PN-AAV-969 21
ISN = 47356
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THE HASHEMITE KINGDOM OF JORDAN

DEPARTMENT OF STATISTICS
IN COLLABORATION WITH
CENTERS FOR DISEASE CONTROL
ATLANTA, GEORGIA, USA
USAID
UNFPA

SYMPOSIUM
ON
POPULATION, FERTILITY & FAMILY HEALTH
AUGUST 28 - 30 1984
AMMAN - JORDAN

Paper No. 3

ESTIMAIES OF FERTILITY MORTALITY LEVELS IN JORDAN
(Based on the Findings of the 1979 Population Census)

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AUGUST, 1984

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ESTIMATES OF FERTILITY AND MORTALITY LEVELS IN JORDAN:

(Based on the Findings of the 1979 Population Census)

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* The view expressed in this paper are those of the Author and do not necessarily represent those of the United Nations or the Department of Statistics/Amman, Jordan.

1. INTRODUCTION

The Conventional approach to measuring fertility and mortality depends upon two data sources, a vital registration system to provide numerators, births and deaths; and regular population censuses to provide the denominators, the population exposed to the risk of the events. The most serious problem is usually with registration data, which generally suffers from some degree of under-registration and misclassification, particularly deaths. Census data are not free from errors, age misreporting being frequently the most obvious example.

Recognizing such problems, a set of indirect methods have been developed in the past few years in order to improve the quality of vital rates estimates drived from census data in situations where vital registration data are defective. These methods involve the case when only a single census is available.

There are several surveys conducted in Jordan that include retrospective data, such as 1976 Jordan Fertility Survey and 1983 Fertility and Family Health Survey. As to censuses, only the 1979 Population Census may be used to obtain estimates of that nature. The 1961 census did not include such information.

The purpose of the present paper is to utilize the single census data of 1979 to estimate vital rates (fertility and mortality) in Jordan. It will not deal with a comparative analysis with other surveys conducted in Jordan.

This paper will attempt to utilize a wide range of indirect methods, some may not be directly applicable to the case of Jordan. For example, high level of international migra-

tion poses a problem, and the assumption of stability may not be accepted.

The 1979 census included several questions on current and retrospective fertility and child mortality. "Current" refers to number of children born (and those still living among them) during a 12-month period immediately prior to the census date. "Retrospective" refers to the total number of live-born children (and those still living) to women over a certain age. A major problem with "current" data is the confusion that exists regarding the length of the reference period being considered. Retrospective data suffers from some uncertainties; such as the omission of live births particularly among older women. These defficulties will be discussed later when appropriate.

This paper will attempt to estimate fertility based on information about children ever born using both the age and duration of marriage models. In addition, estimates based on information on fertility by reverse-survival will be used. As much as possible, estimates will be calculated for urban and rural areas (as will as total) of the East Bank of Jordan separately.

Similarly, estimates of child mortality based on number of surviving children using data classified by age and duration of marriage will be applied. Furthermore, this paper attempts to estimate adult mortality from information on the distribution of deaths by age. Both preston-Coale method and Brass growth balance method are applied. Uncertainties regarding each of these methods will be discussed.

2. Preliminary Evaluation Of Children Ever Born Data

The sex ratios at birth by current age and duration of marriage are presented in Table 2.1.

Table 2.1

Sex Ratios at birth, mean CEB and proportion died by current age (and duration of marriage) (Census 1979)

Current age	Sex at Ratio at Birth	Mean CEB	Proportion died		Duration of Marriage**	Sex Ratio at Birth	Mean CEB	Proportion died
			Male	Female				
15-19	1.036	.1501	.0645	.0639	0-4	1.064	1.0449	.0589
20-24	1.069	1.3392	.0707	.0691	5-9	1.066	3.3545	.0729
25-29	1.064	3.3317	.0732	.0779	10-14	1.065	5.2583	.0869
30-34	1.065	5.2534	.0867	.0902	15-19	1.066	7.0033	.1023
35-39	1.072	6.8434	.1027	.1095	20-24	1.094	8.2017	.1262
40-44	1.100	7.7475	.1294	.1408	25-29	1.104	8.8415	.1548
45+	1.106	8.0103	.1668	.1814	-	-	-	-

* For all Jordanian women living in the East Bank (15-49)

** For all Ever-married Jordanian Females living in East Bank (15-49).

The Sex Ratio for all women (1.085) seems plausible. The sex ratios by age of mother deviates from the expected pattern for women in the age groups 40 or more. It is higher than expected, which may imply some omission of female births particularly for older women. This same conclusion seems valid when we consider duration of marriage instead of age.

