Chapter 4
Is Mortality Under-Estimated?

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Before assessing changes in age- and sex-specific patterns of mortality in Ukraine, we have to decide what line to take towards shortcomings, often mentioned in the literature, in recording deaths. In order to judge the quality of registration of deaths, reference is generally made to age-specific model life tables. Just as for Russia (Shkolnikov et al. 1995a), the specific nature of mortality in Ukraine in the adult age groups makes the use of these models tricky, if not futile. However, we must take into consideration the criticisms often made of the quality of mortality data for the very young as well as for the old.

4.1 Infant Mortality

Several problems with infant mortality in the Soviet Union have been reported (Anderson and Silver 1986; Blum and Monnier 1989; Velkoff and Miller 1995), and we should begin by discussing how they relate to the real Ukrainian situation.

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4.1.1 The Boundaries of Deaths Under the Age of 1

A first problem that is sometimes mentioned (Blum and Monnier 1989; Ksenofontova 1994) relates to errors in classifying deaths under 1 year by age. In fact, this problem essentially concerns the Central Asian Republics and the Caucasus, and even some regions of Russia. It may perhaps have played some role in the European part of the USSR (and therefore in Ukraine) before the War (see Fig. 5.4, Chap. 5), but its consequences there were probably marginal considering the over-arching problem of under-registration of infant mortality.

4.1.2 The 1974 Change

A second problem involves the change which, as Barbara Anderson and Brian Silver (1986) explain, was introduced into the registration system in 1974 and, they claim, produced an increase in the number of recorded infant deaths.[1] A jump in the statistical series of several republics in the USSR can indeed be observed around 1974, but it is not systematic. The issue had already been mentioned by Petukhov and Nikolaev (1981, cited in an unpublished document by Carlson and Bernstam and taken up by Velkoff and Miller, 1995). But for them, this growth in infant mortality – which was actually spread over several years – was due, at least in part, to a change in health care strategy adopted in the mid-1960s, when the provision of midwives and paediatric beds to health care units in villages with less than 700 inhabitants (90% of the Soviet rural population in 1970) was cut, as they were not considered to be financially viable. This was followed, according to Carlson and Bernstam, by a significant increase in infant mortality in rural areas. But what about the particular country that concerns us?

In Ukraine, the increase in infant mortality extended over the period 1971–1976, without any abrupt discontinuity in 1974. On the other hand, if a more precise distinction is drawn between the different components of infant mortality (age and cause), an unexpected jump can be observed between 1973 and 1974 – firstly, for mortality in the first month of life (Fig. 4.1) and secondly, for diseases of early infancy (Fig. 4.2); both cases contrast with a regular rise in the rest of infant mortality over 5 or 6 years from the beginning of the 1970s. Therefore it seems likely that for Ukraine, this phenomenon of a real rise in post-neonatal mortality is combined with a phenomenon that is smaller in scale but more specific, since it may correspond to a change in the definition of live births, stillbirths and infant deaths.

Let us assume here that this unexpected jump – specific to the given age or to causes where infant mortality may indeed be very sensitive to changes in definition – is due to new instructions issued for the registration of deaths. We can then attempt

[1] In 1971, TsSU (the Central Statistical Directorate) decided to record numbers of perinatal deaths and, in 1974, a perinatal death certificate was brought into use.

