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Choice-Disability and HIV Infection: A Cross Sectional Study of HIV Status in Botswana, Namibia and Swaziland

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Abstract Interpersonal power gradients may prevent people implementing HIV prevention decisions. Among 7,464 youth aged 15–29 years in Botswana, Namibia and Swaziland we documented indicators of choice-disability (low education, educational disparity with partner, experience of sexual violence, experience of intimate partner violence (IPV), poverty, partner income disparity, willingness to have sex without a condom despite believing partner at risk of HIV), and risk behaviours like inconsistent use of condoms and multiple partners. In Botswana, Namibia and Swaziland, 22.9, 9.1, and 26.1% women, and 8.3, 2.8, and 9.3% men, were HIV positive. Among both women and men, experience of IPV, IPV interacted with age, and partner income disparity interacted with age were associated with HIV positivity in multivariate analysis. Additional factors were low education (for women) and poverty (for men). Choice disability may be an important driver of the AIDS epidemic. New strategies are needed that favour the choice-disabled.

Resumen La asimetría de poder en las relaciones íntimas puede impedir que las personas más débiles en las parejas se protejan contra el HIV. En un estudio realizado en Botsuana, Namibia y Suazilandia documentamos indicadores de incapacidad para elegir conductas preventivas *[choice disabled]*en una muestra de 7,464 jóvenes de 15 a 29 años. Estos indicadores incluyen pobreza, bajo nivel de educación formal, desigualdad educativa y de ingresos respecto de la pareja, antecedentes de violencia sexual, experiencia de violencia por parte de la pareja, y estar dispuesto a no usar condón aun cuando se piense que la pareja tiene una vida sexual que la expone al VIH. También documentamos conductas de riesgo relacionadas a VIH, como no usar condón de manera responsable y tener múltiples parejas. En Botsuana, Namibia y Suazilandia, respectivamente, el 22,9%, el 9,1% y el 26,1% de las mujeres, así como el 3%, el 2,8% y el 9,3% de los hombres resultaron VIH positivos. Mediante el análisis multivariado, hallamos que las relaciones entre la violencia íntima y la edad, y entre ésta y la disparidad de ingresos en la pareja, se vinculaban de manera independiente con el HIV, tanto en hombres como en mujeres. También fueron factores de riesgo la pobreza para los hombres y el bajo nivel educativo para las mujeres. De estos resultados se desprende que la incapacidad para elegir conductas preventivas puede contribuir a la epidemia del SIDA. Por lo tanto, se necesitan nuevas estrategias dirijidas a esta capacidad de elección.

Keywords HIV · Choice-disability · Risk factors · Intimate partner violence

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Introduction

AIDS prevention programmes in southern Africa have had limited success in controlling the epidemic and we need to examine why this is so. Conventional prevention approaches urge people to make safer choices to protect themselves [1, 2]. But abstinence [3, 4] protects only those able to choose when and with whom to have sex. Not everyone can afford to give up multiple partners [5, 6] or insist on

condom use [7, 8]. For these choice-disabled, urging safer choices has muted relevance.

Perhaps the easiest type of choice disability to envisage is sexual violence. This increases HIV risk directly, for example when trauma leads to sero-conversion of rape victims [9–12]. Coerced first intercourse can also establish the survivor in a victim role with indirect consequences on HIV risk [13, 14]. Many studies show a history of childhood sexual abuse linked with high risk behaviours for HIV in later life [15–20].

Other power gradients have a similar effect, disabling choices of a large population segment. Intimate partner violence (IPV) is one such power gradient that is common in southern Africa: one in every seven household respondents in southern Africa reported IPV in the previous year [21]. A recently published longitudinal study found significantly higher rates of HIV infection among women who experienced more than one episode of IPV, compared with those who reported one or no episode [22]. Cohort studies of HIV discordant partners also show increased risk of infection among partners who report domestic violence [23, 24]. IPV may increase HIV risk by increasing risky behaviours (multiple partners, non-use of condoms) [25, 26].

