AIDS Education and Prevention, 23(5), 437–447, 2011

COMMUNITY-LEVEL HIV RISK BEHAVIORS AND HIV PREVALENCE AMONG WOMEN AND MEN IN ZIMBABWE

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Most studies on HIV risk in sub-Saharan Africa focus on individual-level sociodemographic and behavioral correlates of risk. Only recently have researchers and programmers considered the context within which individuals live. This study uses the 2005-6 Zimbabwe Demographic and Health Survey to examine the correlation between the prevalence of HIV at the community level and the prevalence of HIV risk-taking behaviors. Results show that women and men living in communities with higher HIV prevalence in the opposite sex are at increased risk of HIV. In addition, rural women and men living in communities with greater premarital and nonmarital sex are at greater risk of HIV. Finally, HIV prevalence is higher among women and men living in urban areas with higher intimate partner violence. Programs should address community-level social norms that make high-risk behaviors acceptable and thus increase all women and men's risk of HIV, not just those engaged in high-risk behaviors.

The prevalence of HIV in sub-Saharan Africa varies widely, with the highest rates in the southern Africa region. Even within a given country, rates of HIV prevalence can vary considerably from one area to another. For example, a recent study of the geographical distribution of HIV among youth aged 15-24 in South Africa shows geographic variability in prevalence within and across provinces (Kleinschmidt, Pettifor, Morris, McPhail, & Rees, 2007). To date, most studies that examine factors associated with the risk of HIV in sub-Saharan Africa focus on individual-level sociodemographic and behavioral correlates of risk (Gregson et al., 2001; Gregson et al., 2002; Hallett et al., 2006; Lewis, Donnelly, Mare, Mupambireyi, Garnett, Mahomva et al.,

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This research was also supported by grant 5 R24 HD050924, Carolina Population Center, awarded to the Carolina Population Center at The University of North Carolina at Chapel Hill by the Eunice Kennedy Shriver National Institute of Child Health and Human Development. The contents of this article are solely the responsibility of the authors and do not necessarily represent the official views of the National Institute of Child Health and Human Development. An earlier version of this article was presented as a poster at the annual meetings of the Population Association of America in Dallas, TX, in April 2010.

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2006; Pettifor, Measham, Rees, & Padian, 2004; Sambisa & Curtis, 2007). Descriptive analyses demonstrate that women and men who are more educated; of higher socioeconomic status (as measured through household assets); married, widowed or divorced; and work in the professional and manual/domestic sectors have a higher prevalence of HIV than women and men who are less educated, of lower socioeconomic status, single, and those who work outside of the professional or manual/domestic sectors (Gregson, Zhuwau, Anderson, Chandiwana, 1998; Mishra et al., 2007; Mishra, Medley, Hong, Gu, Robey, 2009). Furthermore, women and men from urban areas are more likely to be HIV positive than women and men from rural areas (Kleinschmidt et al., 2007; Mishra et al., 2009). A number of behavioral factors are also associated with increased risk of HIV infection, including engagement in multiple and concurrent partnerships, nonuse of condoms, and early and premarital sex (Gregson et al., 2002; Hallett et al., 2006; Mishra et al., 2009; Hallett et al., 2007; Hargreaves et al., 2007). Furthermore, gendered power roles, common in sub-Saharan Africa, lead to men having more control over sexual decisionmaking, increasing women's HIV risk (Maman, Campbell, Sweat, & Gielen, 2000). In addition, men use intimate partner violence (IPV) to impose control in relationships. Recent studies on the influence of IPV on HIV prevalence report inconsistent results at the individual level; some studies find a significant effect of IPV on HIV status (Dude, 2009; Pettifor et al., 2004; Silverman, Decker, Saggurti, Balaiah, Raj, 2008), whereas other studies find no effect, controlling for other individual-level factors (Jewkes et al., 2006; Sambisa & Curtis, 2007). Notably, young men's perpetration of IPV has been found to be associated with engagement in risky sexual behaviors, such as having more sexual partners, including casual partners, and greater engagement in transactional sex (Dunkle et al., 2006).

