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Socioeconomic status and HIV seroprevalence in Tanzania: a counterintuitive relationship

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Objective To examine the relationship between multiple dimensions of socioeconomic status (SES) and HIV seroprevalence in Tanzania.

Methods Using a large nationally representative sample of 7515 sexually active adults drawn from the 2003–04 Tanzania HIV/AIDS Indicator Survey, we analysed the relationship between multiple SES measures and HIV seroprevalence using weighted logistic regression models.

Results In adjusted models, individuals in the highest quintile of standard of living had increased odds ratio (OR) of being HIV-positive (male: OR 2.38, 95% CI 1.17–4.82; female: OR 3.74, 95% CI 2.16–6.49). Occupational status was differentially associated with HIV in men and women; women in professional jobs had higher OR of being HIV-positive (OR 1.54, 95% CI 1.02–2.38), whereas unemployed men had higher risk of being HIV-positive (OR 3.49, 95% CI 1.43–8.58). No marked association was found between increasing education and HIV seroprevalence for men ($P = 0.83$) and women ($P = 0.87$).

Conclusion Contrary to the prevailing perception that low SES individuals tend to be more vulnerable to HIV-infection, we found a positive association between standard of living and HIV-infection. Strategies aimed at reducing HIV-infection needs to be cognizant of the complex social heterogeneity in the patterns of HIV-infection.

Keywords HIV, seroprevalence, socioeconomic status, standard of living, education, Tanzania

Introduction

In sub-Saharan Africa, ~24.7 million people are estimated to be HIV-infected, representing about two-thirds of all global HIV infections.[1] To reiterate the continuing pandemic nature of this infection, in 2006, 2.8 million new infections occurred and a further 2.1 million people died of AIDS in this region alone corresponding to 72% of AIDS deaths globally.[1,2] Much of the discussions tend to focus on the overall prevalence of this epidemic, with an implicit assumption that the epidemic is generalized across the entire population. Specifically, little is known regarding the social distribution and patterning of the HIV epidemic in sub-Saharan Africa. The few studies that have examined the relationship between socioeconomic status (SES) and HIV/AIDS have produced mixed and conflicting results.[3–7] It has been posited that in early epidemic stages HIV/AIDS primarily affects the wealthy and that as the epidemic progresses the disease disproportionately affects the poor.[8] Although, poverty is believed to be a significant

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driver of HIV, the relationship is not very clear-cut.[9–11] To some extent, the lack of clarity in the association between SES and HIV-infection can be attributed to the fact that prior studies have mostly relied on small samples from one or more specific communities.[6,12,13] Moreover, even when studies have examined the association between SES and HIV in national samples, the measures of SES have been restricted to poverty or standard of living.[14] The need to consider multiple distinct domains of SES has been increasingly emphasized.[15] Utilizing the latest nationally representative data from Tanzania,[16] with clinically ascertained data on HIV-infection, and multiple measures of SES, we examined the relationship between SES and HIV seroprevalence. Tanzania, meanwhile, is one of the countries in sub-Saharan Africa affected by the HIV epidemic, with ~1.4 million people living with HIV/AIDS.[2] and where HIV/AIDS accounts for 17% of the total mortality.[17]

Methods

Data

We utilized the 2003–04 Tanzania HIV/AIDS Indicator Survey (THIS),[16] which is the first population-based nationally representative survey on HIV seroprevalence. The THIS was based on a two-stage sampling design, which involved the selection of clusters followed by a systematic sampling of households from mainland Tanzania. Adult men and women (aged 15–49 years) in the selected households were eligible for the survey ($n = 12\,522$), with a response rate of 91% and 96% for men and women, respectively. Anonymous HIV testing was performed, with the informed consent of all eligible survey participants with response rates of 77% and 84% for men and women respectively ($n = 10\,743$). Further details on sampling and testing procedures have been described elsewhere[16] (pp. 3–6). As ~80% of HIV transmission in Tanzania (and in sub-Saharan Africa) is through sexual contact,[18] we restricted the analysis to 9153 men and women aged 15–49 who reported ever being sexually active (male $n = 3944$; female $n = 5209$). After excluding missing data necessary for the study, the final analytic sample for men was 3429, and for women was 4086.