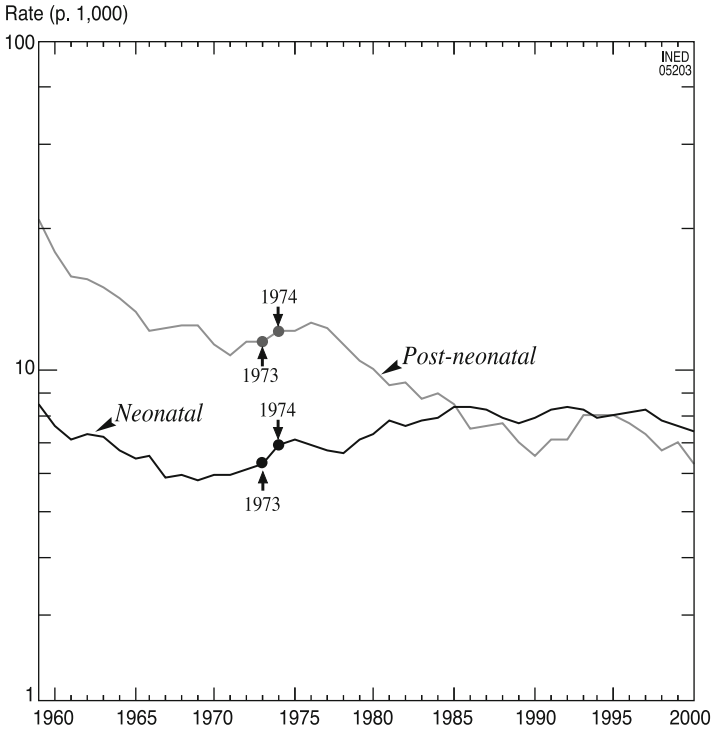

Fig. 4.1 Trends in neonatal and post-neonatal mortality in Ukraine from 1959 to 2000

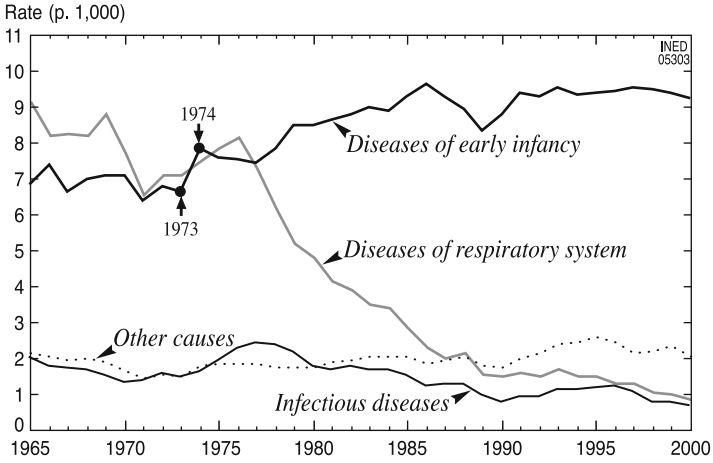

Fig. 4.2 Trends in main causes of infant mortality in Ukraine from 1965 to 2000

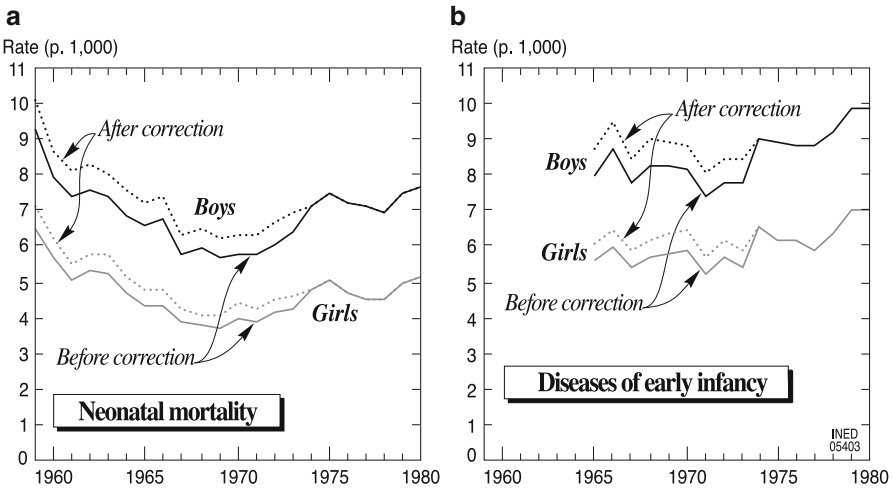

Fig. 4.3 Trends for 1965–1980 in (**a**) neonatal mortality rate and (**b**) rate of infant mortality from diseases of early infancy, before and after correction for the change in registration practice introduced in 1974

to correct the recorded series for the years before 1974, increasing them by a fraction that allows us to bring the 1973 rate in line with the observed trend. We did this, separately for each sex, first for neonatal mortality[2] (Fig. 4.3a), then for mortality from diseases of early infancy[3] (Fig. 4.3b).

