

Substance Use and Sexual Intercourse

Transitions to Substance Use and Sexual Intercourse Among South African High School Students

LORI-ANN PALEN,¹ EDWARD A. SMITH,²
LINDA L. CALDWELL,² CATHERINE MATHEWS,³
AND TANIA VERGNANI⁴

¹RTI International Research Triangle Park, North Carolina, USA

²The Pennsylvania State University, University Park, Pennsylvania, USA

³University of Cape Town, Cape Town, South Africa

⁴University of the Western Cape, Bellville, South Africa

This study examined longitudinal patterns of initiating substance use and sexual intercourse among a sample of 1,143 high school students from a low-income township in Cape Town, South Africa. Longitudinal data on lifetime incidence of sexual intercourse and alcohol and marijuana use were collected semiannually from 2004 to 2006. Latent transition analysis (LTA) was used to test competing models of transitions to these behaviors. Participants were more likely to move from no risk behavior to substance use, rather than from no risk behavior to sexual intercourse. At all time points, the proportion of youth who had engaged in sexual intercourse but not substance use was very small. The study's limitations and directions for future research are discussed. This research was funded by NIH Grants R01 DA01749 and T32 DA017629-01A1.

Keywords adolescence; South Africa; alcohol use; marijuana use; sexual behavior; latent transition analysis

Introduction

In South Africa, as in other areas of the world, substance use and sexual behavior are fairly common, and sometimes problematic, among youth. According to the 2002 South African Youth Risk Behavior Survey, one in eight South African high school students begins drinking alcohol before the age of 13, and nearly one-quarter of students in grades 8 through 11 have engaged in binge drinking in the previous month (Reddy et al., 2003). About 13% of students in these grades have tried marijuana, with the majority of those

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Address correspondence to Lori-Ann Palen, Ph.D., Risk Behavior and Family Research, RTI International, USA 3040 Cornwallis Road, P.O. Box 12194, Research Triangle Park, NC 27709-2194. E-mail: lpalen@rti.org.

having also used it in the past month. Of the more than half of 11th grade students who have engaged in intercourse, nearly 1 in 10 report having had a sexually transmitted infection, and 13% report having either been pregnant or made someone else pregnant. Of particular concern in South Africa are rates of HIV infection, which increase from 3% of children under age 14 to 23% of persons aged 25–29 (Shisana et al., 2005).

Previous research shows that substance use and sexual behavior tend to cooccur within individuals. However, little is known about how the initiation of these behaviors is sequenced, especially in the South African context. Knowing how substance use and sexual behavior unfold together over time may help to reduce the pool of hypothesized mechanisms linking risk behaviors, thereby resulting in a smaller number of plausible mechanisms that can be tested in future studies.

Cooccurrence of Substance Use and Sexual Intercourse

Research with samples of African adolescents suggests that sexual behavior and substance use tend to cooccur within broad time periods (e.g., lifetime). That is, youth who have ever engaged in one of the behaviors are more likely to have also engaged in the other. In our research with high school students from Cape Town, South Africa, we have demonstrated that lifetime use of alcohol or marijuana is associated with higher odds of lifetime sexual intercourse (Palen, Smith, Flisher, Caldwell, and Mpofu, 2006). Similar associations were found in a different sample of Cape Town youth (Flisher, Ziervogel, Chalton, Leger, and Robertson, 1996). Among adolescents and young adults in two Ethiopian samples, use of alcohol, amphetamines, and other substances was also associated with having ever had sexual intercourse (Kebede et al., 2005; Taffa, Klepp, Sundby, and Bjune, 2002).

There are at least two general types of reasons why substance use and sexual behavior may cooccur, which in turn have implications for intervention strategies. First, the two behaviors may have common origins. This is consistent with Problem Behavior Theory (Jessor, 1987) in which factors like external locus of control and low parental monitoring contribute to multiple adolescent risk behaviors. In this situation, the initiation of substance use and sexual intercourse could occur in any order (including simultaneously), depending on the nature of the underlying variables or processes.

Sex and substance use could also cooccur because the initiation of one behavior causes (either directly or indirectly) the initiation of the other. For example, intoxication may lower inhibitions, leading to sexual intercourse that would not have otherwise occurred. Alternatively, one sexual partner may introduce the other to substances for the first time. Regardless of direction of the sequence, a causal association implies that, by addressing the first risk behavior in the sequence, we may reduce the odds of the second behavior occurring. Therefore, knowing if and how risk behavior initiation is sequenced may help to inform interventions.