Only recently have HIV research and programmatic efforts begun to consider the context within which individuals live (Feldacker, Ennett, & Speizer, 2011; Kleinschmidt et al., 2007; Lewis et al., 2007). In particular, a study on rural Malawi shows that proximity to a major road and access to a public health clinic are associated with greater risk of HIV (Feldacker et al., 2011). Furthermore, the higher prevalence of HIV in urban areas is associated with persons (especially men) in urban areas having greater access to resources to attract partners, having greater mobility, and living in an environment where there are less strict controls over sexuality (Mishra et al., 2007). In urban areas there is also greater acceptance and engagement in cross-generational sex (Luke & Kurz, 2002). Cross-generational relationships may be characterized by power imbalances, making it difficult for young women to negotiate the use of condoms and increasing their risk of HIV (Luke & Kurz, 2002). Finally, traditional sexual practices that increase HIV risk vary across community contexts. For example, the acceptability of extramarital sex, the practice of dry sex, female and male circumcision, and other norms and practices that could influence HIV risk vary within and across countries where the prevalence of HIV is high (Lewis et al., 2007; Sambisa, Curtis, & Stokes, 2010).

A number of relationship factors are also associated with women's and men's risk of HIV, indicating the importance of examining the broader context of sexual risk taking and community-level prevalence of HIV rather than solely examining an individual's own behaviors (Boerma & Weir, 2005). For example, married women are exposed to HIV through their husband's sexual behaviors (Lewis, Garnett, Mhlanga, Nyamukapa, Donnelly, & Gregson, 2005: Lopman et al., 2009). Studies from rural Zimbabwe, urban Zambia, and urban Rwanda have shown that community-level HIV prevalence among the opposite sex is associated with women's and men's risk

of HIV (Dunkle et al., 2008; Lewis et al., 2007). In one study, after controlling for men's individual-level factors, partnership-level factors for men (e.g., living arrangement, partner has other partners, age of partner, age difference, and type of partner) were found not to be associated with men's HIV status; however, partnership-level factors for women, particularly suspecting partner infidelity, remained important (Lewis et al., 2007). Furthermore, Dunkle and colleagues (2008) estimated that the majority of new heterosexual HIV infections in urban Zambia and Rwanda occur within married or cohabitating discordant couples and demonstrate that the risks of HIV infection within marriage were associated with premarital and extramarital sexual activity of both partners.

In summary, the literature indicates that there are multiple individual-level demographic and behavioral factors as well as factors related to partnership dynamics and community norms that are associated with risk of HIV. In this study, the focus is on key behavioral factors aggregated at the community level. In particular, we are interested in understanding if women or men from communities with more premarital sex, greater engagement in nonmarital partnerships, higher levels of IPV, and higher HIV prevalence among the opposite sex are at an increased risk for HIV compared with their counterparts in communities where the prevalence of these factors is lower. The majority of the factors included here, in addition to increased condom use in high-risk partnerships, are thought to be associated with recent reductions in HIV prevalence in Zimbabwe (Gregson et al., 2006; Mahomva et al., 2006; Hallett et al., 2006). Notably, condom use in high-risk partnerships is not included in this analysis because it is correlated with the prevalence of nonmarital and premarital sex, two factors already included in the analysis. By stratifying by residence and including prevalence of secondary education in the models, we are able to capture some of the key demographic factors found to be associated with HIV. Using recently collected data from Zimbabwe we examine the correlation between the community-level prevalence of HIV and the community-level prevalence of HIV-risk behaviors. The findings from this study can be used to make recommendations for future interventions to change relationship norms in Zimbabwe and in other locations where HIV prevalence is high.

METHODS

The data for this study come from the 2005-6 Zimbabwe Demographic and Health Survey (DHS), a nationally representative probability sample of 8,907 women (aged 15-49) and 7,175 men (aged 15-54). A household questionnaire gathered basic demographic information on the characteristics of each person in the household as well as details about the household's dwelling unit (e.g., source of water, type of toilet facilities) and ownership of various durable goods. Individual-level questionnaires collected information from eligible women and men on demographic and socioeconomic characteristics, marriage, sexual activity, and knowledge and attitudes toward HIV/AIDS and other sexually transmitted infections (STIs). HIV testing was done using dried blood samples from a finger prick collected on filter paper. Details about the sampling design and data collection procedures are available from the Zimbabwe DHS final report (Central Statistical Office & Macro International, 2007).

