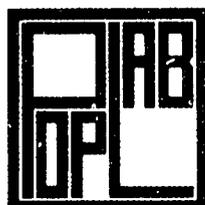


Laboratories for Population Statistics  
Summary Series No. 3  
December 1981

# The 1980 Bolivia National Demographic Survey: A Summary of Results



The International Program of Laboratories for Population Statistics (POPLAB) of the University of North Carolina at Chapel Hill is involved in a project entitled "Birth and Death Data Collection" sponsored by the United States Agency for International Development. The basic objective of this project is to assist developing countries in collecting and analyzing data on levels and trends in fertility and mortality through the use of sample surveys. These surveys are of three types: (1) add-on, adding fertility/mortality questions to existing household surveys, (2) new, initiating new fertility/mortality surveys, and (3) broad surveys, new or add-on, which include collection and analysis of data on variables such as socioeconomic status, labor force participation, migration, use of family planning, as well as basic fertility/mortality questions. POPLAB provides technical and financial assistance in the design, organization, implementation, and analysis of all three types of surveys.

El Programa Internacional de Laboratorios para Estadísticas de Población (POPLAB) de la Universidad de Carolina del Norte en Chapel Hill, está involucrado en un proyecto titulado 'Colección de Datos sobre Muertes y Nacimientos' financiado por la Agencia Internacional para el Desarrollo. El objetivo principal de este proyecto es el de prestar asistencia a los países en desarrollo en la colección y análisis de datos sobre niveles y tendencias de fecundidad y mortalidad por medio del uso de encuestas de muestreo. Tales encuestas son de tres tipos: (1) aumentadas, es decir agregando preguntas sobre fecundidad/mortalidad a encuestas e hogares existentes, (2) nuevas encuestas de fecundidad/mortalidad, y (3) extensas, nuevas o aumentadas, las cuales incluyen colección y análisis de datos de variables tales como nivel socioeconómico, participación en el fuerza de trabajo, migración, uso de planificación familiar, además de preguntas básicas sobre fecundidad/mortalidad. El POPLAB provee asistencia técnica y financiera para el diseño, organización, implementación, y análisis de estos tres tipos de encuestas.

This report is the third in a series containing the major findings of demographic surveys in countries participating in the POPLAB program. The full report of the 1980 Bolivia National Demographic Survey was published (in Spanish) by the National Institute of Statistics, Government of Bolivia, in fall 1981. POPLAB gratefully acknowledges the cooperation of the National Institute of Statistics and CELADE in publishing this summary.

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December 1981



The 1980 Bolivia National Demographic Survey:  
A Summary of Results

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by POPLAB Staff

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*International Program of Laboratories for Population Statistics*  
*James R. Abernathy, Director*

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*The University of North Carolina at Chapel Hill*  
*Chapel Hill, North Carolina 27514*

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# THE 1980 BOLIVIA NATIONAL DEMOGRAPHIC SURVEY: A SUMMARY OF RESULTS

POPLAB Staff

## INTRODUCTION

During the past decade, the Government of Bolivia has worked toward the improvement and dissemination of the country's basic demographic data. The two main sources of recent demographic data prior to 1980 were the 1975 National Demographic Survey (EDEN I) and the 1976 National Census of Population and Housing. The results of both of these activities permitted the estimation of fundamental demographic variables and provided better knowledge of levels and trends of fertility and mortality in the country. The 1980 National Demographic Survey (EDEN II) represented a continuation of the study of population levels and trends in Bolivia through the addition of another set of data for comparative purposes.

This report summarizes the major findings of the 1980 National Demographic Survey conducted by the National Institute of Statistics (INE) of Bolivia. Wherever possible, comparisons are made with similar data collected by the 1975 Survey and the 1976 Census of Population and Housing. This summary is based upon the full report of the survey currently under preparation by INE. The first volume of the final report, *Encuesta Demográfica de Bolivia 1980: Informe Metodológico* was published in December 1981. (INE, 1981b)

## THE SURVEY

The 1980 Survey was a household survey designed to collect information for the purpose of estimating fertility and mortality rates of the country as a whole as well as for urban and rural areas. Data were also collected to estimate internal migration and international outmigration. The survey was carried out under the direction of INE with assistance from the International Program of Laboratories for Population Statistics (POPLAB) and the Latin American Demographic Center (CELADE). Fieldwork was conducted during the period October 13-December 6, 1980.

The sample was a stratified cluster sample comprising 10,573 households. The target population was all housing units within the geographic confines of Bolivia on July 15, 1980 with the exception of eight provinces in remote, tropical areas of the country which were excluded. These provinces comprised approximately 2 percent of the total population of Bolivia. Other features of the sampling design are summarized as follows:

1. Ultimate sample of housing units (household, women of child-bearing age) was self-weighting.
2. Sample was stratified to take into account urban-rural composition and major administrative divisions (departments).
3. Ultimate sampling units were clustered utilizing a multi-stage sample selection procedure in order to exact survey economics while recognizing the greater homogeneity of rural segments over urban segments.
4. Sample designers relied on census maps and other materials available

from the 1976 Census of Population and Housing.

Of the 10,573 households in the sample, 10,235 were interviewed, resulting in a response rate of 96.7 percent. As shown in table 1, there was a total of 47,810 individuals living in the households interviewed.

Table 1. Distribution of Sample Population by Age Group, Sex, Urban and Rural Residence. Bolivia, 1980

S A M P L E P O P U L A T I O N					
Age Group	Total	Males	Females	Urban	Rural
0-4	7,772	3,922	3,850	3,741	4,031
5-9	6,399	3,225	3,174	2,963	3,436
10-14	5,676	2,896	2,780	2,779	2,897
15-19	4,975	2,497	2,478	2,658	2,317
20-24	4,157	1,978	2 179	2,211	1,946
25-29	3,509	1,674	1,835	1,808	1,701
30-34	2,944	1,472	1,472	1,553	1,391
35-39	2,507	1,203	1,304	1,209	1,298
40-44	2,110	1,014	1,096	1,023	1,087
45-49	1,932	924	1,008	870	1,062
50-54	1,672	810	862	757	915
55-59	1,216	585	631	532	684
60-64	1,019	467	552	383	636
65-69	660	315	345	275	385
70-74	539	243	296	174	365
75+	723	314	409	217	506
TOTAL	47,810	23,539	24,271	23,153	24,657

## FINDINGS

### *Age and Sex Distribution*

Age and sex are two important variables in the study of population levels and trends. Percentage distributions of the 1980 sample population are shown in table 2 by age, sex, and rural and urban residence. For purposes of comparison, analogous data are also shown for the 1976 Census in table 2 as well as graphically in figures 1 and 2.