Mean number of children ever born (CEB) increases with both age and duration of marriage, implying that omission in the last two age groups does not seem to have affected the data

5.7

significantly. It seems that data on CEB follow a plausible pattern.

As expected the proportion of dead children (Table 2.1) increases with age and duration of marriage. Such test, may not be very sensitive to the error of omission since these proportions not only reflect the level of mortality, but also the longer exposure to the risk of death of the children of the older women. Neverthless, strong omission of births who later died would result in an decrease in the proportion dead from those ever born to the older or the longer married women.

3. Fertility Estimation

The questions on children ever born alive in the 1979 Population Census were designed to minimize memory errors. First it classifies children ever born to living and deceased, then living children are classified further by whether they live in the household or live elsewere. In each case data were classified by sex. Certainly, this will minimize omission of children though, some omission still is expected to exist. However, if limited to women over 35, the bias is not very serious because most methods of analysis make little use of the data referring to these women.

The problem of misclassification of age or duration of marriage may have some effect. However, it is expected that the overall effect will be small, since the misclassified women are likely to be close to the boundary of adjacent groups (U.N. 1983) It would seem that data classified by marriage duration might be less distorted by dating errors than age, because marriage is a more recent and more personally memorable event than one's own birth (U.N. 1983). The analysis

here will be confined to first marriages, and estimates based on age and duration models will be compared.

It is also assumed that the issue of mortality among women is negligible i.e. women with different parities experience about the same mortality, since mortality risks experienced by women in their child bearing years are fairly low in Jordan. A more serious problem is posed by migration. We may assume, however, that its effect is simillar to that of mortality.

While children ever born involve no dating errors, those born during the reference period will suffer from reference period errors i.e. misperception of the lenth of the reference period. If these errors in the information of current fertility are assumed to be roughly constant with respect to age and duration of marriage, the pattern of observed current fertility can be accepted as correct although its level may be distorted.

Available data from the 1979 Population Census allow us to apply two of the indirect methods of estimating adjusted specific fertility rates, accordingly adjusted total fertility and birth rate. The first method involves comparison of period fertility rates with reported parities. Both models, based on age and marriage duration, will be attempted here. The second is based on the reverse-survival methods. Differentials by Urban/rural areas will be considered when data permit.

3.1 The P/F Ratio Method: Age Model

This method was orginally proposed by Brass. It depends on comparison of lifetime with current fertility data to provide adjustment for cases where the data are distorted by typical errors. In order for this adjustment to be valid, it must be assumed that the fertility of younger women has not changed appreciably (U.N. 1983). However, this method may still yield valid results if the adjustment factor is selected on the basis of information pertaining to the younger age groups.

Table 3.1. below presents a summary of the estimates obtained by applying this method for total East Bank and for rural and urban areas separately (detailed calculations are shown in Appendex A. 1).

Table 3.1

Estimated fertility rates by rural urban areas by the P/F Ratio method based on 1979 Population Census in Jordan (Jordanian Women).

Age Group	Total	Rural	Urban
• Age specific Fertility Rates			
15-19	.0966	.1028	.0928
20-24	.3533	.3852	.3329
25-29	.4288	.4648	.4048
30-34	.3835	.4301	.3538
35-39	.2999	.3459	.2679
40-44	.1520	.1946	.1148
45-49	.0481	.0716	.0481
• Total Fertility Rate	8.811	9.975	8.026
• General Fertility Rate (‰)	247.1	277.6	226.9
• Crude Birth Rate(‰)	49.36	51.07	44.6

