WDP22
February 1988

22 World Bank Discussion Papers

Demographic Trends in China from 1950 to 1982

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The World Bank
Washington, D.C.

The World Bank
1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

Manufactured in the United States of America
First printing February 1988

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Library of Congress Cataloging-in-Publication Data

Hill, Ken, 1945-
Demographic trends in China from 1950 to 1982 / Kenneth Hill.
p. cm. -- (World Bank discussion papers ; 22)
Bibliography: p.
ISBN 0-8213-1022-4
1. China--Population. I. Title. II. Series.
HB3654.A3H553 1988
304.6'0951--dc19 87-35102
CIP

A B S T R A C T

Extensive data, both recent and historical, on the population of China have recently become available. The paper describes the application of numerous consistency checks and adjustment procedures to these data, and draws conclusions about levels and trends of mortality, fertility and population size over the past three decades on the basis of the results obtained. Mortality fell quite rapidly from the early 1950s to the late 1970s, with the infant mortality rate falling from around 200 to below 40 per thousand live births, and expectation of life at birth increasing from around 40 years to nearly 68 years over the period. Fertility was apparently quite high and roughly constant, with a birth rate in the range of 40 to 45 per thousand population and a total fertility rate between 6.0 and 6.5, from the early 1950s to the mid 1960s, when a sharp decline set in such that by 1979 the birth rate was around 18 and the total fertility rate around 2.3. These fertility and mortality trends were interrupted by a major demographic crisis around 1960 during which fertility was halved and infant mortality was almost doubled; this crisis, during which some 30 million people died prematurely, was associated with a period of severe food shortage and famine throughout most of the country. In the very recent past, both infant mortality and fertility appear to have increased somewhat, and the available demographic data suggest that China has by no means yet achieved its one child family policy, though fertility has declined greatly over the last two decades.

CONTENTS

Introduction

For many years, very little hard information was available about the population of the People's Republic of China. Inferences and speculations about population trends were based on press reports, eyewitness accounts and occasional snippets of official information apparently based on a population registration system. This unsatisfactory situation has changed completely in the last four years, reflecting both a general switch to much greater openness on the part of the Chinese authorities and the successful execution of the 1982 population census. A flood of demographic data has poured out of China, including single-year age distributions from the 1953 and 1964 censuses, results from a 10 percent sample of households from the 1982 census, fertility rates for the period 1940-82 from a one-in-a-thousand fertility survey carried out in late 1982, and registration figures for end-year population, birth rate and death rate from 1950 to 1982. These data not only provide a basis for assessing current demographic trends in the PRC, but also for constructing demographic estimates for the entire period back to the establishment of the People's Republic.

Not surprisingly, the sudden availability of extensive data concerning the world's most populous country has generated great interest in the demographic community, and several reviews of China's demographic history

have recently appeared.[1/] All these reviews stress the astonishing consistency of the information from the diverse sources. This consistency is remarkable for a country of China's level of social and economic development, but it is not perfect; the sources agree closely but not exactly. Information from the population register is the most difficult to fit into the general picture; the figures on population size, birth rate and death rate for 1950-82 given in the 1983 Statistical Yearbook and reproduced in Table 1 not only fail to match closely comparable indicators from other sources but also appear to be internally inconsistent. The population sequence from 1956 to 1959 grows faster than the reported rate of natural increase (only possible with substantial net immigration), while from 1960 to 1964 the population growth is below the natural increase rate (only possible with net emigration); similar inconsistencies continue into the 1970's. Therefore, although general demographic trends over the last 30 years can now be established beyond any reasonable doubt, the exact course of short-term deviations from these trends remains ambiguous. It is the purpose of this review to describe both the general trends and short-term deviations more precisely.

Summary

This review uses information from the population censuses of 1953, 1964, and 1982, the 1982 one-in-a-thousand fertility survey, registered birth and death rates by calendar year, and the 1973-75 Cancer Epidemiology Survey.

1/ Judith Banister, "An Analysis of Recent Data on the Population of China," Population and Development Review, vol. 10, June 1984, pp. 241-271; William P. Brass, Mortality in China over the past fifty years: indirect estimates from the 1982 Census. Paper presented at the international seminar on the 1982 Population Census, Beijing, March 1984; Ansley Coale, Rapid Population Change in China, 1952-1982, Report no. 27, National Academy of Sciences Committee on Population and Demography, National Academy Press, Washington, D.C., 1984.

TABLE 1. China - Official Estimates of Total Population and Vital Rates, 1949-82

Year	Year End Population (million)	Apparent Annual Growth rate (%)	Mid-year Census Total (million)	Birth Rate (per '000)	Death Rate (per '000)	Natural Increase (per '000)
1949	541.7	-	-	36.0	20.0	16.0
1950	552.0	1.9	-	37.0	18.0	19.0
1951	563.0	2.0	-	37.8	17.8	20.0
1952	574.8	2.1	-	37.0	17.0	20.0
1953	588.0	2.3	580.6	37.0	14.0	23.0
1954	602.7	2.5	-	38.0	13.2	24.8
1955	614.7	2.0	-	32.6	12.3	20.3
1956	628.3	2.2	-	31.9	11.4	20.5
1957	646.5	2.9	-	34.0	10.8	23.2
1958	659.9	2.1	-	29.2	12.0	17.2
1959	672.1	1.8	-	24.8	14.6	10.2
1960	662.1	-1.5	-	20.9	25.4	-4.6
1961	658.6	-0.5	-	18.0	14.2	3.8
1962	672.9	2.2	-	37.0	10.0	27.0
1963	691.7	2.8	-	43.4	10.0	33.3
1964	705.0	1.9	694.6	39.1	11.5	27.7
1965	725.4	2.9	-	37.9	9.5	28.4
1966	745.4	2.8	-	35.0	8.8	26.2
1967	763.7	2.4	-	34.0	8.4	25.5
1968	785.3	2.8	-	35.6	8.2	27.4
1969	806.7	2.7	-	34.1	8.0	26.1
1970	829.9	2.9	-	33.4	7.6	25.8
1971	852.3	2.7	-	30.6	7.3	23.3
1972	871.8	2.3	-	29.8	7.6	22.2
1973	892.1	2.3	-	27.9	7.0	20.9
1974	908.6	1.8	-	24.8	7.3	17.5
1975	924.2	1.7	-	23.0	7.3	15.7
1976	937.2	1.4	-	19.9	7.2	12.7
1977	949.7	1.3	-	18.9	6.9	12.1
1978	962.6	1.4	-	18.2	6.2	12.0
1979	975.4	1.3	-	17.8	6.2	11.6
1980	987.1	1.2	-	n.a.	n.a.	n.a.
1981	1000.7	1.4	-	20.9	6.4	14.5
1982	1015.4	1.5	1008.2	21.1	6.6	14.5

Source: Statistical Yearbook, 1983.

The analytical strategy followed is to convert the available indices of fertility and mortality into readily comparable forms, and then, in light of the errors likely to affect the different sources, to select best estimates from the available measures for each year. A consistent series of demographic indicators is then constructed from the best estimates for each year.

The analysis is divided into two periods, 1953-64 and 1964-82, the population censuses marking the beginning and end of each period. The censuses are used to divide the periods because they represent crucial elements of the consistency evaluation. Table 2 shows final estimates of demographic indicators for the period 1953-64, and Table 3 completes the series for the period 1964-82. Figure 1 plots the birth rate, the death rate, and the infant mortality rate by year for the entire period. The principal features to be noted are as follows. Fertility remained approximately constant at a moderately high level until the late 1960's, apart from a very marked but short-lived reduction around 1960, and then fell sharply through the 1970's to a level less than half that of the 1960's, before turning upwards again slightly in the early 1980's. This upturn appears to have occurred primarily as a result of increased numbers of first births, with little increase in second or higher order births. Mortality fell from the early 1950's to the late 1970's, though the decline was interrupted by a sharp mortality surge in the period 1958-61. Infant mortality fell from close to 200 per 1,000 live births to under 100 by the mid-1960's, to the upper 30's by 1978, though it rose to over 200 in the mortality surge around 1960, and increased slightly from late-1970's levels in the early 1980's. Expectation of life at birth increased from little more than 40 years in the early 1950's to around 55 years by the mid-1960's, and nearly 68 years by 1981. Both the pace of fertility decline from 1970 and the pace of mortality decline from the

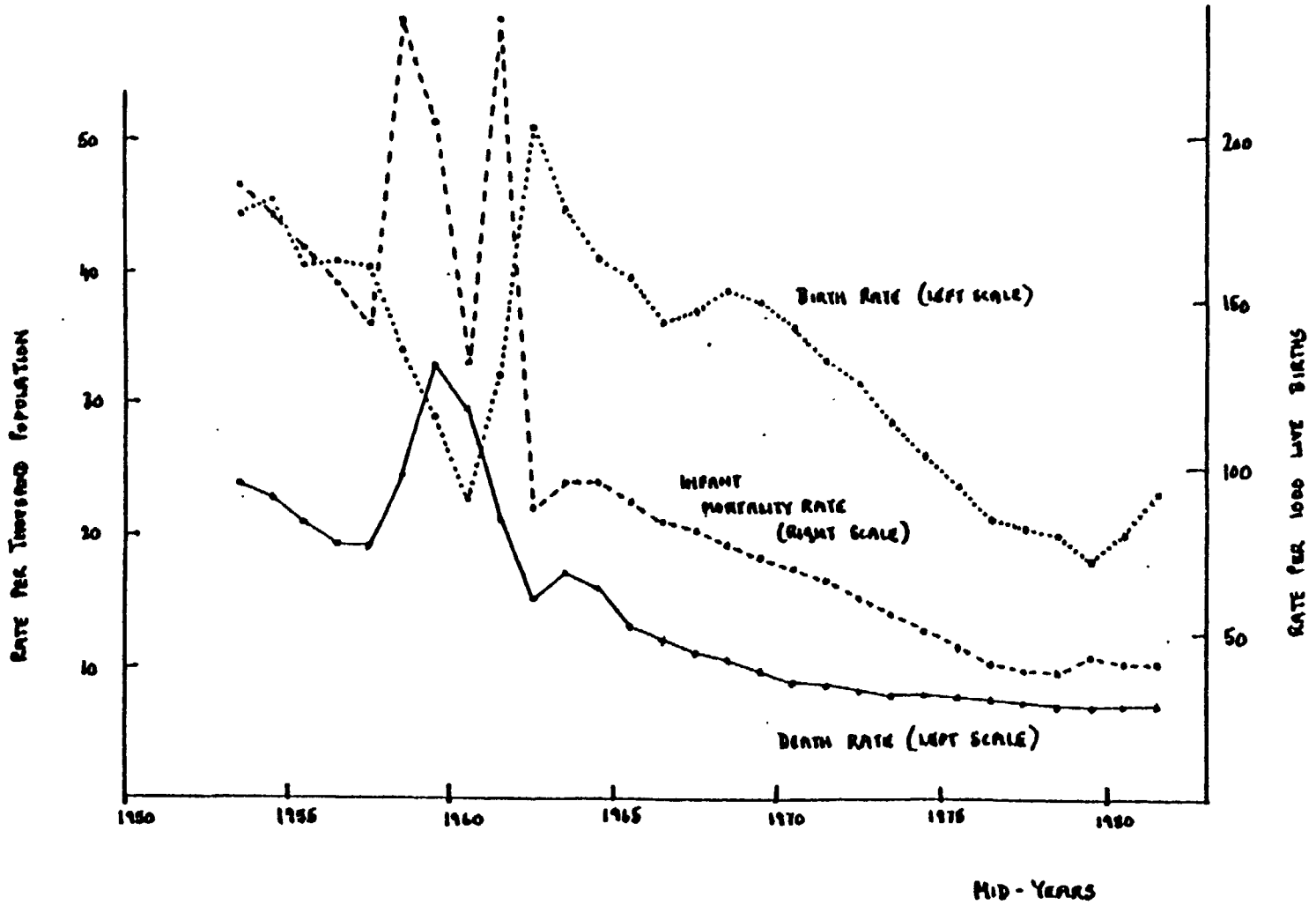
TABLE 2. A Reconstruction of Demographic Changes in China: Selected Indicators, 1953-64