Outcome

The outcome was a dichotomous variable indicating HIV serostatus for each individual. Serostatus was determined via collecting blood samples from each individual, and the samples were tested using the Vironostika Uniform ELISA (Enzyme-Linked Immunosorbent Assay) tests (Vironistika HIV Uniform 2 Ag/Ab and Uni-Form 2 plus O, Organon, Boxtel, The Netherlands).[16] Confirmatory western blot tests were further done on discrepant samples with the INOLIA HIV confirmation western blot kit (Imogenetics, Belgium).[16]

Exposures

The SES was represented by four distinct variables: household standard of living index (SLI), educational attainment and occupational status, reflecting the multidimensional nature of the concept of SES and the distinct pathways through which it may affect individual HIV serostatus. We additionally considered urban–rural status as an area-level marker of SES. Standard of living was defined in terms of ownership of material possessions and assets that has been shown to be a reliable and valid measure of household material well-being.[19] Each individual was assigned a standard of living score that was based on a linear combination of the scores for different items that were recorded for the household in which the person resided and weighted according to a factor analysis procedure. The weighted scores were divided into quintiles for the analytic models.[20] Educational attainment was measured as a categorical variable with the categories reflecting key educational benchmarks appropriate for Tanzania; no education, primary education, secondary education and above. Occupational status was categorized as unemployed, professional, manual labour, agricultural labour. In addition to the above three routinely used constructs of SES, we also considered the urban or rural residence as a dimension of SES, as we believe it is relevant in the context of less-developed economies. This was categorized as capital city, small city, town and rural area. Partner's education and occupation were also included as SES variables in the case of women. Table 1 provides the descriptive characteristics of the above SES indicators as well as other covariates considered in the study.

Covariates

Age, religion and marital status, were considered as confounders. In addition, biological and behavioural factors that increase susceptibility to HIV infection were also included in order to minimize the observed confounding in the SES–HIV relationship. Biological factors included, having a sexually transmitted disease in the previous 12 months, genital discharge in the previous year and male circumcision status. Behavioural factors included condom use at last sexual contact, lifetime number of sexual partners, alcohol use at last sexual encounter, age at first intercourse, perceived risk of contracting HIV and previous testing for HIV. Prior HIV testing was included as a proxy for previous diagnosis of HIV as the survey did not collect this information.

Statistical analyses

We estimated simple and multivariable logistic regression models, stratified by gender, to quantify

Table 1 HIV prevalence by sociodemographic characteristics for all sexually active people, 2003–04 Tanzania AIS[a]

	n (% HIV-Positive)	
	Women	Men
Characteristic		
Age		
15–19	291 (3.3)	339 (2.3)
20–24	828 (6.7)	594 (3.9)
25–29	943 (8.1)	686 (6.5)
30–34	759 (11.4)	618 (8.8)
35–39	585 (8.9)	520 (9.6)
40–49	680 (5.9)	672 (9.5)
Religion		
Moslem	1357 (9.5)	1079 (6.3)
Catholic	1303 (8.2)	1125 (9.1)
Protestant	1101 (6.5)	892 (6.4)
Other	325 (5.3)	333 (4.5)
Place of residence		
Capital city	266 (16.5)	216 (10.1)
Small city	254 (12.9)	194 (14.2)
Town	396 (11.9)	342 (7.7)
Rural	3170 (5.6)	2677 (5.7)
Marital status		
Never married	–	805 (3.3)
Currently married	3638 (6.5)	2425 (7.7)
Formerly married	448 (17.8)	199 (15.0)
Highest educational level		
None	1020 (5.0)	390 (4.5)
Primary school	2882 (8.4)	2750 (7.1)
Secondary and above	183 (13.3)	289 (9.4)
Occupation type		
Unemployed	319 (10.2)	148 (8.4)
Professional	734 (15.1)	535 (10.4)
Manual	101 (7.7)	428 (10.0)
Agricultural	2932 (5.3)	2318 (5.2)
Partner's education		
None	618 (4.6)	N/A
Primary school	3102 (7.6)	N/A
Secondary and above	366 (14.3)	N/A
Partner's occupation		
Professional	825 (11.0)	N/A
Manual	659 (11.7)	N/A
Agricultural	2602 (5.5)	N/A
Wealth index		
Poorest	880 (2.7)	675 (4.2)
Poorer	885 (4.7)	788 (4.4)
Middle	789 (6.6)	656 (5.4)
Richer	817 (10.3)	693 (8.9)
Richest	715 (14.1)	617 (10.9)
Total	4086	3429

[a]Weighted using HIV-sample weight.

the strength and the shape of the association between the SES indicators and the prevalence of HIV-infection. Regression coefficients and standard errors are maximum likelihood estimates and account for the sampling weights and clustering using the PROC SURVEY procedure in SAS version 9.1.[21]

Results

In the Tanzanian population of sexually active individuals, the overall HIV seroprevalence was 7.4% (95% CI 6.5%, 8.3%) (Table 1), and the prevalence of HIV for women and men was 7.8% (95% CI 7.1–8.5%) and 7.0% (95% CI 6.7–7.2%), respectively.

