CHAPTER 4

FERTILITY AND MORTALITY

4.1 Fertility

Contraceptive use in the Mwanza Region has risen from a very low level of 4 percent in 1991/1992 to 16 percent in late 1994.[1] Following increases in the use of modern contraception, levels of fertility are expected to fall. For this particular study area (Kwimba District), no estimates of the total fertility rate exist, although an estimate of 6.9 children per woman in the "Lake Region" of Tanzania (includes study area) was reported for the 1989-91 period.

Drawing from the own birth histories collected in the SACM,[2] this section begins with the description of fertility patterns, and is followed by a presentation of information regarding age of women at first birth and patterns of adolescent childbearing.

The fertility indices presented in this chapter are based on reports provided by women age 15-49 years regarding their reproductive histories. Each women was asked to provide information on the total number of sons and daughters to whom she had given birth who were living with her, the number living elsewhere, and the number who had died. In the birth history, women reported on the detailed history of each of their live births separately, including such information as name, month and year of birth, sex, and survival status. For children who had died, information on age at death was obtained.

4.1.1 Current Fertility

The most widely used measures of current fertility are the total fertility rate (TFR) and its component, age-specific fertility rates (ASFR). The TFR is defined as the number of children a woman would have by the end of her childbearing years if she were to pass through those years bearing children at the currently observed age-specific rates.[3]

Table 4.1 shows the age-specific and aggregate fertility measures calculated from the SACM data. The total fertility rate (TFR) for the SACM sample is 7.4 children per woman. Peak childbearing occurs during ages 20-24 and 25-29, dropping sharply after age 34. A comparison of the number of children ever born among women age 45-49 (7.7 children), which represents past fertility trends, with the current TFR (7.4) suggests that a small recent decline in the study area has occurred.

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[1] Estimates are from the 1991/1992 TDHS (Ngallaba et al., 1993) and the 1994 TKAPS (Weinstein et al., 1995) based on currently married women age 15-49.

[2] To maintain estimates that are representative for the geographic area covered in this study, only the birth histories of Phase I respondents are used in the calculation of demographic rates presented throughout this chapter.

[3] Numerators for the age-specific fertility rates are calculated by summing the number of live births that occurred in the 1-36 months preceding the survey (determined by the date of interview and birth date of the child), and classifying them by age (in five-year groups) of the mother at the time of birth (determined by the mother's birth date). The denominators of the rates are the number of woman-years lived in each of the specified five-year age groups during the 1-36 months preceding the survey.

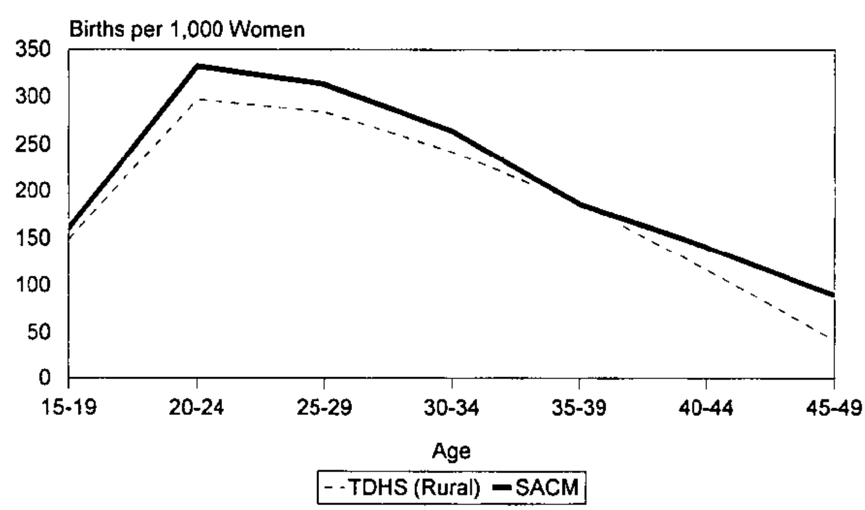
Table 4.1 Current fertility

Age-specific and cumulative fertility rates for the three years preceding the survey, and the mean number of ever born and living children, according to five-year age groups, SACM 1995 (Phase I)

Age group	Fertility rate	Mean number of children ever born	Mean number of living children
15-19	160	0.25	0.23
20-24	332	1.59	1.41
25-29	313	3.25	2.86
30-34	264	4.84	4.06
35-39	186	6.31	5.44
40-44	141	6.88	5.72
45-49	90	7.70	6.17
TFR 15-49	7.4		
TFR 15-44	6.9		
GFR	247		

Compared to the national-level rural TFR estimate of 6.6 children per woman (from the 1991/1992 TDHS survey which used the same estimation methodology), the present estimate for Kwimba District is nearly one child greater. Figure 4.1 shows that higher fertility in the Kwimba District is demonstrated at all ages of women.

Figure 4.1
Age-specific Fertility Rates
1991/1992 TDHS and 1995 SACM



4.1.2 Early Childbearing

Table 4.2 shows that the median age at first birth in Kwimba District is around 19.5 years, which is roughly the same as the national rural estimate from the 1991/1992 TDHS (19.3 years) for the same age group (the cohort currently age 20-34 years). When examining across age groups (cohorts) in the SACM data, it is observed that very little if any change has occurred in the median age at entry to childbearing over the past decade or so. While this broad index has apparently not changed over the last several years, a more detailed analysis of trends in age at first birth does reveal a decline in childbearing at very early ages (i.e., before age 15) from 6 percent of women currently age 30-34 to 1 percent of women age 15-19.