For this study, the community is defined as the primary sampling unit (PSU) used in the Zimbabwe DHS. The DHS used a multistage sampling design. First, PSUs were randomly selected; then within sampled PSUs, about 20 to 30 households

were randomly selected for data collection. In selected households, all women aged 15-49 and all men aged 15-54 were eligible for interview. There were a total of 398 PSUs included in the Zimbabwe DHS. Because this analysis is performed at the community (PSU) level, all study variables were calculated by estimating the weighted mean value of each variable at the community level based on available observations (e.g., the female HIV prevalence is based on the weighted average of all women in the community's HIV test results).

The dependent variable for this analysis is the prevalence of HIV at the community level calculated separately for women and men. Given that there were some missing data on the HIV test, the dependent variable was only calculated for communities where there were five or more female observations (or male observations for the male HIV variable) on the HIV status. For females, two communities (PSUs) had fewer than five observations and thus had missing data on the HIV outcome of interest. For males, there were eight PSUs that fell into this category. For these communities with not enough observations, the HIV prevalence was imputed from nearby PSUs using an inverse distance weighting procedure.

The independent variables in this analysis include the prevalence of secondary or higher education, the prevalence of premarital sex, the prevalence of nonmarital sex, and the prevalence of IPV. The education variable was calculated by aggregating and weighting separately the percentage of women and men with secondary or higher education. Using information on ages at first sex and first marriage, a variable was created at the individual level to indicate whether the individual's first sex was premarital. Notably, the information on age at first sex was provided only as a whole number age variable. When the age at first sex and first marriage were the same whole number value, first sex was coded as marital; this is the more conservative coding approach. From the individual-level information on premarital sex, a weighted aggregated community-level prevalence of premarital first sex was calculated, as was done for the other aggregated variables. A similar approach was used for determining at the individual-level whether the respondent's last sexual partner was a nonmarital partner and then aggregating the individual-level variable to get the prevalence of nonmarital sex at the community level. Finally, for the IPV questions, a variable was created to reflect whether a woman had ever experienced physical or sexual IPV. If a woman reported ever being pushed, shaken, or having something thrown at her; being slapped; having her arm twisted or hair pulled; being punched with a fist or something that could harm her; being kicked, dragged, or beaten up; attempted choking or burning; being threatened or attacked with a knife, gun, or any other weapon; being physically forced to have sex when not desired; or being forced to perform any sexual act when not desired, she was considered to have ever experienced IPV. Based on the individual-level IPV variable, the aggregated community-level IPV prevalence was calculated. There were six communities (PSUs) for which the number of observations for females was too small (less than five) to calculate community-level IPV. As with the dependent variables, missing community-level values for IPV were imputed using an inverse distance weighting algorithm based on nearby PSUs. IPV was only measured in the female sample.

Correlations and standard linear multivariate regression model results are presented. Analyses were performed separately for women's and men's HIV prevalence as the outcomes. For women, the female prevalence of HIV is regressed on whether the community is urban, the proportion of women with secondary or higher education, the prevalence of premarital sex among women, the prevalence of women having nonmarital partners, the prevalence of men having nonmarital partners, the

TABLE 1. Community Characteristics by Residence for Women and Men from Zimbabwe

Variable	Women		Men	
	Urban	Rural	Urban	Rural
HIV prevalence[a]	20.9%	21.6%	14.9%	13.8%
Secondary or higher education	84.9%	49.8%	89.7%	58.5%
Premarital sex	31.4%	3.2%	62.6%	53.1%
Any IPV experience	22.1%	30.2%	NA	NA
Last partner nonmarital	16.6%	9.3%	28.4%	25.7%

Note. IPV – intimate partner violence; NA – not applicable. [a]Two communities for women and eight communities for men had HIV prevalence imputed from neighboring communities owing to too few observations to calculate prevalence.

prevalence of physical or sexual IPV as reported by women, and the prevalence of HIV among men. For men, a similar approach is used whereby the prevalence of HIV among men is regressed on whether the community is urban, the percentage of men with secondary or higher education, the prevalence of premarital sex among men, the prevalence of nonmarital sex among men, the prevalence of nonmarital sex as reported by women, the prevalence of IPV (as reported by women), and the female HIV prevalence. Stratified models by place of residence (urban or rural) are presented for both women and men.