Transactional sex, the exchange of sex for materials or opportunities, is characterised in southern Africa by steep power inequalities [27, 28]. While some transactional sex is a discretionary economic opportunity [29], for those in absolute poverty without sufficient food, survival options are limited. The longer term costs of transactional sex with someone who might be HIV-positive may be outweighed by the risk of immediate hunger [30]. Other sexualized power gradients, like income differentials between partners [31] and inter-generational sex [32], also reduce choices.

Choice disability may also affect access to treatment among the HIV infected. The incomplete uptake of antiretroviral therapy (ART), including as part of prevention of maternal to child transmission (PMTCT), is an increasing international concern [33, 34] as ART becomes more available in southern Africa. Choice disabled people may be less likely to access ART, perhaps mediated through low self-esteem or depression [35, 36]. There is a lack of direct evidence about this, and inconsistent evidence about whether socio economic status influences adherence to ART [37]. If the current "test and treat" mood [38] takes hold in the region, an inability to implement therapeutic choice could undermine the strategy.

We hypothesized that people who are choice disabled will have higher HIV infection rates than others. This could be either because choice disability increases HIV risk, or because HIV infection leads to some forms of choice disability, or both. The 2008 baseline survey for an ongoing randomised controlled cluster trial (RCCT) [39] in Botswana, Namibia, and Swaziland provided an opportunity to examine the association between aspects of choice disability and HIV status among young men and women, and is the basis for this article. The principal outcome studied in the RCCT is HIV status in women aged 15–29 years, since the incidence of new infections is particularly high in this group. In a factorial design the trial tests interventions in favour of the choice-disabled, alone and in combination: an awareness raising programme focussed on transactional and trans-generational sex; concerting of prevention initiatives in favour of the choice disabled; and a structural intervention intended to increase skills and employability of young women. All three countries have a generalised AIDS epidemic. Botswana and Swaziland have among the highest rates of HIV in the world; the prevalence in Namibia is somewhat lower [40]. All three countries promote ABC, encourage HIV testing, and provide ART. Swaziland at the time of the survey was starting to roll out a mass male circumcision programme.

Methods

For the cross-sectional cluster survey we drew a nationally representative random sample of census enumeration areas in each country, stratified into capital, urban, and rural communities. The sample comprised 78 clusters, 25 each in Botswana and Swaziland and 28 in Namibia.

Potential interviewers, identified by word of mouth, included recent university graduates and people working with non-government and community-based organisations. A 1 week intensive training included classroom and practical sessions in non-sample sites, and covered informed consent and confidentiality procedures, administration of the questionnaire, and obtaining finger prick blood samples and preparing dried blood spots safely. Only those who reached the required standard were selected for the field teams. In November and December of 2008, interviewers visited all households in each cluster and invited all young men and women aged 15–29 years present at the time of the visit to be interviewed and give a finger-prick blood sample for anonymous HIV testing. They only interviewed those who consented to give a blood sample and took precautions to ensure privacy for each interview. We did not provide any monetary or other incentives for participants. Prior to the survey, community leaders gave consent for their community to participate in the trial and the survey. They informed their community when the field teams were coming and in some areas this information was broadcast on local radio.

The face-to-face interview included questions about self-reported age, education level, occupation, number of sexual partners in the last month and last 12 months,

marital status, income relative to the partner, education relative to the partner, absolute poverty (insufficient food in the last week), experience of physical intimate partner violence (IPV) in the previous 12 months, lifetime history of forced sex, consistency of condom use with a non-regular partner, willingness to have sex if their partner refused to use a condom, and perception about their own and their partner's risk of HIV. It also asked if the respondent had been tested for HIV in the last 12 months and whether he or she intended to be tested. It did not ask respondents about their HIV status.

Interviewers collected drops of blood on dried blood spot (DBS) cards using a safety auto-retracting lancet. A bar code linked the sample and anonymous questionnaire. The National HIV Laboratory at the South African National Institute for Communicable Disease (NICD) in Johannesburg undertook HIV testing of the DBS specimens, with confirmatory ELISA testing (Veronostika) of specimens positive on the initial screening ELISA test (Genscreen).

Analysis

Operators entered data twice with validation using Epi Info; analysis relied on CIETmap open-source software [41] which is a user friendly interface for the standard open source R, loading established analysis modules as needed. We examined associations between HIV status and potential risk factors in bivariate then multivariate analysis using the Mantel–Haenszel procedure [42] with an adjustment for clustering described by Gilles Lamothe based on a variance estimator to weight the Mantel–Haenszel odds ratio for cluster-correlated data [43, 44]. Finding significant heterogeneity between age and sex categories, we used age as an interaction term (see below) and developed separate models for females and males.