Standard of living

In unadjusted models, men and women in the top quintile of the SLI were 2.78 (95% CI 1.71–4.53; Table 2) and 5.94 (95% CI 3.62–9.75) times more likely to be HIV-infected, compared with those in the lowest quintile of the SLI. Controlling for the socio-demographic characteristics, number of lifetime sexual partners and other HIV risk factors, attenuated

Table 2 Logistic regression results: men's HIV serostatus by socioeconomic status, Tanzania 2003–04 AIS[a]

	OR (95% CI)	
	Unadjusted	Adjusted
Indicator		
Standard of living		
Poorest	1.00	1.00
Poorer	1.04 (0.58–1.86)	0.94 (0.51–1.73)
Middle	1.30 (0.77–2.20)	1.19 (0.67–2.08)
Richer	2.21 (1.33–3.67)	1.91 (1.12–3.28)
Richest	2.78 (1.71–4.53)	2.38 (1.17–4.82)
Highest educational level		
None	1.00	1.00
Primary school	1.61 (0.91–2.87)	1.20 (0.65–2.22)
Secondary and above	2.19 (1.01–4.75)	1.09 (0.48–2.49)
Occupation type		
Unemployed	1.68 (0.81–3.49)	3.49 (1.43–8.58)
Professional	2.13 (1.47–3.08)	1.38 (0.86–2.22)
Manual	2.04 (1.32–3.14)	1.40 (0.85–2.31)
Agricultural	1.00	1.00
Place of residence		
Capital city	1.86 (1.14–3.01)	0.93 (0.49–1.79)
Small ity	2.72 (1.60–4.60)	1.75 (0.89–3.43)
Town	1.37 (0.76–2.47)	0.90 (0.46–1.74)
Rural	1.00	1.00

[a]Weighted using HIV-sample weight.

Table 3 Logistic regression results: women's HIV serostatus by socioeconomic status, Tanzania 2003–04 AIS[a]

	OR (95% CI)	
	Unadjusted	Adjusted
Indicator		
Wealth index		
Poorest	1.00	1.00
Poorer	1.77 (1.02–3.08)	1.79 (1.02–3.17)
Middle	2.54 (1.39–4.66)	2.57 (1.36–4.85)
Richer	4.15 (2.46–6.98)	3.74 (2.16–6.49)
Richest	5.94 (3.62–9.75)	3.70 (1.87–7.33)
Highest educational level		
None	1.00	1.00
Primary school	1.73 (1.17–2.57)	1.06 (0.67–1.67)
Secondary and above	2.90 (1.67–5.04)	1.07 (0.48–2.37)
Occupation type		
Unemployed	2.03 (1.27–3.24)	1.32 (0.75–2.33)
Professional	3.17 (2.32–4.33)	1.54 (1.02–2.38)
Manual	1.49 (0.65–3.39)	0.71 (0.28–1.81)
Agricultural	1.00	1.00
Place of residence		
Capital city	3.34 (2.27–4.93)	1.35 (0.77–2.37)
Small city	2.51 (1.60–3.93)	1.25 (0.78–2.01)
Town	2.28 (1.56–3.34)	1.24 (0.76–2.03)
Rural	1.00	1.00
Partner's education		
None	1.00	1.00
Primary school	1.71 (1.09–2.67)	1.11 (0.71–1.75)
Secondary and above	3.46 (2.01–5.98)	1.43 (0.71–2.88)
Partner's occupation		
Professional	2.11 (1.54–2.90)	0.75 (0.47–1.18)
Manual	2.27 (1.63–3.15)	0.96 (0.61–1.51)
Agricultural	1.00	1.00

[a]Weighted using HIV-sample weight.

the odds ratios to 2.38 (95% CI 1.17–4.82) for men (Table 2), and 3.70 (95% CI 1.87–7.33) for women (Table 3).

Education

In unadjusted models, increasing level of education was also associated with a greater likelihood of having HIV among men (OR 2.19, 95% CI 1.01–4.75) (Table 2). Women with a secondary education or higher were more likely to have HIV compared with those with no education (OR 2.90, 95% CI 1.67–5.04) (Table 3). However, this educational differential was not statistically significant in the adjusted models (OR 1.09, 95% CI 0.48–2.49, $P = 0.83$) and (OR 1.43, 95% CI 0.71–2.88, $P = 0.87$) for men and women, respectively. Women whose partners had a secondary education and above had the highest odds of being HIV infected in unadjusted models (OR 3.46, 95% CI, 2.01–5.98), but this too did not attain conventional levels of statistical significance in adjusted models (OR 1.43, 95% CI 0.71–2.88).

