The Effect of the HIV/AIDS Epidemic on Fertility in South Africa

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Introduction

While there is no doubt that fertility has declined over the last 30 years in South Africa, the effect of the HIV epidemic on the fertility transition is still obscure. With the HIV prevalence levels in South Africa increasing from as low as 0.7% in 1990 to 26.5% in 2002 among women attending antenatal care clinics (DoH, 2003), the epidemic is expected to accelerate the fertility transition. With increased contraceptive use; the declining importance of the marriage institution; and labour migration being factors central to the fertility decline in South Africa (Caldwell & Caldwell, 1993; Moultrie &Timaeus, 2002; Swatz, 2002), HIV/AIDS could further exacerbate the decline. In the context of HIV/AIDS, the premature deaths of women in their reproductive years is expected to result in a substantial decrease in the number of children being born into the population.

Among those who are infected, determinants of lower fertility include: higher rates of foetal loss and stillbirth (Gray *et al*., 1998; Strecker *et al*., 1993); higher rates of co-infection with other sexually transmitted infections causing secondary infertility (Larsen, 1994; United Nations, 2002); and lower frequency of intercourse (Gray et. al., 1998; Martin *et al*., 1991; Setel, 1995), anovulation and amenorrhoea due to illness (Lewis *et al*., 2004; Strecker *et al.*, 1993). Also intentional behavioural responses to the epidemic are expected from the fraction of the population that is infected as they might decide to stop child-bearing in fear of leaving orphans behind; separate/divorce as a result of the infection (Setel, 1995). On the obverse, the uninfected are expected to modify their reproductive aspirations and behaviours in recognition of the HIV risk (Gregson *et al*., 2001; United Nations, 2002). They might opt to increase use of condoms (Gregson *et al*., 1997; Lutalo *et al*., 2000); limit their fertility as caring for orphans of dead relatives would increase economic distress (Grieser *et al*., 2001; Potts & Marks, 2001; Rutenburg *et al*., 2000; Setel, 1995); increase the practice of secondary abstinence; and changes in the practices associated with the inheritance of widows (Caldwell, 1997; Gregson *et al*., 1997; Mukiza-Gapere & Ntozi, 1995; Ntozi *et al.,* 1997). These factors may contribute negatively on fertility.

The HIV epidemic may result in changes in social and cultural norms at an individual and community level. These may influence proximate determinants of fertility such as age of sexual debut, marital and sexual partnership patterns, use of contraceptives, type of contraceptives used, and breastfeeding. At a community level, studies in sub-Saharan Africa have reported a variety of responses to HIV including: parental encouragement for early marriage (Stover, 1993). The HIV epidemic has also a direct effect on the demographic profile through increased mortality. The substantial demographic shifts resulting from HIV/AIDS will either cause positive or negative changes in fertility (Gregson *et al.*, 2001). The paper therefore attempts to measure the effect of HIV/AIDS on the fertility decline in South Africa.

Objectives

The aim of the paper is to assess the overall effect of the HIV epidemic on the fertility decline in South Africa. Therefore the following objectives are constructed:

- To examine the magnitude of the differences between the fertility rates of HIV infected and uninfected women.
- To investigate the determinants contributing to sub-fertility among the HIV infected women.
- To estimate the net effect of HIV on the fertility decline in a rural setting of South Africa.

Data and methods

Data

The study uses longitudinal data from the Africa Centre Demographic Information System (ACDIS). ACDIS is a demographic surveillance system (DSS) started in January 2000 with a study population of over 90,000 people in a rural area of northern KwaZulu Natal. At four monthly visits a range of demographic and health data is recorded including: all births, deaths and migrations; and marital and sexual partnerships. Detailed information is collected about the reproductive and sexual health of all resident women aged 15-59. This includes a complete birth history and contraceptive usage. A more detailed women's health questionnaire was first run in September 2002 with an expanded number of questions about sexual behaviour, contraceptive use, and HIV/AIDS stigma and disclosure. The first serological survey was conducted from June 2003 to December 2004. The study uses data for women 15-49 years of age who participated in the serological survey, whose birth histories was also complete at the end of 2002. The detailed description of the ACDIS is contained in the Africa Centre Monograph (Africa Centre-Population Studies Group, 2003).