Prior to the survey, we defined several indicators that could be relevant to choice-disability: lower educational level (no secondary education); extreme poverty (insufficient food in the last week); lower education than partner; earning less than partner; experience of IPV in last 12 months; lifetime experience of forced sex; and risk intention (would have sex if partner refused to use a condom and (separate question) believed partner at risk of HIV). As there is no single word with the equivalent meaning of the English word "rape" in most of the interview languages, we used the phrase "forced sex without consent" which could be rendered in all languages. Rather than restricting the analysis to those with partners, thus reducing the overall population relevance of the study, we handled having a partner as an interaction term with educational disparity, earning disparity, IPV, and inconsistent condom use. Our risk categories were "having a partner and having lower education than that partner", "having a partner and earning less than that partner", "having a partner and experiencing IPV from that partner", "having a non-regular sexual partner and not always using a condom with that partner", and "having a regular sexual partner and not always using a condom with that partner". Thus those without partners were included in the group without the interaction risk factor. Occupation grouped students and volunteers with the employed group. Partner earning disparity grouped those "with a partner and earning less than that partner" in contrast with those with no partner and those with partners earning the same or more than the partner.

Because age interacted with IPV and income disparity for men and with education disparity and income disparity for women, we included these as fully interacted variables in both male and female models, in addition to IPV, education and income differentials on their own.

Each model was initially saturated with the defined choice-disability indicators and other potential risk factors for HIV: country, urban/rural residence, marital status, multiple partners in the last 12 months, multiple partners in the last month, inconsistent condom use with non-regular partners, inconsistent condom use with regular partners, perception of being at risk of HIV, and circumcision status (for males). Using backward elimination, we excluded the weakest association on each run until only significant associations remained. We report on the final male and female models separately, with the adjusted Odds Ratio (ORa) and cluster-adjusted confidence intervals (CIca).

Given that some choice disability factors like partner violence are clustered, and there was a high degree of heterogeneity between clusters, we repeated the analysis using generalised estimating equation (GEE) in the R package Zelig [45] in an exchangeable correlation structure (logit.gee model, 1000 simulations, robust 95%CI). GEE is a recognised method for analysing clustered data when there is heterogeneity between clusters and provided a means of validating our cluster adjustment.

Ethical Issues

The ongoing randomised controlled trial including the baseline survey described here was approved in Botswana by the Health Research and Development, Ministry of Health (PPME-13/18/1 Vol IV(4), 26 August 2008), in Namibia by the Ministry of Health and Social Services (17/3/3/AP, 22 July 2008), and in Swaziland by the Scientific and Ethics Committee, Ministry of Health and Social Welfare (MH/599B, 26 August 2008). All participants gave written, informed consent to provide a finger prick blood sample to be tested for HIV; for those under 18 years the parent or guardian gave written consent. The participants

understood that the HIV testing was anonymous, that they would not receive the result of their test, and that they should not assume not receiving a result meant they had tested negative. Interviewers did not provide any HIV pre-test counselling. Free HIV counselling and testing is provided by government facilities and encouraged in all three countries and interviewers informed all participants of this service and its nearest venue. The interviewers did not provide counselling for any participants who reported having experienced gender based violence. They gave participants contact information about available counselling and support services.

Results

In the 78 clusters, 7,464 respondents (4549, 60.9% female) completed the interview and agreed to provide a blood sample. Of the 12441 identified as eligible to participate in the households, 20% (2518) were absent at the time of the survey, and 20% (2459) declined to give a finger prick blood sample for HIV testing and were not interviewed. Fieldworkers obtained 7,303 usable finger prick samples (97.8% of interviewed participants). The shortfall was due to failed linkage between sample and questionnaire, or an inadequate blood sample.

Figure 1 shows the age and sex specific HIV prevalence rates in the three countries together.