RESULTS

Zimbabwe, formally the jewel of southern Africa, has recently experienced political and economic difficulties that have led to hyperinflation, out-migration, and declining health status. Zimbabwe is one of the countries with the highest HIV prevalence in sub-Saharan Africa. Descriptive information on women and men in Zimbabwe from the 2005-6 DHS is provided in Table 1 for the key variables by urban and rural residence. As shown in Table 1, the prevalence of HIV is higher among women than among men. Among women and men the prevalence of HIV is similar in urban and rural areas.[1] In Zimbabwe educational attainment is high, as demonstrated by the fact that more than four fifths of women and men in urban areas have secondary or higher education and 50% of women and nearly 60% of men have attained secondary or higher education in rural areas. About 30% of women and more than 50% of men reported premarital sex, with the highest levels among men from urban areas (63%). IPV is more common in rural than urban areas, with nearly 30% of women in rural areas reporting ever experiencing physical or sexual IPV, and 22% of women in urban areas reporting the same. As expected, a greater proportion of men report nonmarital sexual relations as compared with women; however, 9% of women in rural areas and 17% of women in urban areas report recent nonmarital sexual relations.

In Table 2 we present the correlation coefficients from the examination of the prevalence of HIV and the prevalence of each of the key behavioral factors. The correlations are presented for all women and men and then stratified by place of

1. The data on HIV prevalence among women is slightly different than in the final Zimbabwe DHS report because for the two communities that did not have five or more observations, we imputed the prevalence based on communities in the vicinity. This leads to a slightly lower urban female prevalence and a slightly higher rural female prevalence than presented in the DHS report (DHS value for urban women is 21.6%; and for rural women is 20.8% [Central Statistics Office & Macro International, 2007]).

TABLE 2. Correlations Between HIV Prevalence and Key Independent Variables by Residence for Women and Men from Zimbabwe

	Women			Men		
	Total	Urban	Rural	Total	Urban	Rural
Percentage with secondary education (by sex)	0.0553	-0.2569	0.167	0.0355	-0.0397	0.0218
Percentage had premarital sex (by sex)	0.2938	0.1495	0.3388	0.1996	0.054	0.2434
Percentage females with nonmarital last partner	0.2164	-0.0015	0.3279	0.1128	0.0517	0.1285
Percentage males with nonmarital last partner	0.2185	0.0983	0.2606	0.0183	-0.1011	0.1285
Percentage females reporting IPV	-0.0264	0.2432	-0.1282	-0.0007	0.259	-0.0872
Percentage opposite sex with HIV	0.3614	0.2465	0.4075	*	*	*

Note. *Same values for correlations between women and men.

residence. Most of the correlations in this table are small, with the exception of the correlation between female and male HIV prevalence, as expected. Notably, other correlations that are of a moderate size are among women in rural areas. In particular, in rural areas with greater female premarital and nonmarital sex, the prevalence of HIV is higher.

In Tables 3 and 4, we present results from the linear regression models where HIV is regressed on the key behavioral factors for the full sample and then stratified by place of residence. Controlling for all other factors, as expected, for both women and men, the strongest predictor of HIV prevalence is HIV prevalence among members of the opposite sex. Communities with high rates of female HIV prevalence generally have high rates of male HIV prevalence and vice versa. The addition of this single variable to any regression specification generally doubles the *R*-squared goodness-of-fit value. Notably, the role of community-level HIV prevalence of one sex on the other is stronger in rural areas than in urban areas.

For women, the next most consistently strong predictor of HIV prevalence at the community level is the proportion of women whose sexual initiation was premarital. This was found to be particularly important in rural areas. The prevalence of HIV is higher in communities where there is a higher prevalence of premarital sex. The other factor that is also significant in the rural sample is the prevalence of nonmarital sex; in rural communities where a greater proportion of women or men report that their last sexual partner was a nonmarital partner, the prevalence of HIV among women is higher. Nonmarital sex of women and men was not significant in urban areas and only nonmarital sex of men was significant in the full sample. One effect found only in urban areas is for the prevalence of IPV; in particular, in urban communities with higher IPV prevalence, the prevalence of HIV among women is also higher. Among the female sample, women from urban areas with higher educational attainment have lower HIV prevalence. However, the opposite is found for rural areas—higher educational attainment in rural areas is associated with significantly higher HIV prevalence. Finally, in the full sample, women from urban areas have a significantly lower prevalence of HIV than women from rural areas.