Since only a cross-sectional survey on HIV-status is available for this study, it is not possible to make direct inference of the effect of HIV on fertility histories. With the timing of sero-conversion unknown, the analysis of the relationship between the HIV status and fertility history is therefore limited to the fertility in 2002. The assumption is that those women found to be infected in the serological survey should already have been infected during the 2002 period. Even though, this association should be treated conservatively because there is a chance that some women testing HIV positive at the time of the survey could have been uninfected at the time they gave birth.

Methods and analyses

To examine the magnitude of the differences between the fertility rates of HIV infected and uninfected women, several statistical and demographic techniques are employed. Births in the year prior the interview (i.e. births in 2002) are analyzed by HIV status. From simple bivariate analyses, rate ratios (RR) of recent births in HIV infected women are estimated and compared to those of HIV uninfected women. In order to check for confounding factors of the relationship between recent births and HIV status, stratified analyses is conducted. Factors known to be statistically associated with both HIV and fertility include age, marital status, contraceptive use, number of sexual partners and history of STDs; and these are therefore controlled for. The study population used in the analyses of recent birth by HIV infection status comprised of women aged 15-49 sexually active 12 months prior the serological survey. For this purpose, women who reported no sexual activity in the year prior to interview were excluded from the study sample as they were not at risk of conception.

The risk ratio is more commonly used to measure the strength of association in risks. This is because the amount by which an exposure (risk factor) multiplies the risk of an event is interpretable regardless of the size of the risk (Kirkwood & Sterne, 2003). Kirkwood and Sterne (2003) define risk ratio as:

$$\text{Risk ratio (RR)} = \frac{d_1/n_1}{d_0/n_0}$$

Where d_1/n_1 is the risk of child birth in exposed group

and d_0/n_0 is the risk of event in unexposed group.

The formula used for the 95% confidence interval for the risk ratio is:

95% CI (RR) = RR/EF to RR x EF

Where the error factor (EF) = exp[1.96 x s.e.(log RR)]

and s.e.(log RR) = $\sqrt{[1/d_1 - 1 - n_1 = 1/d_0 - 1/n_0]}$

The risk ratios are used in this study as an indicator of the strength of the association between being infected with HIV and the risk of experiencing a child birth. A risk ratio of one occur when the risks are the same in the groups infected and uninfected women; and is equivalent to no association between the risk of child birth and HIV. A risk ratio of greater than one occurs when the risk of child birth is higher among HIV infected women than in HIV uninfected women. A risk ratio less than one occurs when the risk of child birth is lower among those women who are HIV infected, suggesting that the factor (HIV infection) may be a suppressant to fertility (Kirkwood & Sterne, 2003).

To investigate the mechanisms through which HIV could act to reduce fertility among HIV infected women, logistic regression models are fitted. The obtained odds ratios (OR) for recent birth in HIV infected versus uninfected women controlling for confounding factors are discussed. Among other factors, included are period since last sex, partnership patterns, residence, contraceptive use, parity and history of STDs. The logistic models try to capture potential variables which help in singling out factors associated with the risk of recent birth among HIV infected and uninfected women who were sexually active one year before the date of interview.

LOGISTIC REGRESSION MODELS

The binary logistic regression is usually represented by the following equation:

$$Y = \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_p x_p + \mu_i$$

$$\text{Where } Y = \ln\left[\frac{p_i}{1-p_i}\right]$$

is the probability of the event to occur, in this case experiencing a recent birth.

The risk of a live recent birth is one, otherwise it is zero.

$\beta_1 x_1 + \beta_2 x_2 + \cdots \beta_p x_p$ are estimated coefficients associated with individual level characteristics of experiencing the risk of a recent birth, and μ_i are the disturbances in the regression models. The assumption in this analysis is that $E(\mu_i) = 0$.

The Dependent variable

The definition of a birth in this study matches the WHO (World Health Organization) definition, referring to the complete expulsion of the feotus from the mother, and shows any sign of life irrespective of duration (Siegel & Swason, 2004).

