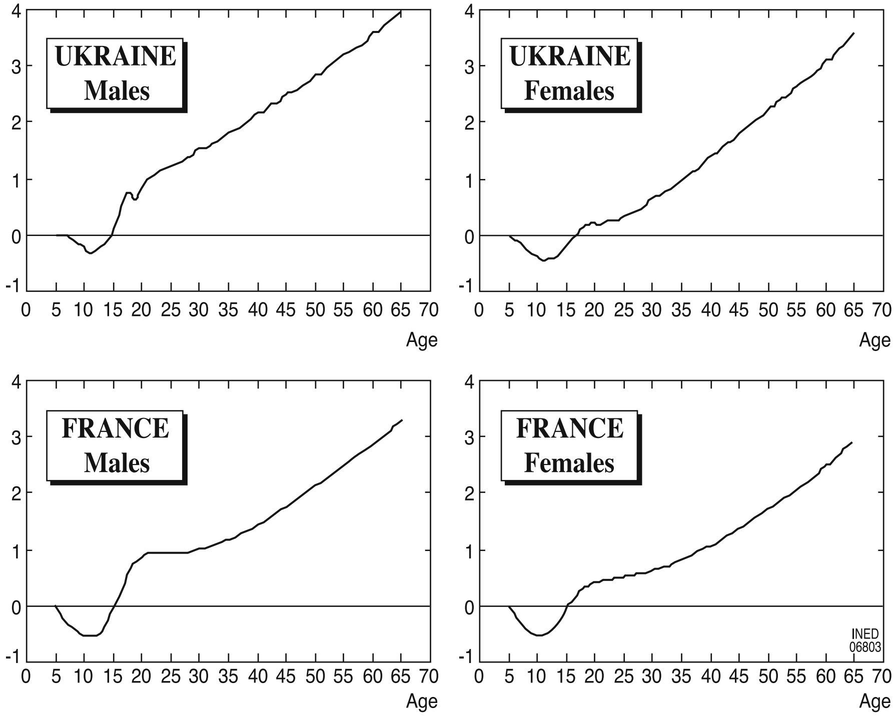

Fig. 7.2 Sex-specific age effects estimated by the APC model, Ukraine and France (1965–1995)

The results in terms of cohort effects (Fig. 7.4) are more difficult to interpret. In Ukraine, they never seriously differ from the reference level, and therefore, where they exist, they play only a minor role compared to age and period effects. Moreover, the estimates fluctuate quite substantially, leading us to fear that the parameter intended to represent stochastic error has failed to absorb much fluctuation. This absence of any notable effect does not necessarily mean that there is no cohort effect. Rather, it indicates that, if the effect exists, the fact that we are attempting to observe it in a limited set of observations prevents us from detecting it.

Better still, the French example clearly shows at what point the application of the APC model to truncated cohort data may become misleading. We should first of all note that short-term fluctuations are much smaller in the French case, probably because the data are of better quality (in particular, the population estimates by year of age, which serve as denominators for the rates); this confirms our view that the Ukrainian fluctuations are random ones. On the other hand, Fig. 7.4 seems to show that in France, notably among males, the mortality of cohorts born in the 1960s is significantly greater than that of the cohorts on either side. In fact, this is deceptive.