The population pyramids of figures 1 and 2 have a rather broad base which is indicative of relatively high fertility, and the data indicate little change in the overall distribution by age and sex since 1976. Slightly more than 42 percent of the

Table 2. Percentage Distribution of the Total Population by Urban and Rural Residence, Sex, and Age Group. Bolivia, 1980, 1976

Age Group	1980 SURVEY						1976 CENSUS					
	TOTAL POPULATION		URBAN		RURAL		TOTAL POPULATION		URBAN		RURAL	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0-4	8.2	8.1	8.3	7.9	8.1	8.2	8.0	7.9	7.4	7.2	8.5	8.3
5-9	6.7	6.6	6.3	6.5	7.2	6.8	6.9	6.8	6.5	6.4	7.3	7.1
10-14	6.1	5.8	5.9	6.1	6.3	5.5	6.1	5.8	6.0	6.0	6.1	5.5
15-19	5.2	5.2	5.6	5.9	4.9	4.5	5.4	5.4	6.3	6.5	4.7	4.6
20-24	4.1	4.6	4.4	5.2	3.9	4.0	4.3	4.5	5.1	5.4	3.8	3.9
25-29	3.5	3.8	3.7	4.1	3.3	3.6	3.6	3.8	3.9	4.2	3.4	3.6
30-34	3.1	3.1	3.3	3.4	2.9	2.8	2.9	3.0	2.9	3.1	2.9	3.0
35-39	2.5	2.7	2.5	2.7	2.5	2.7	2.5	2.7	2.3	2.8	2.6	2.7
40-44	2.1	2.3	2.2	2.3	2.1	2.3	2.0	2.2	1.9	2.1	2.1	2.2
45-49	1.9	2.1	1.7	2.0	2.1	2.2	2.1	2.2	1.9	2.2	2.2	2.2
50-54	1.7	1.8	1.5	1.7	1.8	1.9	1.4	1.6	1.3	1.5	1.5	1.7
55-59	1.2	1.3	1.0	1.3	1.4	1.4	1.2	1.3	1.0	1.2	1.3	1.3
60-64	1.0	1.2	0.7	0.9	1.2	1.3	1.0	1.2	0.8	1.0	1.2	1.3
65-69	0.7	0.7	0.5	0.7	0.8	0.8	0.7	0.8	0.6	0.7	0.8	0.9
70-74	0.5	0.6	0.3	0.4	0.7	0.8	0.5	0.6	0.3	0.5	0.5	0.7
75+	0.7	0.9	0.4	0.6	0.9	1.1	0.7	1.0	0.4	0.6	1.0	1.1
TOTAL	49.2	50.8	48.3	51.7	50.1	49.9	49.3	50.7	48.6	51.4	49.9	50.1
Base Population	47,810		23,153		24,657		4,613,486		1,925,840		2,687,646	

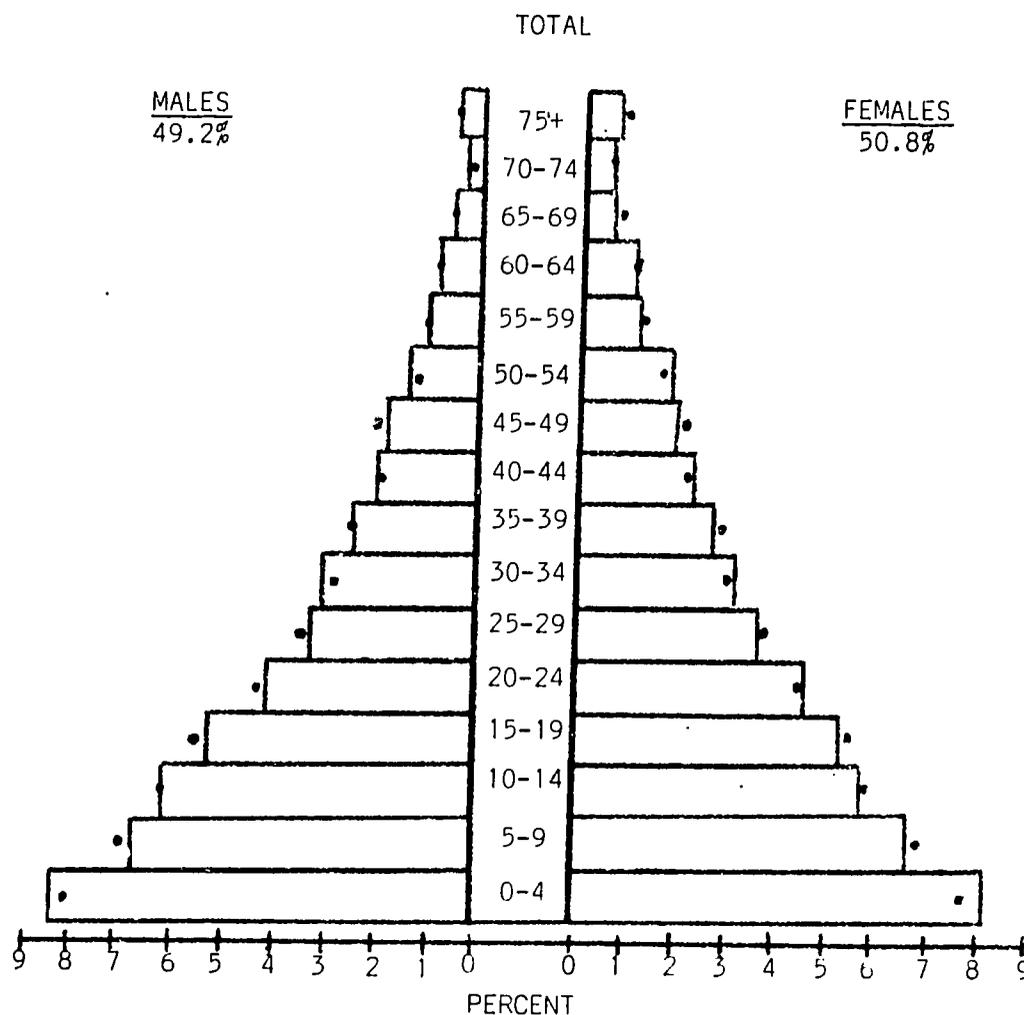
SOURCE: 1976 Census. INE, 1981a

population surveyed in 1980 was under 15 years of age, and 6.3 percent was age 60 or over. These percentages are approximately the same as those found in the 1976 Census. The 1980 Survey data showed 48.4 percent of the population living in urban areas compared to a total urban population of 41.7 percent in the 1976 Census. Substantial rural to urban migration seems to have occurred during this period. Overall, urban areas were about 48 percent male and 52 percent female in 1980. Rural areas were approximately evenly divided by sex.