To our knowledge, there have been no attempts to examine how substance use and sexual behavior unfold together over time among African adolescents. However, cross-sectional studies of sexual behavior and substance use among U.S. adolescents (e.g., Lowry et al., 1994; National Center on Addiction and Substance Abuse, 1999; Zabin, Hardy, Smith, and Hirsch, 1986) have yielded associations similar to those found in cross-sectional African studies. This suggests that U.S. longitudinal studies of these behaviors may have some utility in informing preliminary hypotheses about African risk behavior over time.

Most U.S. longitudinal studies have focused on whether substance use at one time point predicts onset of sexual activity at a later time point. One such study found that past-month alcohol use, reported at baseline, was associated with sexual initiation by a 2-year follow-up

(Blinn-Pike, Berger, Hewett, and Oleson, 2004). Similar results have been found in studies that considered multiple substances and more closely spaced assessments (Guo et al., 2005; Santelli et al., 2004). There is also some evidence for stability in this association across development. Consistent with aforementioned studies, Whitbeck, Yoder, Hoyt, and Conger (1999) found that, after controlling for various other biological, psychological, and social factors, lifetime alcohol use in either the 8th, 9th, or 10th grade predicted higher odds of first intercourse in that same grade.

Few studies have examined an alternative pattern of risk behavior initiation, with sexual behavior preceding substance use. Those that have tended to examine progressions in the severity or riskiness of substance use and sex, rather than simply examining the initiation of the two behaviors. Similar to the studies discussed above, Capaldi, Crosby, and Stoolmiller (1996) found that, among a sample at-risk adolescent boys, frequency of substance use predicted early sexual initiation. However, there was also evidence for an increase in substance use following the initiation of sexual intercourse. Tang (2002) also found a reciprocal relationship between changes in sexual behavior and substance use. Moving to riskier levels of substance use between the 8th and 9th grades was associated with initiation of increasingly risky sexual behavior. However, moving to riskier sexual behavior also predicted movement to higher-risk substance use. These two studies suggest that, for U.S. adolescents, the longitudinal associations between substance use and sexual behavior are complicated. It may be that both types of behavior are driven by similar factors, or it may be that each serves to promote the other.

The Current Study

This study is an extension of our previous work documenting the cross-sectional coincidence of sexual intercourse and substance use among a group of South African high school students (Palen et al., 2006). Our aim here was to describe patterns of the initiation of substance use and sexual intercourse in a sample of low-income South African youth. Specifically, for youth with no history of substance use or sexual behavior, we examined which of these two risk behaviors tended to be initiated first. We also examined whether the initiation of substance use and sex happened at roughly the same time, or whether these events were more spread out over time. Finally, we examined whether sequencing of risk behavior initiation was similar across the entire time period under study, or whether the probabilities of transitions to substance use and sexual activity changed over time.

We believe that this is one of the first studies to analyze longitudinal patterns of initiation of sexual intercourse and substance use in a low- or middle-income country. This study is also unique in the way it integrates sexual behavior and substance use. As mentioned previously, most studies that examine both substance use and sex tend to examine models in which the former precedes the latter. Our plan of analysis allows us to not only examine this particular sequence, but also to study youth who first initiate sexual intercourse and then move on to substance use.

Method

Participants

Participants were high school students from Mitchell's Plain, a low-income township established during apartheid in Cape Town, South Africa. The sample comes from a randomized control trial of a comprehensive leisure and life skills education program (HealthWise: Life

Skills for Adolescents; Caldwell et al., 2004). Given that the present study is concerned with describing patterns of normative development rather than evaluating program effects, we restricted the present sample to include only students from the trial's five control schools.

The data presented here are from the first five assessments of the study's first cohort. There were a total of 1,291 control group participants in the baseline 8th grade assessment. Attrition between each semiannual assessment was fairly modest (5%–17%), so that there were 806 total control group participants by the fifth assessment. However, our statistical analyses (see below) allowed for the inclusion of data from all participants, regardless of whether they were missing assessments.

The Population Act of 1950 (and its subsequent amendments) established four population groups in South Africa: black, white, colored (derived from Asian, European, and African ancestry), and Indian (Ellison, de Wet, IJsselmuiden, and Richter, 1996). These groups were "based on a variety of factors including appearance, descent, language, and behavior" (p. 1259), and they were intended to formalize discrimination. Although apartheid policy has since been repealed, some argue that it continues to have a residual impact on health disparities (Ellison et al., 1996). In terms of the constructs of interest in this particular study, cross-sectional data on both sexual intercourse and substance use show that there are differences between population groups in the timing of initiation (Reddy et al., 2003). Therefore, we feel that population group is an important factor to consider in research on health risk behavior in the South African context.

