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Understanding HIV Risk Behaviors among Young Men in South Africa: A Syndemic Approach

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Abstract

Young men in South Africa experience several adverse socio-structural and psychosocial factors that may contribute HIV risk behaviors. This study applied a syndemic framework to explore whether these factors are interconnected and work in synergy to increase HIV risk behaviors. Five syndemic factors were assessed including: binge drinking, polydrug use, depressive symptoms, violence and food insecurity on two HIV risk behaviors: multiple sex partners and transactional sex. Participants were (N=1,233) young men aged 18 to 29 years from a township in Cape Town, South Africa. Bivariate logistic regression analysis demonstrated that many of the syndemic factors were related to one another. Pairwise interactions (on an additive scale) among the

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Conflict of interest:

Chukwuemeka Okafor declares that he has no conflict of interest.

Joan Christodoulou declares that she has no conflict of interest.

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Mary Jane Rotherman-Borus declares that she has no conflict of interest.

Compliance with Ethical Standards

Ethical approval:

The Institutional Review Boards at UCLA and Stellenbosch University approved all aspects of the study.

Informed consent:

Informed consent was obtained from all individual participants included in the study

syndemic factors revealed significant positive interactions between binge drinking and violence on greater odds of reporting multiple sex partners ($aOR = 5.10$, 95% CI : 3.10, 8.29; $p < .001$) compared to reporting neither factor. Also, food insecurity and violence ($aOR = 2.89$, 95% CI : 1.63, 5.11; $p < .001$) as well as food insecurity and polydrug use ($aOR = 2.73$, 95% CI : 1.54, 4.84; $p < .001$) were associated with greater odds of transactional sex compared to reporting neither factor. Our findings highlight a synergistic relationship between some adverse socio-structural and psychosocial factors on HIV risk behaviors. HIV prevention programs that address multiple syndemic factors simultaneously may achieve greater impact on HIV risk reduction.

Keywords

HIV risk; sexual risk behaviors; syndemics; alcohol; South Africa

Introduction

South Africa has one of the greatest burden of HIV/AIDS in the world, with about 12% of individuals 15 years of age and older living with HIV, with about 2.5 million men living with HIV (1). South Africa's HIV/AIDS epidemic is concentrated in its townships and informal settlements, where HIV prevalence is higher (25%) than the national average (2). The main route of HIV transmission in South Africa is through heterosexual sex, therefore, it is important to assess factors associated with HIV risk among men (1).

Informal settlements in South Africa face a myriad of socioeconomic and structural problems including high unemployment and violence (3,4). These socio-structural problems typically cluster with adverse psychosocial (e.g. mental health problems) and behavioral factors (such as alcohol and drug use and mental health problems) that appear to negatively affect disease and/or health outcomes (5,6). The 'syndemic' theory (or synergistic epidemics) proposes that two or more adverse socio-structural, psychosocial and behavioral factors cluster or are interconnected and work *synergistically* to exacerbate disease and/or health outcomes in disadvantaged populations (7). A growing number of studies, mostly from high-income countries, have employed the syndemic theory to understand HIV risk behaviors in diverse populations including heterosexual men (8), women (9) and Men who have Sex with Men (MSM) (10). Overall, these studies consistently found substantial clustering of the syndemic components which appeared to amplify engagement in HIV risk behaviors.

The current study extends the syndemic framework beyond high-income countries to understand HIV risk behaviors among young men in South Africa. Several factors may serve as potential components of a syndemic that may be associated with HIV risk behaviors among young men in South Africa. Community violence is endemic in South Africa (11) and may contribute to the HIV burden in South Africa (12). Drawing on the "broken windows theory," community violence and physical disorder may signal to others that behaviors that are typically unacceptable [such as intimate partner violence (IPV), multiple sex partners and transactional sex] are permitted (13). In one recent study among male and female adolescents in Johannesburg, South Africa, found that witnessing violence in the

community was associated with having more than one sexual partner (14). Likewise, young men who report perpetrating sexual or physical IPV engage in greater number of HIV sexual risk behaviors than those reporting not perpetrating IPV (3). Therefore, it is possible that residing in townships and informal settlements in South Africa, with high violence, may be associated with individual level HIV risk behavior patterns extending beyond the type of violence observed.