Table 4.2 Age at first birth

Percent distribution of women age 15-34 by age at first birth, according to current age, SACM 1995 (Phase I)

Current age	Women with no births	Age at first birth <15	15-17	18-19	20-21	22-24	25+	Total	Number of women	Median age at first birth
15-19	78.4	1.1	14.3	6.2	NA	NA	NA	100.0	447	a
20-24	16.0	2.6	30.2	27.4	21.3	2.4	NA	100.0	465	19.4
25-29	3.9	4.0	24.7	28.5	24.4	11.3	3.1	100.0	385	19.5
30-34	2.5	5.8	27.3	23.5	21.5	14.1	5.2	100.0	277	19.4

NA = Not applicable
[a] Omitted because less than 50 percent of the women in the age group x to $x+4$ have had a birth by age x

The issue of adolescent fertility is an important one on both health and social grounds. Children born to very young mothers are at increased risk of sickness and death. Adolescent mothers themselves are more likely to experience adverse pregnancy outcomes and, in any case, are more constrained in their ability to pursue educational and economic opportunities than their counterparts who delay childbearing. The slow but steady decrease in very early childbearing discussed earlier may reflect positively on efforts to keep younger women in school to complete more advanced levels, and improve their social and economic prospects.

Table 4.3 looks at the issue of adolescent fertility in more detail, providing the percent distribution of women (age 15-19) who are mothers or are pregnant with their first child at the time of the survey, according to single years of age and educational level. The proportion of teenagers who are already mothers is 22 percent, and another 7 percent are currently pregnant. The proportion of adolescents already on the family formation pathway rises very rapidly with age from 5 percent at age 15 years to 58 percent at age 19 years (Figure 4.2). As expected, adolescents without education start childbearing much earlier than those who have attended school.

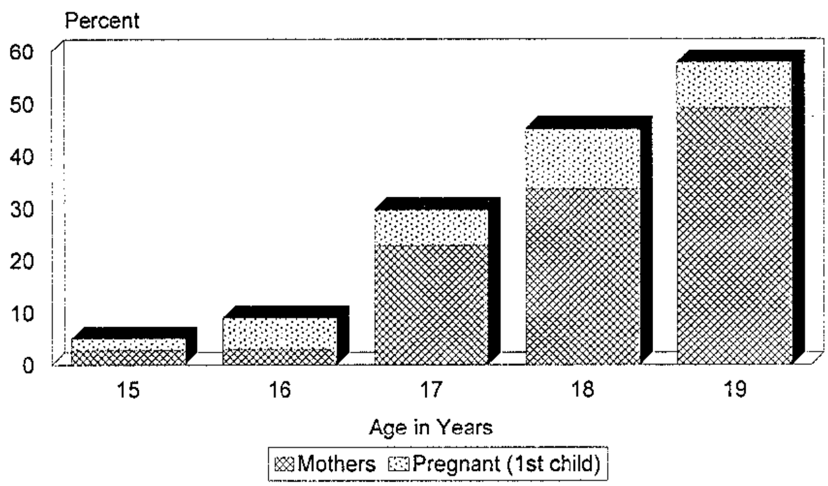
Table 4.3 Adolescent fertility

Percentage of women 15-19 who are mothers or pregnant with their first child, by age and educational status, SACM 1995 (Phase I)

Background characteristic	Percentage who are: Mothers	Percentage who are: Pregnant with first child	Percentage who have begun child-bearing	Number of women
Age				
15	2.8	2.3	5.1	89
16	3.0	6.1	9.1	99
17	22.8	7.0	29.7	79
18	33.7	11.6	45.2	100
19	49.1	8.7	57.8	81
Education				
No education	29.8	11.5	41.3	104
Some education[1]	19.4	5.9	25.3	343
Total	21.6	7.2	28.8	447

[1] All but seven girls had not reached secondary school.

Figure 4.2
Percentage of Women 15-19 Who Are
Mothers or Pregnant with Their First Child, by Age



SACM 1995

4.2 Childhood Mortality

This section presents information on mortality patterns of children under five years of age in the SACM study area; specifically, estimates are presented on levels, trends and differentials in neonatal, postneonatal, infant, and child mortality. This information is relevant for both the demographic assessment of the population and the evaluation of health policies and programs. Estimates of infant and child mortality may be used as inputs into population projections, particularly if the level of adult mortality is known or can be inferred with reasonable confidence. Information on mortality of children also serves the needs of organizations providing health services by identifying sectors of the population which are at high mortality risk.

The mortality rates presented in this chapter are defined as follows:

- **Neonatal mortality (NN):** the probability of dying within the first month of life,
- **Postneonatal mortality (PNN):** the arithmetic difference between infant and neonatal mortality,
- **Infant mortality ($_1q_0$):** the probability of dying between birth and the first birthday,
- **Child mortality ($_4q_1$):** the probability of dying between exact ages one and five,
- **Under-five mortality ($_5q_0$):** the probability of dying between birth and the fifth birthday.

All rates are expressed as deaths per 1,000 live births, except child mortality which is expressed as deaths per 1,000 children surviving to the first birthday.

The mortality rates presented in this chapter are calculated from information drawn from the questions asked in the "own" birth histories of the representative sample of Phase I women. Details of the mortality estimation methods are given in Appendix A.

It is important to note that any method of measuring childhood mortality that relies on mothers' reports (e.g., birth histories) rests on the assumption that adult female mortality is not very high or, if it is high, that there is little or no correlation between the mortality risks of mothers and their children. In countries with high rates of adult female mortality, these assumptions will often not hold and the resulting childhood mortality rates will be understated to some degree. Of course, this inherent problem in survey data was the basis for implementing the present study and is discussed in the next chapter which is largely methodological in nature. Here, the intention is simply to provide the "best" estimates of childhood mortality for this study area with the aim of informing, in a substantive way, policy supporting improved child health and welfare.