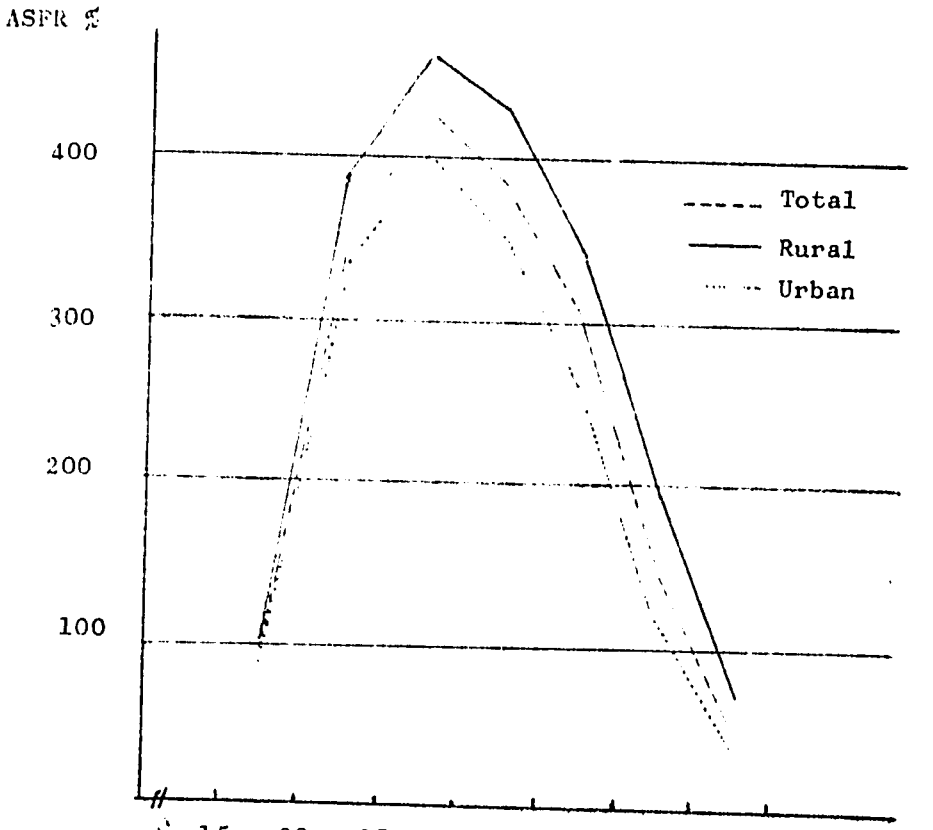

Fig 3.1

Estimated Age-Specific fertility Rates by P/F Ratio Method For Rural and Urban Areas (1979 Census)

The estimates in Table 3.1 seem to be high, the Age Specific Fertility rates are particularly high in rural areas and throughout the age range 20-44. Thus, the total fertility rate is as high as 9.98 in rural areas which corresponds to a CBR higher than 50 per thousand. It seems that these rates are somewhat over-estimated. However, comparing number of births registered in the vital registration system 12 months prior to the Census which amounts to 91595, to the estimated number of births based on these rates which is 100443 (total East Bank), shows that these estimates are plausible, particularly if we assume a certain amount of under registration. Some estimates based on other indirect methods below will assist in reaching better judgment on this matter.

3.2. Estimating Marital Fertility: Marriage Duration Model

In general, it is expected that data with respect to marriage duration may be better since they are likely to be subject to less misreporting than data on age. It is assumed that age misreporting results mainly from the lack of sensitivity to the concept of chronological age. Thus, the use of duration of marriage specific fertility rates rather than the usual use of age specific rates may prove more reliable.

Marriage is relatively stable in Jordan, hence, years since first marriage may be considered as a good indicator of the period of exposure.

The data allowing estimating the pattern of marital fertility are available from the 1979 Population Census from classifying children even born and births occurring during the past 12 months by the mother's duration of marriage. "This method will be less affected by changing age at marriage than will the method based on data classified by age; and it does not require that marital fertility follow the pattern of natural fertility" (U.N. 1980,P.66).

Fortunately, The number of "not stated" cases was very small, which indicates that the zero error i.e. women with no children who are incorrectly recorded as among the not stated, is not significant.

Table 3.2. below shows the estimates resulted by applying this method. (Detailed calculations are shown in Appendex A-2).

Table 3.2

Rural and Urban Fertility Estimates based on the duration model: 1979 Population Census in Jordan. (All ever married Jordanian Women 15-49)

Duration of Marriage	Total	Rural	Urban
• Marital Adjusted Duration Specific Rates			
0 - 4	.3965	.3822	.4085
5 - 9	.4415	.4582	.4312
10-14	.3774	.4060	.3566
15-19	.2995	.3388	.2715
20-24	.2029	.2384	.1780
25-29	.0958	.1212	.0781
Adj. Total Marital fertility rate	9.068	9.724	8.620
Crude Birth Rate (‰)	43.2	45.7	41.5

This method, examining the ratio (Parities) values (Appendix A-2) indicates a fairly consistant values. Furthermore, it seems that ratios are robust to existance of any mix-up in relation to actual cohabitation and official marriage (the contract.) . Thus, if the basic data were fairly accurate, these estimates seems to be plausible and acceptable. However, it must be noted that an overstatment of duration will introduce a downward bias in the reported average parity for duration groups.