Alcohol consumption is widespread in South Africa, with consumption rates among the highest in the world (15). Men with heavy drinking, are more likely to report having a concurrent partner (16–18), engaging in transactional (16,19) and unprotected sex (17,18) as compared to those who do not. Polydrug use – use of two or more drugs concurrently – is a growing problem in South Africa, with 31% to 52% of youth reporting polydrug use (20–23). Research from South Africa has demonstrated links between polydrug use and transactional sex (20,24), unprotected sex (25) and multiple sex partners (26).

Poverty has been recognized as playing a pivotal role in shaping the HIV/AIDS epidemic in South Africa(27–29), as it can drive individuals to engage in HIV risk behaviors, including transactional sex for food and other basic survival needs. Research on the association between poverty-related factors and transactional sex has been conducted mostly among women (30,31), but may also be relevant among men. Indeed, Kalichman et al. (2012) found a significant relationship between food insufficiency and transactional sex among men in South Africa (32).

Poor mental health may be a potentially important syndemic factor contributing to HIV risk in South Africa. Individuals with poor mental health conditions such as depressive symptoms may have decreased ability to discern HIV sexual risk behaviors and to take steps to avoid them. Multiple studies in South Africa, have documented associations between depressive symptoms and HIV risk behaviors (33,34).

Therefore, each of these adverse factors may serve as components of a syndemic; clustering within the population and compounding the impact of one or more of the other factor and increasing the odds of engaging in HIV risk behaviors. It is important to understand whether a syndemic framework is applicable to HIV risk in young men in South Africa because it can help provide support for utilizing interventions that address these adverse factors simultaneously to achieve greater HIV risk reduction. Thus, the aim of the current analysis is to explore whether different syndemic factors co-occur and interact to amplify the likelihood of engaging in HIV risk behaviors among young men in informal townships in South Africa.

Methods

Study Setting and Participants

Data for this secondary analysis were drawn from an ongoing community intervention randomized controlled trial to engage men in HIV testing and reduce substance use with soccer and vocational training programs in informal settlements around the Western Cape, South Africa (35). Research assistants recruited men (18 to 29 years of age) via door-to-door visitation of households in the neighborhood. Young men residing in households at least 4

nights a week were invited to participate with written voluntary informed consent. Up to four eligible young men were enrolled per household. Assessment interviews were conducted at a nearby township site by a team of interviewers from Stellenbosch University (35). Each participant was reimbursed with a RAND140 (about 12 USD) voucher for each assessment.

Measures

Sociodemographic factors—We obtained participant age via an Identity Document or birth certificate partnership status (single, regular partner, married/living together), years of schooling, monthly income, vocational training since leaving school, and whether they had recently (past six months) tested for HIV.

Primary predictors

Syndemic factors

Binge drinking. Participants were asked the following question “In the last three months how often have you had five or more drinks on one occasion?” Response options ranged from “never” to “daily or almost daily.” From this, we created a dichotomous measure of any binge drinking in the last three months.

Polydrug use. Participants self-reported their marijuana (dagga), methamphetamine, (tik) and methaqualone (mandrax) use in the past three months. From these measures, we derived a variable for polydrug use as use of two or more of the above drugs.

Symptoms of depression. The Center for Epidemiologic Studies Depression (CES-D) scale was used to assess symptoms of depression in the last month (36). This assessment was developed for use with community populations and includes components of depressed mood, feelings of worthlessness, sense of hopelessness, sleep disturbance, loss of appetite, and concentration difficulties. Scores on the CES-D of 16 or more suggests a significant level of psychological distress.

Violence. Participants were asked several questions about violence perpetration including the number of times hitting a woman, forcing sexual activity, physical fights, or being arrested or jailed in the last three months. Each of these variables were dichotomized. Using these variables, we created a dichotomous variable to define any violence perpetration as reporting two or more of the violence related activities above.

Food insecurity. Food insecurity was assessed with a single item that asked the number of days in the past week participants had gone hungry. Participants who indicated they had gone at least one day without food were referred to as food insecure.