Occupational status

Men and women working in professional occupations had the highest odds of having HIV compared with agricultural workers (OR 2.13, 95% CI 1.47–3.08) and (OR 3.17, 95% CI 2.32–4.33), respectively, in the unadjusted models. This changed however in the multivariable models for men, with unemployed men having a more than 3-fold risk of being HIV infected (OR 3.49, 95% CI 1.43–8.58), while the association weakened but remained the same for professional women (OR, 1.54, 95% CI 1.02–2.38). Women whose partners were professionals were also more likely to have HIV in the unadjusted models (OR 2.11, 95% CI 1.54–2.90); however partners' occupation was marginally significant in adjusted models ($P = 0.05$).

Urban–rural residence

Unadjusted models showed that men who resided in small cities had the highest odds of being HIV-positive compared with those living in rural areas (OR, 2.72, 95% CI 1.60–4.60) whereas for women living in the capital city carried the highest risk (OR 3.34, 95% CI 2.27–4.93). Place of residence was no longer statistically significant in adjusted models for both men ($P = 0.10$) and women ($P = 0.29$).

In adjusted models, the OR of having HIV were 3.01 (95% CI 2.08–4.35) for females with two or more lifetime sexual partners, compared with those with one partner (data not shown). Women who did not know their risk for HIV had the highest odds of being HIV-positive compared with the referent group (OR 1.87, 95% CI 1.18–2.98). For men, those whose partners consumed alcohol at their last sexual encounter had the greatest likelihood of being HIV-positive (OR 3.62, 95% CI 1.59–8.26), as did those with more than five lifetime sexual partners (OR 2.47, 95% CI 1.25–4.88). In the adjusted models, alcohol use by the female partner at the last sexual encounter was significantly associated with higher odds of having positive HIV serostatus for men (OR 2.42, 95% CI 1.03–5.71). None of the biological risk factors examined predicted the likelihood of having HIV in the adjusted models (data not shown).

Discussion

It has been more than 20 years since HIV was first reported in Tanzania, during which time HIV has become a pandemic. It has been posited that people of

higher SES have a greater risk for HIV during the early stages of the epidemic, and as the epidemic matures those of lower SES become disproportionately affected.[8,22,23] Contrary to this widely accepted hypothesis, we find that high SES individuals have higher probability of having HIV, as compared with low SES individuals, even though there is some variation depending upon the SES measure that is utilized. The clear association pertains to the positive association between economic standard of living (a proxy measure of household wealth) and HIV-infection, which has also been observed for other countries of sub-Saharan Africa.[14] Notably, this relationship was consistent for men and women.

Why should higher levels of economic well-being *increase* HIV-infection? Economic well-being may make it possible, especially for men, to afford having sexual relationships with multiple partners. This was substantiated by the fact that wealthier men were more likely to have had two or more lifetime sexual partners (data not shown). Given that HIV-infection is now a widespread epidemic in many sub-Saharan African countries, having as few as two lifetime sexual partners substantially increases the probability of being in a relationship with an HIV-positive partner. We also found that wealthier men were more likely to have used condoms at their last sexual encounter compared with poorer men, and may point toward their ability to afford condoms. More likely though, this finding and the association between increasing wealth and HIV serostatus, suggests that well off men engage in more high risk sexual behaviour, and are as such more likely to use condoms because of this. This is in keeping with previous Tanzanian studies that found greater condom use among people who engaged in high risk sexual behaviours.[7,24] In the case of women, it is possible that being married to or being one of many partners of a wealthy man, improves their SES, but also increases their likelihood of being HIV-positive as a result of being part of a larger sexual network. Forty nine per cent of the women in the richest standard of living quintile reported having two to four lifetime sexual partners. Evidence exists indicating that in many African countries, including Tanzania, women and men often have more than one concurrent sexual partnership that is usually long-term. This is believed to be a significant contributing factor in the dramatic spread of HIV infection in Africa.[25]

While occupational status was positively associated with HIV, the relationship was substantially different for men and women. Women working in professional jobs had the highest probability of having HIV, but for men it was the unemployed who were more likely to be HIV-positive. It is intriguing why women in higher occupational status are more likely to be infected, while for men it is the lower occupational status that is seen to be a risk. It has been observed that in Tanzania unemployment causes men to travel and migrate, especially from rural to urban areas in search of employment opportunities, which puts them in contact with high risk sexual networks and provides them with the opportunity to engage in casual sexual relationships thereby increasing their likelihood of contracting HIV.[26] Work related travel and mobility have been well documented to be associated with increased risk for HIV in Tanzania as well as other African countries.[27–29] The mechanism at play for professional women could be similar to that discussed for wealthy women in that they could be married to or have sexual relationships with wealthy men placing them at risk of having HIV as well. Fifty three per cent of professional women were in the richest quintile of standard of living, and 83% of them were currently married. The gender difference in HIV prevalence by occupation reflects the potentially hazardous pathways through which various occupations operate to differentially affect men and women's risk for contracting HIV. This suggests the need for HIV prevention efforts that take into account the different ways that wealthier, professional men and women as well as poorer men and women in lower occupational categories may contract HIV.