When the urban and rural populations are examined separately over time (figure 2), slight differences are noted in the age and sex distributions between the 1976 Census and the 1980 Survey for certain age groups, particularly 0-4 for both urban and rural, and 15-24 for urban residents.

Sex ratios were examined by age group for the 1980 Survey and compared with those of the 1976 Census and 1975 EDEN I. Sex ratios from the 1980 Survey closely approximated those from the 1976 Census, beginning around 101.9 at age 0-4 and declining gradually with age.

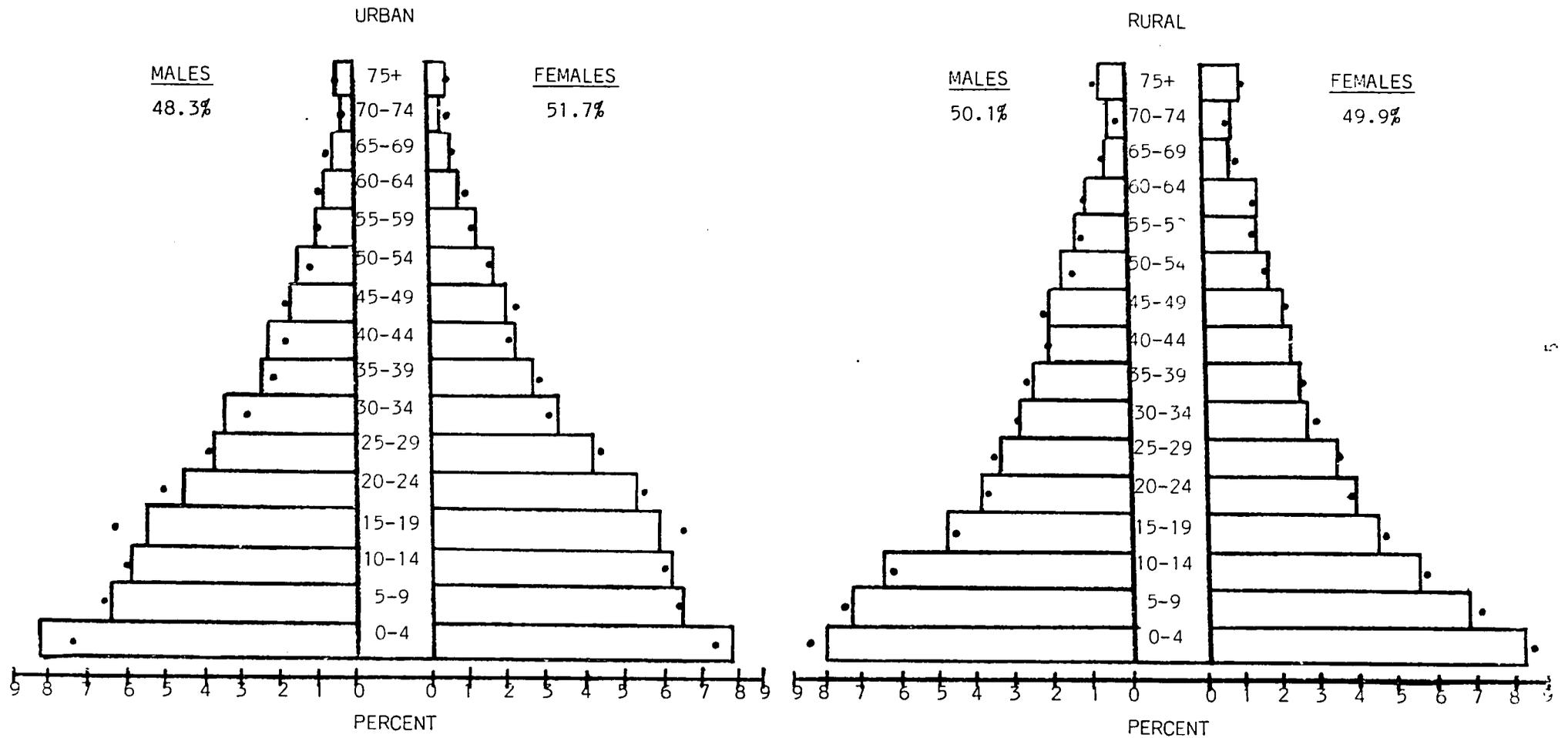
Figure 1. Population Pyramid of 1980 Total Survey  
Population Compared with Data from 1976 Census, Bolivia



(1976 Census data are represented by dots.)

SOURCE: Table 2

Figure 2. Population Pyramids of Urban and Rural 1980 Survey Population Compared with Data from 1976 Census, Bolivia



1976 Census data are represented by dots.

SOURCE: Table 2.

Myers' Blended Method (Shryock and Siegel, 1971) was used to measure preference for certain ages (i.e., age heaping) in the 1980 Survey. Results were compared with similar results from the 1976 Census data. The summary index of 9.2 obtained for the 1980 Survey data was essentially the same as that reported for the 1976 Census (INE, 1981) thereby indicating that the quality of age reporting was similar in the two sources of data.

*Current Marital Status*

All persons 15 years of age and over were asked about their current marital status, i.e., whether they were single, legally married, consensually married, divorced, separate or widowed. Table 3 shows the percentage of males and females by age group who reported their marital status as single. Data are also shown by urban-rural residence.