4.2.1 Levels and Trends in Early Childhood Mortality

Table 4.4 presents childhood mortality rates for periods 0-4, 5-9, and 10-14 years before the survey. Under-five mortality for the period 0-4 years before the survey (circa 1991-1995) is 134 deaths per 1,000 births; this means that, currently, roughly 1 in 7 children do not live to their fifth birthday. This is similar to the under-five mortality rate of 141 per 1,000 estimated for the period 1988-1992 from the 1991/1992 TDHS national survey.

About one-fifth of under-five deaths occur during the first month of life, two-fifths occur during the postneonatal period (1-11 months), and the remaining two-fifths occur during ages 1-4 years. The infant mortality rate stands at 83 deaths per 1,000, and child mortality stands at 55 per 1,000 live births. Breaking down infant mortality into its component parts, the neonatal mortality rate is estimated to be 25 per 1,000 and postneonatal mortality is 58 per 1,000.

Table 4.4 Infant and child mortality

Neonatal, postneonatal, infant, and child mortality rates by five-year periods preceding the survey, SACM 1995 (Phase I)

Years preceding survey	Neonatal mortality (NN)	Postneonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
0-4	25.4	57.7	83.1	55.0	133.5
5-9	21.5	76.6	98.1	63.7	155.5
10-14	12.8	56.3	69.1	89.8	152.7
0-9	23.6	66.0	89.6	58.8	143.2
0-14	21.1	63.8	84.9	66.0	145.3

The 1995 SACM data indicate that under-five survival has improved modestly over the period 1986-1990 to 1991-1995. Mortality before age five has fallen from 156 to 134 per 1,000 over this period and infant mortality from 98 to 83 per 1,000. However, the under-five mortality estimate for the period 10-14 years before the survey (circa 1981-85) is nearly the same as the 1986-1991 estimate, but may be understated due to the apparent shortfall of reported deaths in the neonatal period (see next chapter). Thus, a plausible interpretation of this pattern is that the under-five rate for the period 10-14 years before the survey is in fact slightly higher than that reflected in these data and that rates have been falling in a rather slow but uninterrupted fashion over the last decade in this population.

A significant finding from the SACM is the rather pronounced drop in mortality between ages 1 and 4 years specifically, from 90 to 55 per 1,000 (i.e., 39 percent decline). These are the ages most impacted by successful immunization programs, improvements in prevention and especially treatment of childhood infections.

4.2.2 Socio-demographic Differentials in Early Childhood Mortality

Differences in the risk of childhood death across mothers' socio-demographic characteristics are important to identify since they underscore points of potential program intervention to improve the survival chances of high-risk children. In this section, differentials in mortality by sex of the child, age of the mother at birth, birth order (rank), birth interval length, and educational status of the mother are examined. The mortality estimates are calculated for a 10-year period before the survey so that the rates are based on a statistically sufficient number of cases in each population subgroup.

Typically, male children encounter higher mortality risk than females during early childhood, due largely to heritable factors that lead to greater frailty at birth; this pattern is demonstrated in the SACM data (Table 4.5). Boys experience a 15 percent higher under-five mortality rate than girls (154 versus 134 per 1,000) (Figure 4.3). The male disadvantage in survival is seen at every age group.

The relationship between childhood mortality and mother's age at birth shows the expected U-shaped pattern with children of the youngest and the oldest women experiencing the highest risk of death. The excess risk associated with young maternal age is especially pronounced during ages 1-11 months—a period when supplementary foods are being introduced to the infant child. Older maternal age elevates risk sharply at all ages under five years. A similar but less pronounced pattern occurs regarding birth order of the child. First-order births and those of birth order 7 or more are observed to have higher mortality rates than their counterparts of birth orders 2-6.

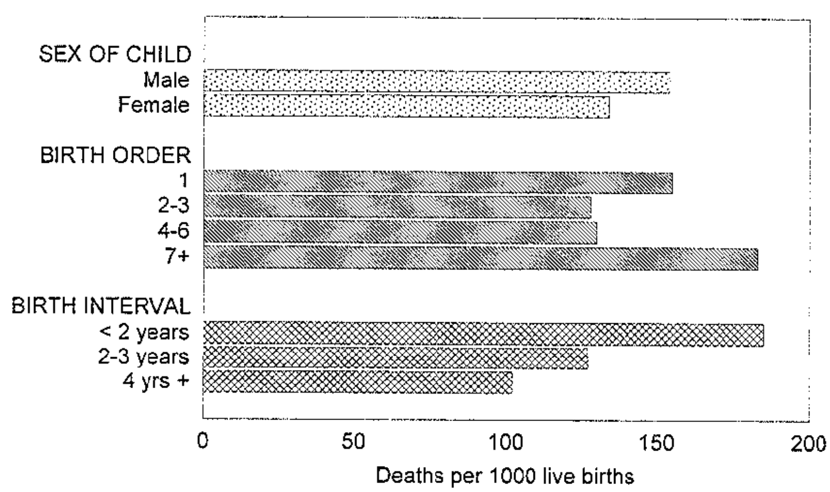
Table 4.5 Infant and child mortality by socio-demographic characteristics

Neonatal, postneonatal, infant, and child mortality rates for the 10-year period preceding the survey, by selected socio-demographic characteristics, SACM 1995 (Phase I)

