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ORIGINAL PAPER

Leisure Boredom, Timing of Sexual Debut, and Co-Occurring Behaviors among South African Adolescents

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Abstract

Sex during adolescence is normative; however, there are substantial individual differences in the timing and context of sexual debut. Leisure boredom is an underexplored correlate of sexual behavior that is associated with many adolescent health outcomes. We investigated if and how individual differences in leisure boredom may be associated with timing of sexual debut, and whether individuals engage in safe or risky behaviors at debut. Survival analysis, logistic regression, and Poisson regression were applied to eight-wave longitudinal data obtained from 3,088 South African adolescents (baseline $M_{age} = 13.9$ years) to examine associations between leisure boredom and cumulative hazard of sexual debut across adolescence, odds of co-occurring sexual behaviors, and incidence rate of co-occurring sexual risk behaviors at debut. Higher levels of leisure boredom were associated with elevated hazard cumulatively across adolescence. Higher levels of leisure boredom were also associated with lower odds of safe sex and higher odds of substance use during sex and transactional sex at sexual debut, but not casual sex or condom non-use at sexual debut. Although odds of singular risk behaviors were lower for girls than for boys, the association between leisure boredom and the number of risk behaviors at sexual debut was stronger for girls than boys. Higher trait leisure boredom was associated with elevated hazard of sexual debut, greater likelihood that risky behaviors accompanied sexual debut, and greater number of co-occurring risky behaviors at sexual debut. Results support leisure boredom as a potential target for preventing sexual risk behavior among South African adolescents.

Keywords Adolescence · Gender differences · Leisure boredom · Sexual debut · South Africa

Introduction

Boredom during leisure and free time contexts has long been recognized as a contributor to adolescent risk behavior (Iso-Ahola & Crowley, 1991). Longitudinal evidence suggests that increase in boredom in leisure from the beginning of Grade 8 to the beginning of Grade 11 leads to increases in alcohol, cigarettes, and marijuana use (Sharp et al., 2011). However, the connection between leisure boredom and sexual risk has been largely unexplored (Miller et al., 2014; Wegner & Flisher, 2009). Therefore, we examine the association between leisure boredom and the timing of sexual debut (i.e., first coital experience) and accompanying risky behaviors. This study takes place in South Africa, where 720,000 young people between the ages of 15 to 24 years live with HIV (Zuma et al., 2016).

Although sexual debut and exploration in adolescence is widely considered normative and not inherently risky (Tolman & McClelland, 2011), understanding the timing of sexual debut, especially early sexual debut, and accompanying risky behaviors is important because early sexual debut exposes adolescents to transmission of HIV and other sexually transmitted infections (Ghebremichael et al., 2009; Mavedzenge et al., 2011; Pettifor et al., 2004) and unwanted pregnancy (O'Donnell et al., 2001). Although sexual debut is not deterministic of all later sexual behaviors and risk, early sexual debut has been

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associated with odds of later engagement in risk behaviors including substance use during sex and not using a condom during sex (Kaplan et al., 2013).

In this paper, we study adolescent sexual debut in South Africa, where, due to the high rates of HIV among young people, early intervention to delay early sexual debut, encourage safe sex, and reduce risky sexual behaviors is imperative. Early sexual debut in South Africa is defined as sex prior to the normative age of 15 years old, and estimates from a multi-national study of African 15-year-olds indicated that 38.1% of boys and 15.8% of girls experienced early sexual debut (Peltzer, 2010).

Despite high rates of sex-related adverse consequences among South African youth, sexual exploration in adolescence can be healthy, positive, and safe when adolescents' well-being and self-efficacy are centered in their sexual experiences and education (Harden, 2014). Part of ensuring healthy and safe sexual exploration is identifying and mitigating correlates of sexual risk behaviors in adolescence. At sexual debut, likelihood of adverse consequences is exacerbated by co-occurring risk behaviors, including casual sex (Grello et al., 2003), concurrent use of substances such as alcohol, marijuana (Baliunas et al., 2010; Hendershot et al., 2010), transactional sex (Zuma et al., 2016), and sex without a condom (Centers for Disease Control, 2014).