Fiscal Year	Population (beginning of fiscal year) (millions)	Births (millions)	Deaths (millions)	Birth Rate	Death Rate	Infant Mortality Rate	Total Fertility Rate	Growth Rate (percent)
1953-54	582.6	26.08	13.99	44.3	23.8	186	6.39	2.05
1954-55	594.7	27.31	13.69	45.4	22.8	177	6.62	2.26
1955-56	608.3	24.82	12.86	40.4	20.9	167	5.96	1.95
1956-57	620.3	25.54	12.10	40.7	19.3	156	6.08	2.14
1957-58	633.7	25.80	12.24	40.3	19.1	144	6.07	2.12
1958-59	647.3	22.11	15.87	34.0	24.4	236	5.17	0.96
1959-60	653.5	18.88	21.37	28.9	32.8	205	4.38	-0.39
1960-61	651.0	14.72	19.17	22.7	29.5	132	3.39	-0.68
1961-62	646.6	20.88	13.79	32.1	21.2	236	4.71	1.09
1962-63	653.7	33.81	10.07	50.8	15.1	88	7.55	3.57
1963-64	677.4	30.71	11.73	44.7	17.1	96	6.82	2.76
1964-65	696.4							

TABLE 3. A Reconstruction of Demographic Changes in China: Selected Indicators, 1964-82

Year	Mid-Year Population (thousands)	Fiscal Year Births (thousands)	Deaths (thousands)	Birth Rate	Death Rate	IMR	TFR	Growth Rate (percent)
1964	696,387	28,808	11,211	40.9	15.9	96	6.19	2.50
1965	713,984	28,506	9,508	39.4	13.1	90	6.36	2.63
1966	732,982	26,781	8,798	36.1	11.9	84	5.48	2.42
1967	750,965	28,064	8,375	36.9	11.0	81	5.72	2.59
1968	770,654	30,059	8,102	38.5	10.4	77	6.38	2.81
1969	792,611	30,251	7,702	37.6	9.6	73	5.81	2.81
1970	815,160	29,486	7,279	35.7	8.8	69	5.78	2.69
1971	837,367	28,111	7,278	33.2	8.6	66	5.09	2.46
1972	858,200	27,438	7,109	31.6	8.2	61	4.87	2.34
1973	878,529	25,387	6,925	28.6	7.8	56	4.44	2.08
1974	896,991	23,600	7,111	26.1	7.9	51	3.80	1.82
1975	913,480	21,797	7,073	23.7	7.7	46	3.39	1.60
1976	928,204	19,846	6,970	21.2	7.5	41	2.95	1.38
1977	941,080	19,340	6,430	20.4	6.8	39	2.74	1.36
1978	953,990	19,157	6,124	19.9	6.4	38	2.60	1.36
1979	967,023	17,547	6,236	18.0	6.4	43	2.31	1.16
1980	978,334	19,704	6,403	20.0	6.5	41	2.54	1.35
1981	991,635	23,121	6,583	23.1	6.6	41	2.96	1.65
1982	1,008,173							

Figure 1: Birth Rate, Death Rate, and Infant Mortality Rate by Fiscal Year, 1953-54 to 1981-82: China



early 1950's, despite the setback around 1960, were remarkably rapid, and represent remarkable achievements for a population the size of that of China. There can be little doubt that the fall in fertility and rise in mortality in the period 1958-61, which has left a clear imprint on the Chinese age distribution, resulted from the social chaos associated with the Great Leap Forward and a major famine that followed closely after it (Ashton et al., 1984). This demographic crisis cost some 30 million premature deaths and some 33 million lost or postponed births, and represents a catastrophe of unprecedented magnitude.

China has achieved a remarkable reduction in both fertility and mortality for its general level of development. The upturn in fertility in the early 1980's seems to have occurred as a result of a change in policy regarding age at first marriage, and the resultant increased rate of family formation (marriages followed by first births) rather than from a substantial increase in second or higher order births. It may be seen as a tempo effect rather than as a quantum effect, therefore, and can be expected to be short-lived. However, the one-child family has clearly not yet become the norm, and fertility declines below the levels of the late-1970's, with a total fertility rate around 2.5, seem unlikely in the near future in the absence of further policy tightening. The rise in infant mortality in the early 1980's, though minor, is probably also a result of existing policy--the rise is accounted for by higher female infant mortality rates, which may well result from female infanticide. Even without this factor, however, the pace of mortality decline appears to have slowed in the late-1970's and early 1980's, a not altogether unsurprising result, given the combination of already low achieved mortality levels and the primary health care focus of the health

services. Further mortality reductions will be increasingly expensive and achieved more slowly than over the past 30 years.

Data Adjustments

The data used in this study have in general not been adjusted, though interpolation has been used to obtain measures for compatible time periods and estimates of demographic parameters have been smoothed to eliminate excessive fluctuations. Two exceptions have been made to the non-adjustment rule, however: the age distributions from the three censuses have all been adjusted to correct for clear shortages of males of military service ages, and fertility rates from the 1982 fertility survey have been adjusted to take account of apparent reporting of births by Chinese rather than Western calendar dates. The justification for, and form of, the adjustments are given below.

Sex ratios (males per female) calculated from the single-year age distributions from the 1953, 1964, and 1982 censuses in general change quite smoothly with age, but in all three cases fall sharply for young adult males. In the case of the 1953 and 1964 censuses, these patterns are not repeated for the same cohorts at the next census, implying that young adult males were under-represented in the age distributions, but were adequately represented at older ages at the next census. For 1982, there is no later age distribution against which to compare the census age distribution, but the reappearance in 1982 of the same pattern strongly supports a recurrence of the same error. Table 4 shows the sex ratios of the population aged 15 to 35 for 1953, 1964, and 1982, together with the sex ratios of corresponding cohorts at the later census (1982 for 1964) or censuses (1964 and 1982 for 1953). The sex ratios for cohorts by census are remarkably consistent, except for the cohorts aged

TABLE 4. Sex Ratios (males per female) for Ages 15-35 for 1953, 1964, and 1982, together with Sex Ratios for Corresponding Cohorts at Subsequent Censuses; China.

Age	Sex Ratio 1953 Age Cohorts			Sex Ratio 1964 Age Cohorts		Sex Ratio 1982 Age Cohorts
	In 1953	In 1964	In 1982	In 1964	In 1982	In 1982
15	1.189	1.153	1.156	1.115	1.097	1.060
16	1.109	1.141	1.138	1.118	1.100	1.055
17	1.056	1.133	1.123	1.088	1.102	1.050
18	1.061	1.122	1.105	1.045	1.094	1.025
19	1.086	1.133	1.120	1.064	1.112	0.995
20	1.064	1.124	1.126	1.088	1.125	0.973
21	1.057	1.129	1.121	1.084	1.136	0.991
22	1.044	1.126	1.140	1.080	1.129	1.050
23	1.042	1.109	1.123	1.090	1.145	1.073
24	1.037	1.105	1.100	1.099	1.139	1.087
25	1.040	1.101	1.104	1.130	1.141	1.076
26	1.068	1.117	1.097	1.153	1.156	1.063
27	1.059	1.099	1.081	1.141	1.138	1.071
28	1.051	1.093	1.067	1.133	1.123	1.063
29	1.052	1.077	1.047	1.122	1.105	1.058
30	1.050	1.077	1.037	1.133	1.120	1.055
31	1.071	1.077	1.027	1.124	1.126	1.064
32	1.063	1.069	1.019	1.129	1.121	1.101
33	1.058	1.058	1.012	1.126	1.140	1.097
34	1.051	1.047	0.978	1.109	1.123	1.100
35	1.060	1.047	0.972	1.105	1.100	1.102

16 to 30 in 1953, aged 17 to 25 in 1964, and aged 18 to 22 in 1982, all of which show low sex ratios—too few males—relative to neighboring ages or subsequent enumerations. It is assumed that too few males were included in the age distributions at these ages, and the age distributions have been adjusted by applying interpolated sex ratios to the female populations to estimate the correct number of males. This adjustment did not affect the total populations for 1953 or 1982, because in both cases the available age distributions do not add up to the total reported populations; the 1953 total includes persons not classified by age, assumed to include the missing males, and persons not surveyed, while the 1982 age distribution excludes the institutional population, assumed to include the missing males. The adjustment increases the 1964 population somewhat, since although the age distribution includes persons of not stated age, the sex ratio of the not stated population is 1.006, suggesting that for both males and females the not-stateds represent true non-response, and do not include the missing young adult males.