Once neonatal mortality (or mortality from diseases of early infancy) corrected in this way has been added to post-neonatal mortality (or mortality from other causes), we obtain the corrected series of infant mortality rates for the years before 1974. Whatever the method (age or cause), the result is fairly similar. Table 4.1 gives the ratios that are finally obtained between the corrected rate and the recorded rate. As we shall see later (Chap. 9), for diseases of early infancy this correction could be made only from 1965[4] while for neonatal mortality we were able to go back to 1959. At the same time, it seems to us more logical to refer, for the correction we are making, to neonatal deaths rather than to deaths from diseases of early infancy, which may run beyond the neonatal period and, at the same time, do not necessarily cover the whole of the early neonatal mortality that is at issue here.

[2]Mortality at 0–27 days.

[3]Mortality from the following causes (the figures in brackets indicate the relevant item numbers in the Soviet classification): congenital anomalies of heart (147), other congenital anomalies (145, 146 and 148–150), birth trauma (151), intrauterine hypoxia and birth asphyxia (152), congenital pneumonia and foetal aspiration (153), other newborn respiratory conditions (154), other perinatal conditions (155–157).

[4]At this stage, we have not yet analysed the move from the 1952 to the 1965 cause-of-death Classification, and therefore we cannot correctly link the 1959–1964 series of deaths from diseases of early infancy with the post-1965 series.

Table 4.1 Correction coefficients for infant mortality, obtained by both approaches (age and cause of death)

	Basis of calculation			
	Deaths from 0 to 27 days		Diseases of early infancy	
Year	Boys	Girls	Boys	Girls
1959	1.021	1.020		
1960	1.023	1.021		
1961	1.024	1.021		
1962	1.025	1.023		
1963	1.025	1.023		
1964	1.026	1.023		
1965	1.027	1.023	1.025	1.022
1966	1.029	1.026	1.027	1.024
1967	1.026	1.023	1.024	1.022
1968	1.026	1.022	1.024	1.021
1969	1.025	1.023	1.023	1.021
1970	1.028	1.026	1.026	1.024
1971	1.030	1.027	1.028	1.025
1972	1.029	1.026	1.027	1.024
1973	1.030	1.027	1.027	1.025

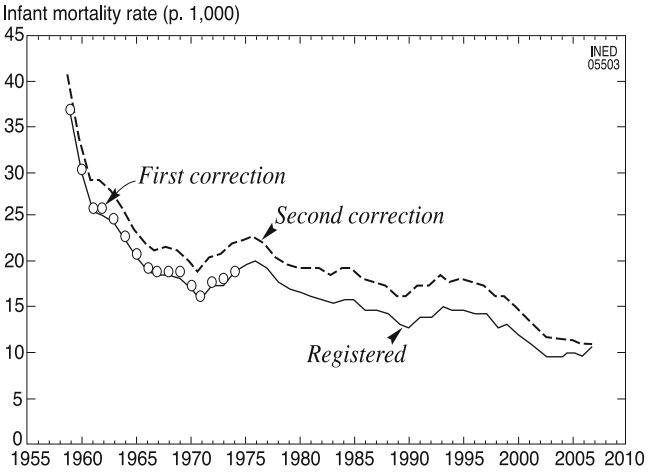

Fig. 4.4 Trends in recorded infant mortality rate and infant mortality rate corrected to take account of 1974 change and 2005–2007 adoption of WHO definition of live birth

Therefore, in the end we chose to correct infant mortality rates by relying on the sets of coefficients calculated from neonatal mortality. The result is illustrated by the 'first correction' in Fig. 4.4, for both sexes. For 1938–1939, when the recorded infant mortality rate was much higher – in the order of 140 per thousand – the effect of this correction must obviously be much smaller, and we arbitrarily used a coefficient of 1.01.

4.1.3 Disparity Between Soviet and WHO Rules

The third problem, which again concerns the definition of live birth, relates to the whole period under study here. The definition in force in the USSR at the time was more restrictive than that of the WHO: children born either before 28 weeks' gestation or weighing less than 1,000 g or measuring less than 35 cm long were never counted as live births or infant deaths if they died during the course of their first week of life, but only as stillborn. Under the WHO rules, it is sufficient for a child who dies to have presented any sign of life whatsoever for both its birth and its death to be registered as such. This most certainly gave rise to under-estimation of neonatal mortality.