Primary outcome

HIV risk behaviors—Number of sexual partners was self-reported, and multiple sex partners was defined as reporting two or more different partners in the past three months. Transactional sex in the last three months was assessed with the following question “*Has a*

woman [or man] paid you for sex with money or presents in the last 3 months?" We defined a dichotomous variable of any sex for money or presents with a man or woman.

Data analysis

We used frequencies and percentages to describe the characteristics of the sample and examined prevalence of each of the syndemic factor. To assess whether the syndemic factors clustered together, we performed logistic regression analysis of associations among the five factors. We also assessed individual relationships among the syndemic factors with the HIV risk behaviors. Next, we tested whether there was an additive association among each of the syndemic factors on HIV risk behaviors. Finally, to determine whether there is an interaction among syndemic factors on the likelihood of reporting HIV risk behavior – which is the test of a syndemic – we tested pairwise interactions on an additive scale of the syndemic factors as predictors of HIV risk behaviors using multivariable logistic regression models (37). Interaction on an additive scale, tests whether the combined effect of two of the syndemic factors is larger than the sum of the individual effects of the two-syndemic factors. Due to potential small counts within levels of the syndemic variables, we did not test greater than two-way interactions. Pairwise interaction terms for syndemic factors were included in the multivariable logistic regression model for HIV risk behaviors. For this analysis, we used the category with the lowest risk when two of the factors are considered as the reference category. We calculated two measures of interaction on an additive scale (here assuming that the odds ratios calculated approximated relative risks): relative excess risk due to interaction (RERI) and attributable proportion due to interaction (AP). RERI and AP values > 0 suggest positive interaction (38). These analyses were planned to be exploratory and thus we did not adjust our analyses for multiple comparisons. Significance level was set at $\alpha = 0.05$ and we performed all analysis using SAS Version 9.4 (SAS Institute Inc., Cary, North Carolina, USA).

Results

Sample characteristics

Much of the sample were aged 18 to 24 years of age (68%), had completed grade 10 or more (71%) and had a regular partner but was not co-habiting (78%; Table 1). About 51% of the sample earned 499 Rand a month (~\$36US, based on 2016 exchange rate) and 57% reported being food insecure. Substance use was prevalent in this sample: 56% reported binge drinking and 52% used marijuana use in the past three months. Over a third of the sample reported hitting a woman and 5% reported forced sex. Just over 50% reported multiple sex partners and 13% reported transactional sex in the past three months.

Co-occurrence among syndemic factors and HIV risk behaviors

There was a considerable degree of clustering among the syndemic factors (Table 2). Participants who reported polydrug use were significantly more likely to report significant depressive symptoms, violence, and food insecurity. Significant depressive symptoms were significantly and positively associated with engaging in violence and food insecurity. For HIV risk behaviors, reporting multiple sex partners was significantly and positively

associated with binge drinking, engaging in violence, but negatively associated with significant depressive symptoms. In addition, transactional sex was significantly and positively associated with polydrug use, engaging in violence and food insecurity.

Associations of syndemic factors on HIV risk behaviors

We conducted two multivariable logistic regression models to test the additive associations. In these models, a positive and statistically significant associations between each of the syndemic factors on HIV risk behaviors will indicate ‘additive’ associations (37). After controlling for sociodemographic factors, only binge drinking [adjusted odds ratio (*aOR*) = 3.02, 95 % confidence interval (*CI*): 2.37, 3.86; $p < .001$] and violence perpetration (*aOR* = 1.68, 95% *CI*: 1.13, 2.50; $p = .001$) were significantly associated with reporting multiple sex partners (Table 3). In the model for transactional sex, after controlling for sociodemographic factors, food insecurity (*aOR* = 1.55, 95% *CI*: 1.09, 2.23; $p = .03$), polydrug use (*aOR* = 1.64, 95% *CI*: 1.20, 2.64; $p = .03$) and violence (*aOR* = 1.60, 95% *CI*: 1.00, 2.54; $p = .04$) were significantly associated with greater odds of reporting transactional sex.