The second adjustment is made to the total fertility rates from the 1982 fertility survey. In a comparison of registered births with births calculated using fertility rates from the 1982 fertility survey, Coale (1982, p. 27) noted that the estimates of registration completeness thus obtained were uniformly low for Chinese leap years, which consist of 13 lunar months as opposed to the 12 lunar months of the non-leap years. For the period 1954 to 1980, the completeness estimates for leap years all fall below a three-year moving average of the annual estimates, the average deviation being -4.6 percent. Coale's convincing explanation of this phenomenon is that births were reported, at least in part, to the fertility survey in terms of the Chinese rather than the western calendar, thus increasing fertility rates for

leap years and reducing those for all other years. If all births were reported in this way, births in leap years would be exaggerated by five percent, while births in other years would be reduced by three percent. For the period 1950 to 1969, the average deviation is close to this maximum five percent, so we have assumed that all births for this period in the fertility survey were reported by the Chinese calendar. Age-specific and total fertility rates for leap years were thus divided by 1.05, and rates for other years by 0.97. For the period from 1969 to 1980, however, the average deviation is only -3.1 percent, so we have assumed that from 1969 onwards, two-thirds of births were reported by the Chinese calendar and one-third by the Western calendar. For this period, age-specific and total fertility rates for leap years were divided by 1.034, those for non-leap years by 0.980.

Demographic Rates 1953-64

The estimation methodology applied to this period is based on the comparison of measures from different sources: the vital registration system (annual births and deaths), the censuses of 1953, 1964, and 1982 (survival of births and previous census population), and the 1982 fertility survey (age-specific and total fertility rates by calendar years 1953 to 1964).

These measures are not directly comparable as they stand. The censuses were all held at mid-year, so the age distributions of children indicate survivors of mid-year to mid-year ("fiscal year") births, whereas the other indicators refer to calendar years; further, the age distributions of children reflect the joint effects of both fertility (births in a one year period) and mortality (survivorship to the census enumeration). Total fertility rates are not comparable with birth rates, since the latter are affected by the population age distribution, though the measures must co-vary

closely over short time periods. A comparison of the different indicators for the period of interest is obviously crucial, however, to an evaluation of the underlying demographic rates. Accordingly, we have converted the available indicators into comparable figures for "fiscal years." There is more scope for examining the consistency of measures of fertility and of implied child mortality than of adult mortality since there are no independent indicators of the timing of adult deaths beyond the registered crude death rates; intercensal population loss indicates the total number of adult deaths, but not their timing. We thus concentrate on fertility and child mortality, and derive trends in adult deaths from registered deaths by year.

Comparisons of the alternative sources of demographic information are made as follows. First, the annual numbers of registered births and deaths are estimated from the reported crude birth and death rates and the geometric mean of the beginning and end-year populations, on the assumption that this is the inverse of the procedure used to calculate the reported annual rates. Numbers of births and deaths for fiscal (mid-year to mid-year) years are then estimated by interpolation, fitting a fourth order polynomial to cumulated births and deaths for four consecutive calendar years centered on the fiscal year of interest. Total fertility rates for fiscal years are obtained by applying the same interpolative procedure to the total fertility rates for calendar years reported by the 1982 fertility survey. The 1953 census age distribution of females aged 4 and over in 1953 is then projected forward by single calendar years to 1964, using smoothed intercensal survival probabilities varying by fiscal year to approximate actual mortality trends suggested by the registered crude death rate; migration was assumed to be negligible. Fiscal year births were then calculated from the age-specific and total fertility rates for fiscal years from the 1982 survey applied to the

projected mid-year female populations. Registered births can then be compared with the projected births for each fiscal year, and apparent completeness of registration can be calculated. The births for each fiscal year from both registration and from the projection, largely determined by the fertility rates from the 1982 survey, can then be compared with the numbers of survivors of those births recorded by the 1964 and 1982 census enumerations; the most convenient form of comparison is apparent survivorship ratios, which can be computed by sex by applying an assumed sex ratio at birth of 106 males per 100 females to the births.

Table 5 shows registered births, projected births using the fertility survey rates, implied completeness of birth registration, and cohort survivorship probabilities by sex to 1964 and 1982 by fiscal years from 1953-54 to 1963-64. The estimates of birth registration completeness fall for the first two years, settle around 80 percent for 1955-56 to 1960-61, with the exception of a high value for 1959-60, and then rise abruptly for the last three years, a rise that continues, as shown in Table 13, to nearly 95 percent in the mid-1960's. The survivorship probabilities to both 1964 and 1982 are remarkably consistent by sex though the sex differential changes from a male advantage for births prior to 1960 through approximate equality for 1960 to 1963, to a female advantage for 1963-1964; the sex differentials in survivorship are more marked to 1964 than to 1982. The survivorship ratios are also reasonably consistent by cohort and by end point (1964 or 1982); the general pattern is of a gradual increase in survival with year of birth, consistent both with gradually falling infant and child mortality and with shorter life span, but there are several notable deviations from the general pattern. Births in 1954-55 have higher than expected survival to both 1964 and 1982; births in 1958-59 have much lower than expected survival to both

TABLE 5. Estimated number of births based on registration and obtained from 1953 census projection and 1982 fertility survey; implied completeness of birth registration and implied survivorship of birth cohorts to 1964 and 1982 censuses: China, fiscal years 1953-54 to 1963-64

Fiscal year	Births (thousands)		Implied Registration Completeness	Survivorship Ratios of Fiscal Year Birth Cohorts[1/]			
				According to the 1964 Census		According to the 1982 Census	
	Registration	Projection and Survey[1/]		Males	Females	Males	Females
1953-54	22,269	26,081	.854	.750	.733	.717	.713
1954-55	21,303	25,645	.831	.817	.792	.773	.763
1955-56	19,545	24,824	.787	.770	.744	.725	.721
1956-57	20,908	25,537	.819	.792	.762	.748	.734
1957-58	20,646	25,800	.800	.811	.780	.765	.744
1958-59	17,793	22,113	.805	.686	.669	.652	.642
1959-60	15,198	17,542	.866	.831	.811	*	.819
1960-61	11,957	14,716	.813	.793	.786	*	.751
1961-62	17,819	20,875	.854	.752	.750	*	.781
1962-63	28,060	30,898	.908	.983	.989	*	.915
1963-64	28,780	30,705	.937	.925	.944	*	.832
Total	224,278	264,736	.847	n.a.	n.a.	n.a.	n.a.

NOTE: Male survivorship to 1982 for some years not given, since male population was adjusted on basis of female population for ages 18-22.

[1/] For explanation of calculations, see text.

1964 and 1982; births in 1959-60 have somewhat higher than expected survival, especially to 1982; births in 1961-62 have lower than expected survival to 1964, though their survival to 1982 is not clearly out of line; and births in 1962-63 have higher than expected survival which is particularly marked to 1964.

Table 5 compares measures from four supposedly independent sources, and the variations observed provide powerful support for this independence. However, the nature of the sources provides some basis for drawing conclusions about the causes of the variations for each birth cohort. We discuss these variations below, by fiscal year of birth.

i) 1953-54: completeness of birth registration is high, but all the survivorship probabilities are reasonable. Since the two censuses and the fertility survey are consistent, birth registration is probably abnormal, a conclusion strengthened by the observation that the official birth and death rates through 1953 are rounded and may not be based on actual registrations. We therefore accept the fertility survey births and their survival probabilities.

ii) 1954-55: completeness of birth registration is rather high, but all the survival probabilities are rather high. Birth registration completeness might come out high as a result of a continuation of the birth rate rounding proposed for 1953-54, but there is no obvious reason why the mortality risks for this cohort should have been lower than those of adjacent cohorts, or why the population aged 9 in 1964 and 27 in 1982 should both have been over-reported. We therefore conclude that the

fertility survey rates for 1954-55 are some seven percent too low, a conclusion that would reduce birth registration completeness to around 77 percent and cohort survivorship ratios by seven percent.

iii) 1955-56 to 1957-58: all the measures are approximately consistent, so the fertility survey rates and survivorship probabilities are accepted.

iv) 1958-59: completeness of birth registration is about normal, but the survivorship probabilities are all low. Since it is unlikely that the population aged 5 in 1964 and 23 in 1982 was consistently under-enumerated, the measures are accepted as consistent but indicating sharply heavier child mortality for this than for earlier birth cohorts.

v) 1959-60: completeness of birth registration is high, and the survivorship probabilities are rather high, to 1964, and high to 1982. The female population aged 22 in 1982 may be over-reported, since it is an officially advocated lower age limit for female marriage, but there is no reason to suppose that the population aged 4 in 1964 was over-reported. We therefore conclude that registration completeness was about the normal 80 percent, implying survivorship to 1964 somewhat lower than normal, and that the fertility survey rates for this year are some six percent too low.

vi) 1960-61: all the measures are approximately consistent, so the fertility survey rates and survivorship probabilities are accepted.

vii) 1961-62: birth registration completeness is rather high, suggesting too few births from the fertility survey, but the survivorship probabilities to 1964 are low, suggesting too many births; survival to 1982 is not so low, but the number of females aged 20 in 1982 may be inflated by age at marriage laws. On balance, we accept the fertility survey results and survivorship probabilities, excepting that for females to 1982, and conclude that birth registration completeness started to rise during this fiscal year.

viii) 1962-63: birth registration completeness is high, survivorship to 1964 impossibly high, and survivorship to 1982 for females also implausibly high. A tempting conjecture would be that one-year-olds were over-reported in 1964, by an upward age shift from age 0, a common error in developing country age distributions. However, female survivorship from 1964 to 1982, age 1 to age 19, is a not-implausible 0.925, so any error in 1964 was followed by an error of similar magnitude at a quite different age in 1982. A more likely explanation seems to be that the fertility survey rates for 1962-63 are too low, possibly as a result of the fiscal year interpolation procedure used here. However, even a registration completeness of 80 percent, the lowest that can reasonably be assumed, would reduce survivorship probabilities only to around 0.87 to 1964, consistent with an infant mortality rate of only about 110 per

thousand live births, which in turn would be consistent with somewhat higher survivorship than that observed from 1964 to 1982. There are thus probably errors in several of the sources: the interpolated fertility survey rates are too low, the 1964 population aged 1 too large, the 1982 female population aged 19 possibly too small (some 19-year-olds having been reported as age 20); all we can conclude is that birth registration was more complete, that fertility was higher than the interpolated rates, and that infant mortality was much lower than its average level over the preceding decade.

ix) 1963-64: though birth registration completeness is high, so is survivorship to 1964; survivorship from the 1964 census to 1982 is somewhat low, though it incorporates an element of high infant and early child mortality. It is hard to evaluate these measures effectively, because of the importance of the age pattern of early child mortality, but it is not evident that any one is inconsistent with the others. We therefore accept the general level of fertility indicated by the 1982 survey and the level of child mortality shown in Table 5.