Explanatory variables

Sexual union, contraceptive use, self perception of general health and history of STDs are some of the factors through which HIV could reduce fertility, and hence are considered in this study. Given small numbers of women in some of the categories, sexual union is categorised into two groups; the never lived with sexual partner and the ever lived with sexual partner. The never lived with sexual partner consists of the single women, and those who ever have lived with sexual partner, and the group consists of the cohabiting, married, separated, divorced and widowed. For the same reason, those who dwell in the peri-urban areas were combined with those from the urban areas, compared to those from rural areas. For the purpose of this study, contraceptive use in 2002 was limited to modern contraception, and all those women who used traditional methods were regarded not to have used a method at all considering their efficacy. Period since last sexual intercourse is also categorised into sexual intercourse below one month and after one month.

Lastly, the paper estimates the effect of HIV on the fertility of a rural setting in South Africa by calculating the population attributable change (PAC) in age-specific rates, general fertility rates, and total fertility among sexually experienced women using the formula:

$$\text{PAC (TF)} = \frac{\text{TF (all women) - TF (HIV – negative women)}}{\text{TF (HIV –negative women)}}$$

The assumption of the PAC(TF) is that the total fertility rate of all women in the absence of an HIV/AIDS epidemic is approximately the same as that observed in HIV uninfected women (Zaba & Gregson, 1998; Lewis et al., 2004). The PAC(TF) can be calculated directly from the age-specific HIV prevalence and fertility rates by HIV status for population based studies. As a result, the population attributable change in total fertility is defined as follows:

$$\text{PAC (TF)} = \frac{\sum p(a)f^{+}(a)}{\sum f^{-}(a)} - \frac{\sum p(a)f^{-}(a)}{\sum f^{-}(a)}$$

Where p(a) is the overall prevalence in each age group

And $f^{+}(a)$ and $f^{-}(a)$ are the fertility rates in the HIV infected and uninfected age groups respectively (Zaba & Gregson, 1998).

Limitations of the study

The greatest limitation to the study on the impact of HIV/AIDS on fertility is the fact that it cannot be quantified with some precision. Since the PAC is defined as the proportionate difference between population fertility and fertility in the HIV uninfected population, it does not take into account changes in overall fertility that are a result of the impact of HIV on the fertility of HIV uninfected women, which could be considerable.

There is no empirical evidence from the ACDIS for measuring this change. Also it should be noted that it is not possible to measure the direct impact of HIV among the infected and uninfected women because the effect is both direct, biologically, and via the proximate determinants of fertility, which might differ between the two groups. This would require the proximate determinants model with the necessary data on the prevalence of the determinants in the HIV infected and uninfected women (Lewis et al., 2004). Therefore the study will rely on the PAC to measure the effect of HIV on fertility, and possibly employ the results from the logistic regression to explain how HIV operates on the proximate determinants of fertility among the HIV infected women.

Results

The study focuses on the fertility of women 15-49 between 2000 and 2002. There were a total of 26704 women followed up in this period with a total of 72951.5 women years of observation. There were 2232 women who were truncated from the study as at December 2002; of which 445 and 1787 were lost due to out-migration and death, contributing 747.83 and 3698.33 women years of observation respectively. Of the women truncated due to death, 970 or 54.3 percent were identified as AIDS related deaths. The rest of the women were censored as of 31 December 2002 because their fertility histories beyond the date are uncertain. The sero-prevalence survey and the verbal autopsies were the two sources used to determine the serostatus of women. The verbal autopsies were used for the deceased between 2000 and 2002. Of the 8248 women whose serostatus was known, 36.7% were HIV positive.

Table 1a TFRs of women all women 15 – 49 calculated using person-years of exposure (Africa Centre Demographic Surveillance Survey, 2000 – 2002)

Year	2000			2001			2002		
Age group	Number	Number	ASFR	Number	Number	ASFR	Number	Number	ASFR
	of births	of women		of births	of women of births	of women			
15-19	557	6349	0.0877	543	6325	0.0858	491	6052	0.0811
20-24	677	5148	0.1315	626	5172	0.1210	634	5398	0.1175
25-29	556	3877	0.1434	491	4126	0.1190	474	4282	0.1107
30-34	360	2891	0.1245	343	2940	0.1167	290	3066	0.0946
35-39	216	2468	0.0875	207	2456	0.0843	195	2404	0.0811
40-44	65	1981	0.0328	73	2076	0.0352	56	2121	0.0264
45-49	15	1177	0.0127	10	1270	0.0079	6	1373	0.0044
TFR			**3.1**			**2.85**			**2.58**