The estimates shown in Table 3.2 indicate a crude birth rate of 43.2 per thousand in the East Bank (45.7 in rural and 41.5 in Urban areas). They are lower than the estimates obtained by the P/F ratio method. The estimated number of births by the present method is 86804 during the 12 months prior to the Census as compared to 91595 from the vital registration. This is indicative of some underestimation of rates based on this method. A conclusion is that actual fertility estimates (Particularly CBR) is some where between the estimates obtained by these two methods of estimation.

3.3. Birth Rate Estimation by Reverse-Survival Methods

This method depends on the accuracy of the reported age distribution in the Census. Thus, errors in age reporting or differential completeness of enumeration, especially the younger ages, will affect the estimates. Since it is expected that there will be underenumeration in the less than one year age group population, a five-year age group is used to minimize this effect. However, it is likely that this method will under-estimate the true number of births occuring in the 5 years immediately preceeding the Census. Furthermore, the estimate obtained by the age group 5-9 years may by affected by errors in the estimation of mortality and may be exaggerated by age reporting errors (U.N., 1983). Thus, the choice of life table model affects fertility estimates.

Neverthless, estimates obtained by this method provide independent birth estimates which can be used to evaluate the plausibility of those obtained from vital registration.

Table 3.3

Crude Birth Rates (per Thousand) as estimated by Reverse Survival method (Census 1979) by Sex.

Age	Males			Females		
	$_5L_x^m$ *	$_5N_x^m$	Births	$_5L_x^f$ **	$_5N_x^f$	Births
0	4.6267	204462	44192	4.6363	192575	41536
5	4.5592	186029	40803	4.5656	173963	38103
CBR (1)			44.39			44.73
(2)			48.82			48.88
Both Sexes (1)			44.56			
(2)			48.85			

* Model life table level 20.76 (South)

** Model life table level 20.31 (South)

(1) The five years immediately prior to Census Nov. 74 to Nov. 1979.

(2) The five years earlier Nov. 1969 to Nov. 1974.

Table 3.3 shows that crude birth rate of 44.56 per thousand population is estimated for the period 1974-79 as compared to 48.85 for the period 69-74. This indicates a clear descrease. The CBR for males and females are consistant. These estimates are also consistant with those obtained by the previous methods. It is worth examining these estimates with those obtained directly from birth registration data. This is shown in table 3.4.

Table 3.4

Comparison of number of births obtained by reverse-survival method form the census and birth registration (1974-1979)

Period and Sex	No. of Births (Annual)		
	Vital registration	Census	Ratio
From 10/11/78 To 10/11/79:			
Male	46426	41327	1.12
Female	44143	39738	1.11
Total	90570	81365	1.11
From 10/11/74 To 10/11/79:			
Male	43545	44192	.985
Female	40516	41536	.975
Total	84061	85728	.981

Table 3.4 indicates a striking trend, that is the Census under-enumerate population less than one year of age, but over-enumerate population 1-4 years of age. It seems that there is an age misreporting resulting in shifting some of the less than one year to the higher age group 1-4. Although this problem needs further indepth examination, it seems plausible to assume that there is under-registration as well as under-enumeration. If we assume complete birth registration at least in the year preceeding the census, we would estimate after some modifications for age misreporting- that there is about 6.5 percent underenumeration for the age group 0-4 in the Census.(1)

(1) This is a subject of analysis currently being undertaken by the Demographic Analysis and Research Unit in the Department of Statistics.

4. Estimation of Child Mortality:

In this section, the Population Census questions on proportions dying among children ever born classified by age of mothers or by duration of marriage will be used to estimate child mortality levels. This type of retrospective data suffers from the same errors discussed earlier. Furthermore, the methods utilized here imply that fertility patterns are assumed to remain constant.

4.1. Data by Age

Table 4.1 below summarizes the findings of the application of the indirect method to estimate child mortality level using data classified by age-(Detailed calculations are found in Appendix B-1).

Table 4.1

Estimates of q(x) for males and females for total East Bank Rural and Urban areas (Jordanian women-Census 1979)

Age	Approx. Reference Year	East Bank		Rural		Urban	
		Male	Female	Male	Female	Male	Female
1	1978	.0710	.0695	.0869	.0800	.0599	.0620
2	1977	.0774	.0755	.0875	.0843	.0699	.0687
3	1975	.0763	.0813	.0875	.0915	.0696	.0733
5	1973	.0901	.0939	.0990	.1011	.0836	.0887

An examination of levels displayed in Table 4.1 shows that the estimates of q(1) and q(2) imply higher male than female mortality in both urban and rural areas. Furthermore, rural mortality is considerably higher than that prevailing in urban areas.

Regardless of some random variations inherent is such estimates, when estimates converted into model life table levels, they decline steadly as age of mother rises, strongly suggesting that child mortality has been falling in the recent past.