From this year-to-year analysis, we draw the following conclusions about fertility:

1. Birth registration was approximately 80 percent complete from 1954-55 to 1960-61, then improved to over 90 percent complete by 1963-64; the

official birth rate for calendar year 1953 was probably not based directly on registered births.

2. Fertility was quite high in the early and mid-1950's, with total fertility between 6.0 and 6.5 and the crude birth rate in the low forties. Fertility then fell in 1958-59 by nearly 20 percent, fell again slightly in 1959-60, fell again by about 25 percent in 1960-61, recovered somewhat in 1961-62, then rose very sharply to a peak in 1962-63, with total fertility over 7.0 and the birth rate close to 50 per thousand, before declining slightly to 1963-64.

Turning to child mortality, we have in Table 5 survivorship ratios for adjusted births by sex and fiscal years to the 1964 census. These survivorship ratios reflect the cumulative effects of different age and period mortality rates as each cohort ages from birth to census enumeration, and they cannot be interpreted as measures of mortality level in the fiscal year of birth, even though the mortality rates suffered will normally be highest in the first year of life. However, by a stepwise procedure we can attempt to estimate period mortality levels from these survivorship probabilities. The survivorship probablity for male (or female) births in 1963-64 represents only the mortality level of that fiscal year, and approximates the life table function ${}_1L_0/l_{(0)}$. For each sex, we can find the implied mortality level in a model life table family, and assume that the same mortality level applied to all birth cohorts as they passed through the year. Using ratios ${}_1L_n/{}_1L_{n-1}$ for the implied level, we can reverse-survive each 1964 single year cohort to mid-1963. We can then repeat the process for male (or female) births in 1962-63, calculating the survivorship ratio to mid-1963, finding the model mortality level of the corresponding ${}_1L_0/l_{(0)}$, assuming that this level applies to all older cohorts, and projecting

backwards to mid-1962. We continue this procedure backwards year by year to 1953, finding model mortality levels for each year that are consistent with the observed cohort survivorship probabilities, the child mortality pattern of the model, and the assumption of a single period mortality level applying to all cohorts passing through the year.

Using the Coale-Demeny (1966)[1/] model life tables, it turns out to be impossible to apply this method across all cohorts. The fluctuations in survivorship probabilities are too sharp from cohort to cohort to be able to assume period levels applying to all cohorts without obtaining negative mortality for at least one period, even using the "East" mortality pattern, which has the highest infant mortality relative to child mortality, and can therefore represent the widest fluctuations of any of the four families. However, by adjusting the survivorship probabilities to 1964 in Table 5 for the ages 1, 4 and 9 in accordance with the above discussion of birth registration and enumeration completeness, by using the East family, and by smoothing somewhat the extreme fluctuations in survivorship probabilities for cohorts aged 2, 5, 6 and 7 (for males) or 8 (for females) in 1964, it is possible to obtain a reasonable sequence of child mortality levels and infant mortality rates by sex for fiscal years from mid-1953 to mid-1964. The levels and infant mortality rates obtained by period, and the implied cohort survivorship probabilities, are shown in Table 6. The fluctuations not accounted for may reflect cohort effects, whereby particular birth cohorts that experienced high initial mortality continued to experience mortality rates above period averages, presumably because they were weakened by their

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1/ Coale, A.J. and P. Demeny. Regional Model Life Tables and Stable Populations. Princeton University Press. Princeton, N.J., 1966.

TABLE 6. Cohort Survivorship Ratios to 1964 and Corresponding Mortality Levels and Infant Mortality Rates, by Sex: China, Fiscal Years 1953-54 to 1963-64

Fiscal Year	Males				Females			
	Cohort Survivorship Ratios		East Mortality Level	Infant Mortality Rate	Cohort Survivorship Ratios		East Mortality Level	Infant Mortality Level
	Observed (birth to 1964)	Model			Observed (birth to 1964)	Model		
1953-54	.750	.750	12.5	185	.733	.733	11.1	178
1954-55	(.760)*	.760	13.0	176	(.738)*	.738	10.6	187
1955-56	.770	.770	13.2	172	.744	.755	(11.5)**	171
1956-57	.792	.773	(14.2)**	155	.762	.762	12.3	158
1957-58	.811	.756	(15.0)**	141	.780	.742	(14.0)**	132
1958-59	.686	.724	(10.0)**	235	.669	.709	(8.0)**	237
1959-60	(.772)*	.772	11.9	195	(.753)*	.753	9.1	215
1960-61	.793	.793	15.9	126	.786	.786	13.6	138
1961-62	.752	.795	(10.0)**	235	.750	.803	(8.0)**	237
1962-63	(.892)*	.892	18.0	93	(.910)*	.910	17.5	83
1963-64	.925	.923	17.0	108	.944	.944	17.5	83

* Adjusted observations.

** Levels smoothed to avoid assumption of impossible or implausible levels in prior years.

TABLE 7. Smoothed East mortality levels under age 10 by sex: China, fiscal years 1953-54 to 1963-64

Fiscal year	Males	Females
1953-54	12.5	10.6
1954-55	13.0	11.1
1955-56	13.6	11.6
1956-57	14.2	12.3
1957-58	15.0	13.0
1958-59	10.0	8.0
1959-60	11.9	9.1
1960-61	15.9	13.6
1961-62	10.0	8.0
1962-63	18.0	17.5
1963-64	17.0	17.5

TABLE 8. Total Registered Deaths, Estimated Deaths under Age 10, and Comparison of Registered Deaths to Registered Births: China, Fiscal Years 1953-54 to 1963-64

Fiscal Year	Estimated deaths: Registered Deaths (thousands)	Estimated deaths: Under 10 (thousands)	Ratio: Estimated Deaths under Age 10 to Total Registered Deaths	Births from Projection and Survey (thousands)	Ratio: Registered Deaths to Births
1953-54	7,926	6,610	0.83	26,081	0.30
1954-55	7,680	6,609	0.86	27,312*	0.28
1955-56	7,275	6,088	0.84	24,824	0.29
1956-57	6,899	5,633	0.82	25,537	0.27
1957-58	7,230	5,193	0.72	25,800	0.28
1958-59	8,389	8,691	1.04	22,113	0.38
1959-60	13,924	6,491	0.47	18,882*	0.74
1960-61	13,782	3,263	0.24	14,716	0.94
1961-62	7,534	7,062	0.94	20,875	0.36
1962-63	6,494	3,197	0.49	33,813*	0.19
1963-64	7,514	3,825	0.51	30,705	0.24
Total	94,647	62,662	0.66	270,658	0.35

*Adjusted on the basis of interpolated survivorship ratios.

ages does not vary closely with the sequence of deaths under age 10. The ratio of deaths under age 10 (which we hope are close to the true numbers) to total registered deaths, assumed to suffer from under-registration, varies around 80 percent to 1957-58, rises to 104 percent for 1958-59, falls to below 50 percent for 1959-60 and 1960-61, rises to 94 percent for 1961-62, and then falls around 50 percent for 1963-64. The period with peak numbers of registered deaths, 1959-61, is a period with relatively few estimated deaths under 10, giving rise to the low ratios of child to total registered deaths, whereas the years of high estimated deaths under 10, 1958-59 and 1961-62, have only moderately higher total registered deaths, giving rise to the high ratios of child to total registered deaths.

There are three possible explanations for the lack of consistency between the series of registered deaths and estimated child deaths. The first is that the series of deaths under 10 is wrong. Accepting this explanation would mean dismissing the consistency between the 1964 age distribution, the 1982 fertility survey results, and registered births by year. Also few births occurred in the period 1959-61, so even a doubling of infant deaths would have had little effect on total deaths; thus, the huge numbers of registered deaths are unlikely to reflect child deaths in the main, and thus provide little information about them. This point is reinforced by the sequence of ratios of registered deaths to adjusted births; these ratios are fairly constant through the mid-1950's, rise to a peak for 1959-61, and then fall to low levels for 1962-64. Thus, it is possible that the sequence of child deaths is wrong, but the sequence of registered deaths does not prove it.

The second explanation is that the completeness of death registration varied sharply year by year, with registered deaths thus not reflecting the trend in actual deaths at all closely. This explanation does not seem very

likely, since the completeness of birth registration apparently remained approximately constant, at least until 1962, and a coverage change in deaths would be expected to be associated with a similar change in births.

The third explanation is that the surge in registered deaths in the period 1959-61 resulted from very high adult mortality in the two years, not reflected in child deaths. This explanation would require that the underlying cause of the high adult mortality did not have a marked impact on child mortality. Though this explanation is not on the face of it very plausible, it is possible that severe famine accompanied by strict food rationing, or other method of food allocation, giving preference to young adults and children could produce such a differential, an account that would be consistent with the very low survivorship ratios for the elderly observed between 1953 and 1964. Famine might also exacerbate various morbid conditions differentially, resulting in marked differentials by age in the effect on mortality; in this respect it is interesting to note that the brunt of the mortality increase around 1960 appears to have been borne by the population already alive in 1920 and thus that lived through the 1919 influenza epidemic.

The demographic evidence tends to favor this third explanation. Both age-specific growth rates and intercensal survivorship probabilities (shown in Table 10) suggest that, on average over the period, mortality above age 40 was substantially higher between 1953 and 1964 than it had been prior to 1953, the excess being particularly severe for males. The sharp drop in survivorship ratios at age 35 (in 1953) would be consistent with a famine combined with a rationing scheme giving priority to those under age 40 during 1959-61.

Thus, the annual numbers of registered deaths are not necessarily inconsistent with the estimated numbers of deaths under 10, since the huge numbers of deaths registered for the period 1959-61 probably reflect very

largely deaths over age 40. Child deaths may have increased in 1958-59 before rationing measures were put into effect, may have fallen to more normal levels in 1960-61 as a result of targeted rationing, and may have increased again in 1961-62 as rationing was relaxed. The obvious alternative hypothesis, that child mortality was actually very high in 1959-61, but that births were severely under-registered because of the high infant mortality, and that births for the period recorded by the 1982 fertility survey were under-reported badly for a similar reason, fails to explain why survivorship ratios to 1964 are actually higher for the births reported for 1959-61 than for the births reported for 1958-59 or for 1961-62; if infant deaths led to omissions of births between 1959 and 1961, then they would be expected also to lead to omissions in 1958-59 and 1961-62.

