Bifurcated Fertility in Areas with Higher HIV prevalence? Evidence from the 2001-2002 Zambia Demographic and Health Survey

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We estimate the effect of community prevalence of HIV on recent fertility behavior in Zambia. Previous efforts to explore the effects of contextual factors have been hampered by poor data regarding HIV risk among various communities. The Demographic and Health Surveys (DHS) now include HIV testing, providing the first estimates of HIV prevalence for nationally representative samples of reproductive-age adults.

Data and Methods

The data are from the 2001-2002 Zambia DHS. The HIV test results cannot be linked to the individual data, but the age, gender, and geographic location (both province and whether a rural or an urban area) of the respondent contributing the blood sample were retained. These limited data nonetheless provide reliable estimates of the HIV risk in areas that respondents to the individual questionnaires—for whom a wide variety of information is available—live in.

We model the probability of birth as a function of the HIV prevalence in the woman's community. Other community and individual variables contribute to fertility outcomes, and we therefore employ multi-level logistic regression models to estimate the determinants of recent fertility. We limit our analytic sample to women aged 20-40 at interview to insure women were at appreciable risk of birth throughout the five-year period prior to interview.

After we establish the effect of contextual factors including HIV on individual fertility, we explore its effects on the variability in fertility within communities.

Community Characteristics

HIV prevalence rates were calculated for the urban and rural areas of each of Zambia's nine provinces.[1] The set of province/residence specific risk rates given in Table 1 show the extent to which HIV infection varies across the country and regions. The national HIV prevalence rate in these data (15.3%) is lower than the average of the province/residence rates because Zambia remains mostly rural while HIV prevalence is higher in urban areas.

[1] In provinces with less than 50 samples per community, adjustments to the HIV prevalence rates were made and matter little in the estimation of the final models. For instance, the individual-level intercept for the province with average HIV prevalence was estimated to be .0281 higher using the unadjusted rates compared to the adjusted ones in the child mortality model; the difference was miniscule in the infant mortality model.

Table 1: Percent HIV positive by province and type of residence

Province	Urban	Rural	Total
Central	26.1	11.8	15.1
Copperbelt	21.7	11.0	19.6
Eastern	21.7*	12.6	13.6
Luapala	21.6	9.4	11.1
Lusaka	23.1	16.7	21.8
Northern	24.8	4.7	8.0
North-Western	18.1	7.7	9.2
Southern	22.1	15.9	17.3
Western	25.4□	10.2	13.0
All Provinces	22.7	10.7	15.3

*Indicates adjusted percentage because original HIV prevalence estimate was based on fewer than 50 cases

We include a number of other community level variables that measure socioeconomic context measured at the cluster level. There were 320 sampling clusters in the 2001-2002 Zambia DHS with an average of 24 women per cluster. We stabilized the cluster estimates using data from the 18 regions based on province and residence. The relative weight given to the province/residence estimates versus the cluster estimates was determined by the distance between the number of observations in the cluster and 50. Where the cluster had more than 50 observations, we simply used the cluster estimate. Kravdal (2004) gives evidence supporting the appropriateness of basing community estimates on the small samples available for DHS clusters, but we nonetheless used only the province/residence estimates for variables where the number of observations in a cluster was below 5.

The socioeconomic indicators that we include at the community level are urban residence, education, household wealth, and maternal nutrition. Each sampling cluster contained either rural or urban households, and therefore urban residence is included as a dummy variable. Community education is the proportion having completed primary school. Community education has been shown to reduce fertility in sub-Saharan Africa to a significantly greater extent than would be predicted based on the negative relationship between education and fertility at the individual level alone (Kravdal, 2002). The wealth index based on housing quality and consumer durables in the household is averaged for the cluster and for providence/residence areas. We measure maternal nutrition as the proportion of women who have given birth in the four years prior to survey (but who are not currently pregnant or less than three months postpartum) with a Body Mass Index (BMI) of less than 18.5.

Individual Variables

We control for the age of the woman in single years. Mother's education is categorized as none, incomplete primary, complete primary, incomplete secondary, complete secondary, and higher: these categories are included as a continuous variable. We also include a dummy variable indicating whether the respondent has ever been married. The wealth index that was averaged at the community level is also used at the individual level. The woman's parity at the beginning of the observation period is also included in the model.

Dependent Variables

We analyze the determinants of births during the five years prior to interview and during the two years prior to interview. Using the age cut-offs as described above, the probability of giving birth in each individual year is remarkably stable for the analytic sample: ranging from .2368 to .2480. Multiple births are more likely in the past five years, and we therefore experiment with fertility as continuous outcome variable, rather than simply there was or was not a birth.

Finally, after estimating the effects of contextual factors on individual fertility controlling for individual attributes, we examine variation in community fertility. At this stage of the analysis, the sample is the comprised of the 18 province/residence areas. The dependent variable is the ratio of the standard deviation in the number of births in the five years prior to survey to the mean number of births.