In the current study, participants were asked to self-identify with one of the four population groups (black, white, colored, and Indian), with "other," "don't know," and "refuse to answer" as additional response options. Most of the subsample self-identified as being colored (93%), with the rest of the students stating that they were black (5%), white (2%), Indian or other (<1%). The small number of noncolored students in the control group did not provide enough power to detect population group differences in risk behavior initiation. Consequently, we chose to restrict the present sample to colored control group students ($n = 1,143$). Descriptive statistics for this sample appear in Table 1.

Procedure

This study was approved by the Institutional Review Boards of both the Pennsylvania State University and Stellenbosch University. Prior to data collection, a letter describing the study was mailed to parents; they were asked to complete and return an enclosed form if they did not want their child to participate in the study. At the beginning of each assessment, any student for whom parental consent was not refused was asked to provide assent. Participants were told that they would be participating in a study of health-related attitudes, knowledge, and behaviors. At baseline and across the full sample (both intervention and control, all population groups), 3% of eligible students did not complete the survey due to a refusal of parental consent or student assent, and 5% of eligible students did not complete the survey due to repeated school absence.

Baseline survey data were collected in 2004 at the beginning of the 8th grade school year. Topics covered in the 200-item survey included leisure behavior, substance use, and sexual behavior. Nearly identical follow-up assessments were collected at the end of 8th grade, at the beginning and end of 9th grade, and at the beginning of 10th grade. Participants completed all survey assessments on hand-held personal digital assistants (PDAs). Surveys were typically administered in each participant's home language, either English or Afrikaans. (For participants with a home language other than these, the survey was

Table 1
Participant demographics at baseline ($N = 1,057$)^a

Demographic variable	Frequency (%)
Female	52
Age	Mean = 13.9 years ($SD = 0.76$)
Religion	
Catholic	20
Christian—other	46
Islam	32
Other	1
Languages spoken at home	
English	61
Afrikaans	52
Xhosa	1
Other	1
Live with mother	89
Live with father	69
Household amenities	
Electricity	98
Tap water	95
Motor car	58

^aThe baseline sample is smaller than the total sample because of school absence at baseline and participant enrollment after baseline.

administered in the language, English or Afrikaans, that was used in their classroom.) The survey instrument was translated from English to Afrikaans and then back-translated to ensure that each item had a similar meaning across languages. Assessments were administered in classrooms by a team of trained South African research fieldworkers, led by two staff members and one faculty member from the HealthWise research team. Participants were instructed in the use of the PDAs prior to completing each assessment, and fieldworkers were available to assist participants as needed. The baseline surveys took up to 1 hr to complete, with this time decreasing over the course of the study (20–30 min by fifth assessment).

Measures

Participants reported their gender at each assessment. Participants who reported gender inconsistently over time ($n = 10$) were coded as missing for this indicator.

At each assessment, participants responded about their lifetime frequency of alcohol and marijuana use (one item for each substance). These items were adapted from those used in previous studies in South Africa (see Flisher, Ziervogel, Chalton, Leger, and Robertson, 1993). A composite dichotomous substance use variable was created to indicate, at each wave, whether a participant reported using either alcohol (any more than sips in church services) or any marijuana in his or her lifetime. At each assessment, participants also responded (yes/no) to the item “Have you ever had sex? This means intimate contact with someone during which the penis enters the vagina (female private parts).” This item has

been used in previous research with South African adolescents (see Flisher, Reddy, Muller, and Lombard, 2003).

Analytic Strategy

Latent transition analysis (LTA; Lanza, Flaherty, and Collins, 2002) is a longitudinal extension of latent class analysis, in which manifest variables are used to classify individuals according to underlying, unobservable constructs. In LTA, latent classes are conceptualized as discrete stages of development (called latent statuses). The LTA framework can be used to test competing models of how people move between these stages over time (stage-sequential development).

We used LTA to describe membership in, and patterns of transition between, latent statuses of risk behavior (hereafter termed risk behavior statuses). At any given assessment, the two risk behavior indicators discussed previously (lifetime vaginal intercourse (yes/no), lifetime substance use (yes/no)) allowed for classification of participants into one of four risk behavior statuses: engagement in neither risk behavior, lifetime substance use only, lifetime sexual intercourse only, and lifetime engagement in both risk behaviors. As mentioned previously, studies of risk behavior initiation typically suggest that development moves from no risk behavior to substance use to sexual behavior. Therefore, these three statuses were important to include in our models. However, given that little is known about youth who engage in sexual intercourse but not substance use, we chose to include this status in our developmental models as well. This would allow us to determine if and where this status fits within the predominant stage-sequential model of risk behavior initiation.