Table 3. Percentage of Males and Females Reporting Marital Status as Single by Age Group and Urban-Rural Residence.  
Bolivia, 1980

Age Group	M A L E S			F E M A L E S		
	Total	Rural	Urban	Total	Rural	Urban
15-19	97.0	97.1	97.0	87.1	88.7	85.8
20-24	63.3	62.4	64.1	46.9	45.5	48.1
25-29	27.2	26.5	27.8	21.4	21.7	21.2
30-34	11.2	12.1	10.4	11.1	12.7	9.8
35-39	8.2	7.4	9.0	7.8	9.6	5.9
40-44	3.8	4.3	3.2	5.2	5.4	5.0
45-49	2.9	3.5	2.2	4.8	5.2	4.3
50-54	3.2	3.4	3.0	4.1	3.8	4.3
55-59	1.9	1.7	2.1	3.7	2.1	5.5
60+	2.9	2.8	3.8	5.3	3.8	7.8
Mean Age at First Union	24.9	24.8	25.0	23.0	23.2	22.8

As can be seen from table 3, the percentage of single males and females declines rapidly as age increases. A high proportion of the population is single at ages 15-19; at ages 35-39, however, fewer than ten percent are single. Although men on average marry later than women, a higher proportion of men than women eventually marries, as is evident from the data showing higher percentages of single women than men at all ages over 40.

Hajnal (Shryock and Siegel, 1971) has developed an indirect method of estimating the average age at first union from proportions single by age. As shown in table 3, this technique produced estimates of mean age at first union of 24.9 for males and 23.0 for females. For both sexes, mean age at first union is lower for urban residents than for rural residents. This urban-rural difference is greater among females than males.

The percentage distribution of females 15 years of age and older by marital status is shown in table 4 for the 1980 Survey and for the 1976 Census. It will be observed that from age 30 and over, a smaller percentage of the female population in the 1980 Survey was classified as single, as compared with the 1976 Census. On the other hand, a higher percentage of the 1980 Survey population, at all ages, was classified as separated or divorced than in the 1976 Census. Only slight differences are evident in the percentage of the population married at various ages between the 1976 Census and 1980 Survey, particularly after age 25.

Table 4. Percentage Distribution of Females 15 Years of Age and Over by Marital Status and Age Group. Bolivia, 1980, 1976

Age Group	1980 SURVEY					1976 CENSUS					
	Single	Married or in Union	Widowed	Separated or Divorced	N	Single	Married or in Union	Widowed	Separated or Divorced	Unknown	N
15-19	87.1	11.8	0.1	1.1	2,478	83.4	15.6	0.1	0.3	0.6	248,
20-24	46.9	49.0	0.7	3.4	2,179	42.6	54.8	0.6	1.2	0.8	209,
25-29	21.4	73.2	1.1	4.3	1,835	20.7	75.3	1.2	2.0	0.7	176,
30-34	11.1	80.4	2.8	5.6	1,472	12.4	81.7	2.6	2.5	0.7	138,
35-39	7.8	82.4	4.5	5.2	1,304	9.7	81.9	4.8	3.0	0.7	126,
40-44	5.2	80.1	8.9	5.8	1,096	8.0	79.6	8.3	3.3	0.9	101,
45-49	4.8	76.3	12.6	6.4	1,008	7.6	75.5	12.4	3.6	0.9	100,
50-54	4.1	70.0	18.3	7.7	862	7.7	69.0	18.8	3.4	1.1	74,
55-59	3.7	62.0	28.5	5.9	631	7.5	62.8	25.1	3.4	1.2	58,
60+	5.3	41.6	49.1	4.0	1,602	7.7	43.3	44.8	2.2	2.1	159,

SOURCE: INE, 1976 Census, (INE, 1981a)

### Crude Birth Rate

Data from the 1980 Survey indicated that the crude birth rate for Bolivia was around 40 per 1,000 population. Based upon direct reporting of births in the past year, the crude birth rate was 39.2; Brass P/F adjustment (Brass, 1975) yielded a rate of 40.2. Application of the Own Children method (Cho, 1973) yielded a crude birth rate of 40.1 for the period 1976-1980.

## Children Ever Born

In addition to obtaining information on date of last live birth, the 1980 Survey collected data on total number of children ever born to women 15 years of age and older. Data on the average number of children ever born to women in the childbearing ages are shown in table 5 for the 1980 Survey, 1976 Census, and 1975 Survey.

Table 5. Average Number of Children Ever Born to Women in the Childbearing Ages, by Age Group.. Bolivia, 1980, 1976, 1975

Age Group of Women	AVERAGE NUMBER OF CHILDREN EVER BORN		
	1980 Survey	1976 Census	1975 Survey
15-19	0.157	0.178	0.114
20-24	1.044	1.191	1.002
25-29	2.381	2.612	2.523
30-34	3.718	4.026	4.091
35-39	4.911	5.115	5.406
40-44	5.698	5.728	6.015
45-49	5.819	5.876	6.169

SOURCE: 1976 (INE, 1981a); 1975 (INE, 1976)

Data from all three sources indicate that Bolivian women who have finished childbearing have given birth to approximately six children. The 1980 Survey data show a slight decline in average children ever born during this five-year period for most of the age groups.

### Age-Specific and Total Fertility Rates

Three sets of age-specific fertility rates from the 1980 Survey are presented in table 6. The rates were calculated from direct reports of births occurring in the past year (column 1), application of the Brass P/F method (column 2), and the Own Children method (column 3). With respect to direct reporting of births, there were 11,372 women in the survey aged 15-49. All were asked about the date of their last live birth (if any). Data on last live birth were incomplete or nonexistent for only 507 women. In most cases with *incomplete* date of last live birth, sufficient information was available to determine if the birth occurred in the last twelve months. Implied total fertility rates and crude birth rates are also shown in table 6.