Socio-demographic characteristic	Neonatal mortality (NN)	Postneonatal mortality (PNN)	Infant mortality ($_1q_0$)	Child mortality ($_4q_1$)	Under-five mortality ($_5q_0$)
Sex of child					
Male	26.2	69.2	95.4	65.2	154.4
Female	20.9	62.8	83.7	52.3	131.6
Mother's age at birth					
< 20	23.1	83.3	106.4	59.8	159.8
20-29	23.1	61.8	84.9	51.1	131.7
30-39	25.0	56.3	81.3	59.2	135.7
40-49	25.1	91.2	116.4	155.9	254.1
Birth order					
1	22.9	81.3	104.2	56.6	154.9
2-3	20.4	64.9	85.3	45.4	126.8
4-6	23.6	52.6	76.2	58.0	129.8
7+	30.3	72.0	102.3	86.7	180.1
Previous birth interval					
< 2 yrs	33.8	81.3	115.1	73.6	180.2
2-3 yrs	20.4	55.4	75.7	53.9	125.6
4 yrs or more	18.7	44.6	63.3	48.6	108.8
Education					
No education	23.0	66.9	89.9	62.3	146.6
Some education[1]	24.1	65.4	89.5	56.1	140.6
Total	23.6	66.0	89.6	58.8	143.2

[1] Less than 1 percent of mortality-risk exposure was to children of women with more than primary school education.

Figure 4.3
Under-five Mortality by
Selected Characteristics



Note: Rates refer to a 10-year period preceding the survey.

SACM 1995

A striking relationship exists between the pace of childbearing and the risk of early childhood mortality. The SACM data indicate that a short interval between births significantly reduces a child's chance of survival. Children born less than two years after their preceding siblings are almost twice as likely to die in infancy than those born four or more years after their preceding siblings (115 versus 63 per 1,000). The interval-mortality relationship is slightly attenuated, but still quite pronounced, after the infant period. During ages 1-4 years, children born after a short interval are 51 percent more likely to die than their counterparts born after a long interval (74 versus 49 per 1,000). These findings point to the potential for childhood mortality reduction that could result from successful efforts to improve and maintain adequate birth spacing in Kwimba District.

Little or no difference is observed between the survival chances of children born to women with some education and children of women with no education. This may in part be due to the very limited advancement in school for those women who do attend (see Chapter 3); less than 1 percent of children's exposure to mortality risk is associated with mothers who reached secondary school.

4.3 Adult and Maternal Mortality

In this section, the SACM data is used to examine patterns of adult and maternal mortality in the study population. First, a brief evaluation of the sibling history data is provided. Following this, the male and female deaths reported in the survey are examined with regard to their reported "cause" and where the reported deaths took place. The bulk of attention is, however, focused on the final two sections where rates of adult mortality (male and female) and then maternal mortality are presented and discussed.

4.3.1 Data Collection

Data were collected in the SACM that allow estimation of adult male and female mortality rates, including maternal mortality. Each respondent was first asked to give the total number of her natural mother's live births. Then the respondent was asked to provide a list of all of the children born to her mother starting with the first-born, and whether or not each of these siblings was still alive at the survey date. For living siblings, current age was collected; for deceased siblings, age at death and years since death were collected. When a respondent could not provide precise information on age or time passed, interviewers were instructed that an approximate quantitative answer was acceptable. For sisters who died at ages 12 years or older, the three following questions were used to determine if the death was maternity-related: "Was [NAME OF SISTER] pregnant when she died?" and if negative, "Did she die during childbirth?" and if negative, "Did she die within six weeks of the birth of a child or pregnancy termination?" A positive answer to any one of these three questions defined a maternal death.

For both brothers and sisters who died at 12 years of age or older, respondents were asked an additional series of four questions intended to establish the cause of death in broad categories; in particular, deaths related to AIDS or HIV infection. First, in two questions, respondents were asked whether the deceased sibling was "very sick for more than 2 months before his/her death" and "very thin in the two-month period before his/her death (wasted)." Next, the respondent was asked to report, in their own opinion, what the cause of the sibling's death was. Lastly, if the open-ended response did not mention AIDS or HIV, the respondent was asked whether the sibling "had AIDS when he/she died." Finally, for all deaths at 12 years of age or older, the respondent was asked "where did the death of [NAME] take place?"

The estimation of adult and maternal mortality by either direct or indirect means requires reasonably accurate reporting of the number of sisters and brothers the respondent ever had, the number who have died, and the number of sisters who have died of maternity-related causes. There is no definitive procedure for establishing the completeness or accuracy of retrospective data on sibling survivorship. Table 4.6 shows the

Table 4.6 Data on siblings

Number and percentage of siblings reported by female survey respondents and completeness of reported data on sibling age, age at death (AD) and years since death (YSD), SACM 1995

Survivorship status	Sisters		Brothers		All siblings	
	Number	Percent	Number	Percent	Number	Percent
All siblings	19,229	100.0	19,293	100.0	38,521	100.0
Living	16,496	85.8	16,211	84.0	32,708	84.9
Dead	2,717	14.1	3,063	15.9	5,780	15.0
Missing survival information	15	0.1	19	0.1	34	0.1
Living siblings	16,496	100.0	16,211	100.0	32,708	100.0
Age reported	16,480	99.9	16,203	100.0	32,683	99.9
Age missing	16	0.1	8	0.1	24	0.1
Dead siblings	2,717	100.0	3,063	100.0	5,780	100.0
AD and YSD reported	2,696	99.2	3,024	98.7	5,720	99.0
AD or YSD or both missing	22	0.7	38	1.2	60	1.0

number of siblings reported by the respondents and the completeness of the reported data on current age, age at death, and years since death.

