

technical note . . .

TABULATION OF CENSUS AND SURVEY DATA ON CHILD SURVIVORSHIP

by Griffith Feeney

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Population censuses and surveys are often relied upon to provide estimates of fertility and mortality. One widely used procedure for estimating mortality utilizes information on number of children born and surviving to calculate the proportion of deceased children among all children born to women in five-year age groups. The most convenient tabulation for this purpose consists of three columns—number of women, total children born, and total surviving children—for women in successive five-year age groups, usually beginning with the 15–19 age group. The number-of-women column should, with the exceptions noted below in connection with nonresponse, include all women, not just ever-married women, even if the questions on number of children born and number of children surviving are asked only of ever-married women.

Table 1 shows such data for Fiji as of the 1966 Census. To calculate the proportions of deceased children for women in a given age group, one simply subtracts children surviving from children born (this gives the number of deceased children) and divides this result by the number of children born. For women aged 20–24 in Table 1, for example, the proportion of deceased children is $27,014 - 24,987 = 2,027$ divided by 27,014, or 0.0750.

This calculation of the proportion of deceased children introduces a subtlety into the handling of nonresponse in

Table 1 Women, children born, and children surviving by age of woman: Fiji, census of 12 September 1966

Age group	Number of women	Children born	Children surviving
15–19	24,070	2,684	2,485
20–24	20,447	27,014	24,987
25–29	16,973	52,643	48,313
30–34	13,262	60,726	54,861
35–39	11,313	65,221	57,930
40–44	8,980	56,396	48,917
45–49	7,984	51,168	43,289
50–54	6,097	38,110	31,281
55–59	4,076	25,354	20,216
60–64	3,030	19,220	14,622
65–69	1,936	11,705	8,407
70–74	1,311	7,853	5,438
75 and over	1,635	9,319	6,072
Total	121,114	427,413	366,818

NOTE: Table includes only women who report age and number of children surviving.

SOURCE: Unpublished tabulation.

Table 1. If a woman reports one or more children born but does not report the number of surviving children, her inclusion in the table will implicitly count all her children as deceased, and this will bias the calculated proportion of deceased children upwards. Conversely, a woman who reports one or more surviving children but not the number of children born will increase the total number of surviving children without a corresponding increase in the number of children born, and this will bias the calculated proportion of deceased children downward. The appropriate procedure is, therefore, to exclude from the tabulation of total children born and total children surviving all women for whom information on either characteristic is not reported. Furthermore, in order that calculation of mean number of children ever born from the table not be biased, these same women should be excluded from the first column as well. Thus women failing to report either number of children born or number surviving should be excluded entirely from Table 1. In censuses where the questions on children born and children surviving are asked only of ever-married women, however, the number-of-women column should include all never-married women as well as all ever-married women who reported both number of children born and number surviving.

Information on numbers of children born and surviving is often presented in two separate tables, one showing women distributed by age and number of children borne, as in Table 2, the other showing women distributed by age and number of living children. The latter table would normally have the same format as Table 2. Where the questions on children born and children surviving are asked only of ever-married women, never-married women should be included in the "0 children born" and "0 children surviving" categories. It is possible, of course, that some never-married women will have had one or more children, but since we know neither how many such women there are nor how many children they have borne, we must either exclude all never-married women from the table or include them with an imputed number of children born. Since the total number of never-married women should always be available from a tabulation of population by sex, age, and marital status, no information is lost by including the never-married women, and since the number of children born to never-married women will usually be relatively small, inclusion is preferable. Both tables should exclude women not reporting both number of children born and number of surviving children in order to avoid biasing the calculated proportions of deceased children, but this prescription has rarely if ever been followed in practice. Tables giving women by number of children born usually include women not reporting number of surviving children, and tables giving women by number of surviving children include women not reporting number of children born.

The number of children a woman has borne is often referred to as her "parity"; hence the distribution of a group of women by number of children borne may be referred to as a "parity distribution." In principle, the total number of children born to a group of women may be calculated from the parity distribution for the group, for the total number of children born equals the number of women who have one child, plus twice the number who have two children, and so forth. In practice, however, published distributions

Table 2 Women aged 15 years and over by age and number of children borne: Fiji, census of 12 September 1966