Casual sex at sexual debut is related to likelihood of multiple partners in the future (Zuma et al., 2010). Likewise, alcohol consumption prior to sex reduces the likelihood of using a condom when having sex with a casual partner (Kiene et al., 2009) and increases the risk for HIV infection (Baliunas et al., 2010), indicating both singular and combined risk behaviors may impact risk of unwanted consequences. Condom use at sexual debut is a significant predictor of later condom use among young adult South Africans (Hendriksen et al., 2007).

Engaging in risk behaviors at sexual debut can inadvertently introduce unwanted health consequences to the otherwise normative and healthy developmental process of sexual exploration. Risk behaviors at sexual debut introduce event-specific risk and links between risk-taking behavior at sexual debut and future risk taking highlight sexual debut as a developmentally important time for prevention, where affecting the timing of, and behavior at, sexual debut may influence later HIV risk behaviors.

Boredom in Leisure and Risk Behavior

There are a number of developmental reasons boredom may be linked to risky behavior in adolescence, although as noted, little research has addressed boredom in leisure and sexual risk, especially in South Africa. Moreover, aside from some of our preliminary work (Miller et al., 2014) there is little longitudinal research that provides insight regarding the developmental course of leisure boredom and concurrent developmental and health outcomes (Spaeth et al., 2015). Thus, to better frame adolescent sexual behavior in a context of leisure boredom, we first articulate and define boredom and highlight the developmental processes that contribute to boredom in adolescence.

Broadly, boredom can be characterized as an emotional state of not being able to engage in satisfying and desired activity, resulting in feelings of emptiness, restlessness, and meaninglessness (Spruyt et al., 2018). Further, limited access to economic, social, and cultural capital is theorized to contribute to boredom (Barbalet, 1999). Combined, these two perspectives suggest that boredom emerges in an undesirable person-environment fit where an under-stimulating environment does not fulfill one's needs or where one lacks skills to fully engage in one's environment (e.g., Spaeth et al., 2015).

In addition to contextual factors, physiological and neurological changes during adolescence contribute to increasing levels of risk taking and sensation seeking, which may in turn contribute to boredom in leisure. Differences in the timing of development in two brain networks—socioemotional, which develops first, and cognitive control, which develops later—increases the risk of engaging in risk-taking behavior (Steinberg, 2016). This temporal difference in brain network development is associated with impulsivity and risk taking (Romer, 2010), as well as the inability to self-regulate in leisure situations with inadequate stimulation (Spaeth et al., 2015). Moreover, hormonal development in adolescence contributes to changes in sexual motivation (Luciana, 2016), ability to weigh risk/reward consequences (Chick, 2015), and sexual and risk-taking behavior (Suleiman et al., 2017). These neurological and physiological changes make adolescence a prime developmental stage in which leisure boredom—experienced as disengagement and dissatisfaction during free time—may impact how developing sexual motivations and behavior manifest.

During adolescence, physiological and neurological development are accompanied by changes in risk-taking behavior. Impulsive action occurs without planning or consideration of consequences, and sensation seeking is based on the desire for experiences that are novel, exciting, or rewarding (Harden & Tucker-Drob, 2011). Sensation seeking peaks around age 19 in males and 16 in females (Romer et al., 2017), making adolescence a developmental period when risk taking is both common and higher than in other developmental stages.

In connection with leisure, anticipating a reward is part of the behavioral activation system that includes fun-seeking (Romer et al., 2017). Fun-seeking and impulsive responses to immediate urges made without thinking through consequences (Romer et al., 2017) could be especially problematic for adolescents experiencing leisure boredom (i.e., disengagement and disinterest in free time) and thus looking for gratifying experiences that provide immediate reward. Furthermore, adolescents may be unable to handle more complex decision making when they are in highly, emotionally charged, social environments (Arain et al., 2013) that may include sexual encounters. Lastly,

younger adolescents have less patience for waiting for a reward and need more immediate gratification (Romer et al., 2017) and thus may have underdeveloped capacity for regulating immediate urges and desire for stimulation.