Table 6. Age-Specific Fertility Rates.  
Bolivia, 1980

Age Group of Women	AGE-SPECIFIC FERTILITY RATES		
	Direct Reports	From Application of Brass P/F Adjustment	From Own Children Method (1976-1980)
15-19	.089	.091	.093
20-24	.242	.248	.249
25-29	.263	.270	.275
30-34	.224	.229	.230
35-39	.174	.178	.163
40-44	.066	.068	.080
45-49	.015	.016	.023
Total Fertility Rate	5.4	5.5	5.6
Crude Birth Rate	39.2	40.2	40.1

The *P/F* ratios for most age groups were close to unity, indicating relatively little difference between fertility estimates based on reported recent births and those based on mean number of children ever born. This is reflected in the implied total fertility rates which changed very little as a result of the adjustment, (5.4 to 5.5). Application of the Own Children method yielded age-specific fertility rates for the five-year period immediately preceding the survey which were only slightly higher than those shown for direct reporting and Brass *P/F* adjustment, with an implied total fertility rate of 5.6. This consistency between the two sets of estimates is reassuring.

Age-specific fertility rates for urban and rural areas of Bolivia are shown in table 7. Rural fertility rates are generally higher than urban fertility rates. Total fertility rates are approximately 30 percent higher for rural than for urban areas.

Table 8 shows age-specific fertility rates from the 1975 Survey, 1976 Census, and 1980 Survey based on Brass *P/F* adjustment. Fertility estimates from the 1980 Survey were lower than those from the earlier sources, particularly in the age group 25-40. The total fertility rate of 5.5 in 1980 was approximately 20 percent lower than the total fertility rates from the census and earlier survey. These data indicate, therefore, that there has been a substantial reduction in fertility during the past four or five years.

The data in table 8 are, of course, dependent on average number of children ever born as reported by respondents in the survey and census. It should be noted that there is some concern that the parities reported in the 1980 Survey are inordinately low. There is also concern that the parities reported in the census and earlier survey are inordinately high. Both possibilities are being explored. If either is found to be valid, the decline in fertility shown in table 8 would be less pronounced.

Table 7. Urban and Rural Age-Specific Fertility Rates.  
Bolivia, 1980

Age Group of Women	AGE-SPECIFIC FERTILITY RATES					
	U R B A N			R U R A L		
	Direct Reports	Brass P/F	Own Children (1976-1980)	Direct Reports	Brass P/F	Own Children (1976-1980)
15-19	.093	.091	.089	.083	.090	.100
20-24	.233	.228	.241	.253	.273	.258
25-29	.255	.249	.257	.272	.293	.295
30-34	.184	.180	.198	.269	.290	.266
35-39	.143	.140	.136	.202	.217	.190
40-44	.048	.047	.054	.080	.087	.104
45-49	.008	.008	.016	.022	.023	.030
Total Fertility Rate	4.8	4.7	4.9	5.9	6.4	6.2

Table 8. Age-Specific Fertility Rates Based on Brass P/F Method.  
Bolivia, 1980, 1976, 1975

Age Group of Women	AGE-SPECIFIC FERTILITY RATES		
	1980 Survey	1976 Census	1975 Survey
15-19	.091	.097	.078
20-24	.248	.281	.254
25-29	.270	.311	.357
30-34	.229	.279	.299
35-39	.178	.216	.215
40-44	.068	.111	.103
45-49	.016	.041	.057
Total Fertility Rate	5.5	6.7	6.8

SOURCE: 1976 (INE, 1981a); 1975 (INE, 1976)

Crude Death Rate

In the 1980 Survey, household respondents were asked about deaths of members of the household in 1979 and 1980. In response to these questions, 821 deaths were reported. These deaths occurred during a period of approximately 22 months (January 1, 1979 through October 31, 1980), assuming that the average date of fieldwork, which took place from October 1 - December 6, was October 31. Thus, in order to estimate the annual crude death rate, the number of deaths was multiplied by the fraction 12/22. As is shown in table 9, using this adjusted number of deaths, a crude death rate of 9.4 per thousand population was obtained. This rate is improbably low for Bolivia, suggesting that death reporting was incomplete.

Table 9. Population, Number of Reported Deaths, and Estimated Death Rates by Age Group. Bolivia, 1980

Age Group	Sample Population	Reported Deaths†	Estimated Deaths in One Year††	Estimated Annual Death Rate
0-4	7,772	312	170.2	21.9
5-9	6,399	14	7.6	1.2
10-14	5,676	9	4.9	0.9
15-19	4,975	20	10.9	2.2
20-24	4,157	29	15.8	3.8
25-29	3,509	21	11.5	3.3
30-34	2,944	20	10.9	3.7
35-39	2,507	33	18.0	7.2
40-44	2,110	27	14.7	7.0
45-49	1,932	31	16.9	8.8
50-54	1,672	41	22.4	13.4
55-59	1,216	40	21.8	17.9
60-64	1,019	45	24.5	24.0
65-69	660	32	17.5	26.5
70-74	539	28	15.3	28.4
75+	723	112	61.1	84.5
Unknown	--	7	3.8	--
TOTAL	47,810	821	447.8	9.4

† Reported deaths over a period of 22 months.

†† Reported deaths multiplied by 12/22.

An attempt was made to adjust the reported deaths for presumed underreporting using a method developed by Brass (1975), referred to as the death distribution technique. This method is attractive because it permits, theoretically, an estimation of recent mortality (in our case, that of the past two years), whereas other indirect methods estimate the level of mortality prevailing in the more distant past. However, this method has an important disadvantage in that it is only applicable to mortality rates of persons at or older than a specific age (age 5, for example). In other words, it does not provide an estimation of infant or child mortality rates.

Brass (1975) has shown that under specific conditions,

$$\frac{n(x)}{p(x)} = r + f \frac{d(x)}{p(x)} ,$$

where  $n(x)$  is the number of persons at age  $x$ ;  $p(x)$  is the population above age  $x$ ;  $d(x)$  is the number of deaths above age  $x$ ;  $r$  is the growth rate of the population, and  $f$  is the adjustment factor to correct underreporting. Underlying assumptions of the method are that: (1) the proportionate underreporting of deaths is alike at all ages, (2) the population is approximately stable, and (3) the ages of both living and dead are correctly reported.

Application of the method to the 1980 Survey data estimated  $r = .025$  and  $f = 1.26$  and indicated that reported deaths for ages 5 and over were approximately 79 percent complete. The mortality rates for the population 5 years of age and over were adjusted using the above results.

The next step involved calculation of the estimated death rate for children under 5 years of age based on data relating to children ever born and children surviving to women 20-34 years of age. The average estimates of infant mortality for males and females from child survivorship data of women 20-34 years of age using the South mortality pattern were 133 and 111, respectively, per thousand live births (table 10). These estimates correspond to mortality levels of 14.2 for males and 15.2 for females in the South family of model life tables. Death rates for children under 5 were thus obtained from model life tables corresponding to the above mortality levels.