4.2. Duration of Marriage Variant

The duration based method should be applied only to data from currently married women still in their first union "However, in practice, no serious biases will arise when they are applied to data pertaining to all ever-married women, as long as their marriage duration is calculated as the time elapsed since first marraige" (U.N. 1983. P. 75).

Table 4.2 presents a summary of findings of the application of this method. (see Appendex B-2 for details)

Table 4.2

Estimates of q(x) Using data by duration of marriage (all ever-married Women) by sex and rural/Urban)areas: 1979 Population Census

Duration	x	Approx. Ref. Year	East Bank			Rural			Urban		
			Male	Female	Both	Male	Female	Both	Male	Female	Both
0-4	2	1977	.0748	.0681	.0727	.0940	.0812	.0877	.0627	.0596	.0611
5-9	3	1975	.0759	.0781	.0770	.0854	.0905	.0879	.0691	.0694	.0692
10-14	5	1973	.0886	.0921	.0902	.0969	.1012	.0990	.0821	.0853	.0837

Table 4.3

The estimated mortality levels of the estimats for total East Bank (South Variant).

x	Approx. Ref. Year	Male		Female	
		l(x)	Level	l(x)	Level
2	1977	.9252	20.95	.9219	20.92
3	1975	.9241	21.19	.9219	20.49
5	1973	.9114	20.61	.9079	19.84
10	1970	.8954	19.91	.8887	18.96
15	1968	.8738	18.96	.8596	17.40

The average of duration-based mortality levels in rural areas is somewhat higher than that obtained by age-based model but the reference period of duration-estimates is somewhat more recent for any given value of x.However,the differences are very moderate: generally speaking, the estimated mortility levels show a fairly coherent trend and reasonable consistency by sex.

Given the uncertainties associated with the limitations of methods and the quality of data, it is difficult to identify a single "best" approximation of the level of mortality for Jordan. Use of survey data such as these of the Fertility and Family Health Survey will be especially useful to provide a wider range of possible estimates of the level of mortality. Both sources together will increase confidence in tracing the proper course of mortality in Jordan.

5. Estimation of Adult Mortality from Information on the Distribution of Deaths by Age:

The fact that death registration is "incomplete" has often led to ignoring it. However, incomplete registration systems can prove to be very useful. According to Preston " A registration system that records 60 percent or more of deaths represents a very useful source of mortality information; if completeness is much below this level, however, problems of non-representiveness sharply limit the value of the data" (Preston, 1984, P.66).

Jordan's death registration is known to be highly incomplete this has led researchers to ignore it. There are several indirect methods currently available for estimating the completeness of death registration. Two methods could be applied in the present context, namely the preston-Coale method and

the Brass Growth Balance Method (see U.N., 1983 and Preston, 1984). The basic idea is that registration data will produce underestimated death rates. If adjusted for under-registration, implied death rates could be estimated.

Both methods just mentioned are based on the assumption that the population is stable. "However, both are fairly robust to violations of the assumption of stability, particularly to recent changes in fertility and to gradual changes in mortality"(U.N. 1983. P. 81).

Another important underlying assumption here is that completeness of reporting of deaths is the same at all ages, but because childhood and adult deaths are very often underreported to different extents, the methods mentioned here will be used only to estimate adult mortality, say age 10 or more. The estimate of registration completeness obtained is relative to the completeness of Census enumeration.

5.1. Preston-Coale method

As stated above, the preston -Coale procedure is based on the recognition that the ratio of the birthday rate above x to the death rate above x is, in a stable population, completely a function of the age distribution of deaths above that age and of the growth rate (Preston, 1984 p. 68). In general, this method seems to be less sensitive to violations of the assumption of stability than Brass' method in section 5.2. This method is also vulnerable to age-misstatement and omission at the older ages, where these errors are most likely.

Since this method requires as input an estimate of growth rate, experimenting with few growth rates seem to suggest 2.5 percent as a reasonable value since no intercensal estimation is possible.

The application here will be done separately for males and females in the East Bank, since registration data are not available by rural-urban areas.