Pairwise interactions of syndemic factors on HIV risk behaviors

In most pairwise interactions of the syndemic factors on the HIV risk behaviors that were tested, few were statistically significant. However, the interactions between binge drinking and violence on higher odds of multiple sex partners as compared to those with neither factor was statistically significant (Table 4). Specifically, the joint impact of both binge drinking and violence was associated with 5.10 odds of reporting in multiple sex partners (*aOR* = 5.10, 95% *CI*: 3.10, 8.29; $p < .001$) compared to those reporting neither factor. Regarding transactional sex, the joint effects of food insecurity and polydrug use (*aOR* = 2.89, 95% *CI*: 1.63, 5.11; $p < .001$) as well as food insecurity and violence (*aOR* = 2.73, 95% *CI*: 1.54, 4.84; $p < .001$) was associated with increased odds of reporting transactional sex compared to those reporting neither factors respectively (Table 4). Also, all measures of interaction assessed i.e. RERI and AP, were > 0 , indicating a positive and greater than additive interaction.

Discussion

In this sample of young men, aged 18 to 29 years in a low-resource, semi-urban informal township setting in South Africa, we found a substantial degree of clustering among the syndemic factors and HIV risk behaviors. Binge drinking and violence perpetration were independently associated with reporting multiple sex partners, whereas, food insecurity, polydrug use and violence perpetration were independently associated with reporting transactional sex.

As discussed in earlier, the syndemic theory proposes that multiple adverse factors (in this case binge drinking, polydrug use, food insecurity and violence) cluster together and each of these factors can magnify the adverse impact of one or more factors (i.e. they interact with each other) on increasing the odds of engaging in HIV risk (7,37). To demonstrate the syndemic theory requires a positive and statistically significant interaction between the

syndemic factors on greater odds of HIV risk behavior. We found some evidence that binge drinking and violence were associated with greater odds of reporting multiple sex partners when compared to reporting only one or neither of these factors. Similarly, food insecurity and violence as well as food insecurity and polydrug use emerged as a syndemic on greater odds of reporting transactional sex compared to reporting only one or neither of both syndemic components.

Since Singer et al (7), first described the syndemic theory, a growing number of studies have utilized this framework to understand HIV sexual risks in diverse populations in North America (39–42), Asia (43) and now emerging in sub-Saharan Africa (9,44). Here we extend the syndemic framework to young men residing in an informal township setting in Cape Town, South Africa. Our results illustrate substantial clustering of these syndemic factors among young men in this sample, which lend support to the concept that multiple factors co-occur within a marginalized population – the first tenet of a “syndemic theory.” Most notably, polydrug use, depression, violence and food insecurity emerged to be positively correlated with one another. Additionally, we found some evidence of the existence of an interaction between some of the syndemic factors on increased odds of engaging in HIV risk behavior, as binge drinking and violence perpetration were associated with greater odds of reporting multiple sex partners. Additionally, food insecurity and violence perpetration as well as food insecurity and polydrug use were associated with greater odds of reporting transactional sex.

Our finding that food insecurity and violence perpetration were associated with greater odds of reporting transactional sex is novel. Most studies on the relationship between food insecurity and HIV risk behaviors in South Africa have focused on women, and have found food insecurity to be associated with increased HIV risk behaviors (4,30). Studies on the relationship between food insecurity and HIV risk behaviors among men are emerging. Our findings are consistent with a study of men in Cape Town, South Africa, that found that men who reported food insecurity were more likely to report transactional sex (32). Our finding suggests that men without reliable or sufficient food may exchange sex for money or resources to secure food. Transactional sex is more frequently documented among women (30), but has been observed among men in low-income settings (31,45) and among MSM (46,47) in sub-Saharan Africa. Although, we do not have data on the sexual orientation of the young men in our sample, some (n=12) indicated engaging in transactional sex with a man. Concerning other HIV sexual risk behaviors, one recent study found lower food insecurity to be associated with unprotected vaginal intercourse among men in South Africa. This finding suggests that HIV risk behaviors may be elevated among men with greater resources (4) In addition, associations between violence perpetration and HIV risk behaviors among men in South Africa has been observed in previous studies (3). Further research to understand the interrelationships between food insecurity, violence perpetration on transactional sex among young men in these settings is warranted.