Age group	Parity																Total number of women	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15 or more		Not stated
15-19	21879	1768	366	54	5	0	0	0	0	0	0	0	0	0	0	0	1365	25437
20-24	7838	4772	3788	2343	1116	453	110	27	8	2	0	0	0	0	0	0	672	21129
25-29	2250	2032	2470	3089	2848	2139	1235	594	229	63	20	8	2	0	1	0	267	17247
30-34	1114	948	1146	1356	1777	1910	1738	1436	967	491	223	96	44	14	4	2	133	13399
35-39	773	702	756	717	964	1186	1300	1314	1227	995	619	375	203	104	39	43	138	11455
40-44	687	560	543	558	636	662	787	902	969	835	713	454	338	162	82	96	109	9093
45-49	656	559	474	502	508	577	629	739	757	705	606	459	352	213	115	141	80	8072
50-54	480	430	405	431	392	486	539	512	581	515	442	317	249	124	97	103	102	6205
55-59	311	285	295	271	260	322	366	373	411	324	287	202	167	87	59	61	66	4147
60-64	191	206	195	176	206	266	309	289	319	265	217	138	105	65	41	48	75	3111
65-69	144	143	121	125	125	183	201	194	201	171	114	78	62	31	19	25	44	1981
70-74	101	83	81	105	105	122	125	139	115	95	79	64	48	22	14	13	33	1344
75 and over	125	113	130	121	142	146	188	181	152	106	80	53	46	23	16	17	58	1697
Not stated	49	5	3	7	5	3	0	3	2	2	2	3	2	0	0	0	20	106
Total	36598	12606	10773	9855	9089	8455	7527	6703	5938	4569	3402	2247	1618	845	487	549	3162	124423

SOURCE: *Report on the Census of the Population, 1966*, by F.H.A.G. Zwart, Suva, Fiji: Census Department, 1968.

are usually incomplete because women who have borne large numbers of children are grouped to conserve space. Suppose, for example, that we wish to calculate from Table 2 the total number of children born to women aged 45-49. This group of women may be divided into two subgroups, those who have had fewer than 15 children, and those who have had 15 or more children. The total number of children born to the former group may be calculated as $559 + 2 \times 474 + \dots + 14 \times 115 = 48,990$. But the number of children born to women in the latter group is indeterminate. We know that there are 141 women who had 15 or more children, hence that the total number of children born to this group of women must be at least $141 \times 15 = 2,115$, but we can be reasonably sure this figure is low, since it is unlikely that all the women who had 15 or more children had exactly 15 children.

Saw Swee-Hock (1964, Appendix 3) has shown that, if the tail of the parity distribution forms a geometric series, then the mean number of children born to women who have borne 15 or more children equals 15 plus the number of women who had 15 or more children divided by the number of women who had 14 children, and similarly for women in any open-ended parity group. With this method the mean number of children born to women aged 45-49 who had 15 or more children may be estimated as $15 + (141 \div 115) = 16.23$ and the number of children born to this group of women as $141 \times 16.23 = 2,288$. Total children born to all women aged 45-49 who report number of children born is thus estimated to be $48,990 + 2,288 = 51,278$, which compares favorably with the figure of 51,168 given in Table 1. The same procedure may be followed in calculating total number of surviving children to a group of women from the distribution of the group by number of surviving children.

This estimation procedure works well only when the distributions of women by parity and number of surviving children are reasonably complete. If Table 2 and the corresponding table for surviving children ended with the interval "9 or more" instead of "15 or more," for example, the calculated proportions of deceased children would deviate from the correct values by 10 to 20 percent for the age groups over 35. There is, however, a simple modification of Table 2 which eliminates the need for this approximation

altogether: the inclusion of a column showing total number of children born. The necessary space could be freed by beginning the open-ended parity group at 13 or 14 instead of 15 children born. Indeed, the numbers of women at very high parities are of relatively little intrinsic interest and the principal justification for extending the distribution as high as 14 is to minimize errors in the calculation of total children born. Since this problem is eliminated by including a column for total children born, the size of the table might be reduced without any significant loss of information. The table giving women by number of surviving children would likewise contain the total number of surviving children to women in each age group. This form of tabulation was used in the 1973 Census of the Gilbert and Ellice Islands.

This hybrid tabulation form suggests a new and optimal procedure for handling nonresponse to questions on children born and children surviving. The table giving women by number of children born should include all women reporting children born and should contain an extra column showing the number of children born to women who did not report surviving children. Likewise, the table giving women by number of children surviving should include all women reporting children surviving and should contain an extra column showing number of children surviving for women who did not report number of children born. This tabular format makes it possible to eliminate women not reporting one or the other characteristic when calculating proportions of deceased children without suppressing any information.

Several recently developed mortality estimation techniques utilize child survivorship data for ever-married women distributed by duration of marriage. The requisite tabulations have the same form as Tables 1 and 2, the only differences being that, first, the tables include ever-married women only and, second, the age classification is replaced by a duration-of-marriage tabulation. The estimation of mortality from such duration tabulations will be discussed in a future Newsletter note. □

REFERENCE

Saw Swee-Hock, "A Note on the Under-registration of Births in Malaya during the Intercensal Period 1947-1957." *Population Studies*, July 1964.