Table 1 shows the HIV prevalence rates in relation to sample characteristics. HIV rates were higher in Botswana and Swaziland than in Namibia. In all countries the HIV rates were higher among women and higher in the older (20–29 years) age range. Thus, in those aged 20–29 years, among women the proportions HIV positive in Botswana, Namibia and Swaziland were: 28.1, 15.3, and 35.2%, and among men these proportions were 11.1, 4.8, and 15.8%. Several factors were significantly associated with HIV status in a bivariate analysis. Age and sex were the strongest factors, interacting statistically with most other factors.

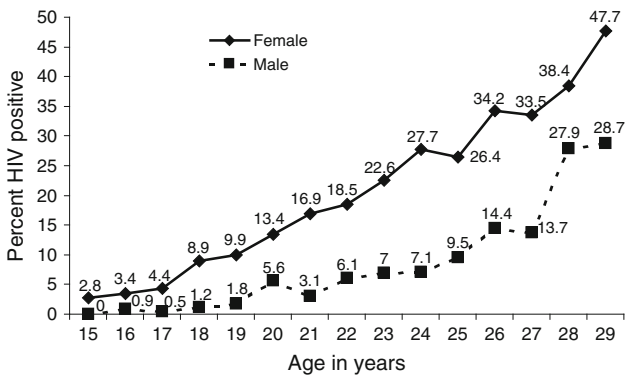

Fig. 1 HIV seroprevalence by age among men and women aged 15–29 years in Botswana, Namibia and Swaziland

Table 2 shows the final multivariate models for HIV status. Taking choice disability indicators into account, neither final model included the conventional HIV risk factors of multiple partners or inconsistent condom use. Country was a factor for both men and women. Three choice-disability indicators were associated with HIV status in women: lower education (ORa 1.87, 95%CI 1.38–2.53), experience of IPV (ORa 1.44, 1.15–1.8), experience of IPV interacted with age (ORa 2.95, 95%CI 2.25–3.87) and partner income disparity interacted with age (OR 2.89, 95%CI 1.97–4.22). For men, the factors were insufficient food (ORa 1.63, 95%CI 1.11–2.40), experience of IPV (ORa 2.15, 1.22–3.8), experience of IPV interacted with age (ORa 6.6, 95%CI 2.18–20.1) and partner income disparity interacted with age (OR 2.68, 95%CI 1.67–4.30).

The repeat analysis using GEE, exchangeable correlation matrix, produced very similar results (Table 2).

In a generalised model of cumulative HIV risk, we included all four choice-disability factors significantly associated with HIV status (education, IPV, income disparity and food insufficiency) in the models for both males and females (Table 3 and Fig. 2). Among women, with each factor added, an additional 10% of the subgroup were HIV-positive, levelling off after three factors (χ^2 for trend 205.4, 4df). For men, starting at a lower level of risk, the increase in risk showed a similar trend (χ^2 for trend 52.2, 4df).

Discussion

This study confirmed an association between choice-disability indicators and HIV infection. For women, partner income disparity, experience of IPV and lower education were all independently associated with positive HIV status, while for men, serious poverty (food insufficiency), partner income disparity, and experience of IPV were associated with HIV status. This supports the idea that choice-disability is not just a women's issue. For both men and women, taking choice-disability indicators into account eliminated the association between HIV status and the conventional risk factors of multiple partners [46] and inconsistent condom use [47, 48]. There is extensive evidence in the literature of a link between the experience of IPV and HIV infection [25, 49]. Particularly in women, more education has been shown in a number of studies to be associated with lower rates of HIV [50].

Although the primary intention of our analysis was not to estimate absolute HIV infection rates, the age and sex distribution of infection (Fig. 1) illustrates the well-known

Table 1 HIV status by sample characteristics and country in youth aged 15–29, and country-and cluster-adjusted odds of being HIV positive