The sex ratio of enumerated siblings (the ratio of brothers to sisters) was 1.00,[4] which is slightly low for this population and could be due to undereporting of male births by the respondent. In very few cases (< 0.1 percent), sibling's ages were not reported by the respondent. In the case of deceased siblings, complete reporting of age at death and years since death was also nearly universal. More than 99 percent of deceased siblings have both age at death and years since death reported. Rather than exclude the small number of siblings with missing data from further analysis, information on the birth order of siblings in conjunction with other information was used to impute the missing data.[5] The sibling survivorship data, including cases with imputed values, were used in the direct estimation of adult and maternal mortality.

4.3.2 Reported Cause of Death

It should be emphasized at the outset of this section that a detailed verbal autopsy was not included in the SACM questionnaire. Aside from the standard series of three maternity-related questions, these data were not expected to yield information that would allow reliable cause-specific mortality rate calculation. Frank reports of AIDS- and HIV-related deaths were of interest as was a broad classification of "causes" that

[4] From Table 4.6, the ratio is calculated as follows: 19,293 reported males/19,229 reported females = 1.003.

[5] The imputation procedure is based on the assumption that the reported birth ordering of siblings in the sibling history is correct. The first step is to calculate birth dates. For each living sibling with a reported age and each dead sibling with complete information on both age at death and years since death, the birth date was calculated. For a sibling missing these data, a birth date was imputed within the range defined by the birth dates of the bracketing siblings. In the case of living siblings, an age was then calculated from the imputed birth date. In the case of dead siblings, if either the age at death or years since death was reported, that information was combined with the birth date to produce the missing information. If both pieces of information were missing, the distribution of the ages at death for siblings for whom the years since death was unreported but age at death was reported, was used as a basis for imputing the age at death.

would be reported in an open-ended format feasible within a large DHS-type national survey effort. The open-ended responses were analyzed by two physicians associated with the study and classified with an eye towards informing the research and evaluation community in Tanzania about the utility of this simple type of data collection.

Table 4.7 Reported cause of death

Percent distribution of adult male and adult female deaths in the 15 years before the survey, according to reported cause of death, SACM 1995 (Phase 1)

Reported cause of death	Female (n = 234)	Male (n = 261)
Maternal deaths	33	--
Non-maternal deaths	67	100
AIDS/HIV	6	6
Tuberculosis	9	10
Malaria/Fever[1]	12	9
Other infectious disease	14	13
"Pains" of various types	25	17
Accidents/Trauma	5	8
"Bewitched"	2	3
Other unspecific	22	25
Don't know/missing	5	10
Total	100	100

[1] For both females and males, if unspecified "fever" is removed, this category would be reduced to 3 percent.

The SACM sibling histories uncovered a total of 495 deaths at ages 15 years and above (261 males and 234 females) (Table 4.7). For 10 percent of the male deaths and 5 percent of the female deaths, no useful information was provided by the respondent that would allow cause-of-death classification.[6] Presumably, the information on females was more completely reported for two reasons: (1) some maternal deaths in particular were more readily defined since a set of three questions are initially and directly put to the respondent on these specific causes, and (2) the respondents were female and therefore may have been more familiar with the circumstances surrounding their sisters' deaths than those of their brothers' deaths.

Nearly one-third (33 percent) of all female deaths were maternity-related, which is barely in the range (25-33 percent) typically reported for developing countries (Royston and Lopez, 1987; Graham et al., 1989), but much higher than the 14 percent reported by Walraven et al. (1994) for the same general Kwimba District population, using Brass-type data (i.e., aggregate-level information).

Of the remaining (non-maternal) female deaths, 6 percent were AIDS-related,[7] 9 percent were reported as due to tuberculosis, 12 percent to malaria/fever, 14 percent to "other" specific (named) infectious diseases, 5 percent to traumatic events including accidents and murder, 25 percent to reported "pain" (mainly "abdominal pain"), and 22 percent to "other" causes that included unspecific signs such as "swelling" and "bleeding." Two percent of nonmaternal female deaths were reported to have been caused by "bewitchment."

The distribution of male deaths by reported "cause" is similar to the non-maternal female cause-of-death distribution, except that deaths associated with various "pains" and malaria/fever were less commonly reported and those related to traumatic events, bewitchment, and other unspecified causes were more commonly cited amongst the male deaths.

Some lessons can be drawn from these findings. The most important result of this exercise is that a high proportion of all female deaths in this population (33 percent) is related to maternity-related

[6] These include missing and "don't know" responses on the open-ended question, "In your opinion, what was the cause of [NAME]'s death?" but only if the death had not already been classified as maternal based on the three standard "maternity-related" questions.

[7] These include only those reported as due to AIDS or HIV infection, and does not include others where symptoms may have pointed to AIDS or HIV infection. The estimate of AIDS proportionate mortality reported here is therefore a lower bound estimate. When looking at the responses to the questions on long-term illness and wasting (2 months or longer), they were found to be highly sensitive (all but one of the reported AIDS deaths were also reported as having had a long-term illness and wasting), but highly unspecific (5-6 times as many non-AIDS deaths were also reported to have experienced these two "symptoms"), thereby demonstrating the questions' limited utility in estimating AIDS-related mortality rates.

causes—much higher than previously reported for this population (14 percent) (Walraven et al., 1994). It seems likely that a full sibling history, which allows probing on causes of deaths for specific (named) sisters, produces better results than the sisterhood method that relies on aggregate-level data collection.