Competing models were fit in the WinLTA program (Collins, Lanza, Schafer, and Flaherty, 2002). Fit in latent class and latent transition models is assessed with the G^2 statistic. Under certain conditions, G^2 approximates a χ^2 distribution. However, given that latent class modeling involves large contingency tables, some of the cells of these tables can be sparsely populated. In this situation, the G^2 and χ^2 distributions can be different. Therefore, hypothesis testing for latent class and latent transition models is less exact than with other statistical techniques. A model is considered to be a reasonable fit if G^2 is smaller than its associated degrees of freedom. Comparative fit between two models is assessed using χ^2 difference tests (Collins, Fidler, Wugalter, and Long, 1993; Lanza et al., 2002).

Given that WinLTA uses the Expectation Maximization (EM) algorithm to arrive at parameter estimates, missing data can be accounted for in the models (Collins et al., 2002). Provided that the data are missing completely at random or missing at random (i.e., ignorable missingness), the resultant parameter estimates are unbiased (Schafer, 1997).

Two initial models were estimated in order to determine whether subsequent hypothesis-testing models needed to be fit separately by gender. These initial models estimated five sets of parameters: measurement precision of the gender indicator, proportion of boys and girls in the sample, measurement precision of the risk behavior indicators for each gender, proportion of participants in each risk behavior status at baseline for each gender, and probabilities of transition between risk behavior statuses for each gender.

In the first model, all of the above parameters were freely estimated. In the second model, all of the parameters were freely estimated *except* for the parameters representing measurement precision of the risk behavior indicators, which were constrained to be equal across gender. If the first model were a significantly better fit than the second, this would indicate that subsequent models needed to be fit separately by gender. If not, models could be fit for both genders simultaneously.

Results

Model Specification

Preliminary analyses showed that a model in which the risk behavior measurement parameters were constrained to be equal across gender ($G^2(1998) = 597$) fit significantly worse than a model in which these parameters were freely estimated ($G^2(1997) = 525$; $G^2\text{diff}(1) = 72$, $p < .001$). In other words, the measurement precision parameters varied significantly by gender. Consequently, separate hypothesis-testing models were fit for boys and girls. These models estimated three sets of parameters: measurement precision of the risk behavior indicators, proportion of participants in each risk behavior status at baseline, and probabilities of transition between risk behavior statuses.

Measurement Precision Parameters

The measurement parameters show the probability of a given response to an item measuring risk behavior conditional on risk behavior status. Any deviations from a probability of 0 or 1 reflect measurement error from sources that include model misspecification and missing data. In these models, for the sake of parsimony, all probabilities of a “correct” response (e.g., responding “yes” to the lifetime substance use items when one has, in fact, used substances) were fixed to be equal, as were all probabilities of an “incorrect” response (e.g., responding “yes” when one has never used substances). In the final model, the probabilities of being correctly classified on substance use and sexual behavior were estimated as .92 for boys and .97 for girls.

Group Membership Parameters

The proportions of participants in each risk behavior status at each assessment appear in Table 2, as well as in Figure 1. At baseline, both boys and girls were most likely to be classified in the group with no history of risk behavior. By the 10th grade follow-up, participants were most likely to indicate only having used substances. At all assessments,

Table 2
Proportion of participants in each risk behavior status

	Start 8th grade	End 8th grade	Start 9th grade	End 9th grade	Start 10th grade
Boys					
Neither risk behavior	.49	.40	.32	.26	.21
Substance use only	.43	.46	.47	.47	.46
Sexual intercourse only	.00	.00	.00	.01	.01
Both risk behaviors	.09	.15	.21	.27	.33
Girls					
Neither risk behavior	.62	.48	.38	.29	.23
Substance use only	.37	.49	.56	.62	.65
Sexual intercourse only	.00	.01	.01	.01	.01
Both risk behaviors	.01	.03	.05	.08	.11