If we accept the sequence of deaths under age 10 in Table 8, it is clear that the registration of deaths under age 10 was substantially less complete than the registration of deaths at age 10 and over. The increase of child deaths of 3.5 million from 1957-58 to 1958-59 is associated with an increase in registered deaths of only 1.2 million, while the decline in child deaths of 3.9 million from 1961-62 to 1962-63 is associated with a decline in registered deaths of only 1.0 million. Taken together, these two observations suggest that the registration of child deaths was only about 30 percent complete. We can estimate total intercensal deaths as the 1953 population plus intercensal births minus the 1964 population, giving 156,875 thousand. Deaths at age 10 or over can be estimated by subtracting deaths under 10, giving 94,213 thousand. If 30 percent of deaths under 10 were registered, then 78,848 thousand deaths at 10 or over were registered, implying a completeness of registration of 80.5 percent. Marked differentials in registration completeness between child and adult deaths are commonly observed

in developing countries, so such a difference for China is not implausible. That the completeness of registration for adult deaths is roughly the same as that for births is not necessarily implausible either, since births rapidly followed by death may be much less likely to be registered than births that survive a year or more. Table 9 shows the numbers of deaths by year under age 10, 10 and over, and total, assuming that the registration completeness of deaths under 10 was 30 percent, while that for deaths over 10 was 80.5 percent. The sequence of deaths 10 or over by year looks quite reasonable, except perhaps for the increase in 1963-64, a year in which death registration completeness may have increased, as it apparently did for birth registration.

The sequence of registered deaths is the only available source of information about the timing of adult mortality between 1953 and 1964, but survivorship ratios from 1953 to 1964 by age group provide an indication of the age pattern of intercensal mortality. Survivorship ratios by sex for initial age groups aged 10 and over in 1953 are shown in Table 10 with corresponding "East" mortality levels. In terms of mortality levels, the survivorship ratios plunge for initial age groups over 30 in 1953; for males, the levels continue to drop as age increases, whereas for females they stabilize around level 7. It seems unlikely that the mortality patterns implied by the 1953-64 survivorship ratios were standard features of Chinese mortality, since the age-specific growth rates (Table 10) fall sharply for males from about age 45 to negative values above age 65, and fall sharply for females above age 65 to close to zero; if mortality had been falling prior to and during the period, the age-specific growth rates would be expected to increase with age above age 40. A further indication that the 1953-64 experience was not typical of China prior to 1953 is the changes in the age distribution above age 40 from 1930 (taken from the Chinese Farmers Survey,

TABLE 9. Estimated deaths (thousands) under age 10 and age 10 or over: China, fiscal years 1953-54 to 1963-64

Fiscal year	Under age 10	Age 10 or older	Total
1953-54	6,610	7,382	13,992
1954-55	6,609	7,077	13,686
1955-56	6,088	6,768	12,856
1956-57	5,633	6,470	11,103
1957-58	5,193	7,045	12,238
1958-59	8,691	7,182	15,873
1959-60	6,491	14,877	21,368
1960-61	3,263	15,903	19,166
1961-62	7,062	6,727	13,789
1962-63	3,197	6,875	10,072
1963-64	3,825	7,908	11,733
Total	62,662	94,213	156,875

TABLE 10. Intercensal Age- and Sex-specific Survival Ratios, 1953-54, Implied East Mortality Levels, and Growth Rates by Age Group and Sex: China, 1953-54 to 1963-64

Age Group (1953)	Males			Females		
	Intercensal Survival Rates	Mortality Level	Growth Rate (percent)	Intercensal Survival Rates	Mortality Level	Growth Rate (percent)
10-14	.924	5.7	3.83	.959	12.7	4.58
15-19	.940	11.9	1.30	.949	12.8	1.61
20-24	.929	11.3	0.66	.933	11.8	0.57
25-29	.921	11.4	1.42	.925	11.8	1.13
30-34	.893	10.0	2.07	.883	8.0	1.47
35-39	.818	5.6	1.13	.852	6.1	0.91
40-44	.754	3.9	0.90	.830	6.2	1.02
45-49	.687	3.1	0.48	.802	7.8	0.55
50-54	.584	1.7	0.47	.728	8.0	0.83
55-59	.448	< 1.0	0.16	.601	7.3	1.27
60-64	.323	< 1.0	0.00	.458	7.2	0.96
65-69	-	-	-0.64	-	-	0.11
70-74	-	-	-1.02	-	-	-0.37
75-59	-	-	-0.08	-	-	0.51
80+	-	-	-0.54	-	-	-0.22

and admittedly not necessarily representative of all China) through 1953 to 1964. The age distributions, shown in Table 11, show increasing proportions above age 60 from 1930 to 1953, consistent with declining mortality, but falling proportions for the same age groups from 1953 to 1964. The information thus suggests that, on average over the period, mortality above age 40 was substantially higher between 1953 and 1964 than it had been prior to 1953, the excess being particularly severe for males. The sharp drop in survivorship ratios at age 35 (in 1953) would be consistent with a large number of famine-associated deaths at ages 40 and over during the period 1958-62.

We lack year-by-year information on the age pattern of mortality, so we have no basis for the direct calculation of annual life tables or of summary measures such as expectation of life at various ages. However, we have annual estimates of deaths and population over age 10, so we can calculate death rates over age 10. By assuming the population over age 10 to be approximately stable, we can obtain rough estimates of expectation of life at age 10, using the death rates over age 10 to interpolate within the Coale-Demeny model stable populations. Rough estimates of expectation of life at birth for each fiscal year can then be obtained by splicing on the child life table levels arrived at in Table 7. Results are shown in Table 12. Expectation of life at birth rose by almost one year per year between 1953 and 1964, despite falling to a level almost 10 years below the 1953-54 level in 1959-60. Life expectancy at age 10 rose by only some two and a half years over the period: major gains were clearly made in child mortality reductions, with less impressive gains for adults.

TABLE 11. Distribution of the population aged 40 years and older by age group and sex (percent) according to the Chinese farmers survey of 1930 and according to the National Censuses of China, 1953 and 1964

Age group	Males			Females		
	1930	1953	1964	1930	1953	1964
40–44	24.39	22.65	24.14	20.92	20.48	21.12
45–49	23.47	20.20	20.57	22.57	18.97	18.59
50–54	17.06	17.12	17.40	15.88	16.06	16.22
55–59	14.63	14.32	14.07	15.55	13.69	14.51
60–64	9.68	11.02	10.64	10.17	11.44	11.72
65–69	5.68	7.43	6.69	7.02	8.59	8.01
70–74	2.90	4.55	3.93	4.02	6.07	5.37
75–79	2.20	1.88	1.80	3.87	3.00	2.92
80+		0.82	0.74		1.70	1.53
40 and older (Total)	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 12. Death Rates over Age 10, Expectation of Life at Age 10 and at Birth, by Sex and Fiscal Years, 1953–54 to 1963–64: China

Fiscal Year	Death Rate 10+	e(10)*	e(o)	Death Rate 10+	e(10)*	e(o)
1953–54	18.3	43.0	39.4	15.9	47.7	41.7
1954–55	17.3	44.7	41.4	15.1	49.3	43.6
1955–56	16.4	46.4	43.6	14.2	51.4	45.9
1956–57	15.4	48.3	45.9	13.4	53.3	48.5
1957–58	16.5	46.2	45.4	14.4	51.0	47.9
1958–59	16.6	46.0	37.7	14.4	51.0	39.6
1959–60	34.1	33.5**	30.7	29.5	37.3**	32.3
1960–61	36.4	32.2**	35.1	31.4	36.2**	37.0
1961–62	15.2	48.7	39.5	13.1	54.0	41.6
1962–63	15.2	48.7	51.5	13.0	54.2	56.8
1963–64	17.1	45.1	47.1	14.7	50.3	53.4

* For stable population of growth rate 1.5% and death rate 10+ as shown, except for 1959–60 and 1960–61.

** From death rates 10+ for 1953 age distributions.

Demographic Rates 1964-82

For the period 1964-82, we have one information set less to work with than for the period 1953-64, since we do not have an age distribution for well after the end of the period, but we also have several additional information sets: a distribution of deaths by age for the years 1973-75 from the Cancer Epidemiology Survey (CES), a life table for 1981 based on deaths by age in 1981 from the 1982 census, and children ever born and children surviving by age group of mother from the 1982 census, providing the information needed for the indirect estimation of child mortality.

As a first step, however, we can repeat the analysis applied to the period 1953-64: calculating fiscal year births and deaths from the registration system, calculating fiscal year births from the interpolated female population and fertility survey age-specific fertility rates, calculating child survivorship probabilities for the births to 1982, and estimating period child mortality levels recursively from the survivorship probabilities. Table 13 shows the births calculated from the two sources, the birth registration completeness implied for each year by the fertility survey rates, and the survivorship rates to 1982 by sex, assuming a sex ratio at birth of 106 males per 100 female births. No birth or death rates for 1980 have been published, so the 1980 registered birth rate was estimated by interpolating between 1979 and 1981 on the basis of fertility survey total fertility rates for the three years.

The birth registration completeness implied by the fertility survey starts at around 95 percent for the first four fiscal years, 1964-68, drops to around 91 percent for the four fiscal years 1968-72, possibly associated with the Cultural Revolution, rises to around 92 percent for the three fiscal years 1972-75, then falls steadily for the five fiscal years 1975-80, before rising

TABLE 13. Estimated Numbers of Births from Registration and Fertility Survey, Birth Registration Completeness Implied by Fertility Survey, and Survivorship to 1982; China, Fiscal Years 1964-65 to 1981-82

Fiscal Year	Births (thousands)		Implied Registration Completeness	Survivorship Ratios of Fiscal Year Birth Cohorts to 1982	
	Registration	Projection and Survey		Males	Females
1964-65	27,145	28,808	.942	.8471	.8524
1965-66	26,413	28,506	.927	.9008	.9028
1966-67	25,490	26,781	.952	.8516	.8495
1967-68	26,633	28,064	.949	.8771	.8737
1968-69	27,464	30,059	.914	.9415	.9408
1969-70	27,307	30,251	.903	.8792	.8758
1970-71	26,546	29,486	.900	.9314	.9255
1971-72	25,679	28,111	.914	.9014	.8959
1972-73	25,285	27,438	.922	.9179	.9142
1973-74	23,477	25,387	.925	.9499	.9466
1974-75	21,719	23,600	.920	.9271	.9216
1975-76	19,763	21,797	.907	.9411	.9355
1976-77	18,043	20,126	.897	.9701	.9633
1977-78	17,583	19,944	.882	.9384	.9330
1978-79	17,417	20,113	.866	.9821	.9725
1979-80	15,953	18,530	.861	.9957	.9799
1980-81	17,914	19,109	.938	.9201	.9018
1981-82	21,021	20,892	1.006	1.0062	.9892
Total	410,852	447,002	.919	n.a	n.a.

sharply for the last two fiscal years of the period, 1980-81 and 1981-82, the estimate of the latter year reaching more than 100 percent. The survivorship rates to 1982 are remarkably consistent by sex, showing a slight female advantage for the first two years, 1964-66, then a slight male advantage for 13 years, 1966-79, and a marked male advantage for the last three years, 1979-82. The survivorship ratios show considerable variations by year, however, with high values for the birth cohorts of 1965-66, 1968-69, 1970-71, 1973-74, 1976-77, 1978-79, 1979-80, and 1981-82. Each of these years includes a Chinese leap year, so we may have over-corrected the fertility survey births for leap years somewhat, or the 1982 population may itself be affected by leap year effects, if age were reported by the Chinese calendar. The general trend of the survivorship rates does not seem to reflect the variations in implied birth registration completeness, however, supporting the conjecture that registration completeness really did vary during the period.