The application of this method on the females population seems more plauisble than males, probably because the female population is closer to stability than males. The average level of the sequence of the proportion of estimated to actual female population over a certain age x when plotted with age was almost horizontal, indicating that assumed growth rate (3.5%) is appropriate (see Fig, 5.1)

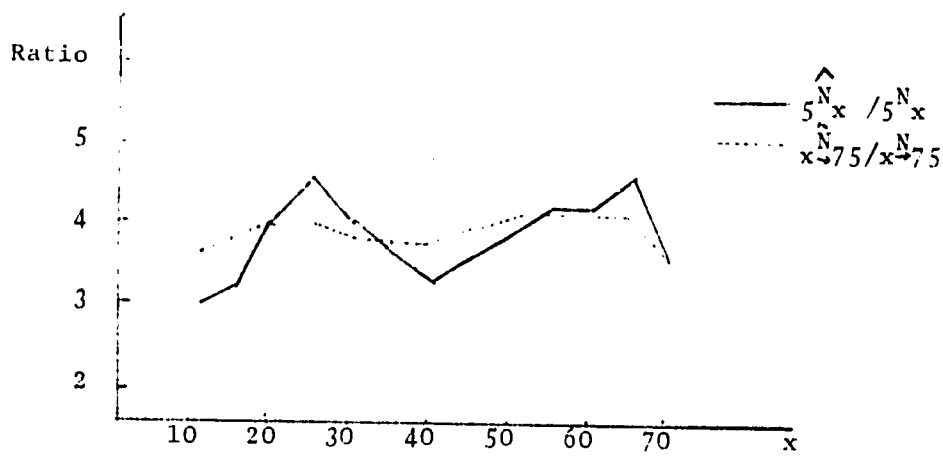

Fig 5.1

Plot of ${}_5\hat{N}_x/{}_5N_x$ and ${}_{x\to}\hat{N}_{75}$ / ${}_{x\to}N_{75}$ by Age(Females)

Figure 5.1 shows, however, some up-and-down movements, which could be interpreted as deviations of the reported age distribution from the stable form or more likely as a result of differential omission i.e. a tendency to misstate age. Thus, age misreporting appears to have also produced an inexact reported age distribution of deaths.

The result of this method is that (C) the completeness of death registration is aproximately .3891 (median value). C is to be adjusted to make allowance for the difference existing between the date of Census and midyear (which is equal to 1.0126). Thus the estimated C is .3940 or approximately 40%.

The conclusion is that the death registration compeleteness is about 40% of the adult female deaths. Thus, if ${}_5D_s$ denotes number of registered deaths for the age x to x+5 and ${}_5N_x$ denotes population of that same group. Thus the age specific death rate is: ${}_5m_x^f = \frac{{}_5D_x}{{}_5N_x}$

Therefore, taking the estimate C obtained, the adjusted female rates may be estimated by:

$$\text{Adj. } {}_5m_x^f = {}_5D_x \,/\, {}_5N_x \cdot C$$

for all ages 10 or more.

The estimated rates are shown in Table 5.1 below. It must be noted, however, that adjusted deaths represent the overall level of mortality moderately well, but these detailed rates would probably be distorted. The findings from other sources, such as the Fertility and Family Health Survey, 1983 will shed some light on these estimates.

As for males the proportions $\frac{\hat{N}(x)}{N(x)}$ or $\frac{\hat{N}(x \text{ to } 75)}{N(x \text{ to } 75)}$

are not clearly horizontal, though the second is better in this respect. This indicates, more likely, lack of stability, particularly the high peak in the age range 20-34. The estimated adjusted C_m obtained is .7305.

Thus the adult male (10 or more) death registration is approximately 73% complete, which is significantly higher than that obtained for females.

Similarly, adjusted age specific death rates (10+) may be estimated. Results are shown in Table 5.1. (Detailed calculations are presented in Appendix C-1).

Table 5.1

Estimated Age-specific mortality rates for males and females in East-Bank based on indirect method of death distribution by Age (1979)

Age	Estimated Age Specific Death Rates (per thousand)	
	Females	Males
10-	.863	1.148
15-	1.317	1.016
20-	1.727	1.725
25-	1.924	1.529
30-	2.011	2.060
35-	3.777	2.835
40-	5.212	4.442
45	7.373	7.234
50-	7.361	10.864
55-	13.935	17.767
60-	21.388	24.819
65-	37.340	33.129
70*	41.857	44.717
75+	91.172*	85.959*