Source: ACDIS, 2004

Table 1b TFRs of HIV uninfected women 15 – 49 calculated using person-years of exposure (Africa Centre Demographic Surveillance Survey, 2000 – 2002)

Year	2000			2001			2002		
Age group	Number	Number	ASFR	Number	Number	ASFR	Number	Number	ASFR
	of births	of women		of births	of women of births	of women			
15-19	84	1392	0.0603	142	1696	0.0837	148	1963	0.0754
20-24	74	476	0.1555	79	541	0.1460	115	664	0.1732
25-29	69	362	0.1906	68	377	0.1804	61	386	0.1580
30-34	67	433	0.1547	70	413	0.1695	70	402	0.1741
35-39	69	587	0.1175	69	566	0.1219	69	540	0.1278
40-44	27	621	0.0435	32	630	0.0508	22	608	0.0362
45-49	6	223	0.0269	--	313	----	2	437	0.0046
TFR			**3.75**			**3.76**			**3.75**

Source: ACDIS, 2004

Table 1c TFRs of HIV infected women 15 – 49 calculated using person-years of exposure (Africa Centre Demographic Surveillance Survey, 2000 – 2002)

Year	2000			2001			2002		
Age group	Number	Number	ASFR	Number	Number	ASFR	Number	Number	ASFR
	of births	of women		of births	of women of births	of women			
15-19	58	470	0.1234	52	422	0.1232	43	344	0.125
20-24	91	627	0.1451	68	540	0.1259	80	493	0.1623
25-29	64	574	0.1115	72	540	0.1333	64	482	0.1328
30-34	53	467	0.1135	32	435	0.0736	36	384	0.0938
35-39	25	345	0.0725	22	314	0.0701	15	274	0.0547
40-44	7	244	0.0287	2	235	0.0085	3	218	0.0138
45-49	1	111	0.0090	--	118	----	--	1373.17	----
TFR			**3.02**			**2.67**			**2.91**

Source: ACDIS, 2004

There were 6883 live births during the period of observation. Of the live births 2446, 2292 and 2146 occurred in 2000, 2001 and 2002 respectively. In 2000 there were 2380 single live births and 33 twins; 2211 single live births, 36 twins and 3 triplets in 2001; and 2102 single live births and 22 twins in 2002. The General Fertility Rate (GFR) for the 3 years was 102.39, 94.07 and 86.89 per 1000 person years lived. Table 1a below shows the TFRs for the same period has been declining from 3.18 in 2000 to 2.82 in 2001. In 2002, the TFR had declined to 2.52, a decrease of 21% from 2000.

Tables 1b and 1c show the TFRs of women whose sero-status was known. The TFRs for uninfected women are higher than those of uninfected women. While there was no significant change in fertility among the uninfected women during the study period, there was an approximate decrease of 7.6% between 2000 and 2002. This indicates that HIV has a negative effect on fertility. Another interesting feature arising from the analysis of the ASFRs for HIV infected women in the 15-19 year age groups is higher compared to that of HIV uninfected women. This could partly be due to the selectivity of the epidemic. Those women who were relatively exposed to unsafe sexual practices earlier are more susceptible both to HIV infection and the risk of pregnancy, hence have higher ASFRs. With the maturity of the disease, by the time they are 20+ years in age, which is therefore 5-10 years of exposure to the epidemic, the social and biological mechanisms of HIV/AIDS would have started to operate on the fertility of HIV infected. While the HIV/AIDS epidemic could indirectly affect the HIV uninfected women, evidence shows that the effect is more among the infected women.

Fertility in HIV infected and uninfected women

The stratified analyses of the risk ratios and their confidence intervals for a recent birth in HIV infected women to HIV uninfected women are provided in Table 2. The rate ratio for recent birth among all women is 0.92; 95% CI 0.73-1.16, indicating that recent fertility among HIV infected women is 8% lower to that of HIV uninfected women. The results also show that age group and history of STD infection are significant in reducing fertility among HIV infected women. As the age of women increases, the lower the chance of a recent fertility among the HIV infected women compared to HIV uninfected women. While HIV infected women in the age group 20-29 are have higher recent birth than uninfected women, those in the ages 30+ have reduced fertility as the age group increases. This vindicates the fact that age acts as a proxy for duration of HIV infection (Terceira et al., 2003). Women at older ages who are already infected are more likely to be at the advanced stages of the disease, since they have been at risk for a longer time.