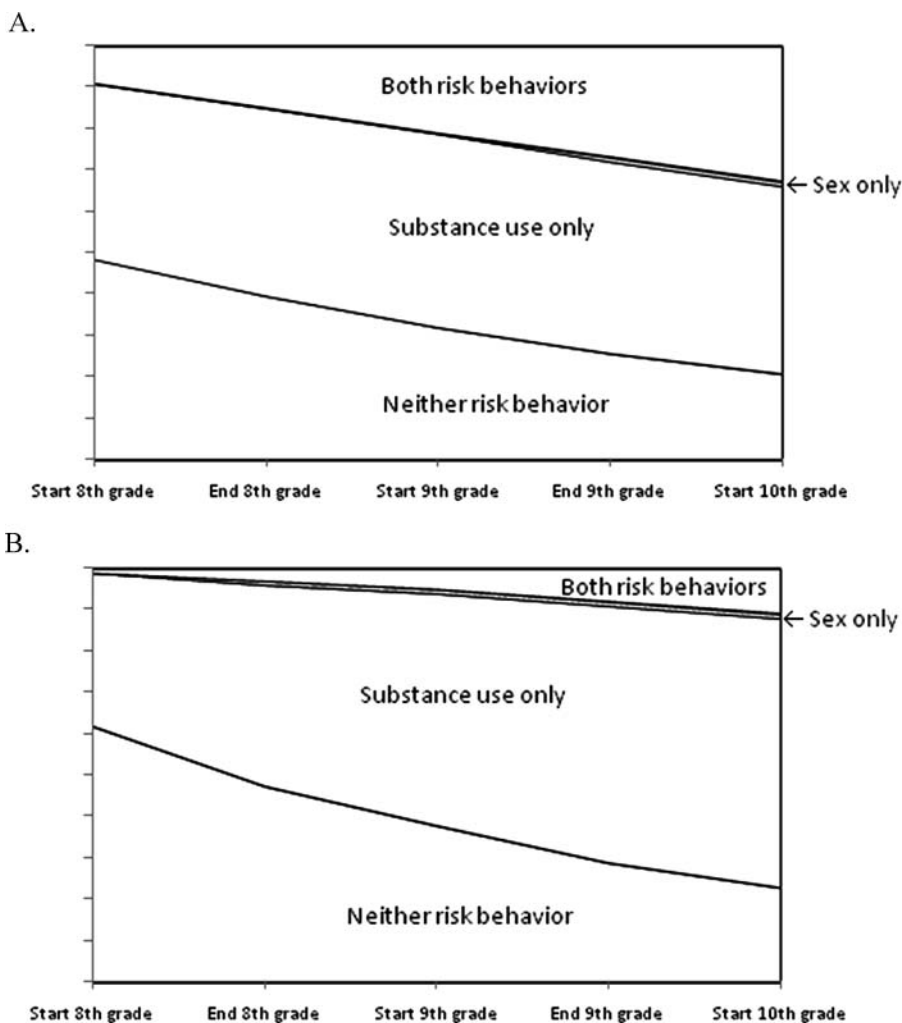


Figure 1. Panel A: Proportion of boys in each risk behavior status by time point. Panel B: Proportion of girls in each risk behavior status by time point.

the probability of youth having only engaged in sexual intercourse was very small ($\leq 1\%$).

Transition Parameters

The transition parameters represent the probability of being in a given risk behavior status at one time point, conditional on risk behavior status at the previous time point. First, we constrained the transition parameters in such a way that it was impossible for a participant to indicate lifetime engagement in a given risk behavior at one time point and then indicate no lifetime engagement in that same risk behavior at a later time point. Any of these contradictory responses actually appearing in the data would then contribute to uncertainty in the parameter estimates, manifested as reduced precision in the measurement parameters and

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Table 3
Risk behavior transition probabilities

Risk behavior, previous assessment	Risk behavior, subsequent assessment			
	1	2	3	4
Boys				
1. Neither risk behavior	.80	.16	.01	.03
2. Substance use only	0*	.89	0*	.11
3. Sexual intercourse only	0*	0*	.92	.08
4. Both risk behaviors	0*	0*	0*	1*
Girls				
1. Neither risk behavior	.78	.21	.01	.01
2. Substance use only	0*	.96	0*	.04
3. Sexual intercourse only	0*	0*	.55	.45
4. Both risk behaviors	0*	0*	0*	1*

Note. *Indicates a fixed value.

worse model fit. Follow-up analyses revealed that 14% of the sample reported no lifetime substance use after reporting lifetime substance use at at least one previous assessment. Nine percent of the sample reported never having had sex at an assessment later than one in which they reported having had sex.