In the male analyses, the main factor (besides female HIV prevalence) in rural areas found to be associated with higher HIV prevalence is greater male engagement in premarital sex. The prevalence of HIV is higher among men from rural communities with higher premarital sexual activity than in rural communities with lower premarital sexual activity. The male premarital sex effect was not found in urban areas but was seen in the full sample. In urban areas the prevalence of IPV as reported by women is found to be associated with a higher prevalence of HIV. There was no

TABLE 3. Multivariate Regression Coefficients (Standard Errors) for Community-Level Factors Associated With Community-Level Female HIV Prevalence, Zimbabwe DHS, 2005-06

Variable	Full Sample	Urban	Rural
Urban	-.03 (.01)*	NA	NA
% women with secondary or higher education	.05 (.03)+	-.20 (.08)*	.07 (.03)*
% premarital sex among women	.14 (.04)***	.14 (.07)+	.12 (.04)**
% women report ever physical/sexual IPV	.02 (.03)	.12 (.06)*	-.00 (.04)
% women nonmarital last partner	.05 (.05)	-.07 (.09)	.15 (.06)*
% men nonmarital last partner	.09 (.03)**	.09 (.06)	.09 (.04)*
HIV prevalence among men	.36 (.05)***	.21 (.09)*	.39 (.06)***

Note. DHS – Demograhic and Health Survey; NA - not applicable; IPV – intimate partner violence. n = 398 primary sampling unit (PSU) for full sample; n = 127 PSU for urban; n = 271 PSU for rural. $+p \leq .10$; $*p \leq .05$; $**p \leq .01$; $***p \leq .001$.

significant effect in rural areas nor in the full sample. One male finding found in the urban, rural, and full samples was counterintuitive: men from communities with higher male involvement in nonmarital sex have lower prevalence of HIV than men from communities with lower nonmarital sex; this may reflect greater condom use in communities with greater engagement in nonmarital sex. Conversely, in urban areas, communities with higher female nonmarital sex have a higher prevalence of HIV, as expected; this effect was nonsignificant in the rural and full samples. Finally, there were no significant effects found for urban residence (full sample) or for education in any of the samples.

DISCUSSION

This study extends findings from individual-level studies that examine risk factors for HIV. Not surprisingly, living in a community with higher HIV prevalence among the opposite sex increases women's and men's risk of HIV; this was found in both urban and rural areas. In addition, women living in communities where women and men engage in higher risk behaviors, such as premarital and nonmarital sex, are at greater risk of HIV. In particular, communities with a higher prevalence of premarital sex also have a higher female HIV prevalence; this was particularly important in rural areas. Furthermore, rural communities with a higher percentage of men or women who have nonmarital partners are the communities with a higher female HIV prevalence. Notably, women in urban communities with a higher prevalence of IPV also have a higher risk of HIV. The findings are similar for the analyses of male HIV prevalence and community-level risk taking in urban and rural areas.

Notable differences were found between urban and rural areas in this study. In particular, in urban areas, the main, consistent factor associated with HIV prevalence is the prevalence of physical or sexual IPV. Conversely, in rural areas, among men and women, the prevalence of nonmarital and premarital sex was more consistently related to HIV whereas IPV was not related to HIV prevalence. Recent studies from Zimbabwe demonstrate that the prevalence of early sexual debut and engagement in extra-marital partnerships have declined (Chapman et al., 2010; Gregson et al., 2006; Hallett et al., 2006; Mahomva et al., 2006). If this decline began in urban areas this could explain our finding of less correlation between these behaviors and HIV prevalence in urban settings.

TABLE 4. Multivariate Regression Coefficients (Standard Errors) for Community-Level Factors Associated with Community-Level Male HIV Prevalence, Zimbabwe DHS, 2005-6

Variable	Full Sample	Urban	Rural
Urban	-.01 (.01)	NA	NA
% men with secondary or higher education	.02 (.03)	.04 (.10)	.02 (.03)
% premarital sex among men	.13 (.03)***	.07 (.08)	.14 (.04)***
% men nonmarital last partner	-.08 (.03)*	-.13 (.07)+	-.07 (.04)+
% women nonmarital last partner	.04 (.05)	.14 (.08)+	-.01 (.06)
% women report ever physical/sexual IPV	.01 (.03)	.15 (.06)*	-.03 (.04)
HIV prevalence among women	.34 (.05)***	.23 (.09)*	.36 (.05)***

Note. DHS – Demograhic and Health Survey; NA - not applicable; IPV – intimate partner violence. n = 398 primary sampling unit (PSU) for full sample; n = 127 PSU for urban; n = 271 PSU for rural. $+p \leq .10$; $*p \leq .05$; $**p \leq .01$; $***p \leq .001$.