Under-resourced contexts, physiological and neurological development, and reward-motivated behavior converge to make adolescence a period in which leisure boredom is especially salient. Adolescents experiencing high leisure boredom—disinterest and disengagement in free time—may be driven by impulsive urges and reward gratification to seek stimulating experiences including through sexual behavior.

The South African Context

Research suggests South African adolescents experience high levels of leisure boredom (Wegner et al., 2006). Parks and recreational spaces in many communities are often no more than open fields with broken or stolen equipment, and the majority of free time is occupied by hanging out on street corners. Adolescents generally report there is nothing else to do, which inevitably leads to boredom (Wegner, 2011). A correlational study indicated associations between leisure boredom and sex (also under the influence of alcohol and marijuana; Miller et al., 2014), and in a qualitative study, South African adolescents reported engaging in sex to alleviate boredom and pass the time (Edin et al., 2016). In this paper, we further examine how leisure boredom may influence timing of sexual debut and co-occurring safe and risky sex behaviors.

There are gender differences in leisure boredom, sexual debut, and co-occurring sexual risk behaviors. Boys and girls view sexual risk and safe sex differently (Harrison et al., 2001). South African boys viewed themselves as not-at-risk and described condoms as an instrument for safe sex with casual partners. In the same study, girls understood condoms as a symbol of love and affection from their sexual partner (Harrison et al., 2001). Although girls in one study reported greater fear of negative consequences (e.g., HIV, unwanted pregnancy) than did boys (Harrison et al., 2001), girls in another study were less likely than boys to use condoms at sexual debut (Zuma et al., 2011). In addition, there are inconsistent findings concerning gender differences and leisure boredom (Wegner & Flisher, 2009). Early studies of leisure boredom were mixed, with some studies finding higher levels of leisure boredom in girls (Patterson et al., 2000; Wegner et al., 2006) and other finding higher levels in boys (Newberry & Duncan, 2001; Shaw et al., 1996). More recent studies found no gender differences in leisure boredom or its association with behavioral health outcomes (Spaeth et al., 2015; Weybright et al., 2015). Building from the documented differences between boys' and girls' interpretation of sexual experiences and safe sex behavior, and the mixed findings on gender differences in leisure boredom, we check for gender differences in the association between leisure boredom and both timing of sexual debut and co-occurring behaviors.

Current Study

In a previous study, Miller et al. (2014) used dichotomous data and chi-square analysis to examine whether youth who experienced leisure boredom in Grade 9 would be more likely to engage in future risky sexual behaviors. This study, which uses survival analysis to examine when sexual debut occurs, and whether it is accompanied by multiple co-occurring risky or safe sex behaviors, expands on the Miller et al. (2014) study in three distinct ways. First, we specifically consider early sexual debut, which as noted, is a meaningful developmental transition during normative adolescent sexual development. The analytical approach explicitly considers individual differences in timing of developmental transition. Second, this study is the first to examine gender differences in the association between sexual debut behaviors and leisure boredom. Third, this study operationalizes leisure boredom as a continuum, rather than as discrete high versus low categories (as done in previous research: Miller et al., 2014). With these extensions, this study is able to describe the full gradient of risk from high to low boredom.

We posit four hypotheses.

(H1) Leisure boredom is associated with greater cumulative likelihood of sexual debut across adolescence.
(H2) Leisure boredom is associated with lower odds of safe sex at sexual debut, and
(H3) higher odds of each singular risky behavior accompanying sexual debut.
(H4) Individuals with higher leisure boredom report greater incidence of multiple risky behaviors at sexual debut.

Additionally, we examine whether the associations between leisure boredom and sexual debut behaviors are moderated by gender. We expected girls to report sexual debut at a later age on average compared to boys; however, given the inconsistent findings in the literature regarding leisure boredom and gender, we did not hypothesize the direction of gender moderation effects.