Next, we tested two competing models of transitions across the different waves: one in which transitions were constrained to be identical across waves, and one in which transitions were allowed to vary across waves. This allowed us to determine whether or not patterns of transition were stable over the time period under study. For both genders, the model in which transitions were allowed to vary ($G^2_{\text{boys}}(999) = 335$; $G^2_{\text{girls}}(999) = 191$) did not fit significantly better than the model in which transitions were identical ($G^2_{\text{boys}}(1,014) = 353$; $G^2_{\text{girls}}(1,014) = 209$; $G^2 \text{ diff}(15) = 18$). Therefore, the same set of transition probabilities could be used to represent all waves of data. These probabilities appear in Table 3. Given that the G^2 for these final models were smaller than their associated degrees of freedom, they can be considered to be a reasonable fit with the data (Collins et al., 1993; Lanza et al., 2002).

Every row in Table 3 shows the probability of being in each risk behavior status, given risk behavior status at the preceding time point. So, for example, the first row of the table represents boys who had no history of risk behavior at one point in time. At their next assessment, these boys had a .80 probability of continuing to exhibit no risk behavior, a .16 probability of using substances only, a .01 probability of being sexually active only, and a .03 probability of both using substances and being sexually active.

Participants who had no history of risk behavior were much more likely to transition to the substance use only status, rather than to sex only or both risk behaviors. Participants who were already engaging in substance use had a relatively low probability of initiating sex (.11 for boys, .04 for girls). In other words, substance use tended to be the first risk behavior that the youth initiated, and this transition happened at a different time from the transition to sexual behavior.

Discussion

The purpose of this study was to describe transitions to new risk behavior among high school students in one area of South Africa. It went beyond previous research by examining a unique and high-risk population, by including substance use and sexual intercourse in a single model, and by examining the initiation of the behaviors in either order.

Results showed that students in our sample were most likely to initiate substance use as their first risk behavior, before moving on to sexual intercourse at a later time point. The potential explanations for this sequencing fall into two categories. The initiation of substance use may be a direct or indirect cause of sexual initiation. Alternatively, substance use may precede sex because of an outside factor or process.

In terms of causal links, it is possible that the transition to substance use prompts the initiation of sexual intercourse. There is a common assumption that there is a direct link between the behaviors (e.g., intoxication causes sexual encounters) and much of the cross-sectional research in this area, as well as many preventive messages given to youth, revolves around this direct causal assumption. However, given that the two behaviors tended to be initiated in different waves (i.e., at least 4 months apart) in the current study, we feel that an indirect, mediated association is more plausible. It may be that the initiation of substance use causes interpersonal and intrapersonal changes that make the initiation of sexual intercourse more likely. For example, engaging in substance use may draw youth into social circles with youth who are older or who are more willing to engage in a variety of risk behaviors. Consequently, the pool of potential sexual partners may increase, which in turn increases the odds of actually initiating sexual intercourse. To our knowledge, these types of social processes have yet to be examined empirically.

It is also possible that substance use causes shifts in the types of risk that youth are willing to take. Adolescents may perceive substance use and sexual intercourse as lying along a continuum of risk, with sex being the riskier behavior because of potential consequences that include negative emotional experiences, disease, and pregnancy. Therefore, substance use may represent a “safer” entry to the risk behavior arena. If, as a result of their substance use, youth experience positive consequences (e.g., high, excitement, social approval) and no negative consequences (e.g., hangover, punishment by parents), they may be more motivated and less inhibited to try other, riskier behaviors. However, this explanation is speculative, and we are unaware of related theoretical or empirical support.

It is also worth noting that there is one type of causal hypothesis that is less plausible, given the current results. Given their temporal ordering, for most adolescents, it is unlikely that the initiation of sexual behavior causes the initiation of substance use. One sexual partner is probably not introducing the other to substances for the first time, nor does it seem likely that adolescents are initiating substance use as a way of coping with or celebrating their first sexual experiences.

As an alternative to a causal link, the sequencing of substance use and sexual behavior may be due to an outside factor or process. For example, initiation of both risk behaviors could be a product of physical and social development. Among these two risk behaviors, the role of development is probably more important for sex than substances. There may be few physical or social developmental barriers to a youth having a drink or taking a puff of marijuana at a party. Sexual intercourse, however, requires a willing partner (assuming that it is consensual). Among adolescents undergoing pubertal changes, either seeking or attracting a willing partner may be enhanced by physical maturation, which generally

corresponds with age. The outward signs of physical maturation, for both boys and girls, may make one more attractive to a potential sex partner (Smith, Udry, and Morris, 1985). In addition to physical development, it may take time to acquire the social skills required in the negotiation of a sexual encounter. Unfortunately, there is a lack of empirical research on how social skills relate to sexual initiation (Buhi and Goodman, 2007). Therefore, while substances may be more accessible than sex for younger adolescents, this is an idea that awaits stronger empirical support.