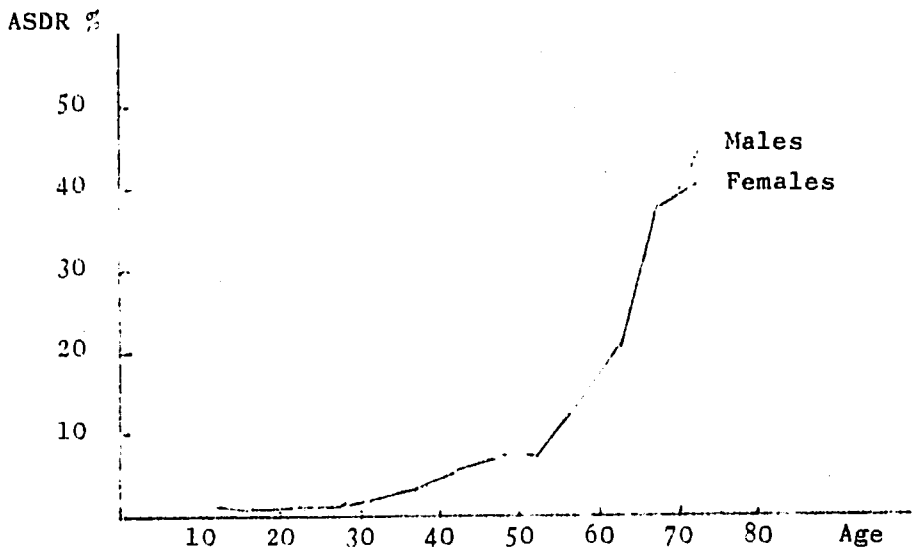

Fig 5.2

Estimated Age-Specific Death Rates
for males and Females (1979)

5.2. Brass Growth Balance Method

As indicated, this method is more sensitive to violation of the assumption of stability. Declining fertility is usually not a serious problem "because the initial age at which estimation begins can be chosen in such a way as to exclude cohorts that have been reduced in age by fertility decline" (Preston, 1984 p. 67). Martin (1980) provided a way of adjusting the estimates obtained by this method for mortality decline, a procedure that requires knownledge of the speed and duration of mortality decline. This adjustment is not attempted in the present paper.

This method is based on fitting a straight line as follows: (U.N. 1983 P. 140).

$$\frac{N(x)}{N(x+)} = r+k\ (D(x+)/N(x+))$$

Where r is the growth rate,

When this method is applied to males and females in the East-Bank, particularly the plot for males was distorted. Thus, this method is particularly invalid to be used to estimate K. large observed deviations from linearity may be due to one or all of the following:- inaccuracy due to age misreporting, or differential completeness of death registration by age, or finally and more likely, lack of stability of the male population in Jordan.

Application of this method on females, gives an adjusted estimate of C approximatly 41.4% (with a growth rate 36.96 per thousand). (using trimmed mean of all available points-see U.N. 1983., 141).

In conclusion, no great deal of confidence may be attatched to the results obtained by this method.

As preston (1984) stated, resulting estimates of C rarely differ, from those obtained in the Preston-Coale method by more than 0.03, thus we tend to prefer here the Preston-Coale method.

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Appendix A - 1

Calculations of Age Specific Fertility Rates Estimates based on P/F Ratio Method For Total East Bank

Age	i	All Jor. Women	CEB	Births 12 Months	pi	f(i)	Wi	K.fi*	Pi/Fi	Est. No. of Births
11-19	1	109036	16367	7212	.1501	.0661	.0556	.0966	1.133	10532
20-24	2	71872	96250	20150	1.3392	.2804	.0943	.3533	1.207	25392
25-29	3	52666	175467	18986	3.3317	.3605	.1097	.4288	1.185	22583
30-34	4	50773	266733	16756	5.2534	.3300	.1165	.3835	1.155	19471
35-39	5	45400	310689	11911	6.8434	.2624	.1553	.2999	1.140	13615
40-44	6	40642	314874	5728	7.7475	.1409	.1902	.1520	1.120	6177
45+	7	31430	251763	1580	8.0103	.0503	-	.0481	1.083	1511

- TER = 5x1.7622
  = 8.811
- CBR = $\frac{99281}{2011051}$ x 1000 = 49.36
- GFR = $\frac{99281}{401819}$ x 1000 = 247.1

Appendix A - 2

Calculations of the Duration Specific Fertility Rates Estimates For the East Bank.

Duration of Marriage	Index	No. of Ever Married Women	CEB	Births in 12 Months	Pi	gi	Gi	Rates Pi/Gi	Est. Births
0-4	1	58694	61327	21955	1.0449	.3741	1.0386	1.0061	23272
5-9	2	50032	167833	20838	3.3545	.4165	3.1433	1.0672	22089
10-14	3	48644	260648	17315	5.3583	.3560	5.0499	1.0611	18354
15-19	4	41962	293874	11855	7.0033	.2825	6.6162	1.0585	12566
20-24	5	40773	334406	7802	8.2017	.1914	7.7593	1.0570	8270
25-29	6	23514	207898	2126	8.8415	.0904	8.4133	1.0509	2263