Results

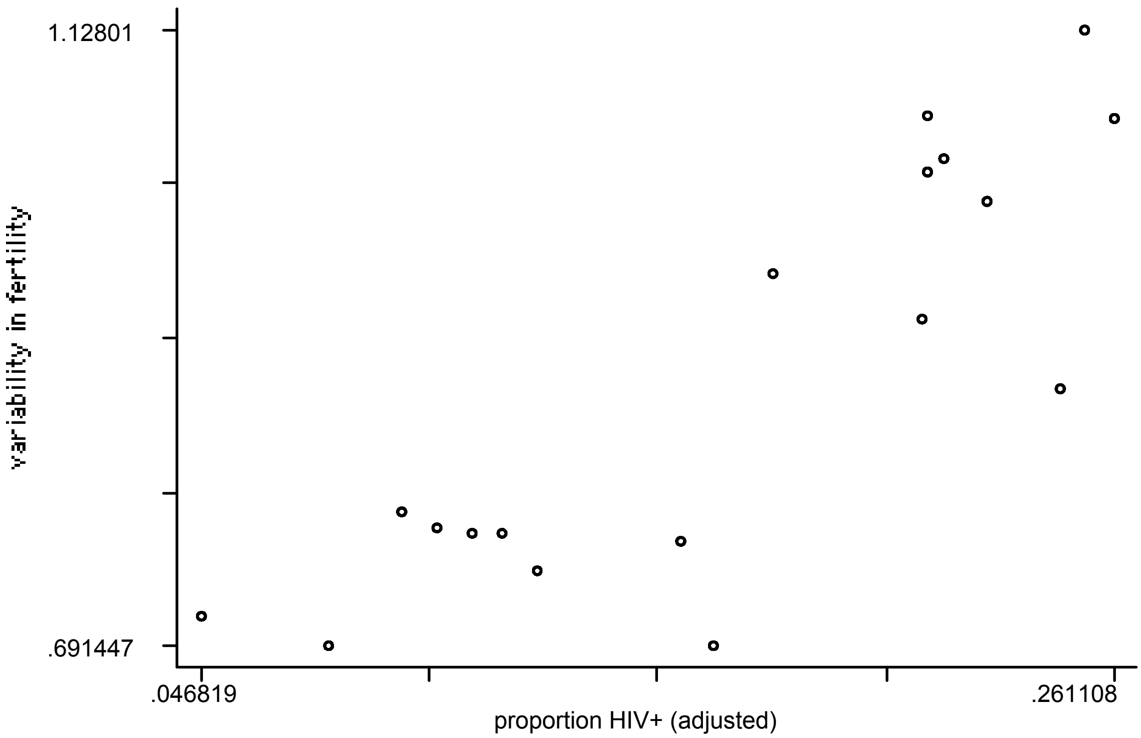
In the bivariate, there is a strong negative effect of HIV prevalence on fertility: areas where HIV infection rates are higher have lower fertility. However, the more socio-economically advanced areas of Zambia are also those with the highest infection rates. These areas would be expected to have lower fertility rates even in the absence of the epidemic. When we introduce controls for individual women's characteristics as well as controls for characteristics of the communities in which they live other than HIV prevalence, we no longer find a significant effect of HIV on recent fertility.

Table 2: Population averaged models with robust standard errors

Outcome	Births in last 2 years	Births in last 5 years
Individual-level characteristics: *logistic coefficients*		
Age	-0.131***	-0.208***
Education	-0.056	-0.027
Never married	-1.293***	-2.028***
Wealth index	-0.210***	-0.183**
Parity at beginning of observation period	0.200***	0.393***
Community-level characteristics: *OLS coefficients*		
Intercept	-0.139***	1.428***
HIV prevalence	-1.034	-1.681
Urban	-0.387*	-0.270
Percent completed primary school	0.025	0.094
Wealth	0.085	0.018
Low BMI	0.275	1.274

* significant at p≤.05; ** significant at p≤.01; *** significant at p≤.0.001

We then test whether the HIV prevalence rate affects variability in fertility at the community level. Because the standard deviation in fertility is lower in absolute terms where fertility levels are also lower, we use standard deviation as a percentage of the mean in the province/residence area to measure variability in fertility across communities. The scatterplot below shows that variability in fertility increases as the proportion HIV positive in the community increases.



Conclusions and Directions for Future Research

Although the data presented here are quite supportive of the hypothesis that community levels of HIV may have important effects on fertility even when these do not show up in the aggregate, further research on diverging fertility patterns where HIV is prevalent is necessary. We intend to explore age-specific and parity-specific effects at the individual level as further information about which groups are contributing most to fertility variability within communities may help explain the mechanisms through which higher HIV risk affects fertility.