Substance use might also precede sexual initiation because of cultural values and norms. To the degree that adolescent sexual activity is seen as more undesirable than adolescent substance use, there may be more logistical and social barriers to engaging in sex than substance use. For example, parents might restrict opportunities for their child to be alone with dating partners or peers might reject those who are sexually active. This could lead to a delay in sexual debut, relative to the onset of substance use. While there is some evidence that sexual activity is discouraged among South African girls (Varga, 2003), we are unaware of any studies that have directly contrasted sexually related values with those pertaining to substance use.

Beyond having an effect on the timing of actual behavior, it is possible that values and norms impact reporting of risk behavior. If early sexual initiators anticipate social stigma as a result of their behavior, they may be reluctant to report it. If the stigma is comparatively less for substance use, this could artificially result in the sequence found in this study. There is some evidence of unreliable reporting of sexual intercourse in this population; however, it appears that the phenomenon is not unique to sex and is also found with reports of substance use (Palen et al., submitted).

Limitations and Future Directions

It should be noted that the sample used for these analyses was fairly homogenous, made up of students who self-identified as Colored in one area of Cape Town. These results may not generalize to youth from other population groups, social classes, or geographic areas. Therefore, while the patterns exhibited here are consistent with results drawn from longitudinal studies of U.S. youth (e.g., Blinn-Pike et al., 2004; Capaldi et al., 1996; Guo et al., 2005; Santelli et al., 2004; Tang, 2002), we continue to advocate that others base the development and refinement of health behavior interventions on a solid understanding of the sequencing of risk behavior within their specific population of interest.

We also confined ourselves to an examination of alcohol and marijuana, which were considered as one variable. We did not examine the independent position of each substance in risk behavior sequencing, nor did we examine other substances. (See Patrick et al., in press, for an analysis of substance use sequencing in this sample.)

Similarly, this study only examined vaginal sexual intercourse. Future studies might examine how sexual behaviors such as kissing, petting, oral or anal sex, condom use, and multipartnering fit within the sequence described here. In addition, our data did not allow us to distinguish between consensual and nonconsensual intercourse. Forced sexual intercourse is more common in South Africa than in many other areas of the world (Petersen, Bhana, and McKay, 2005). During the data collection process, the question most frequently asked by participants was how to respond to the lifetime sexual intercourse item when their only experience was forced intercourse. Survey administrators instructed these participants to enter "no" for the item. Therefore, we believe that our

results most closely reflect consensual sexual behavior. However, we also acknowledge that there may have been youth who experienced nonconsensual intercourse but did not seek clarification from survey administrators, so this study cannot be considered a pure examination of consensual sexual experiences. Future survey instruments should be designed in a way that can distinguish between consensual and nonconsensual sexual experiences.

In addition, this study employed self-report survey data. Given that substance use and sexual behavior are “sensitive” topics, it is possible that students either under- or overreport these behaviors in ways that they feel are socially desirable (e.g., Brener, Billy, and Grady, 2003). While sexual behavior is difficult to measure using methods other than self-report (Catania, Gibson, Chitwood, and Coates, 1990), future studies might incorporate other modes of assessing substance use, such as biological measures.

The results presented here are consistent with two types of hypotheses about the mechanisms linking substance use and sex: a mediated association leading from substance use to sexual behavior or an outside factor or process influencing the sequencing of the two behaviors in similar ways. These different possibilities need to be tested in future research. The present study, and we would argue, most other studies, do not have data that are appropriate for answering this type of research question. However, there are several alternative research designs that may provide better information, which are discussed below.

First, collecting qualitative data may answer questions about process, as well as inform the design and analysis of future quantitative studies. Adolescents could report on what linkages, if any, they perceive between substances and sex, both generally and in regard to specific hypothesized mechanisms. Do any changes occur in an adolescent’s life once he or she begins using substances? Does he or she meet and spend time with new friends? How are they different from former friends? Is the adolescent more willing to take new risks? What barriers do substance use and sex share, and which barriers are relevant for only one of the behaviors?

Second, in order to answer questions about mechanisms and processes, quantitative assessments may also need to be done more frequently than twice per year. Collins and Graham (2002) suggest that assessments should be timed to coincide with the timing of processes of interest. If we believe that the act of initiating substance use prompts a series of changes that lead to sexual initiation, then we need a number of assessments closely following that event. This could be accomplished as a modification to a design with more widely spaced assessments. When a youth first reports substance use in one of his or her assessments, this could prompt selection into a group with more frequent follow-up. Important mechanisms to assess may include time spent around potential sexual partners and increases in risk-taking or sensation-seeking.