Soon after their independence, the Baltic States adopted the WHO definition – Latvia and Lithuania from 1991, and Estonia in 1992 (Estonian Medical Statistics Bureau et al. 1993). This was immediately followed by a clear discontinuity in the regularity of the corresponding statistical series. Thus, in the case of these republics, it was possible to attribute an estimated 50% increase in early neonatal mortality (at 0–6 days) to the change in definition (Shkolnikov et al. 1995a).

A definition close to that advocated by the WHO was also introduced in Russia, in January 1993. However, although this change coincided with a significant increase in infant mortality in 1993, the latter essentially related to post-neonatal mortality and not very much to neonatal mortality, which leads one to think that it was more due to the economic and social crisis – then hitting Russia hard – than to the change in definition of live birth, which did not produce the same effect at all as in the Baltic States. According to Evgenii Andreev (1995), the early neonatal mortality rate in fact went from 9.0 per thousand in 1992 to 9.7 in 1993, while the total infant mortality rate went from 18.0 to 19.9 per thousand. In fact, a December 1992 circular required register offices to continue to view as live births only infants weighing over 1,000 g at birth. Therefore the only difference from the pre-1993 situation was that it was no longer necessary for the length of gestation to be over 28 weeks or for the infant to measure more than 35 cm. Consequently it is probable that, from this point of view, infant mortality continues to be under-estimated in Russia.

In Ukraine, it was only in 2007 that the WHO definition was officially adopted, but on reading recently observed trends, it seems clear that an initial improvement in registration was associated with the introduction of the 10th Revision of the International Classification of Diseases (ICD-10) in 2005 (Fig. 4.4, registered rates). In order to come closer to the reality of infant mortality in Ukraine, therefore, a second correction must be made to all the pre-2007 data, but in two stages in order to take into account the 2005 improvement.[5] For the whole period before 2005, we are now in a position to state that the correction made for the French edition of this book, published in 2003,

[5] When updating our data set it was possible to get cause-of-death data until 2006 only. It was possible to get infant mortality data until 2007, which made possible correction here discussed for the years 2006 and before.

has already given us a result that is completely in line with the corrections suggested by the changes observed in 2005 and 2007. We then hypothesized that something similar would be observed in Ukraine to what was seen in the Baltic States when those countries adopted the WHO rules: a 50% increase in early neonatal mortality (death at 0–6 days). It would have been ideal to be able to apply the Baltic correction coefficient directly to rates of early neonatal mortality in Ukraine, but unfortunately we did not have any information about the latter. On the other hand, we were able to attempt an overall correction of the neonatal mortality rate (death at 0–27 days)[6] by relying on the Russian figures: according to Andreev (1995), the proportion of early neonatal mortality there was 81% (9.0/11.1). We therefore increased Ukrainian neonatal mortality rates for the whole period 1959–1995 by 40% (50% x 0.81) and added the post-neonatal mortality rates to these corrected rates, thus obtaining corrected infant mortality rates up to 2000. We have continued the same reasoning up to 2004 in order to bring the 'second correction' illustrated in Fig. 4.4 up to that date; and, in order to complete this corrected series by linking it to the year 2007, we have increased the 2005 and 2006 neonatal mortality rate pro rata to the jump observed between 2006 and 2007. This correction finally led us to increase the infant mortality rate by 13% in 2005 and 2006 and by roughly 20% in the years 1990–2004; but, when we went further back in time, the increase diminished in scale because the proportion of neonatal mortality was reduced by larger post-neonatal mortality: in the early 1960s, it was only 10%. In linking the 1938–1939 life table in the preceding chapter to this correction, we were not able to use Ukrainian neonatal mortality – which we do not know – but took as our reference the age structure of urban infant mortality in Russia[7]. Moreover, it is clear that at the level of infant mortality in Ukraine then (144 per thousand in uncorrected data), the proportion of early neonatal mortality within neonatal mortality must have been much lower than it is today. Going by the French data from the beginning of the century (Bunle 1954), we estimated it at 50%. So, after corrections, we obtain an infant mortality rate of 153 per thousand, which is an increase of 6.3%. Where the 1926–1927 table was concerned, we used results already corrected in the course of an in-depth study of data from the time (Adamets and Shkolnikov 1995), which led to a corrected rate of 217 per 1,000, an increase of 3.1% over the 210 per 1,000 registered.