Contrary to our expectations, education was not associated with HIV serostatus after adjustment for other risk factors in the analysis, although the direction of the association was positive for women and negative for men. The lack of a relationship between education and HIV serostatus has also been observed in studies conducted in Tanzania and other African countries.[30,31] Other studies conducted in Eastern and Southern Africa have however found a positive association between educational attainment and HIV.[7,32–34] Although, education is typically related to wealth, we observed a positive but weak correlation between wealth and education in Tanzania ($r = 0.38$, $P \leqslant 0.0001$). Given the positive association between wealth and HIV seroprevalence, we would have expected similar findings with education and given that this was not the case leads us to believe that this reflects the complex social forces underlying the HIV epidemic in Tanzania. Conversely, it could mean education does not equate with wealth, which again points to the need for tailoring HIV prevention programmes to meet the unique needs of different socioeconomic groups. Importantly, the lack of an association between education and HIV infection, to some degree, presents challenges for the role of communications and delivery of health messages as a way to prevent the spread of the epidemic.

Place of residence while not significantly related to HIV serostatus was significantly associated with condom use at last sex and lifetime number of sexual partners, with men and women in urban areas more likely to use condoms and have more lifetime partners. Similarly, for women partner's education and occupation were not significantly associated with being HIV-positive.

Our findings need to be considered alongside the following limitations. The fact that these data are on HIV prevalence as opposed to incidence makes it difficult to determine the temporal sequencing of the exposures in relation to HIV serostatus. The possibility of reverse causation also exists. Since SES was measured at one time point, we do not know whether HIV led to low SES for instance or vice versa, which may explain why unemployed men were more likely to have HIV. Selection bias is also a potential problem. The observed high prevalence of HIV among the wealthy may reflect their increased survival time due to access to life-prolonging anti-retroviral treatment (ART), which poorer people may not be able to afford, thus resulting in earlier death for them. However, since no data were collected on previously confirmed diagnosis of HIV or on current ART treatment status, it was not possible to test this, although an attempt was made to account for this by including prior testing for HIV in the models. Additionally, the scaling up of access to ART was not yet underway in Tanzania during the period the data was collected (2003–04). By the end of 2004, only 3000 people living with HIV were on ART, although there were 44 000 people who required treatment.[35] Additionally, unmeasured characteristics such as cultural background and practices that may influence an individual's SES in later life as well as their risk for HIV may possibly account for the observed relationships.

In summary, this is the first study to examine the relationship between SES and HIV prevalence in Tanzania from a nationally representative population-based sample, and contributes to understanding the current complex social patterning of the epidemic in the country. The use of a clinically ascertained outcome, as opposed to using self-reported risk behaviours, for ascertaining the social epidemiology of HIV is a critical strength of this study, along with the use of multiple measures of SES. It is important, however, to be cognizant of the fact that the HIV epidemic within sub-Saharan Africa are not homogenous and as such these factors have to be examined keeping this in mind, even though the positive association between standard of living and HIV has been observed across other sub-Saharan African countries.[14] The higher prevalence of HIV among higher SES people at this late stage of the epidemic runs contrary to accepted beliefs on the dynamics of the epidemic, and necessitates the need to consider the entire spectrum of economic well-being while designing strategies to prevent HIV-infection. Finally, this study highlights the fact that widely held beliefs concerning the social milieu in which sexual relationships occur in Tanzania and sub-Saharan Africa, have to be rescrutinized. This is particularly true with respect to way researchers view, conceptualize and understand the gender dynamics of HIV/AIDS in Africa. While it is true that many African women fall victim to HIV/AIDS as a result of poverty and unequal gender relations, there is a need to take a broader perspective on this issue and consider that wealthier, professional women may have different reasons than poor women for engaging in sexual relationships, but which nonetheless place them at equal risk for HIV. Taking a narrow view on HIV/AIDS' socioeconomic and gender dynamics runs the risk of failing to institute appropriate preventive measures.

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