The crude death rate for the total population was estimated by combining the adjusted death rate for the population 5 years of age and over with the estimated rates for the population under 5 years of age. The resulting death rate estimate for the total population was 14.7 deaths per thousand population.

#### *Estimates of Childhood Mortality*

Indirect estimates of infant and child mortality were made from data indicating the survivorship of children ever born to women 15 years of age and over enumerated in the survey. Survivorship data were collected by asking each woman a series of eight questions: the number of her own sons and daughters who were living in the household, the number living elsewhere, the number who had died, and the total number of sons and daughters ever born. This series of questions is considered the most appropriate for obtaining childhood survivorship data (World Fertility Survey, 1975; POPLAB, 1978). Nonresponse was low for this set of data; of the 14,467 enumerated women aged 15 years and over, 14,332 (99 percent) provided complete data.

The methodology of indirect childhood mortality estimates requires that the survivorship data be aggregated by five-year age groups of women and that proportion dead statistics be calculated for each age group. These statistics are then transformed

into mortality probabilities by any of several existing models (Brass, 1968; Sullivan, 1972; Trussell, 1975; Feeney, 1980). In this report, results obtained from the Sullivan and Trussell models are reported. These models are based on the North, South, West, and East life table systems (Coale and Demeny, 1966). Because it is generally considered that women aged 20-24, 25-29, and 30-34 report child survivorship data more accurately than older women, estimation is restricted to those age groups. To facilitate comparison of mortality estimates from each of these age groups of women, the estimates are reported in terms of a single index, the infant mortality rate (IMR).

When mortality levels have been changing in a population, it is necessary to indicate the number of years preceding the survey,  $t^*$ , to which an indirect mortality estimate applies. Under the assumption that mortality change occurs in a linear fashion, several models exist for estimating  $t^*$  (Brass, 1975; Coale and Trussell, 1978; Preston and Palloni, 1978; Sullivan and Udofia, 1978; Feeney, 1980). In this report,  $t^*$  estimates obtained from the Coale and Trussell model are reported.

Indirect IMR estimates for Bolivia from the 1980 Survey are shown in table 10. The points in time to which the estimates apply ( $t^*$ ) are also shown. For example, IMR estimates derived from the data reported by women aged 20-24 apply to a point in time approximately 2.2 years before the survey (i.e., calendar year 1978).

Table 10. Indirect Infant Mortality Rates (IMR)  
Using Sullivan Age Models. Bolivia, 1980

Age Group of Women	Number of Women	Number of Births	Births Which Died	Proportion Dead Among CEB	Number of Years Prior to Survey ( $t^*$ )	IMR per 1,000 Births by Mortality Pattern			
						North	South	East	West
<u>BOTH SEXES</u>									
20-24	2174	2269	334	.147	2.2	118	120	134	126
25-29	1833	4364	779	.179	3.9	117	124	142	131
30-34	1468	5458	1043	.191	5.9	111	122	143	127
<u>MALES</u>									
20-24	2174	1144	173	.151	2.2	124	126	140	133
25-29	1833	2296	448	.195	3.8	131	137	158	147
30-34	1468	2852	603	.211	5.8	126	136	162	145
<u>FEMALES</u>									
20-24	2174	1125	161	.074	2.2	111	114	127	118
25-29	1833	2068	331	.160	4.0	102	110	124	114
30-34	1468	2606	440	.169	6.1	95	108	123	109

For Bolivia, IMR estimates for both sexes vary from 111 to 143 per 1,000 births, depending on the age group of reporting women and the mortality pattern of the estimation model. Most of this variation occurs across mortality patterns rather than across age groups of reporting women. Nevertheless, estimates from the North, South, and West patterns cluster in a tight manner, while those from the East model are distinctly higher. Thus, to simplify the presentation, discussion is confined to the estimates from the South model since they are intermediate in value between those of the North and West models. For both sexes, IMR estimates from the South model were 120, 124, and 122, per 1,000 births for 1978, 1976, and 1974, respectively. Estimates for males exceed those for females by approximately 15 to 20 percent.

For urban areas, the infant mortality rates based on the South model were 106, 109, and 109 for 1978, 1976, and 1974, respectively, while those for rural areas were 135, 138, and 136. In both urban and rural areas, male infant mortality rates exceeded those of females.

In general, the indirect IMR estimates from the 1980 Survey display the expected urban-rural and sex differentials. Moreover, the estimates derived from survivorship data reported by women in different age groups do not indicate any consistent time trend in infant mortality levels in the six-year period preceding the survey. However, indications concerning mortality trends based on data reported by women in different age groups are not conclusive, due to the well-known limitations of the indirect estimation models.

For the purpose of investigating time trends in child mortality, indirect mortality estimates available from the 1975 Survey and the 1976 Census can be compared with those from the 1980 Survey. Results from the earlier surveys have been reported in terms of  $q(2)$ ,  $q(3)$ , and  $q(5)$  estimates based on the Trussell West model. Those results are presented in table 11, along with comparable results from the 1980 Survey (i.e.,  $q(2)$ ,  $q(3)$ , and  $q(5)$  estimates based on the Trussell West model). Before comparing results, one difference between the census and earlier survey, and the 1980 Survey should be pointed out. In the census and earlier survey, respondents were asked about the number of children ever born and the number surviving. Thus, as opposed to the 1980 Survey, the 1975 Survey and 1976 Census made no direct inquiry about children who had died.

The estimates of  $q(x)$  for  $x = 2, 3, \text{ and } 5$  from the 1975 Survey and the 1976 Census (column 4) are quite similar for a given value of  $x$ . This is consistent with the fact that mortality levels probably did not change significantly in one year. Moreover, all of these  $q(x)$  estimates correspond to about the same level of mortality (column 5), i.e., about level 10.5 in the West model life table system. On the other hand, the  $q(x)$  estimates from the 1980 Survey are, for a given value of  $x$ , about 25 percent lower than those from the census and earlier survey. This suggests an overall decline of about 25 percent in childhood mortality levels over the four or five-year period preceding the 1980 Survey. A decline of this magnitude in such a short period is quite possible and is not unlike the declines which have been documented for other countries at similar levels of mortality (Arriaga, 1980).