4.1.4 Other Causes of Under-Registration

Setting aside these specific problems, it can be agreed that there was a recognizable general improvement in registration of infant deaths over the course of the 1960s and 1970s throughout the USSR. However, it seems to us that this phenomenon,

[6] Available cause-of-death distributions for infants aged under 1 year in fact differentiate deaths at 0–27 days.

[7] Statistical Report No. 5, RGAE, fonds 15, series 329, file 269.

Table 4.2 Consequences for life expectancy at birth of the two corrections made to infant mortality rates, from 1958–1959 to 2000

	Males		Females	
Year	Before correction	After correction	Before correction	After correction
1958–1959	66.2	65.9	72.8	72.5
1965	67.8	67.5	74.7	74.5
1970	66.5	66.2	74.4	74.2
1975	65.5	65.3	74.2	74.0
1980	64.6	64.4	74.1	73.8
1985	65.2	65.0	74.0	73.8
1990	65.6	65.4	74.9	74.7
1995	61.3	61.1	72.5	72.4
2000	62.2	62.0	73.6	73.3
2001	62.3	62.1	73.6	73.5
2002	62.1	62.0	73.7	73.5
2003	62.3	62.1	73.5	73.4
2004	62.0	61.9	73.6	73.5
2005	61.5	61.4	73.4	73.3
2006	62.3	62.2	73.8	73.7

See, in Annex II, Table 1, on the website (http://www.demogr.mpg.de/books/drm/009 or http://extras.springer.com/), the full annual breakdown

N.B. For 1958–1959, 'life expectancy before correction' as used here was obtained by recalculating a full life table from total population numbers and total deaths by year of age. It is slightly different from the one published by Goskomstat (which gave 66.1 years for males and 72.4 years for females) and from the one published by Korchak-Chepurkovskii (1996)

which had a strong impact on Central Asia and perhaps, to a lesser extent, the Caucasus and certain parts of Russia, was much less strong in the European regions of the USSR. In the absence of any precise information on this topic, here we assume that – with the above corrections – infant death statistics for Ukraine are complete.

In the end, the two corrections used for infant mortality reduce life expectancy at birth by about two-tenths of a year until the 2000s, and then by just under half that in 2005 and 2006 (Table 4.2).

4.2 Old-Age Mortality

From 1959, age-specific mortality rates can be calculated by comparing registered deaths to Goskomstat's annual age-specific population estimates. So we were able to construct complete life tables for the years 1959–1964 and link the results of these to the results of the series that had previously been calculated from death statistics and Goskomstat's annual age-specific population estimates (see Chap. 7). For 1958, we had already made an estimate based on registered deaths compared to a population estimate obtained by retropolation (see Chap. 3); so, even though no

registered deaths were available for that year, we made another estimate by comparing the age-specific probabilities of dying from the official 1958–1959 table and the table calculated for 1959.[8] The results of these two estimates were very close. Here we chose to apply our reasoning on the quality of recording old-age mortality – which is the second problem often mentioned in regard to Soviet data – to the second estimate.

Anderson and Silver (1989a, 1990) proposed to increase probabilities of dying over the age of 60, taking mortality in the middle age groups as a reference. Given the particularly high level of adult mortality in Ukraine, such a correction here would lead to an over-estimate of old-age mortality. We prefer to rely, as we did for Russia (Shkolnikov et al. 1995a), on entering the model life tables using the level of Ukrainian infant mortality to decide on the corrections to be made – even if, given the earlier corrections needed to infant mortality, this solution is not entirely satisfactory.

