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Volume Author/Editor: Samuel H. Preston and Michael R. Haines

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Chapter Author: Samuel H. Preston, Michael R. Haines

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APPENDIX C

THE MORTALITY INDEX

THE MORTALITY INDEX used to analyze the American data in Chapters 3–5 takes the form of the ratio of child deaths to expected child deaths. It is computed for each currently married woman who reported that she had borne at least one child and whose reported duration of current marriage was less than 25 years. When women are combined into a group, the ratio consists of the sum of child deaths to women in that group divided by the sum of expected child deaths among those women.

The number of child deaths (D) that have occurred to woman i is found simply by subtracting her reported number of surviving children, S_i, from her reported number of children ever born, P_i:

$$D_i = P_i - S_i.$$

The expected number of child deaths for woman i is based upon her reported number of children ever born, P_i, and the expected proportion dead among children ever born to women in her duration of marriage category. The categories used are 0–4, 5–9, 10–14, 15–19, and 20–24 years. For woman i in marital-duration category j, the expected number of child deaths, ED_{ij}, is found by

$$ED_{ij} = P_i \times EPD_j.$$

Finally, the expected proportion of children who have died among women in marital-duration category j is based upon equations of the type first developed by William Brass and Jeremiah Sullivan to translate proportions dead into life table measures of survivorship. These equations are of the form:

$$\begin{aligned}
q(2) &= PD(0\text{–}4) \times K(0\text{–}4),\\
q(3) &= PD(5\text{–}9) \times K(5\text{–}9),\\
q(5) &= PD(10\text{–}14) \times K(10\text{–}14),\\
q(10) &= PD(15\text{–}19) \times K(15\text{–}19), \text{ and}\\
q(15) &= PD(20\text{–}24) \times K(20\text{–}24),
\end{aligned}$$

where $q(x)$ is the cumulative probability of dying before age x in the underlying life table, $PD(j)$ is the proportion dead among children ever born in marital duration category j (0–4, 5–9, . . . 20–24), and $K(j)$ is a multiplier (close to unity) that is appropriate for women in marital duration category j.

The multiplier is a function of $\bar{P}(0–4)$, $\bar{P}(5–9)$, and $\bar{P}(10–14)$, the mean parities of all women in marital durations 0–4, 5–9, and 10–14 years. The multipliers are designed to take account of the marital-duration profile of childbearing. For example, in a population in which childbearing is unusually "late" within marriage (i.e., where $\bar{P}(5–9)/\bar{P}(0–4)$ is unusually high), children born to women of a particular marital duration will have been exposed to morality for an unusually short period of time. Hence, a particular value of $PD(j)$ will translate into an unusually high value of $q(x)$: the same proportion dead will translate into higher mortality and poorer survivorship than is typically the case, and $K(j)$ will be unusually high.

For present purposes, we invert the normal procedure. Rather than translate observed proportions dead into estimated life table measures, we translate a given life table into expected proportions dead. In other words, we rewrite the estimating equations as

$$\begin{aligned} EPD(0–4) &= q(2)/K(0–4), \\ EPD(5–9) &= q(3)/K(5–9), \\ EPD(10–14) &= q(5)/K(10–14), \\ EPD(15–19) &= q(10)/K(15–19), \text{ and} \\ EPD(20–24) &= q(15)/K(20–24). \end{aligned}$$

Formulas for estimating $K(j)$ are drawn from United Nations 1983a: Table 56. In applying these equations, we use values of $\bar{P}(0–4)$, $\bar{P}(5–9)$, and $\bar{P}(10–14)$ for all women of those marital durations in the census sample. Finally, the life table values of $q(2)$, $q(3)$ . . . $q(15)$ are taken from Coale and Demeny's (1966) Model West life table, level 13.0 (with males and females combined in the ratio of 1.05 to 1.00). This level provides a good fit to the data for women in marital durations 0–24, with a ratio of the number of dead children to the expected number of dead children of 1.0088 for this group as a whole in the sample.

Implicit in this procedure is the assumption that social and environmental conditions will act multiplicatively on the $q(x)$ function through age 15. Trussell and Preston (1982) show that this multiplicative assumption is highly accurate within same model life table systems: populations with higher mortality have, to a close approximation, $q(x)$ functions that are constant multiples of those in lower mortality populations within the same model life table system. We have demonstrated in Chapter 2 that the Model West system is very appropriate to American mortality conditions at the turn of the century, as it has proven to be subsequently.

At West level 13.0, $q(5)$ is .191, the infant mortality rate is .129, and life expectancy at birth is 48.5 years. Other values of the mortality

TABLE C.1
Values of Certain Mortality Functions in Model West Life Tables Corresponding to Particular Values of the Child Mortality Index

Child mortality index	$q(5)$	*Infant mortality rate*	*Life expectancy at birth (years)*	*"West" level*
.6000	.113	.081	57.7	16.8
.8000	.152	.105	52.9	14.8
1.0088	.191	.129	48.5	13.0
1.2000	.227	.152	44.7	11.5
1.4000	.265	.177	40.8	9.9
1.6000	.303	.203	37.2	8.4

index can also be mapped into these functions by reference to the West model life table system (see Table C.1).

For example, if a group has a mortality index of .80, the implied $q(5)$ is approximately .152. As we argue in Chapter 2, and as is implied by the position of $q(5)$ in the middle of our estimation equations, $q(5)$ is the most robustly estimated life table function onto which the mortality index can be mapped. Values of $q(5)$ are not very sensitive to the choice of standard life table (West level 13.0). If the West model life table system is appropriate for a group, then the mortality index can also be translated into the group's levels of the infant mortality rate and life expectancy at birth, functions whose identification is more dependent upon assumptions about the nature of relationships among age-specific death rates within the group.