The period from 1976 to 1982 merits special attention. Implied registration completeness falls for four years to 0.861 in 1979-80, the lowest level for the whole 18-year period, and then increases sharply for the last two years to the highest observed level with complete registration in 1981-82. The survivorship ratios to 1982 implied by the fertility survey births fluctuate sharply, but are implausibly high for four years (1976-77, 1978-79, 1979-80, and 1981-82) out of the six, particularly for males. Such sharp fluctuations in birth registration completeness, which had been in the range of 90 to 95 percent for the previous 12 years, seem unlikely to be correct, though the implementation of the one-child family policy could have led to lower registration completeness in the first four years followed by an official crackdown resulting in higher completeness in the last two years. However, if registration completeness was in fact essentially constant

throughout, the fertility survey recorded too few births in 1980-81 and 1981-82, and too many for the years 1976-80; such an error might also arise from the one-child family policy, if respondents to the survey pushed back the dates of recent births to give the impression that they occurred further in the past. The survivorship ratios indicate errors either in the fertility survey births (too few) or in the census population (too many) for the birth cohorts of 1976-77, 1978-79, 1979-80, and 1981-82. The census age distribution may itself be distorted by reporting errors induced by the one-child family policy, again by exaggerating the age of young children, and thus pushing back the reported date of birth. It will not be possible to sort out this tangle of errors until another age distribution or fertility history sequence becomes available. It is clear, however, that there are errors, and it seems likely that both the fertility rates and the age distribution are affected by them, given the implausible sequence of birth registration completeness in Table 13 (assuming the fertility survey to be correct) and the even more implausible sequence that would result from assuming the age distribution to be correct. We therefore conclude that both the fertility survey and the age distribution from the 1982 census are distorted for this period by date or age reporting errors, and assume that birth registration completeness remained constant over the period at its average level over the period of 90.9 percent. The total fertility rates in Table 3 for the years 1976-82 are the fertility survey rates adjusted for level so as to maintain this level of registration completeness for each year.

Although the exact trend in fertility in the years immediately preceding the 1982 census remains unclear, all the sources show a rise in fertility for 1981 and 1982. The registered birth rate increases from around 18 per thousand in 1979 to around 21 per thousand in 1981 and 1982, the total

fertility rate from the fertility survey increases from 2.24 in 1980 to 2.63 in 1981, and the 1982 census population aged 0, born in 1981-82, is nearly 20 percent larger than the population aged 1. Most of this increase in fertility appears to have resulted from changes in the timing of fertility rather than in changes in general fertility level. The sum of age-specific first birth rates recorded by the 1982 fertility survey increased from 0.869 in 1980 to 1.162 in 1981. Cumulated first birth rates indicate the proportion of women who will ultimately become mothers given the current period rates throughout their lives; thus, the 1980 sum indicates that 86.9 percent of women would become mothers given 1980 first birth rates, probably somewhat below the proportions of each cohort of Chinese women who will actually have at least one child, and thus indicating some postponement of first births. The 1981 sum indicates that 116 percent of women would ultimately become mothers given the 1981 first birth rates, clearly an impossibility and indicating a bringing forward of first births, no doubt related to the relaxation in 1980 of some local restrictions on age at female marriage. Changes from 1980 to 1981 in the sums of second birth rates (0.564 to 0.624), and third-plus birth rates (0.802 to 0.839) were more modest, increasing by 10.6 and 4.6 percent respectively. Thus, the fertility survey data suggest that most of the fertility increase in the early 1980's resulted from a change in age at family formation rather than from changes in individual fertility level within families. The rise in fertility should not therefore be seen as a major public rejection of official fertility policy; there was some increase in the rates of bearing second and higher order children, but most of the fertility increase came about from a bunching of first births in 1981 (and probably also in 1982). Once this timing effect has run its course, fertility can be

expected to fall again. With more normal first-birth rates, the 1981 total fertility rate would have been around 2.4.

Turning to child mortality, the survivorship ratios by cohort fluctuate too sharply from year to year to be able to use the step-by-step procedure applied to estimate annual child mortality levels for the period 1953-64. We have therefore applied the procedure to a three-year moving average of the calculated ratios. We also have some independent information on the pattern of child mortality. The 1981 life table indicates a "North" pattern of child mortality, whereas the 1973-75 CEM indicates a "West" pattern. We have therefore used a "West" pattern from 1964 to 1976, and a "North" pattern for 1976 to 1982. Survivorship ratios for male cohorts aged under five in 1982 could not be fitted with plausible mortality levels, so fiscal year levels were assumed in such a way as to show some slight downward trend in child mortality and to fit observed survivorship by 1975-76. For females, the 1981 life table indicates that female child mortality was about one level lower (that is, heavier mortality) than male mortality. However, the survival ratios for female births in the years 1979-82 indicate a much larger female disadvantage than one mortality level. We have therefore assumed that the excess female disadvantage represents excess female early infant deaths associated either with infanticide or intentional neglect, and we have estimated one level of mortality for female infants and another, taken as one mortality level below the corresponding male estimates, for female mortality after age 1. Table 14 shows the observed survivorship ratios (three-year moving averages of the values in Table 13), the cohort survivorship ratios implied by the step-by-step process, and the period mortality levels obtained by the process. Some local smoothing of period levels was applied to avoid extreme year-by-year fluctuations (indicated by

TABLE 14. Cohort Survivorship Ratios to 1982 and Corresponding Period Mortality Levels by Sex; China, Fiscal Years 1964-65 to 1981-82

Fiscal Year	Males			Females			
	Cohort Survivorship Ratios		'West' Period Mortality Level**	Cohort Survivorship Ratios		'West' Period Mortality Level**	
	Observed*	Model		Observed*	Model	Infancy	Childhood
1964-65	-	-	-	-	-		
1965-66	.8665	.8665	16.5	.8682	.8692		(15.4)
1966-67	.8765	.8776	(16.5)	.8753	.8753		16.0
1967-68	.8901	.8901	17.3	.8880	.8843		(16.0)
1968-69	.8993	.8993	18.0	.8968	.8968		16.7
1969-70	.9174	.9052	(18.5)	.9140	.9018		(18.0)
1970-71	.9040	.9106	(18.5)	.8991	.9036		(17.0)
1971-72	.9169	.9169	18.9	.9119	.9119		17.7
1972-73	.9231	.9231	19.1	.9189	.9189		17.9
1973-74	.9316	.9316	19.7	.9275	.9275		18.5
1974-75	.9394	.9394	20.4	.9346	.9346		19.4
1975-76	.9461	.9461	20.6	.9401	.9401		19.3
1976-77	.9499	.9552	(21.3)	.9439	.9493		(20.0)
1977-78	.9635	.9610	(21.8)	.9563	.9563		20.6
1978-79	.9721	.9658	(22.2)	.9618	.9618		21.1
1979-80	.9660	.9679	(22.2)	.9514	.9514	18.8	21.3
1980-81	.9740	.9715	(22.5)	.9570	.9570	19.2	21.5
1981-82	-	.9760	22.5	-	-	19.2	21.5

* Three-year moving averages of fiscal year cohort values.

** 'North' model used for 1976-77 to 1981-82; local smoothing to avoid fluctuations applied for years when the observed and model ratios do not agree (mortality levels in parentheses).

mortality levels enclosed in parentheses). The resulting sequences of mortality level show fairly steady declines in child mortality over the period, and roughly constant male-female differentials of about one mortality level at least until 1979. Final estimates of child mortality level from this stepwise process, shown in Table 15, were obtained by some further smoothing. The estimated infant mortality rates, also shown in Table 15, fit in reasonably well with the sequence estimated for the period 1953-64 in Table 6. The excess female infant deaths in the years 1979-82 total around 375,000, and increase the female infant mortality rate from around 35 to over 45 per thousand live births.

The period infant and child mortality levels in Table 15 can be compared with three independent sources. The 1982 census included a question on household deaths by age and sex in 1981, and a life table has been constructed from the reported deaths (Jiang et al., 1984).[1/] This life table indicates somewhat higher male infant and child mortality and higher female child mortality than the stepwise sequence, but indicates lower female infant mortality. Part (a) of Table 16 compares the "North" mortality levels under age 10 from the life table with the stepwise results. We do not usually expect a retrospective question on deaths to overestimate mortality, particularly in childhood, but accepting the 1981 life table childhood mortality, at least for males (the 1981 life table shows no female infanticide effect), would mean rejecting the cohort survivorship rates in Table 14 as far back as the mid-1970's, even assuming that child mortality had not fallen at

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1/ Jiang, Zheng-hua, Zhang Wei-min, and Zhu Li-wei. The Preliminary Study to the Life Expectancy at Birth for China's Population. Paper prepared for International Seminar on China's 1982 Population Census. Beijing, China; March 1984.