It is also interesting to note that while there is no difference in recent fertility among HIV infected and uninfected women without a history of STDs, the recent fertility of those HIV infected women with a history treated STD is 15% lower than that of HIV uninfected women. The recent fertility among HIV infected women with a history of an untreated STD is tremendously reduced fertility (0.62 95% CI 0.06-0.95). Also, HIV infected women who perceive themselves to have a poor health have a higher recent fertility compared to uninfected women (1.97 95% CI 0.88-4.37), unlike those who perceive themselves to have a good health (0.86 95% CI 0.68-1.09). This is also true for women who reside in the rural areas compared to those residing in the urban areas.

Table 2: Risk Ratios of recent birth in HIV infected and uninfected sexually experienced women: Stratified analysis.

	Recent Birth			
	RR	**95% CI**	**No. with characteristic**	
Characteristic			**HIV+**	**HIV-**
All women	0.92	0.73-1.16	813	1679
Age group				
15-19	0.48	0.25-0.93	97	293
20-24	1.27	0.84-1.92	153	242
25-29	1.08	0.68-1.71	166	167
30-34	0.58	0.33-1.02	148	171
35-39	0.29	0.09-0.93	94	252
40-49	0.16	0.02-1.18	155	554
Marital status				
Never lived with partner	0.96	0.75-1.23	675	1380
Ever lived with partner	0.72	0.39-1.34	138	299
Contraceptive use				
Non-use	0.89	0.68-1.16	679	1495
Use	0.88	0.55-1.42	134	184
Sexual partners in previous year				
One	0.86	0.66-1.13	556	1272
Two or more	1.8	0.49-6.67	40	36
Sexual intercourse				
<1 month	0.96	0.70-1.32	362	806
>=1 month	0.89	0.64-1.24	451	873
History of STD (genital discharge)				
No STD	1.00	0.76-1.31	535	1230
Treated STD	0.85	0.49-1.46	161	209
Untreated STD	0.62	0.30-1.26	117	240
Recent health				
Good	0.86	0.68-1.09	905	1850
Poor	1.97	0.88-4.37	88	145
Residence				
Urban	0.86	0.54-1.36	314	350
Rural	1.03	0.79-1.34	499	1290

Source: ACDIS, 2004

Factors associated with fertility in HIV infected and uninfected women

The results of the two logistic regression models fitted separately for HIV infected and uninfected women are shown in Table 3. One set of models (Model 1) controlled for all other variables like age group, contraceptive use, residence, ever lived with sexual partner, period since last sex, history of STDs and parity. The results show that controlling for all afore mentioned variables, age group and parity were significant in explaining the experience of recent birth among both the infected and uninfected women.

Table 3: The logistic regression models for recent fertility among HIV infected and uninfected sexually active women.

Characteristic		HIV uninfected	HIV infected
Age group			
35-39		0.02**	0.00**
30-34		0.13**	0.01**
25-29		0.33**	0.11**
20-24		0.51**	0.58
15-19	(ref)	1.00	1.00
Contraceptive use			
Non-use		0.74	0.69
Use	(ref)	1.00	1.00
Ever lived with sexual partner			
Never		0.81	1.56
Ever	(ref)	1.00	1.00
Coital frequency			
Sex in last month		0.82	0.79
No sex in last month	(ref)	1.00	1.00
History of STDs			
No STD		0.99	2.02
Treated STD		1.20	1.71
Untreated STD		1.00	1.00
Parity		1.39**	1.84**
General Health			
Good		1.52	0.60
Poor	(ref)	1.00	1.00
Residence			
Urban		0.81	0.63
Rural	(ref)	1.00	1.00
Sexual partners in previous year			
One		1.79	0.83
Two+	(ref)	1.00	1.00

$^{+}p\leq.1$; $^{*}p\leq.05$; $^{**}p\leq.01$
ref: reference category
Source: ACDIS, 2004

The logistic regression analyses results show that all other age groups are less likely to experience a birth compared to the age group 15-19 for both HIV infected and uninfected women. However, the reduced fertility is more pronounced among the HIV infected women.