In summary, the infant mortality rate for Bolivia is estimated at 120 infant deaths per thousand live births in 1978. Male mortality exceeds female mortality by some 15 percent and rural mortality exceeds urban mortality by about 25 percent. Comparison with previous estimates indicates that infant and child mortality have declined significantly in recent years.

Table 11. Indirect Infant and Childhood Mortality Estimates  
 Derived from Trussell's West Mortality Estimation Equation.  
 Bolivia, 1980, 1976, 1975

Age Group of Women	Proportion of Dead of CEB $D_i$	Age to Which Probability of Dying is Estimated $x$	Estimate of Probability of Dying Between Birth and Age $x$ $q(x)$	Corresponding Level of West Model Life Table† Level	Number of Years Prior to Survey $t^*$	Estimated Average Level of IMR per 1,000 Births† $q(1)$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<u>1975 SURVEY</u>						
20-24	.200	2	.218	10.1	2.1	
25-29	.208	3	.213	11.2	3.8	164
30-34	.236	5	.243	10.8	5.9	
<u>1976 CENSUS</u>						
20-24	.201	2	.212	10.4	2.3	
25-29	.228	3	.229	10.5	4.1	167
30-34	.250	5	.253	10.4	6.4	
<u>1980 SURVEY</u>						
20-24	.147	2	.156	13.3	2.3	
25-29	.179	3	.181	12.8	4.1	128
30-34	.191	5	.195	12.8	6.2	

† Mortality levels are derived from Coale and Demeny, 1966. The higher the level, the lower the mortality.

†† The IMR rate was obtained as the simple average of the IMRs of the West Model life table cited in column 5.

SOURCE: 1976 (INE, 1981a); 1975 (INE, 1976)

*Estimates of Adult Mortality*

Indirect adult mortality indices can be derived from information reported by survey respondents on survivorship of their mothers and fathers (maternal and paternal orphanhood). These indices can also be estimated from information reported by ever-married respondents, including those in consensual unions, on the survivorship of their first spouse (female and male widowhood). Both types of data were collected in the 198 Survey (orphanhood and widowhood). From these data, adult mortality levels were estimated for the period of approximately 15 years preceding the survey. The incidence of nonresponse was low for the questions related to the various types of survivorship: 0.2 and 1.1 percent for maternal and paternal orphanhood data, respectively, and 0.5 percent for both female and male first spouse widowhood data.

The proportion of respondents by age group who reported their mothers and fathers still alive and the proportion of ever-married respondents who reported their first spouse still alive are shown in table 12.

Table 12. Proportion of Respondents with Mother Alive, Father Alive, and Proportion of Ever-Married Respondents with First Spouse Alive by Age Group. Bolivia, 1980

Age Group of Respondents	O R P H A N H O O D		W I D O W H O O D	
	Proportion of Respondents With Mother Alive	Proportion of Respondents With Father Alive	Proportion of Wives With First Husband Alive	Proportion of Husbands With First Wife Alive
5-9	.9720	.9489	-	-
10-14	.9470	.9044	-	-
15-19	.9138	.8444	-	-
20-24	.8640	.7587	-	-
25-29	.7873	.6543	.9819	.9918
30-34	.6867	.5331	.9517	.9755
35-39	.5867	.4093	.9245	.9490
40-44	.4743	.2900	.8754	.9259
45-49	.3340	.1972	.8375	.8858
50-54	-	-	.7705	.8680
55-59	-	-	.6611	.8471

The proportions shown above are, by themselves, indicators of mortality but do not represent mortality conditions in any exact age interval. However, they can be transformed into probabilities of surviving from one exact age to another exact age. Details of the method are shown in the full report of the 1980 Survey to be published by INE.

The adult mortality estimates from orphanhood and widowhood data are summarized in table 13 in terms of mortality levels in the South model life table system. The table is organized so that all estimates of a particular row pertain to approximately the same calendar year.

Table 13. Period-Specific Adult Mortality Levels by Sex, Orphanhood and Widowhood Data. Bolivia, 1980

(South Model Life Table)

Approximate Time Reference of Estimated Mortality Levels	Estimated Mortality Levels†			
	F E M A L E S		M A L E S	
	Orphanhood	Widowhood	Orphanhood	Widowhood
1980	-	-	-	15.6
1978	-	19.9	-	16.8
1976	15.8	17.7	14.1	14.8
1974	15.5	15.8	13.3	14.5
1972	14.9	15.6	11.9	13.4
1970	13.8	14.4	10.4	13.9
1968	12.3	15.6	9.0	13.5
1966	10.7	16.9	8.4	12.0
1965	10.5	-	7.8	-
1964	10.9	-	9.5	-
1963	10.7	-	-	-

†Mortality levels are derived from Coale and Demeny, 1966. The higher the level, the lower the mortality.

Female adult mortality estimates based on orphanhood data are around level 11 (corresponding to an expectation of life at birth,  $e_0^0$ , of 45 years) for the period 1963-66, and increase to approximately level 16 ( $e_0^0 = 57.5$ ) in 1976. Based on widowhood data, estimates of female adult mortality are around level 16 for 1966-68, dropping to level 15 ( $e_0^0 = 55$ ) in 1976-78. Thus, the orphanhood data indicate higher mortality for females than do the widowhood data. In addition, the orphanhood estimates indicate a smooth and consistent decline in mortality, while the widowhood estimates indicate an irregular pattern over time. Moreover, the widowhood estimate of mortality level in the years 1976-78 (near level 19) is unrealistically high. Overall, the mortality estimates derived from orphanhood data seem preferable. They indicate a level of female mortality of approximately 15 ( $e_0^0 = 55$ ) for the four to ten-year period preceding the survey.