Aside from maternal death ascertainment, this type of simple data has limited use. Over half of all nonmaternal deaths (54 percent of female deaths and 55 percent of male deaths) could not be placed in a biomedically useful category.[8]

4.3.3 Place Where Death Occurred

Table 4.8 shows the distribution of male, maternal, and non-maternal female deaths by the reported place where the death occurred. Overall, 22 percent of adult deaths took place in the hospital and another 6 percent on the way to the hospital. Over half of deaths (54 percent) took place at the person's home, 7 percent at the traditional healer's home, and 5 percent elsewhere. For 7 percent of deaths, the respondent either did not know the location of the sibling's death or the response was not given or not recorded (i.e., missing data).

Maternal deaths were much more likely than other deaths (male or female) to have occurred in the hospital (36 percent) or on the way to the hospital (12 percent)—a finding which is not surprising since 38 percent of deliveries in this population occur in the hospital (see Chapter 3). Female non-maternal deaths are more likely than male deaths to have occurred at home (64 percent); male deaths are more likely than female deaths to have taken place at the traditional healer (10 percent).

Table 4.8 Reported place of death

Percent distribution of adult deaths in the 15-year period before the survey by reported place where death occurred, according to sex, SACM 1995 (Phase I)

Place of death	Male	Female maternal death	Female non-maternal death	Total
Home	51.3	40.8	63.9	53.7
Traditional healer	10.0	5.3	2.5	6.9
Hospital	18.8	35.5	19.6	21.6
On way to hospital	5.0	11.8	4.4	5.9
Other	6.5	2.6	3.2	4.8
Missing	8.4	3.9	6.3	7.1
Total	100.0	100.0	100.0	100.0
Number	261	76	158	495

4.3.4 Adult Mortality

Direct estimates of adult mortality were calculated from the sibling history data using the approach developed for the DHS project by Rutenburg and Sullivan (1991). The method maximizes use of the available data, using information on the age of surviving siblings, the age at death of siblings who died, and the number of years ago the sibling died. This permits the data to be aggregated to determine the number of person-years of exposure to mortality risk and the number of sibling deaths occurring in defined calendar

[8] This is the best scenario in that deaths associated with unspecified "fever" are placed together with malaria (see footnote at bottom of Table 4.7).

periods. Age-specific, period-specific rates of adult mortality are obtained by dividing the number of deaths by person-years of exposure.[9]

Table 4.9 presents the age-specific rates of male and female mortality (15-49 years) for the 14-year period before the survey, calculated through direct procedures. Since the numbers of deaths on which the rates are based are not large (180 female and 197 male deaths), the estimated rates for five-year age groups have large *relative* standard errors and should be interpreted with this in mind.

In Table 4.9 and in Figure 4.4, the observed age-specific rates are compared with model mortality schedules for males and females. Embodied in a model life table is the relationship between mortality during

Table 4.9 Adult mortality rates

Direct estimates of male and female adult age-specific mortality rates for the period 0-9 years before the survey, SACM 1995, and model life table rates, by age

MALES					
				Model Life Table Rates[1]	
Age	Deaths	Exposure	SACM mortality rates	Coale-Demeny WEST (55 years)	Coale-Demeny SOUTH (56 years)
15-19	14	11,875	1.18	3.50	2.15
20-24	31	11,239	2.76	4.99	3.26
25-29	33	9,394	3.51	5.43	3.29
30-34	53	6,858	7.73	6.21	3.88
35-39	26	4,578	5.68	7.50	4.46
40-44	24	2,759	8.70	9.54	5.95
45-49	16	1,486	10.77	12.31	7.96
15-49	197	48,187	4.51[a]	5.61	3.49

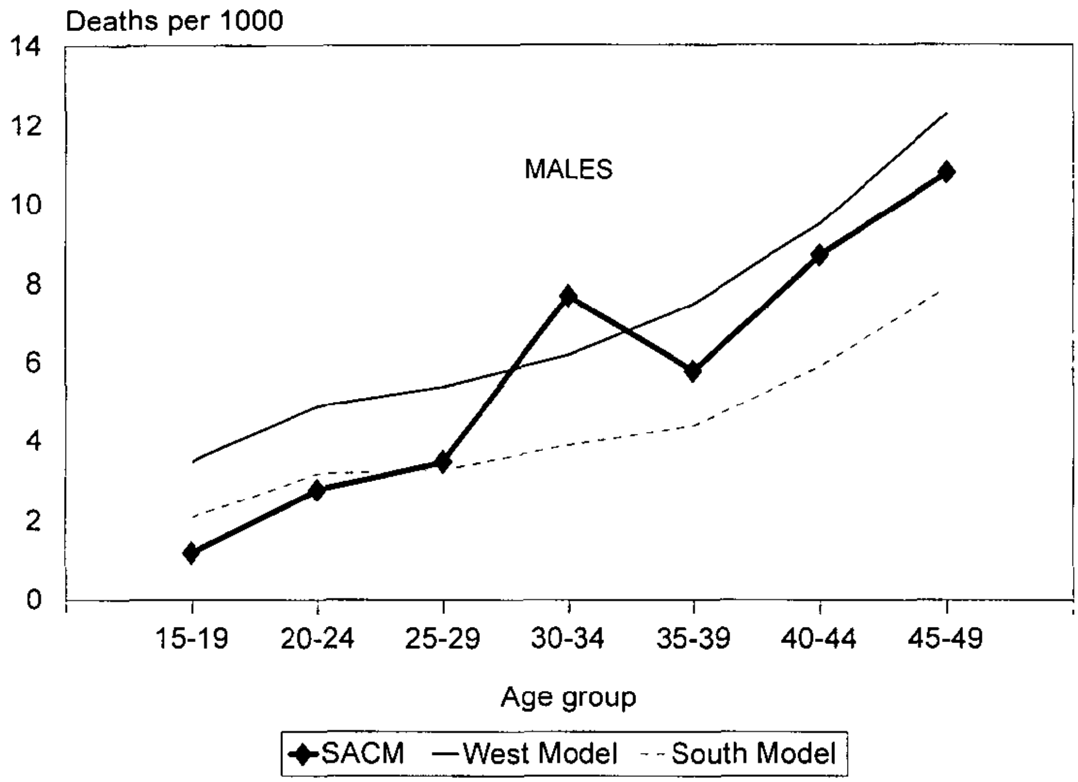
FEMALES					
				Model Life Table Rates[1]	
Age	Deaths	Exposure	SACM mortality rates	Coale-Demeny WEST (56 years)	Coale-Demeny SOUTH (61 years)
15-19	27	12,213	2.21	3.34	1.73
20-24	38	11,438	3.32	4.29	2.30
25-29	32	9,351	3.42	5.06	2.66
30-34	31	6,808	4.55	5.77	2.89
35-39	30	4,315	6.95	6.55	3.38
40-44	18	2,577	6.99	7.58	4.12
45-49	4	1,327	3.02	9.15	5.03
15-49	180	48,029	3.84[a]	4.92	2.58