Table 4 below shows the results for logistic regression models adjusted for the effects of age group, ever lived with sexual partner, parity and contraceptive use among HIV infected and uninfected women. In Model 1 the results show that adjusting for the fore mentioned factors, HIV infected women were 20% less likely to have experienced a recent birth in 2002 compared to HIV uninfected women. Further analysis with all other factors adjusted for, but modifying for the effects of contraceptive use show that HIV infected women who were not using contraceptives were 25% less likely to have experienced a birth compared to HIV uninfected women who were not using contraceptives. The results show that even among those HIV infected women using contraception, their fertility was also lower compared to uninfected women.

Table 4. Adjusted odds ratios of recent birth in HIV infected and uninfected sexually active women:

Model and characteristic	Recent birth		
	OR[1]	**95% CI**	**N**
Model 1	0.80	0.55-0.92	2492
Model 2: Effect modification for modern contraceptive use			
Non-use	0.75	0.55-1.02	2174
Use	0.79	0.54-1.16	318

[1] OR: odds ratios adjusted for the effects of age group, ever live with sexual partner, and contraceptive use (except Model 2)
Source: ACDIS, 2004

The population impact of HIV/AIDS on fertility

The population level impact of HIV/AIDS on fertility can be assessed using the PAC(TF) (Zaba & Gregson, 1998). The effects of HIV on the PAC, ASFRs, GFR and the TFR of the study population are shown in Table 5. The PAC for sexually experienced women indicates that the ASFRs and the TFR were substantially lower in HIV infected women compared to uninfected women. There is a substantial increase in fertility among HIV infected women in the age group 15-19. This apparently is the period when most young women get infected, and as well this confirms the fact that teenage fertility contributes substantially to the fertility of South Africa (Swartz, 2002). By the age group 20-24, the reduction effect of HIV on fertility is evident, and peaks at the age group 25-29. It then slows reduces until the age group 40-49. where its association seems to weaken.

The 25-29 age group is the worst affected, in which fertility is reduced by 36% than what it would have been in the absence of HIV. This indicates two things, firstly that the population under study has a mature epidemic, and also it confirms the lengthy latency

Table 5: Population attributable change in age-specific and total fertility among sexually experienced women, ACDIS 2000-2002.

	Recent Birth										
	HIV+ women			HIV- women			All women			HIV	PAC
Characteristic	Births	N	ASFR	Births	N	ASFR	Births	N	ASFR	%	%
Sexually experienced women											
15-19	153	1236	1238	374	5051	740	527	6287	838	13.3	13.5
20-24	239	1660	1440	268	1682	1593	507	3342	1517	42.7	-4.4
25-29	191	1596	1197	207	1125	2293	398	2721	1463	62.6	-36
30-34	140	1286	1089	208	1247	1668	348	2533	1374	59.5	-18
35-39	67	936	716	202	1928	1048	269	2625	1025	43.3	-2.9
40-49	13	1044	125	89	2833	314	102	3877	263	31.4	-16.1
TFR			**3.88**			**3.98**			**3.37**	**33.2**	**-15.3**

Source: ACDIS, 2004

period of HIV, where age acts as a proxy for duration of HIV infection, hence the peak of the HIV prevalence is among the 25-39 years age group. Older women would have had the disease for longer than younger women, and the lifetime risk of both widowhood and infection with other sexually transmitted diseases will increase with age. In addition, older women may also be more likely to suspect that they may be infected, either because they or their partners are ill.

The results in Table 5 show that the total fertility of sexually experienced women is 15.3% lower than what it could have been in the absence of the HIV epidemic. The association between HIV prevalence and PAC(TF) in this study shows that a 1% change in HIV prevalence is associated with a change of 0.45% in total fertility. Table 6 shows the total fertility of women in an HIV scenario, and Table 6 assumes the absence of HIV using data from women who participated in the serological survey. The total fertility of the study population in the context of HIV is estimated at 3.37. The TFR for HIV infected women was 3.88 while that of uninfected women was 3.98. The estimated ASFRs and TFR in the absence of HIV are shown in Table 6, and the TFR rises from 3.37 to 3.53. This therefore implies that the estimated reduction of the total fertility associated with HIV infection in the ACDIS is 0.16 births per woman or 4.5%.