Characteristic	Percent (fraction) HIV positive				OR adjusted[a] (95%CI)
	Botswana	Namibia	Swaziland	All countries	
Whole sample	17.8 (443/2488)	6.6 (174/2619)	18.8 (412/2196)	14.1 (1029/7303)	
Age					
15–19 years	5.1 (33/650)	2.2 (29/1346)	6.5 (58/898)	4.1 (120/2894)	5.50
20–29 years	22.3 (410/1838)	11.4 (145/1273)	27.3 (374/1298)	20.6 (909/4409)	(4.22–7.17)
Sex					
Male	8.3 (72/871)	2.8 (28/1014)	9.3 (89/959)	6.6 (189/2844)	3.41
Female	22.9 (371/1617)	9.1 (146/1605)	26.1 (323/1237)	18.8 (840/4459)	(2.78–4.17)
Marital status					
Single, divorced, widowed	15.3 (303/1977)	5.5 (121/2214)	14.1 (243/1721)	11.3 (667/5912)	2.64
Married or cohabiting	27.4 (138/504)	13.2 (53/402)	35.9 (165/459)	26.1 (356/1365)	(2.06–3.39)
Education					
Secondary or more	17.1 (369/2156)	6.0 (129/2139)	17.9 (282/1574)	13.3 (780/5869)	1.38
Primary complete or less	22.5 (73/324)	9.0 (42/469)	22.2 (127/571)	17.7 (242/1364)	(1.10–1.74)
Partner education disparity					
Edn same/higher/no partner	15.6 (260/1667)	5.0 (100/1990)	15.4 (218/1415)	11.4 (578/5072)	1.73
Edn lower than partner	22.2 (160/722)	10.5 (55/525)	24.5 (163/664)	19.8 (378/1911)	(1.44–2.09)
Occupation					
Income earning	13.8 (140/1014)	4.1 (62/1505)	13.0 (146/1120)	9.6 (348/3639)	2.00
Unemployed/housewife	20.4 (300/1467)	10.2 (112/1103)	25.0 (261/1045)	18.6 (673/3615)	(1.70–2.36)
Partner income disparity					
Earns same/more/no partner	11.1 (137/1229)	4.5 (83/1843)	12.0 (128/1064)	8.4 (348/4136)	2.80
Respondent earns less	24.6 (303/1231)	12.0 (91/757)	29.0 (259/893)	22.7 (653/2881)	(2.30–3.40)
Area					
Capital	17.6 (54/307)	3.3 (12/364)	24.2 (44/182)	12.9 (110/853)	C + U vs R
Urban	17.4 (192/1102)	9.8 (86/878)	28.7 (100/348)	16.2 (378/2328)	1.32
Rural	18.3 (197/1079)	5.5 (76/1377)	16.1 (268/1666)	13.1 (541/4122)	(0.99–1.76)
Food sufficiency					
Sufficient food last week	15.9 (280/1759)	6.0 (132/2193)	16.9 (257/1524)	12.2 (669/5476)	1.55
Insufficient food	22.4 (161/720)	10.0 (42/422)	23.5 (153/651)	19.9 (356/1793)	(1.31–1.83)
Risk intention[b]					
No risk intention	16.9 (392/2317)	5.8 (140/2403)	17.5 (338/1936)	13.1 (870/6656)	2.13
Risk intention	28.5 (47/165)	15.4 (32/208)	29.3 (73/249)	24.4 (152/622)	(1.63–2.78)
Intimate partner violence					
No IPV in previous year	14.6 (291/1991)	6.1 (141/2320)	15.9 (301/1888)	11.8 (733/6199)	2.63
IPV in previous year	30.6 (151/494)	10.8 (32/295)	37.2 (111/298)	27.0 (294/1087)	(1.98–3.49)
History of sexual violence					
Never experienced SV	16.9 (364/2156)	6.3 (145/2320)	18.3 (354/1933)	13.5 (863/6409)	1.45
Ever experienced SV	23.7 (78/329)	9.8 (29/297)	22.4 (57/255)	18.6 (164/881)	(1.17–1.80)
Multiple partners in last year					
No partner or one partner	16.8 (304/1810)	6.9 (145/2105)	18.7 (332/1774)	13.7 (781/5689)	1.10
More than one partner	20.4 (137/671)	5.5 (28/506)	19.4 (77/396)	15.4 (242/1573)	(0.93–1.31)
Multiple partners in last month					
No partner or one partner	17.5 (396/2259)	7.0 (166/2363)	18.9 (380/2015)	14.2 (942/6637)	0.93
More than one partner	20.2 (45/223)	3.1 (8/255)	18.2 (30/165)	12.9 (83/643)	(0.76–1.15)
Condom use non-regular partner					
Always use/no non-regular	17.9 (432/2407)	6.9 (170/2447)	20.1 (393/1953)	14.6 (995/6807)	0.89
Do not always use	23.8 (10/42)	1.4 (1/74)	18.8 (15/80)	13.3 (26/196)	(0.59–1.33)