Male adult mortality estimates based on orphanhood data are near level 8 ( $e_0^0 = 36.2$ ) in 1965-66 increasing to level 10 ( $e_0^0 = 40.6$ ) in 1970 and to level 14 ( $e_0^0 = 49.6$ ) in 1976. The increases in associated values of life expectancy are particularly sharp between 1970 and 1976, perhaps too sharp to be plausible, thus raising concern about the accuracy of the data reported for survivorship of fathers. Estimates of male mortality from widowhood data indicate a level near 14 ( $e_0^0 = 49.6$ ) during the late 1960's and early 1970's, near 15 ( $e_0^0 = 51.9$ ) in 1976, and 16 ( $e_0^0 = 54.0$ ) in the late 1970's. These widowhood estimates provide a smooth and consistent increase in mortality levels and are compatible with the female adult mortality estimates from orphanhood data. Overall, the adult male mortality estimates derived from widowhood data seem preferable. They indicate a level of male mortality of approximately 14.2 ( $e_0^0 = 50$ ) for the four to ten-year period preceding the survey.

In summary, adult mortality was estimated to be near level 15 ( $e_0^0 = 55$ ) for females and near level 14.2 ( $e_0^0 = 50$ ) for males for the four to ten-year period preceding the survey. These adult mortality levels are compatible with levels reported in the previous section for infant and child mortality.

## REFERENCES

- Arriaga, E. (1980). La Mortalité des enfants dans quelques pays d'Amérique Latine. Chapter 7 in *La Mortalité des Enfants Dans le Monde et Dans L'Histoire*. Liege, Belgium: Department de Demographie, Université Catholique de Louvain, Ordina Editions.
- Blacker, J.G.C. (1981). Experience in the Use of Special Mortality Questions in Multi-Purpose Surveys: The Single Round Approach. United Nations/World Health Organization Working Group on Data Bases for Measurement of Levels, Trends, and Differentials in Mortality, October 1981, IESA/P/AC.17/9. Bangkok, Thailand.
- Brass, W. (1975). *Methods for Estimating Fertility and Mortality from Limited and Defective Data*. Occasional Publications. Chapel Hill, N.C.: International Program of Laboratories for Population Statistics, University of North Carolina at Chapel Hill.
- \_\_\_\_\_, and Coale, A.J. (1968). Methods of Analysis and Estimation. In *The Demography of Tropical Africa*. Princeton, N.J.: Princeton University Press.
- Brass, W., and Hill, K.H. (1973). Estimating Adult Mortality from Orphanhood. *International Population Conference Proceedings Vol. 3*. Liege, Belgium: International Union for the Scientific Study of Population.
- Brass, W., and Bamgboye, E.A. (1981). The Time Location of Reports of Survivorship: Estimates for Maternal and Paternal Orphanhood and the Ever-Widowed. Working Paper no. 81-1. London: Centre for Population Studies, London School of Hygiene and Tropical Medicine.
- Cho, L.J. (1973). The Own-Children Approach to Fertility Estimation: An Elaboration. *International Population Conference Proceedings Vol 2*. Liege, Belgium: International Union for the Scientific Study of Population.
- \_\_\_\_\_, and Feeney, G. (1978). *Fertility Estimation by the Own-Children Method: A Methodological Elaboration*. Reprint Series no. 20. Chapel Hill, N.C.: International Program of Laboratories for Population Statistics, University of North Carolina at Chapel Hill.
- Coale, A.J., and Demeny, P. (1966). *Regional Model Life Tables and Stable Populations*. Princeton, N.J.: Princeton University Press.
- Coale, A.J., and Trussell, T.J. (1978). Estimating the Time to Which Brass Estimates Apply. Annex I to Fine-Tuning Brass-Type Mortality Estimates with Data on Ages of Surviving Children, by Samuel H. Preston and Alberto Palloni in *Population Bulletin of the United Nations*, no. 10-1977. New York: United Nations, Department of Economic and Social Affairs.
- Feeney, G. (1980). Estimating Infant and Childhood Mortality Under Conditions of Changing Mortality. *Population Studies*. 34(1): 109-128.
- \_\_\_\_\_. (1976). Estimating Infant Mortality Rates from Child Survivorship Data by Age of Mother. *Asian and Pacific Census Newsletter*. 3(2): 15-16.

- Hill, K.H., and Trussell, T.J. (1977). *Nuevos Adelantos en la Estimación Indirecta de la Mortalidad. Series D, no. 87.* Santiago, Chile: Centro Latinoamericano de Demografía, (CELADE).
- International Program of Laboratories for Population Statistics. (1978). *A Basic Demographic Questionnaire: Data Collection and Analyses in Sample Surveys. Manual Series no. 7. (with supplement).* Chapel Hill, N.C.: International Program of Laboratories for Population Statistics (POPLAB), University of North Carolina at Chapel Hill.
- Instituto Nacional de Estadística. (1981a). *Resultados del Censo Nacional de Población y Vivienda 1976, Vol. 10.* La Paz, Bolivia: Instituto Nacional de Estadística.
- \_\_\_\_\_. (1981b). *Encuesta Demográfica de Bolivia 1980: Informe Metodológico.* La Paz, Bolivia: Instituto Nacional de Estadística.
- \_\_\_\_\_. (1976). *Principales Resultados de la Encuesta Demográfica Nacional 1975.* La Paz, Bolivia: Instituto Nacional de Estadística.
- Preston, S.H., and Palloni, A. (1978). *Fine-Tuning Brass-Type Mortality Estimates with Data on Ages of Surviving Children. Population Bulletin of the United Nations, no. 10-1977.* New York: United Nations, Department of Economic and Social Affairs
- Shryock, H.S., and Siegel, J.S. (1971). *The Methods and Materials of Demography.* Washington, D.C.: U.S. Bureau of the Census, Department of Commerce.
- Soliz, A., Bartlema, J., and Chackiel, J. (1980). *Mortalidad y Fecundidad, 1950-1976.* La Paz, Bolivia: Instituto Nacional de Estadística.
- Sullivan, J.M. (1972). *Models for the Estimation of the Probability of Dying Between Birth and Exact Ages of Early Childhood. Population Studies, 26(1): 79-97.*
- \_\_\_\_\_, and Udofia, G.A. (1979). *On the Interpretation of Survivorship Statistics: The Case of Non-stationary Mortality. Population Studies, 33(2): 365-374.*
- Trussell, T.J. (1975). *A Re-estimation of the Multiplying Factors for the Brass Technique for Determining Survivorship Rates. Population Studies, 29(1): 97-107.*
- World Fertility Survey. (1975). *Core Questionnaires. Basic Documentation, no. 1.* London: World Fertility Survey.

POPLAB STAFF

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