TABLE 15. Estimates of Infant and Child Mortality Levels, and Infant Mortality Rates, by Sex: China, Fiscal Years 1964-65 to 1981-82

Fiscal Year	Males			Females			
	Mortality Level	Coale-Demeny Family	Infant Mortality Rate	Mortality Level		Coale-Demeny Family	Infant Mortality Rate
				Infancy	Childhood		
1964-65	16.0	'West'	99	15.0		'West'	93
1965-66	16.5	'West'	92	15.5		'West'	88
1966-67	17.0	'West'	86	16.0		'West'	82
1967-68	17.3	'West'	83	16.3		'West'	78
1968-69	17.6	'West'	79	16.6		'West'	75
1969-70	18.0	'West'	74	17.0		'West'	71
1970-71	18.3	'West'	71	17.3		'West'	67
1971-72	18.6	'West'	67	17.6		'West'	64
1972-73	19.0	'West'	63	18.0		'West'	60
1973-74	19.5	'West'	57	18.5		'West'	55
1974-75	20.0	'West'	52	19.0		'West'	50
1975-76	20.5	'West'	46	19.5		'West'	45
1976-77	21.3	'North'	37	20.0		'North'	40
1977-78	21.8	'North'	33	20.6		'North'	35
1978-79	22.2	'North'	30	21.1		'North'	31
1979-80	22.2	'North'	30	18.8	21.2	'North'	50
1980-81	22.5	'North'	27	19.2	21.5	'North'	46
1981-82	22.5	'North'	27	19.2	21.5	'North'	46

TABLE 16

TABLE 16. Comparisons of Step-wise Estimates of Child Mortality Levels with Independent Estimates; China, Various Years, 1970-82

Part (a): Comparison with 1981 Life Table

Age x	Males			Females		
	Life Table		Step-wise	Life Table		Step-wise
	$_nq_x$	'North' Level	'North' Level	$_nq_x$	'North' Level	'North' Level
0	.03556	21.5	22.5	.03372	20.9	19.2
1	.01600	20.9	22.5	.01778	20.3	21.5
5	.00650	21.6	22.5	.00537	21.2	21.5

Part (b): Comparison with Banister-Preston 1973-75 Life Table

Age x	Both Sexes			
	Life Table		Step-wise 'West' Level	
	$_nq_x$	'West' Level	1973-74	1974-75
0	.05629	19.0	19.0	19.5
1	.01998	19.0	19.0	19.5
5	.02393	12.0	19.0	19.5

Part (c): Comparison with Estimates from 1982 Proportions Dead of Children Ever Born

Age of Mother	1982 Census		Cohort Average Parity from Fertility Survey		Cohort Parity Ratio	Age x	West Model		Reference Date	Step-wise Level
	Proportion of Children Dead	Average Parity	1977	1982			$_xq_0$	Level		
20-24	.0621	.420	.020	.414	.0483	2	.0708	18.6	1980.8	21.9*
25-29	.0637	1.593	.526	1.588	.3312	3	.0669	19.2	1979.2	21.7*
30-34	.0754	2.763	2.055	2.766	.7430	5	.0741	19.1	1975.4	19.7
35-39	.0975	3.802	3.490	3.781	.9230	10	.0947	18.3	1971.7	18.0

*'North' rather than 'West' model.

all over the period. The 1981 life table for childhood is thus inconsistent with the fertility survey births and 1982 age distribution of children under age 10. Since the life table itself must be based in part on the 1982 age distribution for rate denominators, omission of young children from the census age distribution (or an upward shift in their ages) would result in overestimates of child mortality in the life table, but would also result in overestimates of early child mortality from the stepwise process. The difference between the two sets of estimates is therefore due largely to errors either in deaths reported for 1981 or in births obtained from the fertility survey. The most likely way in which deaths might be over-reported is by the inclusion of deaths that occurred either before or after 1981. Such an error is a possibility, especially for China with two calendar systems being used. However, it remains possible that the estimates of child mortality for the early 1980's in Table 15 may be underestimating child-mortality in the early 1980's by a Coale-Demeny level or so, and overestimating slightly the pace of child mortality decline for the period 1975-82.

The second independent source for child mortality is the 1973-75 CES, which covered some 90 percent of China's population, and provides deaths by five-year age groups for both sexes combined for the study population. The CES also provides an age distribution for the study population, but the reference date for this population is not clearly defined. However, Banister and Preston (1981)[1/] have derived an adjusted life table from the basic data. Panel (b) of Table 16 shows age-specific mortaity rates under age 10 from this life table, together with the implied "West" model life table

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1/ Banister, J. and S. H. Preston. Mortality in China. Population and Development Review, Vol. 7, No. 1, pp. 98-110.

mortality levels. Under age 5, the life table and stepwise mortality levels agree closely, but the life table shows very much heavier mortality for the age group 5-9, a differential with the mortality levels under age 5 not matched by any model life table system or reliably recorded real life table. Under age 5, the life table supports the stepwise sequence, while for age group 5-9, the life table is probably wrong.

The third independent basis for child mortality estimates is the 1982 census data on children ever born and children surviving by age group of mother. A number of procedures have been developed for obtaining child mortality estiates from proportions dead of children ever born, founded on pioneering work by Brass (1964).[1/] The early methods assumed constant fertility and mortality in the past, clearly inapplicable to China in 1982, but more flexible methods have recently been introduced to obtain reference dates for the estimates and to allow for changing fertility (U.N., 1983).[2/] We use here a method that estimates period child mortality risks under conditions of changing fertility using ratios of average parities (numbers of children ever born) for cohorts at two dates five years apart to allow for changing fertility. The 1982 census provides average parities by age group for mid-1982, but not for mid-1977. We have therefore used the single year of age/single calendar year-specific fertility rates from the 1982 fertility survey to estimate average parities by cohort at the end of 1981 and at the end of 1976, and used these parities to calculate cohort parity ratios.

1/ Brass, W. Uses of Census or Survey Data for the Estimation of Vital Rates. Paper prepared for the African Seminar on Vital Statistics, Addis Ababa, 14-19 December 1964.

2/ United Nations. Manual X. Indirect Techniques for Demographic Estimation. Population Studies, No. 81. Department of International Economic and Social Affairs. United Nations. New York, N.Y., 1983.

Results are shown in part (c) of Table 16. It may be noted in passing that the average parities thus obtained from the fertility survey are remarkably similar to the average parities calculated from the 1982 census, indicating that the age-specific rates from the fertility survey for the cohorts considered are highly consistent with the lifetime fertility reported to the 1982 census. The estimates of child mortality level shown in Table 16 (c) do not agree closely with the stepwise estimates. The agreement is adequate for the early and mid-1970's, but the indirect estimates for around 1980 indicate much higher child mortality than either the stepwise process or the 1981 life table; indeed, they suggest an increase in child mortality from 1979 to 1981. In applying the indirect estimation procedure, it is common to find estimates of child mortality based on reports of women aged 15-19 and (to a lesser extent) 20-24 that are heavier than those based on reports of women aged 25-34; we believe that selection effects often distort the estimates for younger women. However, these problems do not generally extend to women aged 25-29, who are also in this application providing high estimates of child mortality relative to the stepwise estimates. It is possible, however, given the high age at first birth in China in the late-1970's and early 1980's--the modal age at first birth in 1980 and 1981 was 24 years--that these selection biases have continued to a higher than normal age, affecting even the proportions dead of women aged 25-29. Thus, these indirect estimates confirm the general level of child mortality in the early and mid-1970's, but provide an additional indication that there was little change in child mortality from the mid-1970's onwards, and that the stepwise process is underestimating child mortality for this period. However, the indirect procedure is not immune from error, and could in this instance overestimate recent child mortality if abortions and still-births were included in reports of children ever born and

children not surviving. Accepting the indirect estimates would imply that there was a substantial underestimation of children under age 10 by the 1982 census relative to coverage at other ages, necessary to explain the underestimates of the stepwise process. The group census-taking format of the 1982 census might omit children differentially, though checks with registers were supposedly made.

In conclusion, these comparisions with independent sources confirm the general trend of child mortality decline from 1964 to the mid-1970's, but indicate heavier child mortality, and a slower rate of mortality decline from 1975 onwards than does the stepwise process. For this recent period, we are unable to draw firm conclusions about child mortality levels and trends. All the data sources used may contain errors, and we have no firm basis for choosing between the various estimates. In what follows, we accept the stepwise estimates because such acceptance maintains consistency between the key sources—the 1982 age distribution, birth registration, and the fertility survey. In the summary section, however, we accept final estimates of infant and child mortality that are more or less consistent with the 1981 life table, and thus a compromise between the stepwise and indirect estimates, though our conclusions for this period must be heavily qualified by admissions of uncertainty.

Turning to adult mortality, we can proceed as for the period 1953-64—estimate total intercensal deaths and the deaths before age 10 (using the period mortality levels in Table 15) by fiscal year, then estimate total deaths at ages 10 and over, and then distribute these deaths by fiscal year on the basis of assumed trends in death registration completeneness, both under and over age 10. For the period 1964-82, however, we have two additional pieces of information: deaths by age group from the CES, and the 1981 life

table. Rather than use the CES calculated or adjusted life tables, which are based on a suspect population age distribution, we have derived a life table above age 10 directly from the age distribution of deaths using age-specific population growth rates between 1964 and 1982. Deaths by age in any population can be converted into deaths in the stationary or life table population by expanding the deaths by age by the cumulated population growth rates below the age in question. The resulting life table will be correct, so long as the age distribution of deaths and the growth rates are correct; that is, regardless of absolute registration coverage, so long as coverage is constant by age. The calculations and derived life table measures--survivorship from age 10 and age-specific mortality rates--are shown in Table 17. The age-specific mortality rates are then applied to a 1974 age distribution above age 10 for all China obtained by interpolating between the 1964 and 1982 census age distributions to estimate true deaths over age 10 in 1974. Total deaths over age 10 are calculated as 4981 thousand for 1974, for which year child deaths are estimated as 1999 thousand, and registered deaths totaled 6572 thousand. It is then possible to calculate combinations of death registration completeness below and above age 10 consistent with these values: if deaths over age 10 were completely registered, deaths under age 10 were 79.6 percent covered, whereas if deaths under age 10 were completely registered, deaths over age 10 were 91.8 percent covered. We then used the ratio of "true" deaths under age 10 to "true" deaths over age 10, 0.4013, and the corresponding ratio from CES deaths, assumed to be based on registration, 0.3743, to estimate the true combination of registration completeness under and over age 10. The estimates obtained indicate that deaths over age 10 were 96.0 percent registered, whereas deaths under age 10 were 89.5 percent registered.