Table 1 continued

Characteristic	Percent (fraction) HIV positive				OR adjusted[a] (95%CI)
	Botswana	Namibia	Swaziland	All countries	
Condom use with regular partner					
Always use or no regular partner	16.4 (300/1831)	5.2 (90/1721)	17.6 (215/1223)	12.7 (605/4775)	1.75
Do not always use	24.4 (141/578)	10.9 (82/750)	26.0 (192/739)	20.1 (415/2067)	(1.46–2.09)
Perceived personal risk of HIV					
Do not think at risk	10.6 (141/1329)	3.9 (60/1536)	10.3 (117/1131)	8.0 (318/3996)	3.01
Think at risk	25.8 (283/1096)	9.9 (99/1001)	27.3 (268/980)	21.1 (650/3077)	(2.43–3.72)
Circumcision (males only)					
Circumcised	9.3 (9/97)	2.6 (7/265)	7.6 (6/79)	5.0 (22/441)	1.04
Not circumcised	8.2 (63/771)	2.8 (21/741)	9.4 (82/872)	7.0 (166/2384)	(0.60–1.81)

[a] Cluster adjusted odds ratio from bivariate analysis of group with characteristic, compared with counterfactual group (for example, age 20–29 compared with age 15–19); the odds ratio is also adjusted for country, by stratification

[b] Risk intention: Would have sex with a partner who refused a condom when (separate question) partner is thought to be at HIV risk

Table 2 Multivariate analysis of HIV risk factors for men and women aged 15–29 years

	OR un-adjusted	Mantel–Haenszel analysis with cluster adjustment		GEE with exchangeable correlation matrix	
		OR adjusted[a]	Cluster adjusted 95%CI	OR[b]	Robust 95%CI
Female		$n = 4376$		$n = 4549$	
Primary or less education	1.71	1.87	1.38–2.53	1.91	1.47–2.48
Experienced IPV	1.61	1.44	1.15–1.80	1.43	1.17–1.74
Experienced IPV*age[c]	2.92	2.95	2.25–3.87	2.76	2.05–3.71
Income disparity*age[c]	7.75	2.89	1.97–4.22	2.81	1.95–4.06
Country[d]	3.29	2.44	1.73–3.55	2.49	1.75–3.55
Male		$n = 2708$		$n = 2915$	
Poverty (insufficient food)	2.13	1.63	1.11–2.40	1.64	1.17–2.31
Experienced IPV	2.15	2.15	1.22–3.79	1.98	1.28–3.04
Experienced IPV*age[c]	6.23	6.6	2.18–20.05	2.16	1.21–3.87
Income disparity*age[c]	18.37	13.69	3.49–53.68	4.96	2.77–8.89
Country[d]	3.47	2.68	1.67–4.30	2.67	1.66–4.30

[a] Adjusted Odds Ratio from multivariate analysis of group with characteristic, adjusted for all other factors in the model. Details of the initial model are provided in the text

[b] An identical modelling process served for GEE

[c] Interacted variable with age 15–19 and 20–29 years

[d] Country contrasts Botswana and Swaziland, which share many of the same characteristics, with Namibia

epidemiology of the HIV epidemic in southern Africa [51]. Infection rates increase rapidly in young women from 15 years of age onwards, probably related to intergenerational, transactional and forced sex by older HIV-positive males. The rates in young men only take off in their late twenties, probably reflecting unprotected sex with infected women of similar age.

Recognising that causality could be in both directions, a generalised model of cumulative choice disability and HIV risk (Fig. 2) shows the associations in men and women. Without any choice disability factors, men have lower HIV risk than do women. Each additional factor is associated with increased HIV rates (around 10% per factor) for men and women. We recognise that the relative importance of different choice disability factors in relation to the risk of HIV is likely to vary in different contexts.