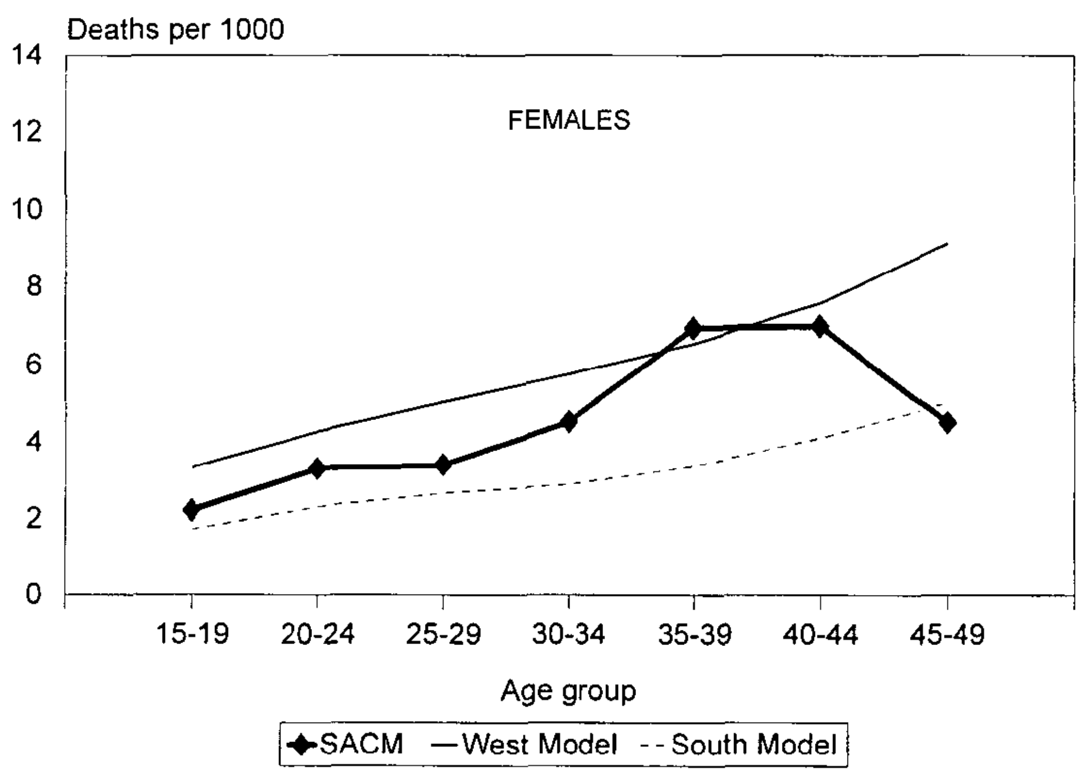
[a] Age-adjusted rates
[1] Model life tables were selected at a level of mortality approximately corresponding to a sex-specific probability of dying between birth and age 5 for the period 0-9 years before the survey (i.e., 154 per 1,000 for males, 134 per 1,000 for females). Mortality rates are expressed per 1,000 population. Life expectancies at birth are given in parentheses.

Source: Coale and Demeny, 1966

[9] Unlike "rates" of childhood mortality which are calculated as life table *probabilities*, the rates of adult mortality are true *rates*, i.e., deaths per person-*year*.

Figure 4.4
Adult Mortality by Age Group, for the Period 0-13 Years Before the SACM, and Two Model Life Tables





childhood and mortality during later years. Some models posit high child mortality relative to adult mortality levels, while others describe low child mortality relative to adult mortality. Therefore, by selecting model mortality schedules based on an observed under-five mortality level, one can assess whether estimated adult rates are "too low" or "too high" due to data quality problems, although deviations from models can occur as the result of real, if atypical, changes in the population under study. In this analysis, the SACM under-five mortality estimates of 154 per 1,000 for males and 134 per 1,000 for females (from Table 4.5) are used to enter the West and South families of Coale-Demeny's model mortality schedules (Coale and Demeny, 1966).[10]

While there is clearly some effect of sampling variation, the adult mortality rates derived from the SACM data are surprisingly stable, showing expected increases in both male and female rates with increasing age. However, the rates produced for males under age 25 and for females at ages 45 and over appear to be underestimated as they fall below the lower bounds described in the models. In the case of the female data, any measurement errors in the age group 45-49 years will, however, have only a very limited effect on overall mortality for ages 15-49 since this age group contributes so little weight to the overall exposure. For ages 15-44, the data for females are plausible and, within this age range, a rather steep rise in mortality rates between ages 25-29 and 35-39 is indicated. For males above age 25, mortality climbs very rapidly, and conforms roughly with model expectations in that male mortality levels are well above female levels. For all ages combined, the rate of male mortality (4.5 per 1,000) exceeds female mortality (3.8 per 1,000) by some 17 percent; if ages 15-24 are ignored, the difference is 30 percent.