Our study found depressive symptoms to be significantly associated with decreased odds of reporting multiple sex partners. This finding contrasts with the majority of studies from North America that find depressive symptoms to be predictive of greater likelihood of reporting HIV risk behaviors (48,49). Among men in South Africa, the relationship between

depressive symptoms and HIV risk behavior has been mixed (33,50,51). For example in a study among young men aged 15 to 26 years in the Eastern Cape region of South Africa, young men with depressive symptoms were more likely to report ever engaging in transactional sex (51). Yet, in another study, Meade et al. (2016) found no significant relationship between depression symptoms and unprotected sex, multiple sex partners and sex trading (50). Therefore, additional investigation on the relationship between depression symptoms and HIV risk behavior among young men in South Africa is warranted.

Limitations

Some limitations of the study are noted. Our study was cross sectional and relied on self-report on all measures. Self-report of sensitive behaviors (e.g. substance use and HIV sexual risk behavior) is not always reliable and often underreported. However, data from a previous analysis using a subset of men in this sample found the validity between self-report and rapid drug testing was high to moderate (70% to 48%)(52). Further, given that our study was cross-sectional, our findings are correlational and so should not be interpreted as causal. In addition, our measure of food insecurity comprised only single item. The broad conceptual definition of food insecurity encompasses more constructs that are included in our measurement. In addition, our study did not investigate other socio-structural factors (e.g. cultural norms) that are potentially associated with HIV risk behaviors.

Conclusion

In conclusion, our study findings indicate the potential utility of a syndemic framework in understanding HIV risk behavior among young men living in a township community in Cape Town, South Africa. Young men who reported binge drinking and violence perpetration were more likely to report having multiple sex partners. Additionally, young men who reported polydrug use and violence perpetration as well as polydrug use and food insecurity had greater odds of reporting transactional sex than either having either factor alone. Our findings suggest that HIV prevention programs focused on young men in South Africa that address multiple syndemic factors simultaneously may achieve greater preventive impact than addressing either factor alone. Many of the HIV prevention interventions in South Africa addressing multiple syndemic factors simultaneously have focused on women (53–56), and men who have historically received less attention (57), are now being included in HIV prevention programs (35,58–61). Therefore, there is a need to investigate additional individual, psychosocial and structural level factors that may constitute components of a syndemic among young men in this setting that can guide intervention development.

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Table 1.

Characteristics of young men in the study

	N	(%)
Total	1233	(100)
Age		
18 to 24 yrs.	836	(67.8)
24+ yrs.	397	(32.2)
Years of schooling		
Grade 9 or less	363	(29.4)
Grade 10 to 11	532	(43.1)
Grade 12 or more	338	(27.4)
Live with parents	769	(62.4)
Relationship status		
Single	190	(15.4)
Regular partner but not living together	970	(78.7)
Living together/Married	73	(5.9)
Monthly income		
0 to 499 Rand	627	(50.9)
500 to 1000 Rand	312	(25.3)
1001 to 2000 Rand	166	(13.5)
2000 Rand and above	128	(10.4)
Gone hungry for 1 day	705	(57.2)
Vocation training	370	(30.0)
Recent HIV test	519	(42.1)
HIV-Positive	44	(3.6)
Binge drinking	690	(56.0)
Used marijuana	642	(52.1)
Used mandrax	184	(14.9)
Used methamphetamines	231	(18.7)
Polydrug use	136	(11.0)
Forced partner to have sex	60	(4.9)
Hit a woman	419	(34.0)
Recently arrested	58	(4.7)
Recent physical fight	183	(14.8)
Depression	448	(36.3)
Transactional sex with a man/woman	162	(13.1)
With a woman	157	(12.7)
With a man	12	(0.97)
Multiple (2+) sex partners		
0 to 1	604	(49.0)

	N	(%)
2+	629	(51.0)

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Table 2.