Whatever the direction of causality, there is good reason to consider the choice-disabled a possible reservoir of HIV infection. Backed into a corner by poverty, partner income disparity, intimate partner violence and lack of education, women might not have recourse to or perhaps motivation for monogamy or protected sex [52, 53]. Insofar as HIV

Table 3 Proportions HIV negative and HIV positive among men and women with increasing numbers of choice-disability factors related to HIV infection in sex stratified models

	Percentage (number)					
	No factors	1 factor	2 factors	3 factors	4 factors	Subtotals
Male						
HIV-negative	95.2	93.1	87.1	77.8	66.7	2560
	(1378)	(855)	(283)	(42)	(2)	
HIV-positive	4.8	6.9	12.9	22.2	33.3	187
	(69)	(63)	(42)	(12)	(1)	$\chi^2 = 52.2$, 4df
Female						
HIV-negative	92.3	82.9	74.0	64.0	60.7	3539
	(947)	(1526)	(812)	(220)	(34)	
HIV-positive	7.7	17.1	26.0	36.0	39.3	826
	(79)	(315)	(286)	(124)	(22)	$\chi^2 = 205.4$, 4df

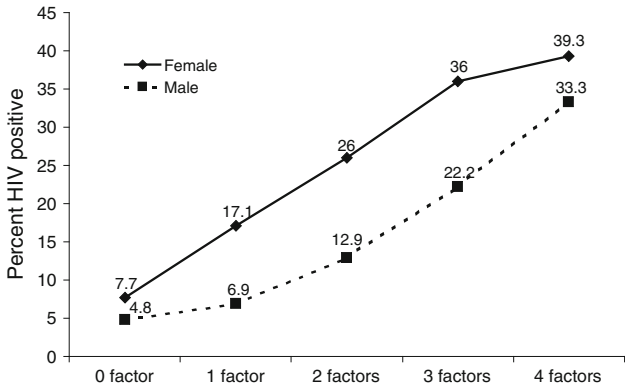

Fig. 2 Proportions of men and women HIV positive among those with 0, 1, 2, 3, or 4 choice disability factors, based on final models of sex-stratified multivariate analyses

infection accentuates choice disability, their disadvantage is amplified. Whether HIV leads to choice disability or choice disability leads to HIV infection, once they have the infection they go on to infect spouses, casual partners or perpetrators of forced sex.

The strong association of male-reported experience of IPV with HIV (Table 2)—especially in the context of age—raises an issue of interpretation. Although female initiation of IPV in general is well recognised in southern Africa [54, 55], we do not consider the male reported experience of IPV necessarily clarifies who initiated the recent episodes. We did not ask who initiated the episode and we do not have any measure of who was more harmed during any physical altercation between partners.

There is continuing debate about the role of poverty in HIV infection. Our finding of an association between serious poverty (insufficient food in the last week) and HIV infection is in line with the finding in a cross-sectional study in Botswana and Swaziland that women who reported insufficient food were also more likely to report risky sexual behaviours such as inconsistent condom use, transactional sex, and intergenerational sex [56], but at first glance contrasts with the finding from DHS surveys in sub-Saharan Africa that HIV prevalence was higher in wealthier households [57]. A small study in Botswana found economic independence to be strongly associated with negotiating power and condom use, whereas education was not a crucial factor [58]. Among those who had remunerated employment in our study, people with higher earning employment were at higher risk; this factor dropped out of the multivariate model including extreme poverty.

Two a priori choice-disability factors (lifetime history of sexual violence and condom related choice-disability) were not "active" in the multivariate models. There was an overlap between people who reported lifetime experience of sexual violence and people who reported physical IPV, which did remain in the multivariate models for both men and women. This overlap, with the well recognised association between IPV and HIV [59, 60], could explain why a history of sexual violence did not stay in the multivariate model. Our classification of people as having condom-related risk intention may have included volitional risk-takers; we nevertheless expected an association between this intention to take a risk and HIV status.

Limitations

The sample represents only those present in the households when the interviewers visited. Young men and women in the target age group may have been absent due to work outside the cluster or not near their homes. This could have biased the sample towards those without remunerated employment, who could also be those with lower levels of education.