These findings demonstrate moderate to high adult mortality in this population of northwestern Tanzania, but not so high as to suggest the manifold increase in rates predicted by modelers of the AIDS impact. The most parsimonious explanation for this rather unexceptional mortality *level* and *pattern* is that the trajectory of the AIDS epidemic in rural Kwimba is still in its early stages, and that significant mortality impact per se may only be observed in later years. A reported HIV prevalence of only 4 percent in adjacent populations (Grosskurth et al., 1995) is consistent with this interpretation. Alternatively, the SACM respondents may have omitted large numbers of both male and female deaths at all ages, but this appears unlikely given the patterns exhibited in the data. An analysis of trends in adult mortality would be a useful extension to this line of inquiry; unfortunately, the sparseness of the data will not support a statistically reliable look across the relevant calendar periods.

4.3.5 Maternal Mortality

Age-specific estimates of maternal mortality from the reported survivorship of sisters are shown in Table 4.10 for the 14-year period before the survey. The number of maternal deaths (57) is small, so that age-specific rates have large associated *relative* sampling errors, and should thus not be overinterpreted; the preferred approach is to calculate one estimate for all childbearing ages (15-49 years).

Table 4.10 Direct estimates of maternal mortality

Direct estimates of maternal mortality for the period 0-13 years before the survey, SACM 1995

Age	Deaths	Exposure	Mortality rates[1]
15-19	12	12,213	0.98
20-24	17	11,438	1.49
25-29	9	9,351	0.96
30-34	13	6,808	1.91
35-39	4	4,315	0.93
40-44	2	2,577	0.78
45-49	0	1,327	0.00
15-49	57	48,029	1.12
General Fertility Rate (GFR)			0.241
Maternal Mortality Ratio (MMR)[2]			463

[1] Expressed per 1,000 woman-years of exposure
[2] Per 100,000 live births; calculated as the maternal mortality rate divided by the general fertility rate

[10] The West and South families essentially encompass the plausible range for estimates of the relationship between adult and child mortality.

For the period circa 1981-1995, the rate of mortality due to causes related to pregnancy and childbearing years is 1.1 maternal deaths per 1,000 woman-years of exposure. As mentioned earlier, maternal deaths represent approximately 33 percent of all deaths to women age 15-49.

The maternal mortality rate can be converted to a maternal mortality ratio and expressed per 100,000 live births by dividing the rate by the general fertility rate of 0.241 calculated for the same time period. In this way, the obstetrical risk of pregnancy and childbearing is underlined. By direct estimation procedures, the maternal mortality ratio is estimated as 463 maternal deaths per 100,000 live births during 1981-1995.

The indirect approach to estimation of maternal mortality, or the sisterhood method, has simpler data requirements than the direct method. None of the information on dates and ages related to the respondent's sisters is used, and the data on all sisters are used to estimate the lifetime risk of maternal death. As the estimates pertain to the lifetime experience of respondents' sisters, a well-defined calendar reference period is not derived, but rather the derived estimates represent mortality conditions over the past 45-50 years or so. Assuming changes in mortality over time are linear, the reference period can be considered to be centered about 12-13 years before the survey date (Graham et al., 1989). In a previous study of two villages in the present study area, a maternal mortality ratio of 286 was estimated (Walraven et al., 1994).

The indirect estimates of maternal mortality are given in Table 4.11. When aggregating the data over all respondents, the lifetime risk of maternal death in this population is 0.039, reflecting a 1 in 26 risk of dying from maternal causes. The lifetime risk of maternal mortality can be converted to an estimate of the maternal mortality ratio (MMR) by using the formula shown in Table 4.11. This procedure gives an estimated MMR of 480 maternal deaths per 100,000 live births, applicable to a period centered around the year 1982.

Given the consistency of the direct and indirect estimates and admitting the possibility of an underestimate of mortality at ages 45-49 years, a cautious reading of the SACM findings is that the maternal mortality ratio over the last 10-15 years is around 500 maternal deaths per 100,000 live births.

Table 4.11 Indirect estimates of maternal mortality

Estimates of maternal mortality using the indirect method, SACM 1995

Age	Number of respondents (a)	Number[1] of sisters 15+ (b)	Number of maternal deaths (c)	Adjustment factor (d)	Sister units of exposure to risk (e)=(b)x(d)	Lifetime risk of maternal death (f)=(c)/(e)
15-19	458	1,131	5	0.107	121	0.0434
20-24	469	1,158	10	0.206	239	0.0419
25-29	391	965	19	0.343	331	0.0583
30-34	281	728	17	0.503	366	0.0455
35-39	215	554	12	0.664	368	0.0326
40-44	130	320	5	0.802	257	0.0205
45-49	166	437	11	0.900	360	0.0250
15-49	2,130	5,256	78	--	2,041	0.0386

TFR 1982-86	7.88 children per woman
MMR	480 per 100,000 live births

TFR = Total fertility rate
MMR = Maternal Mortality Ratio = $(1 - [(1 - \text{Lifetime risk}]^{1/TFR}) \times 100{,}000$, where TFR represents the total fertility rate 10-14 years preceding the survey.
[1] Adjusted for age distribution of respondent's sisters (see Graham et al., 1989)