TABLE 17

TABLE 17. Estimation of 1974 Life Table from Cancer Epidemiology Survey Deaths by Age and Age-specific Growth Rates, 1964-82, and Estimated Deaths over Age 10 in 1974: China

Age Group x,x+4	Both Sexes Population 1964	1982	$5^{r}x$	Deaths 73-75	$5^{d}x$	1974 Life Table Functions l(x)/l(10)	$5^{m}x$	1974 Estimated Mid-Year Population	Deaths
10-14	86959	132048	.02321	95	100.7	1.0000	.00104	98019	102
15-19	63179	126793	.03870	81	100.2	.9948	.00104	92367	96
20-24	52319	75724	.02054	112	160.7	.9896	.00169	85051	144
25-29	50804	92761	.03345	104	170.8	.9813	.00181	61455	111
30-34	47037	73095	.02449	102	193.6	.9725	.00207	50716	105
35-39	41460	54306	.01499	133	278.6	.9625	.00302	49028	148
40-44	35897	48474	.01669	168	380.9	.9480	.00420	45391	191
45-49	31071	47457	.02353	221	554.1	.9283	.00627	38874	244
50-54	26693	40925	.02374	291	821.1	.8997	.00967	32906	318
55-59	22728	33971	.02233	375	1187.3	.8572	.01486	26736	397
60-64	17797	27431	.02404	512	1820.3	.7958	.02515	22182	558
65-69	11718	21306	.03321	559	2293.2	.7017	.03693	16811	621
70-74	7430	14374	.03666	653	3190.1	.5831	.06593	11037	728
75-79	3784	8621	.04575	485	2911.4	.4181	.08786	5977	525
80+*	1826	5058	.05660	579	5171.6	.2675	.20000	3470	694
Total	500702	802344	.02620	4470	19334.5	59.67			4981

*Expectation of life at age 80, e(80) assumed to be 5.0 years.

Numbers are in thousands.

We then apply the 1981 life table to an estimated 1981 population obtained by reverse projecting the 1982 age distribution by one year. Deaths over age 10 total 5282 thousand. Deaths under age 10, taken from the stepwise procedure child mortality estimates applied to annual births (assuming constant registration completeness of 0.909 from 1976 onwards) total 986 thousand. Registered deaths totaled 6361 thousand in 1981, implying an overall completeness of death registration of 101.5 percent. This implied over-registration of deaths in 1981 is a further indication that the stepwise estimates of child mortality may be too low for the years up to 1982. We assume that death registration was in fact virtually complete in 1981, both below and above age 10.

Total deaths between 1964 and 1982 are found as the difference between the 1964 population (696,387 thousand) plus intercensal births (447,002 thousand) and the 1982 population (1,008,175 thousand), giving 135,214 thousand deaths, of which 115,670 thousand were registered. Given deaths by fiscal year under 10 from the stepwise process, and assuming that in 1964-65 deaths under 10 were 45 percent registered while deaths over age 10 were 80 percent registered, total deaths by year were found, assuming that registration completeness improved both for child and adult deaths in such a way as to pass through the estimates derived above for 1974 and 1981 and also to give the correct total of intercensal deaths. The results are shown in Table 18. The fiscal year total deaths are shown again in Table 3, where the population evolution from 1964 to 1982 is obtained from annual births and deaths. The sequence of deaths in Table 18, and death rates in Table 3, look plausible enough, but the year-to-year changes should be interpreted with caution, since the annual sequence of completeness estimates consists of a series of guesses passing through two empirically estimated points. Thus, the

TABLE 18. Registered Deaths, Estimated Child and Adult Deaths, Registered Deaths and Death Registration Completeness, and Total Estimated Deaths: China, Fiscal years 1964-82

Fiscal Year	Registered Deaths	Deaths under Age 10			Deaths over Age 10			Total Estimated Deaths
		Estimated Deaths	Registration Completeness	Registered Deaths	Registered Deaths	Registration Completeness	Estimated Deaths	
1964-65	7508	4197	0.45	1889	5619	0.80	7014	11211
1965-66	6564	3872	0.50	1936	4628	0.82	5636	9508
1966-67	6384	3492	0.55	1921	4463	0.84	5306	8798
1967-68	6335	3359	0.60	2015	4320	0.86	5016	8375
1968-69	6369	3334	0.65	2167	4202	0.88	4768	8102
1969-70	6299	3194	0.70	2236	4063	0.90	4508	7702
1970-71	6143	3041	0.75	2281	3862	0.91	4238	7279
1971-72	6364	2820	0.80	2256	4108	0.92	4458	7278
1972-73	6363	2545	0.83	2112	4251	0.93	4564	7109
1973-74	6342	2175	0.86	1871	4472	0.94	4750	6925
1974-75	6655	1823	0.89	1632	5023	0.95	5288	7111
1975-76	6714	1513	0.91	1377	5337	0.96	5560	7073
1976-77	6643	1373	0.92	1270	5373	0.96	5597	6970
1977-78	6202	1154	0.94	1085	5117	0.97	5276	6430
1978-79	5921	957	0.95	909	5012	0.97	5167	6124
1979-80	6091	1006	0.96	966	5125	0.98	5230	6236
1980-81	6266	920	0.97	892	5374	0.98	5483	6403
1981-82	6507	968	0.98	949	5558	0.99	5615	6583
Total	115670	41743	0.75	29762	85908	0.92	93471	135214

Numbers are in thousands.

general trends are probably approximately correct, but may well miss short-term fluctuations. For instance, if mortality over age 10 increased in a particular year while death registration completeness fell, the methodology applied here would not detect the mortality increase.

Average post-child mortality for the period 1964-82 can be estimated from intercensal survivorship ratios from 1964 to 1982. Table 19 shows the survivorship ratios and the implied "West" mortality levels. Intercensal survivorship ratios for long intervals such as that between 1964 and 1982 under conditions of changing mortality tend to overweight period mortality levels for which the cohort death rates are highest. Thus, the survivorship ratio for the cohort aged 0-4 in 1964 will overweight mortality levels early in the intercensal period, when most of the cohort deaths occurred, whereas the ratios for cohorts aged 50 and over in 1964 will overweight mortality levels toward the end of the period when most of the cohort deaths were occurring. The most robust estimates of average intercensal mortality levels should thus be obtained from the survivorship ratios for the central range of ages, where mortality rates are not changing rapidly with age. For cohorts aged 10-49 in 1964, the average "West" mortality level for males is 20.1, implying an expectation of life at age 10 of 58.6 years; comparable figures for females are a "West" level of 19.3 and an expectation of life at age 10 of 60.5 years. The 1974 life table derived in Table 17 indicates an expectation of life at age 10 for both sexes of 59.7 years, very close to the both sexes average of 59.5 years obtained from intercensal survival. Two other features of Table 19 may be noted. First, the mortality levels for males over age 45 in 1964 fall quite sharply with age, indicating higher old-age male mortality than would be expected on the basis of young and middle-age mortality; females show a similar, though less pronounced, pattern. Second, the survivorship

TABLE 19. Intercensal Mortality Estimates by Sex from Cohort Survival; China, 1964-82

Cohort Age, 1964	Males				Females			
	Cohort Population		Survivorship Ratio	'West' Mortality Level	Cohort Population		Survivorship Ratio	'West' Mortality Level
	1964	1982			1964	1982		
0-4	51814	49373	.9529	18.1	49033	46383	.9460	16.9
5-9	49621	46878	.9447	16.1	45219	43511	.9622	17.8
10-14	45314	43178	.9529	18.6	41645	40346	.9688	19.6
15-19	33205	31523	.9493	19.3	29974	28553	.9526	18.7
20-24	27805	26309	.9462	19.8	24514	23125	.9433	18.7
25-29	27036	25315	.9363	20.1	23768	22293	.9379	19.3
30-34	24891	23373	.9390	22.0	22146	20702	.9348	20.4
35-39	21739	19226	.8844	20.7	19721	17580	.8914	19.0
40-44	18565	15497	.8347	21.0	17332	15017	.8664	20.1
45-49	15819	11342	.7170	19.0	15252	11926	.7819	18.7
50-54	13384	7943	.5935	18.3	13309	9136	.6865	18.8
55-59	10823	4627	.4275	16.6	11905	6297	.5289	17.6
Average Level 10-49				20.1				19.3

ratios for males and females aged 5-9 in 1964 are lower than expected, suggesting either high adolescent mortality relative to mortality at other ages, an over-enumeration of 5-9 year-olds in 1964, or an under-enumeration of 23-27 year-olds in 1982, relative to overall enumeration completeness. We found no clear indication of relative over-enumeration of 5-9 year-olds in 1964, so the survivorship ratios suggest that there may have been some under-enumeration of young adults of both sexes in 1982. Such a relative under-enumeration might help explain the problems with the stepwise child mortality estimation procedure, since too few women would result in too few estimated births on the basis of the 1982 survey fertility rates, and thus survivorship ratios of births to the 1982 census that were too high.

The procedure used to obtain rough estimates of expectation of life at birth and at age 10 by fiscal year for the period 1953-64 cannot be applied to the period 1964-82. As the intercensal growth rates in Table 17 show, the population over age 10 was by no means stable over the period--age-specific growth rates vary sharply by age--and the death rates over age 10 by fiscal year are affected by the changing age structure, with the effects of falling mortality being attenuated by a gradual aging of the population. We do, however, have estimates of expectation of life at birth and age 10 from the 1981 life table, and of expectation of life for both sexes at age 10 from the 1974 life table; this latter value can be used as a basis for estimating both expectation of life at age 10 by sex, assuming the male-female differential implied by the intercensal survival ratios in Table 19, and expectation of life at birth by sex, adding in the average of the stepwise child mortality estimates for 1973-74 and 1975-75. Our estimates of life expectancy for 1974 and 1981 are given in Table 20.

TABLE 20. Expectation of Life at Birth and at Age 10 by Sex; China, 1974 and 1981

Year	Males		Females	
	e(o)	e(10)	e(o)	e(10)
1974	63.6	58.8	65.1	60.6
1981	66.4	60.4	68.3*	63.4

* Adjusted for estimated effects of excess infant female deaths.

Population Age Distribution, Mid-1980

For population projection purposes, it is useful to have an age distribution for mid-year 1980 as a starting point for projections by standard five-year periods. Table 21 provides such an age distribution, obtained by reverse-projecting the 1982 age distribution (after adjustment for military-age males and redistribution of the population under age six to conform to the assumption of constant birth registration completeness from 1976 to 1982) using the 1981 life table.

TABLE 21. Population by Age and Sex, Mid-1980, China

Age Group	Males	Females
0-4	48647	45384
5-9	64030	60073
10-14	66060	62201
15-19	54629	51489
20-24	44351	41150
25-29	45554	42762
30-34	34150	30972
35-39	27061	23895
40-44	25654	22426
45-49	24101	21365
50-54	20470	18432
55-59	16831	15984
60-64	12876	13080
65-69	9356	10278
70-74	5934	7572
75-79	3052	4581
80+	1368	2565
Total	504125	474209

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ISSN 0259-210X / ISBN 0-8213-1022-4 / DP0022

Paper Number 22

Demographic Trends in China from 1950 to 1982

The World Bank