Around 20% of eligible people declined to participate, a rate similar to that reported in other surveys in the region that included HIV testing [61–63]. Some may have refused because they knew or feared themselves to be HIV infected. It is also possible that those who declined to participate

were different to those who did participate in respect of choice disability. Evidence from Malawi suggests that people who know their HIV-positive status are less likely to accede to testing in a survey and that this may lead to underestimates of HIV prevalence in surveys [64]. In the follow-up impact assessment of our RCCT [39], we will attempt to interview all those who decline to provide a blood sample, in an effort to understand how they are different from those who agree to provide a sample.

Around one half of participants said they had been tested (61.5% in Botswana, 40.5% in Namibia and 37.1% in Swaziland), broadly similar to the proportions reported from other recent surveys in the region [61, 65, 66]. Thus some of those who were HIV positive will have known their status. Knowing they were HIV positive could possibly have influenced the responses among this group. We did not ask respondents if they knew their HIV status, but we did ask if they intended to have a test in the future. Assuming that those who intended to have a test did not know they were HIV positive, we did a subgroup analysis on those who said they intended to take an HIV test. In Botswana, Namibia and Swaziland, 95.2% (837/879), 83.6% (867/1037) and 78.6% (774/985) of male respondents respectively said they intended to take a test; and 97.9% (1591/1625), 91.1% (1481/1626) and 86.1% (1105/1283) of women respectively said this. The subgroup analysis of factors related to HIV status among those who said they intended to have an HIV test produced very much the same results as among the whole group.

Some choice disability factors, like IPV, are notoriously clustered, as is HIV occurrence. We adjusted for the effect this clustering had on our confidence intervals. It is possible, however, that the clustering had an effect on the measured relative risk. We conducted an alternative analysis to focus on the in-cluster dynamics: GEE (exchangeable correlation matrix). This produced almost identical results to the Mantel–Haenszel procedure, possibly because of the fairly large number (78) of fairly large clusters [67].

The evidence of association in this cross-sectional study does not necessarily mean that HIV infection is a consequence of choice disability. Causality is possible and indeed likely in both directions. For those who know and who disclose their HIV status, the infection could affect partner relations; and as the longer term debilitating consequences of the infection come into play, loss of income could affect food security and income parity. There is also a compelling argument that choice disability might lead to HIV infection: people who have experienced IPV are more likely to have risky sexual behaviours [25]; and people who are at material disadvantage to their spouses and the rest of their community are probably less able to implement choices to protect themselves from HIV, such as insisting on a condom or limiting their number of partners.

Conclusion

In an analysis that took into account conventional risk factors like multiple partners and inconsistent condom use, the prominence of choice disability factors suggests that this group of factors could be important in the HIV/AIDS epidemic.

Choice disability is not the same as vulnerability to HIV infection: choice disabled people are likely to be vulnerable to infection, but not all those vulnerable to infection are choice disabled. For example, rape victims are vulnerable and, clearly, choice disabled. Sex workers and men who have sex with men (MSM) may be vulnerable to HIV infection, but they are not necessarily choice disabled. There is an overlap between vulnerability and choice disability, just as the distinctions between sex work, survival sex, and transactional sex are often unclear.

Prevention messages in mass media and individual counselling often start from the premise that everyone is empowered to implement their prevention choice. By developing a unifying construct for people at the weaker end of steep interpersonal power gradients, we hope that a clearer focus on their plight might help to shift the prevention discourse in their favour. Choice disability may be a common mechanism of otherwise daunting or even unassailable dynamics of HIV transmission: extreme poverty, lack of education and IPV. While elimination of these dynamics is beyond HIV prevention budgets of most countries, understanding how they affect the ability to make protective choices and eventually how to mitigate choice disability may help to interrupt the transmission of HIV among these people.

Forced passivity implicit in choice disability could paradoxically drive the epidemic—both through choice disability increasing HIV risk and HIV infection increasing choice disability. Reducing this blind spot in HIV prevention could have compound benefits. If programmes could take into account the choice disabled, more people would implement their prevention and treatment choices, increasing the uptake of investment currently geared for the choice enabled.

Prevention research should focus on interventions that reduce choice-disability. At least three randomised trials in southern Africa have addressed or are addressing this through structural interventions [68], education [69], and a combination of a structural intervention, education and concerting prevention efforts in favour of the choice disabled [39].

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