Table 4.3 compares the observed values of life expectancy at age 70 to those given by each of the four families in Coale and Demeny (1983) corresponding to infant mortality observed in Ukraine.[9] We can see that from 1965 the observed value is always lower than the mean value of life expectancy at 70 in the model life tables from the four families. It seems to us that this is consistent with the fact – already emphasized – that, from the mid-1960s, in both Ukraine and Russia, adult mortality rose to levels much higher than the norm. It is in no way astonishing that this anomaly continues to be visible here among the old.

On the other hand, before 1965, observed life expectancy seems to have over-estimated the real situation, especially among females. In 1958, observed life expectancy at age 70 among males was 1 year higher than the mean of the model life tables used for reference. In 1960, the difference was still 0.3 years, but then it disappeared. Among females, this gap was larger (2 years in 1958) and persisted for longer (up to 1964). Therefore it seems helpful to correct mortality after age 70 up to 1960 for males and 1964 for females.

A correction is also required for the 1926–1927 and 1938–1939 tables. However, as we have indicated in earlier chapters, these tables have already been corrected for under-estimation of old-age mortality; so we accepted them here as they stood (Adamets and Shkolnikov 1995).[10]

Life expectancy resulting from the two successive corrections (infant mortality and old-age mortality) is given in Table 4.4 for the period 1958–1965 (Table 4.2 has already given the continuation for the years when only infant mortality had to be corrected). The correction in old-age mortality is significant for males up to 1960

[8] We estimated the age-specific probabilities of dying for 1958 by applying to the 1958–1959 probabilities of dying a ratio such that the mean for 1958 and 1959 again produced the 1958–1959 probability.

[9] By interpolating the values given by the model tables.

[10] For the 1938–1939 table, Sergei Adamets and Vladimir Shkolnikov made no corrections to infant mortality, but did correct old-age mortality.

Table 4.3 Life expectancy at age 70 (e^{70}): observed values and values in Coale-Demeny model life tables corresponding to the same level of infant mortality (m^0)

Year	Estimated m_0 (per 1000)	Observed e_{70}	Values of e^{70} in models					Mean difference
			North	South	East	West	Mean	
Males								
1958–1959	45.7	11.1	11.1	11.5	9.8	9.8	10.6	–0.5
1958	44.4	11.6	11.1	11.6	9.9	9.8	10.6	–1.0
1959	45.6	10.6	11.1	11.5	9.8	9.8	10.6	0.0
1960	37.1	11.2	11.4	12.1	10.1	10.0	10.9	–0.3
1961	32.3	11.1	11.5	12.5	10.2	10.2	11.1	0.0
1962	32.3	10.4	11.5	12.5	10.2	10.2	11.1	0.7
1963	31.1	10.8	11.6	12.6	10.3	10.2	11.2	0.4
1964	28.9	11.1	11.8	12.7	10.4	10.4	11.3	0.2
1965	25.7	10.7	12.0	12.8	10.5	10.5	11.5	0.8
1970	22.2	9.9	12.3	(12.8)	10.7	10.7	11.6	1.7
1975	24.8	9.8	12.0	(12.8)	10.6	10.5	11.5	1.7
1980	21.8	9.6	12.3	(12.8)	10.7	10.7	11.6	2.0
1985	20.8	9.4	12.4	(12.8)	10.8	10.8	11.7	2.3
1990	17.4	9.9	12.7	(12.8)	11.0	11.0	11.9	2.0
1995	19.2	9.1	12.6	(12.8)	10.9	10.9	11.8	2.7
Females								
1958–1959	36.3	13.2	11.9	13.6	11.0	10.9	11.8	–1.4
1958	35.6	13.8	11.9	13.6	11.0	10.9	11.8	–2.0
1959	35.1	12.5	11.9	13.7	11.0	10.9	11.9	–0.7
1960	29.4	13.2	12.1	14.3	11.3	11.1	12.2	–1.0
1961	25.0	13.1	12.3	14.8	11.6	11.3	12.5	–0.6
1962	25.0	12.4	12.3	14.8	11.6	11.3	12.5	0.1
1963	24.1	13.0	12.4	14.8	11.7	11.4	12.6	–0.4
1964	22.0	13.4	12.6	14.8	11.8	11.5	12.7	–0.7
1965	19.3	12.9	12.8	14.8	12.1	11.7	12.9	0.0
1970	17.0	12.4	13.1	(14.8)	12.3	11.8	13.0	0.6
1975	18.6	12.3	12.9	(14.8)	12.1	11.7	12.9	0.6
1980	15.8	12.0	13.2	(14.8)	12.4	11.9	13.1	1.1
1985	15.8	11.8	13.2	(14.8)	12.4	11.9	13.1	1.3
1990	13.1	12.3	13.5	(14.8)	12.7	12.2	13.3	1.0
1995	14.7	11.5	13.3	(14.8)	12.5	12.0	13.2	1.7