Method

Sample

Data were from an effectiveness trial evaluating a leisure-based risk prevention program, HealthWise South Africa: Life Skills for Young Adults, that was conducted in a low-income

township near Cape Town, South Africa. Comprehensive information about the design and outcomes of the HealthWise trial are detailed in Caldwell et al. (2004b) and Smith et al. (2008). Analyses for this paper were based on the no-treatment control group. Longitudinal survey data were provided by three successive cohorts that initiated study participation in Grade 8 and completed surveys in their classroom on handheld digital devices in English or Afrikaans, depending on student preference, at roughly six-month intervals for two to four years.

Cohorts did not differ in demographic or behavioral distributions. Therefore, all three cohorts were combined, after removal of cases that were missing pertinent demographic data (i.e., gender, age, treatment/control) at every assessment ($n = 29$); reported sexual debut before the launch of the study ($n = 338$); and provided data on only one occasion ($n = 113$). Because forced sex is qualitatively different than consensual sex (Moore et al., 2007) and outside the frame of positive, normative sexual development (Harden, 2014), data from individuals who reported forced sex at sexual debut ($n = 158$) were not included in the analyses. Models were tested with and without potential outliers (between two to three SDs from sample mean for leisure boredom), with no differences in model interpretation or conclusions.

There were 3,088 participants (55.3% girls; $M = 13.9$ years, $SD = 0.8$) at baseline. The majority self-identified as mixed-race (87.1%); the remaining students identified as Black (4.2%), White (3.9%), and Indian or other (< 1.0%; 3.9% not reporting race). Measures of socioeconomic status were based on recommendations from local project team members for gauging socioeconomic standing in Cape Town area townships and reflected general socioeconomic homogeny in the sample. About 98% of participants had access to electricity, 94.8% had access to tap water, and 82.2% lived in a brick home (versus backyard dwellings, tents, or shacks).

This study was approved by the Institutional Review Boards of The Pennsylvania State University and Stellenbosch University. Adolescent assent and passive parental consent were obtained prior to the study. Participants were identified with numbers rather than names and completed all surveys privately.

Measures

Our analysis focused on questions regarding sexual debut, accompanying safe and risk behaviors at sexual debut, leisure boredom, and gender. All measures were included in each wave of data collection.

Sexual Debut

Participants responded "yes" or "no" to a question about lifetime sex, "Have you ever had sex? This means intimate contact with someone during which the penis enters the vagina (female private parts)." Those responding "yes," were asked a follow-up question regarding timing of most recent sex, "When was the last time you had sex?" with response options of "more than 6 months ago," "4–6 months ago," "2–3 months ago," and "in the last month." Together with age, the first report of most recent sex was used to estimate age of sexual debut, coded into number of months (i.e., 6 = more than 6 months, 5 = 4–6 months ago, 2.5 = 2–3 months ago, 0.5 = in the last month) and subtracted from current age to obtain timing of sexual debut. For example, a 14-year-old participant who reported first lifetime sex at Wave 3 with most recent sex as "2–3 months ago" (2.5 months or 0.21 years) would have an age of sexual debut of 13.79 years (Wave3age—[most recent sex/12]). Because of the structure of the underlying items and time lag between data collection waves, estimated age of sexual debut is accurate to within five months.

Risky Behaviors

Participants who reported that they had sex were asked about accompanying behaviors at their last sexual experience: casual sex, "how would you describe your relationship with that person?" (1 = just met that day, 0 = I've known them for a while, 0 = serious dating partner); alcohol with sex, "did you use alcohol?" (0 = no, 1 = yes); marijuana with sex, "did you use dagga?" (0 = no, 1 = yes); transactional sex, "did you [have sex] for money, drinks, or food?" (0 = no, 1 = yes), and sex without a condom, "did you or your partner use a condom?" (0 = no, 1 = yes; reverse coded). Indicating "no" for singular co-occurring behaviors did not equate safe sex at sexual debut. For example, a participant reporting condom use may have engaged in sex under the influence of alcohol. Thus, to measure a broader, more comprehensive measure of safe sex, a variable was created that indicated sexual debut without any reported risk behaviors (0 = any risks, 1 = no risks/safe sex).