Discussion and conclusions

In South Africa, the HIV prevalence levels have increased most rapidly in the 1990s, from as low as 0.7% in 1990 to 22.8% in 1998. By 2002, the estimated HIV prevalence in

Table 6: Estimated TFR in the absence of HIV among sexually experienced women, ACDIS 2000-2002.

	Recent Birth								
	HIV+ women			HIV- women			All women		
Characteristic	Births	N	ASFR	Births	N	ASFR	Births	N	ASFR
Sexually experienced women									
15-19	132	1236	1069	374	5051	740	506	6287	805
20-24	250	1660	1506	268	1682	1593	518	3342	1550
25-29	260	1596	1629	207	1125	2293	467	2721	1716
30-34	150	1286	1634	208	1247	1668	358	2533	1413
35-39	69	936	737	202	1928	1048	271	2625	1032
40-49	15	1044	144	89	2833	314	104	3877	268
TFR									**3.53**

Source: ACDIS, 2004

South Africa was 26.5%. Concomitantly, the fertility of South Africa has declined from 4.2 in 1990 (Sibanda & Zuberi, 1999) to 3.3 in 1996 (Udjo, 1998), to approximately 2.9 between 1996 and 1998 (DoH, 1999). These national figures compare well with those from the ACDIS data, which show a steady fertility decline from 4.1 in 1990-1994 to 3.4 in 1995-1999 (Camlin *et al*, 2003), and now it stands at 3.37 in 2002. Concurring with the preliminary results which suggested that HIV may be responsible for only about 12% of the fertility decline in the study population (Camlin, 2003), and the study shows that fertility will be reduced by approximately 15%. If the results of the ACDIS were indicative of the situation in the country as a whole, with the fertility declining from 4.2 to 2.9 (a decline of 31%) during the period of the fast growing epidemic, then the total fertility in South Africa in the absence of HIV would be approximately 3.04 (i.e.: 2.9/(1-0.045). In which case, 11% of the national decline in the total fertility would be directly attributable to the HIV epidemic.

The findings from this study are consistent with the review from other 13 studies which show that a 1% prevalence level of HIV is associated with a decrease in population total fertility of around 0.4% (95% CI 0.30% - 0.44%) (Carpenter *et al*., 1997; Lewis *et al*., 2004; Ryder *et al*., 1991; Zaba & Gregson, 1998). These estimates confirm the fact that HIV would accelerate the fertility decline in South Africa, especially if the HIV prevalence continues to soar.

The results from the rate ratios and regressions show that age is the most significant factor associated with the fertility among HIV infected women. The results on age are a vindication that age acts as a proxy for duration of HIV infection, since women at older ages who are already infected are more likely to be at the advanced stages of the disease as they would have been exposed to the risk of infection for a longer period (Terceira et. al., 2003). Also, the results show that there is an inverse association between a history of STDs and fertility among HIV infected. This corroborates other scientific studies which have concluded that STDs are likely to cause pelvic inflammatory diseases among women, leading to sterility (UN, 2002). Given that in KwaZulu-Natal, where an estimated 25% of women have STDs and that 50% of these are asymptomatic conditions that remain undetected and therefore untreated (Wilkinson *et al.*, 1997), then STD screening and treatment, as part of the current anti-AIDS programs should be intensified. The provision of antiretroviral drugs, including nevirapine, as well as the effective treatment of STDs would greatly improve peoples' fertility choices in the era of HIV/AIDS.

The substantial effects of HIV on fertility in South Africa can therefore not be ignored. The fast declining fertility could soon bring the TFR of South Africa below replacement levels. The impact of HIV/AIDS on the population structure and development is beyond the scope of this study, but the effect of HIV on fertility is severely negative. The effects of such a fertility decline on the social, economic and political consequences need to be explored. While a lower TFR is desirable for the development of a population, it could not be achieved through an epidemic like HIV/AIDS, which deteriorates the quality of life in a population.

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