Ultimately, knowing about the processes linking substance and sexual initiation can inform improvements to programs designed to prevent multiple risk behaviors. If there is a causal association between substance use and sex, then disrupting the initiation of substance use may be sufficient to delay sexual onset. If, instead, the link is the result of a third variable or process, then knowledge of that outside process may assist in the prevention of both substance use and early sexual initiation. For example, if initiation of substance use and sexual intercourse are both influenced by parental limit-setting, then a parenting program may be effective in delaying both types of behavior. The current study represents a preliminary step in informing these types of preventative interventions.

Declaration of Interest

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the article.

RÉSUMÉ

Cette étude a examiné les modèles longitudinaux, comparant l'initiation des rapports sexuels et l'usage de stupéfiants parmi un groupe de 1,143 étudiants de lycée, d'une banlieue de bas revenu à Cape Town, Afrique du Sud. Des données longitudinales sur la durée de l'incidence des rapports sexuels, de l'usage de l'alcool et de la marijuana ont été recueillies deux fois par an, entre 2004 et 2006. "Latent transition analysis" a été utilisée pour vérifier les modèles concurrents de transitions à ces comportements. Les participants étaient plus aptes à changer leur comportements, allant d'un comportement sans risque à l'usage de stupéfiants, plutôt que de changer leur comportements sans risque, menant à des relations sexuelles. À tous les points de mesure, la proportion de jeunes qui se sont livrés à des rapports sexuels, mais pas à l'usage de stupéfiants, était très faible. Les limites de l'étude et de l'orientation de la recherche future sont discutées. Cette recherche a été financée par NIH Grants R01 DA01749 et T32 DA017629-01A1.

RESUMEN

Este estudio examinó patrones longitudinales del uso principiante de drogas y del sexo en medio de un grupo de 1.143 estudiantes de escuela secundaria de un ayuntamiento de bajo nivel socio-económico en El Cabo, África del Sur. Se coleccionaron los datos longitudinales sobre los incidentes en el curso de su vida de sexo y el abuso de alcohol y/o marihuana semi-anualmente entre 2004 y 2006. Se empleó un análisis de forma transición implícita para probar modelos competitivos de transiciones para estos comportamientos. Se descubrió que los participantes solían mudarse de comportamiento sin riesgo hacia el abuso de drogas, en vez de mudarse de comportamiento sin riesgo hacia el sexo. Durante todo el estudio, la proporción de la juventud que estaba ocupada con el sexo, omitiendo el abuso de drogas, fue bien pequeña. Se discuten las limitaciones del estudio y las oportunidades para investigaciones futuras. Se fundó este estudio por las subvenciones del NIH R01 DA01749 y T32 DA017629-01A1.

THE AUTHORS



Lori-Ann Palen, Ph.D., is a research associate in the Risk Behavior and Family Research program at RTI International. Her substantive interests include adolescent risk behavior, positive youth development, and adolescent free-time activities. Her current work focuses on the evaluation of programs to prevent sexual risk behavior and interpersonal violence among adolescent populations.



Edward A. Smith, Ph.D., is the Director of Evaluation Research for the Prevention Research Center at the Pennsylvania State University. He also serves as the program director for the Center's NIDA-funded Prevention and Methodology Training Program. He is the Co-Principal Investigator of the HealthWise South Africa Project.



Linda L. Caldwell, Ph.D., is a Professor of Recreation, Park, and Tourism Management and Human Development and Family Studies at the Pennsylvania State University. She is the Co-Principal Investigator of the HealthWise South Africa Project. Most of her research centers on the intersection of youth development, leisure and health, and prevention. She primarily focuses on interventions that develop youth competencies, promote healthy lifestyles, and reduce risky behavior in and through leisure.



Catherine Mathews, Ph.D., is a senior scientist for Health Systems Research Unit of the South African Medical Research Council. She is also an honorary lecturer in the Department of Public Health and Primary Health Care at the University of Cape Town.



Tania Vergnani, Ph.D., is Director of the HIV/AIDS program at the University of the Western Cape. She is also a registered clinical psychologist and an associate professor in UWC's Faculty of Education. Her academic passions revolve around life skills and HIV/AIDS education and prevention, counseling, care and support, and teacher training. She has authored a number of life skills textbooks and is actively involved in the development and teaching of courses for teachers and teacher educators in HIV/AIDS education.

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