Leisure Boredom

Leisure boredom was measured with four items from the Leisure Experience Battery for Adolescents (LEBA) (Caldwell et al., 1992, 2004a). Sample items include "For me, free time just drags on and on" and "Free time is boring" each answered using a five-point Likert scale (0 = *strongly disagree* to 4 = *strongly agree*). Leisure boredom scores were calculated as the average across the four items (Cronbach's $\alpha = 0.67$) at each wave and then across waves (see also Weybright et al., 2015). Thus, scores represent stable, trait level between-person differences in leisure boredom.

Gender and Covariates

Gender was binary with boys as the reference group (0 = boy, 1 = girl) and entered into the models as girl. Binary and dummy-coded variables for race, cohort, access to electricity, access to tap water, home type were included as covariates in follow-up tests of model robustness. In logistic regression models investigating likelihood of safe sex and singular risk behaviors and Poisson regression investigating number of risk behaviors, we controlled for age at sexual debut.

Data Analysis

Three sets of analyses were used to test the hypotheses. (1) Survival analysis, specifically Cox proportional hazards regression (Cox, 1972) was used to examine the association between leisure boredom and timing of sexual debut and assess whether that association was moderated by gender. Although event driven survival analysis estimates a *hazard ratio*, the ratio should be interpreted statistically as an estimate of cumulative likelihood for the event to occur over time (Cox, 1972) and not to mean sexual debut is an inherently hazardous or risky event. Survival analysis was conducted using the full sample ($n = 3{,}088$) and included all participants regardless of reported sexual debut. (2) Six logistic regression models were used to examine how leisure boredom was, among the sexually active subsample ($n = 804$), related to odds of each behavior accompanying the sexual debut event: safe sex, casual sex, alcohol with sex, marijuana with sex, transactional sex, and sex with no condom. (3) Finally, the association between leisure boredom and the number of risk behaviors co-occurring at sexual debut was examined using a zero-inflated Poisson regression with the sexually active subsample ($n = 804$).

Models were estimated using *survival* (Therneau, 2017), *lme4* (Bates et al., 2015), and *pscl* (Zeileis et al., 2008) packages in R version 3.4.0 (R Core Team, 2016). In cases where there was no evidence that gender moderated the association between leisure boredom and the outcome of interest, gender was only included as a main effect. For completeness, the robustness of each model was tested for effects of cohort, race, age at sexual debut, and SES factors (i.e., access to electricity, access to tap water, and home type).

Results

Boredom and Sex-Related Behaviors

For the full sample, the mean leisure boredom score was 1.61 ($SD = 0.62$), with boys' scores trivially higher than girls' scores ($M = 1.64$, $SD = 0.64$ and $M = 1.59$, $SD = 0.64$, respectively; $F = 4.99$, $p < .05$; Cohen's $d = 0.08$). Although some individuals reported high levels of boredom, overall, the sample average was below the midpoint (range: 0–4) for possible leisure boredom scores. The average age of sexual debut of the 804 (26.0%) sexually active participants was 15.22 years ($SD = 1.06$), with more boys debuting than girls (36.4%, $n = 470$ and 20.7%, $n = 334$, respectively). Boys, on average, debuted at an earlier age than girls ($M = 15.1$ years, $SD = 1.1$ and $M = 15.40$ years, $SD = 1.00$, respectively; $t(1133) = 358.3$, $p < .001$; Cohen's $d = 0.27$). As expected, average level of leisure boredom was higher among those who reported sexual debut during the study ($M = 1.74$, $SD = 0.63$) than those who did not ($M = 1.56$, $SD = 0.61$; $t(5231) = 93.28$, $p < .001$; Cohen's $d = 0.30$).

Of the sexually active subsample ($n = 804$), 53.0% ($n = 426$) reported safe sex (i.e., no risk behaviors), 29.0% ($n = 239$) reported only one risk behavior, and 18.0% ($n = 139$) reported more than one risk behavior at sexual debut. Of the participants reporting at least one risk behavior ($n = 378$), 23.0% ($n = 87$) reported casual sex, 37.0% ($n = 140$) reported alcohol with sex, 26.2% ($n = 99$) reported marijuana with sex, 6.6% ($n = 25$) reported transactional sex, and 57.1% ($n = 216$) reported sex without a condom.