Total Marital Fertility Rate $= 1.06 \times 5 \times 1.7109$

$= 9.0678$

$$CBR = \frac{86804}{2011051} \times 1000 = 43.16$$

Appendix B - 1

Calculations for Estimating Child Mortality Level: Age Variant : East Bank

Age Group	i	Average Parity		Proportion Died		K(i)		x	q(x)	
		Male	Female	Male	Female	Male	Female		Male	Female
15-	1	.0764	.0737	.0645	.0639	1.1007	1.0884	1	.0710	.0695
20-	2	.6921	.6471	.0707	.0601	1.0946	1.0930	2	.0774	.0755
25-	3	1.7176	1.6141	.0732	.0779	1.0422	1.0434	3	.0763	.0813
30-	4	2.7096	2.5438	.0867	.0902	1.0387	1.0406	5	.0901	.0939
35-	5	3.5400	3.3033	.1027	.1095	1.0530	1.0550	10	.1081	.1155
40-	6	4.0579	3.6896	.1294	.1408	1.0302	1.0321	15	.1333	.1453
45+	7	4.2068	3.8034	.1668	.1814	1.0169	1.0185	20	.1696	.1848

Appendix B - 2

Calculation of Estimates of Child Mortality Using the Duration of Marriage Variant: East Bank

Duration Group	Average Parity		Proportion died		Multipliers		x	q (x)	
	Male	Female	Male	Female	Male	Female		Male	Female
0 - 4	.5387	.5062	.0616	.0561	1.2137	1.2132	2	.0748	.0681
5 - 9	1.7310	1.6235	.0719	.0740	1.0559	1.0558	3	.0759	.0781
10-14	2.7640	2.5943	.0853	.0887	1.0382	1.0334	5	.0886	.0921
15-19	3.6142	3.3892	.0993	.1056	1.0534	1.0538	10	.1046	.1113
20-24	4.2855	3.9162	.1214	.1315	1.0398	1.0400	15	.1262	.1368
25-29	4.6387	4.2028	.1478	.1626	1.0349	1.0350	20	.1530	.1683
30+	4.8267	4.3479	.1884	.2047	1.0393	1.0394	25	.1958	.2128

Appendix C

Application of the Preston-Coale Method to Estimate Death Registration Completeness

1. Females

x	$_5D_x$	Estimated Population $\hat{N}(x)$	$_5\hat{N}_x$	$_x\hat{N}$ to 75	$_5\hat{N}_x/_5N_x$	$_x\hat{N}_{75}/_xN_{75}$
75+	365	466.8	-	-	-	-
70	135	703.4	2925.5	2926	.3574	.3574
65	138	988.5	4229.8	7156	.4509	.4074
60	115	1303.0	5728.8	12885	.4198	.4128
55	97	1658.0	7402.5	20288	.4190	.4151
50	70	2051.5	9273.8	29561	.3819	.4040
45	94	2546.3	11494.5	41056	.3552	.3891
40	86	3127.0	14183.3	55239	.3387	.3747
35	70	3801.3	17320.8	72560	.3682	.3732
30	42	4573.9	20938.0	93498	.3950	.3778
25	42	5494.3	25170.5	118669	.4543	.3918
20	51	6600.5	30237.0	148906	.4035	.3941
15	58	7925.8	36315.8	185221	.3248	.3783
10	50	9495.7	43553.8	228775	.2960	.3593
5	108	11429.2	52312.3	281087	.3007	.3467

Appendix C (Cont.)

2. Males

x	$_5D_x$	Estimated Population $\hat{N}(x)$	$_5\hat{N}_x$	$_x\hat{N}$ to 75	Ratios $_5N_x/_5\hat{N}_x$	$\frac{_x\hat{N}_{75}}{_xN_{75}}$
75+	723	933.97	-			
70	269	1406.19	5850.4	4850	.7104	.7104
65	255	1953.36	8398.9	14249	.7822	.7591
60	262	2612.79	11415.4	25665	.7899	.7725
55	245	3379.74	14981.3	40646	.7936	.7802
50	222	4268.23	19119.9	59766	.6835	.7464
45	171	5270.95	23848.0	83614	.6755	.7248
40	145	6437.01	29269.9	112884	.6550	.7053
35	107	7784.55	35553.9	148438	.6882	.7011
30	79	9359.18	42859.3	191297	.8164	.7240
25	67	11221.78	51452.4	242750	.8580	.7488
20	100	13476.53	61745.8	304496	.7780	.7546
15	90	16151.55	74070.2	378566	.6110	.7214
10	134	19357.59	88772.9	467339	.5555	.6827
5	176	23250.85	106521.1	573860	.5726	.6591