Unadjusted associations among syndemic factors and HIV risk behavior

	Odds ratio 95% CI						
	Binge drinking	Polydrug use	Depression	Violence	Food insecurity	Transactional sex	
Binge drinking	-						
Polydrug use	0.74 (0.52, 1.06)	-					
Depression	0.87 (0.69, 1.10)	1.89 (1.32, 2.70)***	-				
Violence	1.81 (1.43, 2.30)***	2.49 (1.59, 3.90)***	1.78 (1.25, 2.52)**	-			
Food insecurity	1.14 (0.91, 1.43)	2.08 (1.41, 3.08)***	4.33 (3.32, 5.64)***	1.99 (1.35, 2.91)***	-		
Transactional sex	1.20 (0.86, 1.68)	1.77 (1.12, 2.79)*	1.17 (0.83, 1.64)	1.75 (1.12, 2.75)*	1.69 (1.19, 2.40)***	-	
Multiple partners	3.20 (2.53, 4.05)***	1.17 (0.81, 1.67)	0.66 (0.52, 0.83)***	2.04 (1.41, 2.94)***	1.03 (0.82, 1.29)	3.39 (2.33, 4.95)***	

Sample size=1,233

* $p < .05$;

** $p < .01$;

*** $p < .001$

Note- CI=Confidence interval

Table 3.

Multivariable Logistic Regression among Syndemic Factors and HIV Risk Behaviors

	Dependent variables	
	Multiple sex partners	Transactional sex
	AOR (95% CI)	AOR (95% CI)
Age (vs. 24+ yrs.)		
18 to 24 yrs.		0.65 (0.45, 0.91) ***
Years of schooling (vs. Grade 9 or less)		
Grade 10 to 11	0.91 (0.68, 1.22)	-
Grade 12 or more	0.67 (0.48, 0.92) *	-
Vocational training	-	2.13 (1.51, 3.01) ***
Relationship status (vs. Single)		
Regular partner but not living together	2.08 (1.43, 2.88) ***	-
Living together/married	1.26 (0.70, 2.27)	-
Monthly income (vs. 0 to 499 Rand)		
500 to 1000 Rand	1.15 (0.86, 1.54)	-
1001 to 2000 Rand	1.70 (1.17, 2.47) **	-
2000 Rand and above	1.70 (1.12, 2.58) *	-
Recent HIV test	1.36 (1.06, 1.74) *	-
Food insecurity	1.16 (0.90, 1.50)	1.55 (1.09, 2.23) *
Binge drinking	3.02 (2.37, 3.86) ***	
Polydrug use	1.37 (0.92, 2.02)	1.64 (1.20, 2.64) *
Depression	0.63 (0.48, 0.82) ***	-
Violence	1.68 (1.13, 2.50) *	1.60 (1.00, 2.54) *
Binge drinking X Violence	5.10 (3.13, 8.29) ***	-
Food insecurity X Polydrug use	-	2.89 (1.63, 5.11) **
Food insecurity X Violence	-	2.73 (1.54, 4.84) **

Sample size=1,233

* $p < .05$;** $p < .01$;*** $p < .001$

Note- AOR=Adjusted odds ratio; CI=Confidence interval

Table 4.

Joint Effects of Syndemic Factors on HIV Risk Behaviors and Measures of Interaction on Additive Scale

		Adjusted odds ratio			
		Multiple sex partners [†]	Transactional sex [‡]	RERI	AP
Binge drinking	Violence				
No	No	Ref		1.41	0.28
Yes	No	3.02 (2.37, 3.86) ***			
No	Yes	1.67 (1.13, 2.50) *			
Yes	Yes	5.10 (3.13, 8.29) ***			
Food insecurity	Polydrug use				
No	No	-	Ref	1.06	0.37
Yes	No	-	1.52 (1.04, 2.23) *		
No	Yes	-	1.31 (0.48, 3.57)		
Yes	Yes	-	2.89 (1.63, 5.11) ***		
Food insecurity	Violence				
No	No	-	Ref	0.62	0.23
Yes	No	-	1.58 (1.07, 2.30) *		
No	Yes	-	1.53 (0.60, 3.90)		
Yes	Yes	-	2.73 (1.54, 4.84) **		

Sample size=1,233

*
 $p < .05$;**
 $p < .01$;***
 $p < .001$

Note-

[†] Adjusted for years of schooling, relationship status, monthly income, HIV test, and food insecurity;[‡] Adjusted for age and vocational training, Ref=Reference

RERI=Relative Excess Risk due to Interaction;

AP=Attributable Proportion due to Interaction.

RERI/AP=0 means no interaction

RERI/AP>0 means positive interaction or more than additivity

RERI/AP<0 means negative interaction or less than additivity

Ref=Reference