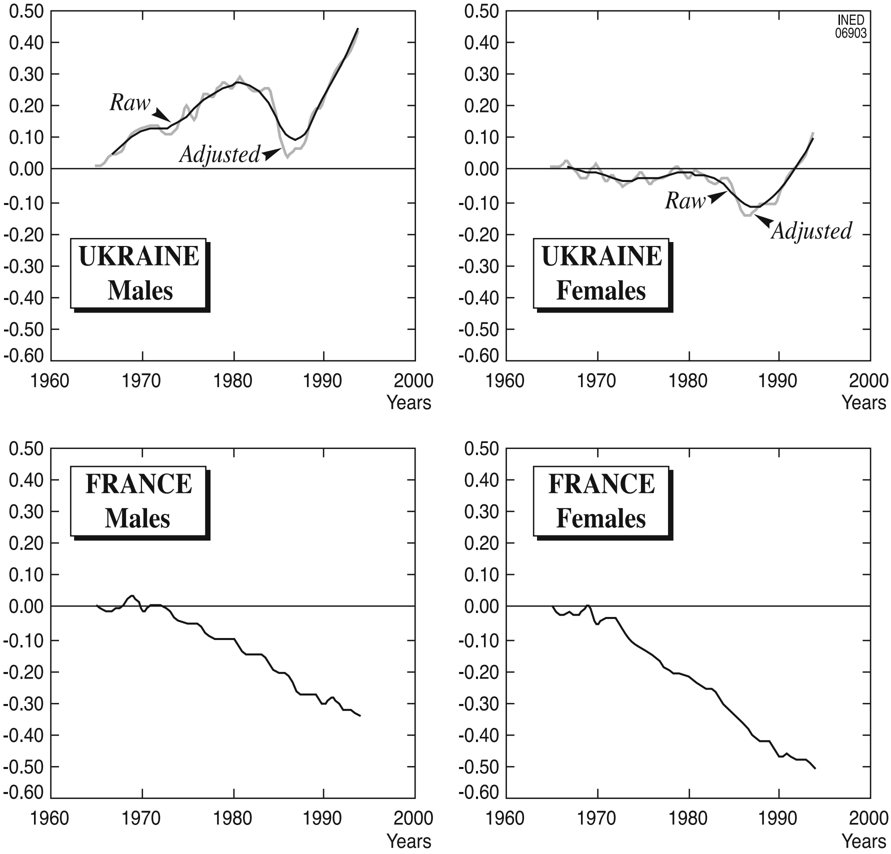

Fig. 7.3 Sex-specific period effects estimated by the APC model, Ukraine and France (1965–1995)

The 1960s cohorts reached the age of 20 at the time when mortality from road accidents among young people of this age reached its peak, having increased steadily since the Second World War. They are also the same cohorts that reached the age of about 30 at the time when, in its turn, mortality from AIDS reached its maximum level. In both cases, earlier and later these cohorts actually enjoyed more favourable mortality levels. This makes it clear that the detected effects – may be at least partially false because of a lack of observations on mortality at older ages cannot be observed. In reality, there was a chain of circumstances here that led to the same group of cohorts suffering the consequences of two successive events separated by the same distance in time as the gap between their target ages. When the APC model highlights a result like this so clearly, it is because, for the cohorts concerned, the analysis is limited to the young adult age groups particularly affected by these two setbacks.

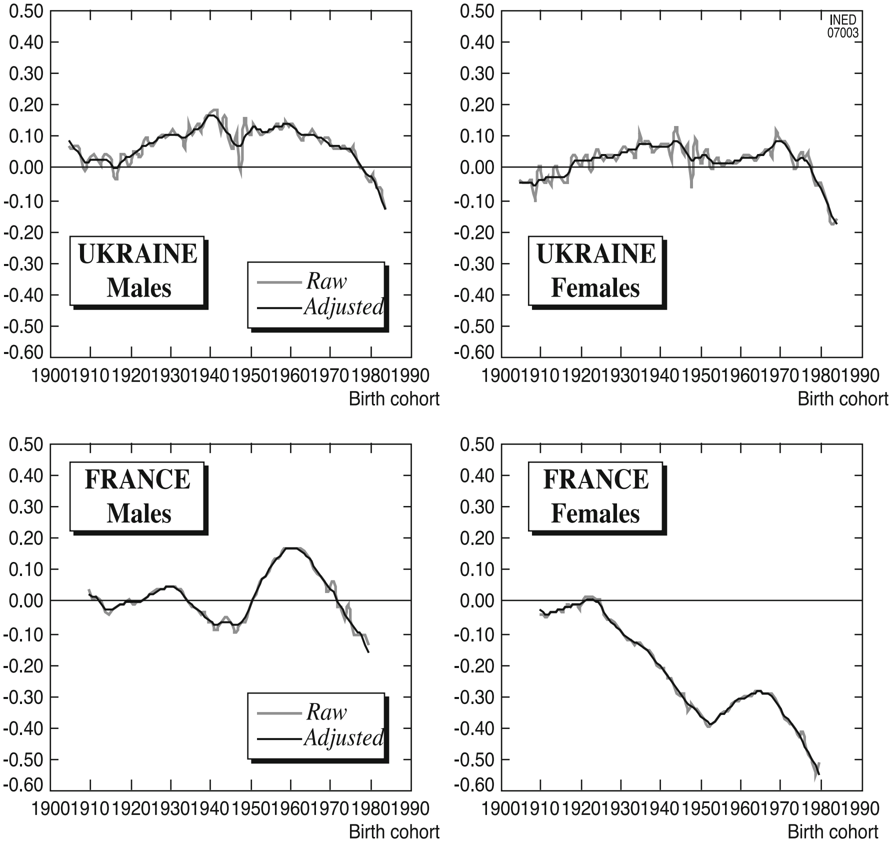

Fig. 7.4 Sex-specific cohort effects estimated by the APC model, Ukraine and France (1965–1995)

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