Previous studies that examine IPV as a predictor of HIV at the individual level have found inconsistent results (Dude, 2009; Jewkes et al., 2006; Pettifor et al., 2004; Sambisa and Curtis, 2010; Silverman, Decker, Saggurti, Balaiah, Raj, 2008); this may be because the focus is at the individual rather than the community level. For example, studies from Zimbabwe and South Africa find bivariate associations between experiencing sexual violence and HIV status, however, adding controls for demographics, gender equity, and male partner characteristics, attenuates the results (Jewkes et al., 2006; Sambisa & Curtis, 2007). Our study finds that in urban settings, the association between the community-level prevalence of IPV and both female and male HIV prevalence remains even after controlling for other behavioral factors and the prevalence of secondary education.

Gender norms around sexual and reproductive behaviors in sub-Saharan Africa mean that an individual woman's sexual behaviors may not increase her risk for HIV; however, because of her partner's sexual behaviors she may be at an increased risk of HIV (Lewis et al., 2007). In settings where sexual and reproductive decision-making is dominated by men and where IPV is relatively common (Chapman et al., 2010), our findings and others demonstrate that community norms and behaviors related to sexual initiation, multiple and concurrent partnerships, and IPV can increase all women's and men's risk of HIV, even when individuals do not practice high-risk behaviors (Chapman et al., 2010; Lewis et al., 2007). This may help to explain differences between men's and women's HIV prevalence in this context. In particular, men's HIV prevalence is associated with men's normative sexual behaviors, including their use of IPV. For women, as demonstrated here, their HIV prevalence is associated with both their own sexual behaviors (the prevalence of premarital sex and having nonmarital partnerships) but also the behaviors of the men in their communities, including men's use of IPV. Therefore, a greater percentage of women are likely exposed to HIV risk as compared with their male counterparts, leading to a higher overall HIV prevalence among women.

This study has a number of limitations that are worth mentioning. First, the data for this study come from a cross-sectional sample; therefore, it is not possible to know the direction of causality between living in a community with high risk-taking behaviors and HIV prevalence. To better understand causality requires panel or longitudinal data that permit a close examination of the timing of the events. Second, the measure of "community" used in this analysis comes from the DHS

primary sampling units. Although these are small census enumeration areas, it is possible that these sampling units do not define communities well. Future studies are needed that better define neighborhoods and communities for contextual-level analyses in developing countries. Third, other risk-taking behaviors, such as condom use and sex in exchange for money or goods, are not included in these analyses since these are highly correlated with the prevalence of nonmarital partnerships and are behaviors specific to these types of unions. Future studies that include an exogenous measure of community-level condom use and/or transactional sex would be useful for assessing the effect of these factors on community-level HIV prevalence. Finally, the measure of premarital sex is based on imprecise measures of age at first sex and age at first marriage; one is available in month and year format for the date of the event while the other is only available in a whole number age. A conservative approach was taken to code this variable.

Despite these limitations, this study still provides important insights for future programmatic and research activities in Zimbabwe and other settings with high HIV prevalence. In particular, where a person lives and the behaviors within a person's community matter. Thus, although changing individual-level risk behaviors, including delaying sexual debut, reducing IPV exposure, reducing the number of sexual partners, and promoting condom use, are important HIV prevention approaches that will lead to reduced HIV incidence over time, there is also a need to consider community-level risks in tandem. For example, programs that target communities with higher nonmarital sex and communities with greater premarital sex may need to address social norms that make these behaviors acceptable and thus increase all individual's risk of HIV, not just those engaged in these high-risk behaviors. Furthermore, programs may need to undertake different contextual approaches in urban and rural areas. For example, although premarital and nonmarital sex are common in both urban and rural areas, it is only in rural areas where these behaviors were consistently associated with increased risk of HIV; this may be related to greater condom use in urban areas, especially in these high-risk unions. In addition, these findings indicate that promotion of IPV prevention programs, specifically in urban areas, can lead to reduced risk of HIV for those most in need.

Future research should explore ways to improve the measurement of community-level risk taking and ensure that the definition of the community is meaningful to participants. This will enrich efforts to develop appropriate HIV prevention programs at the community and individual levels. Research and programmatic efforts that consider community-level context have the potential to reduce the risk of HIV for all women and men in Zimbabwe and other high-prevalence settings.

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