and for females up to 1965. The maximum change is 0.6 years for males and 1.3 years for females in the late 1950s. The effect of the second correction fluctuates between 0.1 and 0.2 years from 1965 for both sexes.

The corrections do not call into question the general trend in life expectancy at birth described by the crude data (Fig. 4.5). Progress simply proved a little more rapid between 1958–1959 and 1965, and the decline slowed slightly between 1965 and 1980. This confirms that there really was a deterioration in the state of health of males and a stagnation in that of females.

As our reconstruction of cause-of-death series here will start in 1965, no correction of cause-of-death figures is needed for the old. As for infant mortality, we shall

Table 4.4 Life expectancy at birth: combined results of the two corrections made to infant mortality rates and to life expectancy at age 70 (e^{70})

	Male e_0			Female e_0		
		After correction			After correction	
Year	Observed	of infant mortality rate	of infant mortality rate and of e_{70}	Observed	of infant mortality rate	of infant mortality rate and of e_{70}
1958–1959	66.2	65.9	65.6	72.8	72.5	71.6
1958	66.8	66.5	66.2	73.5	73.2	72.2
1959	65.7	65.4	65.2	72.1	71.9	71.1
1960	67.3	67.0	66.9	73.8	73.5	72.8
1961	67.6	67.3	67.3	74.1	73.9	73.3
1962	67.0	66.8	66.8	73.5	73.3	73.0
1963	67.6	67.3	67.3	74.2	74.0	73.6
1964	68.4	68.1	68.1	75.1	74.9	74.4
1965	67.8	67.5	67.6	74.7	74.6	74.5

The result given here for 1958 is slightly different from that in Table 3.20, Chap. 3. This is because it relies on the estimate that we made from the official life table for 1958–1959 and our calculations of probabilities of dying for 1959, whereas the result in Chap. 3 relied on registered deaths and a population estimate obtained by retropolation

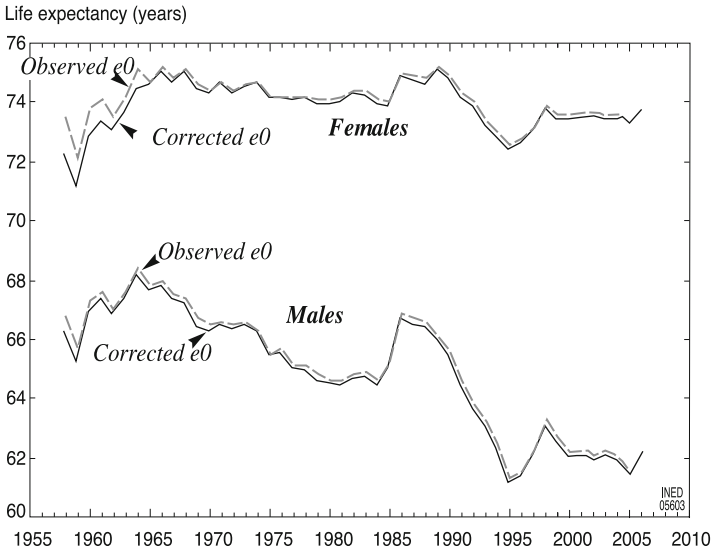

Fig. 4.5 Trends in life expectancy at birth before and after correction

divide the unregistered deaths derived from our corrections among causes of death in early infancy, pro rata to registered deaths. And having done so, we can now make use of these corrections at the two ends of life in our assessment of age-specific mortality trends and the proportions of different age groups in long-term life expectancy trends.

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