Sexual Debut Survival Analysis

Results from survival analysis examining associations between leisure boredom and cumulative hazard of sexual debut over time (reported as continuous measure of age) are shown in Table 1. Gender did not moderate the association between leisure boredom and hazard of sexual debut and was thus only included as a main effect. As seen in Table 1, girls' hazard for sexual debut was only about half as large ($HR = 0.522$) as boys' hazard of sexual debut. This indicates a difference in the hazard ratio due to gender, which means boys had a higher hazard for sexual debut. As expected for both boys and girls [H1], leisure boredom was associated with hazard of sexual debut, such that every one unit difference in individuals' leisure boredom was associated with

Table 1 Cox proportional hazards model examining association between timing of sexual debut and leisure boredom and gender

	Main effects model	
	HR	*CI*
Leisure boredom	**1.575**	[1.404, 1.766]
Girl	**0.522**	[0.454, 0.601]
R^2	0.049	

$n = 2883$ (185 missing); boldface hazard ratios (*HR*) indicate significance at $p < .001$; *CI* = 95% confidence interval.

1.575 times greater hazard of sexual debut. As shown in Fig. 1, individuals with high boredom (+ 1 SD, dotted line) had an elevated cumulative risk of sexual debut compared to individuals with low leisure boredom (− 1 SD, dashed line). The increasing gap between high/low leisure boredom hazard ratio curves and average leisure boredom hazard ratio reflects the cumulative nature of hazard ratios.

Safe and Risky Behavior at Debut

Results from six logistic regression models examining associations between leisure boredom and behavior at sexual debut are shown in Table 2. Gender did not moderate the leisure boredom–behavior association for any of the six outcomes, and thus, we interpret main effects only models. Looking at the first model, the odds of safe sex at sexual debut were higher for girls than boys and, as hypothesized [H2], inversely related to leisure boredom. Each unit increase in leisure boredom was associated with 0.714 lower odds of safe sex. Odds of having casual sex were lower for girls, but were not associated with leisure boredom. The odds of using alcohol at sexual debut and the odds of using marijuana at sexual debut were lower for girls than boys and, as hypothesized [H3], associated with leisure boredom. For each unit increase in leisure boredom the odds of using alcohol with sex were 1.643 times higher and the odds of using marijuana with sex were 1.508 times higher. Additionally, a one unit increase in leisure boredom was associated with a 2.424 times greater odds of transactional sex. However, contrary to hypotheses, odds of sex without a condom were not associated with leisure boredom or gender.

Number of Co-Occurring Behaviors at Sexual Debut

Results from the zero-inflated Poisson regression examining how total number of behaviors occurring at sexual debut were related to leisure boredom and gender are shown in Table 3. Results of the count model indicated that for those reporting at least one co-occurring behavior, being a girl was associated with lower incidence of co-occurring behaviors than boys by a factor of 0.347. However, for girls, leisure boredom was more strongly associated with number of co-occurring risky behaviors ($IRR = 1.506$), than was boys' leisure boredom. These differences are illustrated in Fig. 2. The level of boys' (blue) co-occurring behavior incident rate is greater than girls' (red). The narrowing distance between the boys and girls lines is due to the moderating effect of gender. A one unit increase in leisure boredom is associated with a greater difference in incident rate ratio for girls than for boys.

Across all models, effects of interest were robust to inclusion of other covariates (e.g., cohort, SES), but did sometimes reveal differences across race (cumulative hazards, number of co-occurring risk behaviors) or cohort (odds of transactional sex). Differences by race in this data set are difficult to interpret because the sample is predominantly mixed-race (87%) and the remaining race groups each constituted less than five percent of the sample, and thus, sufficient power to detect differences was only achieved by aggregating several different race groups into one category. In addition,

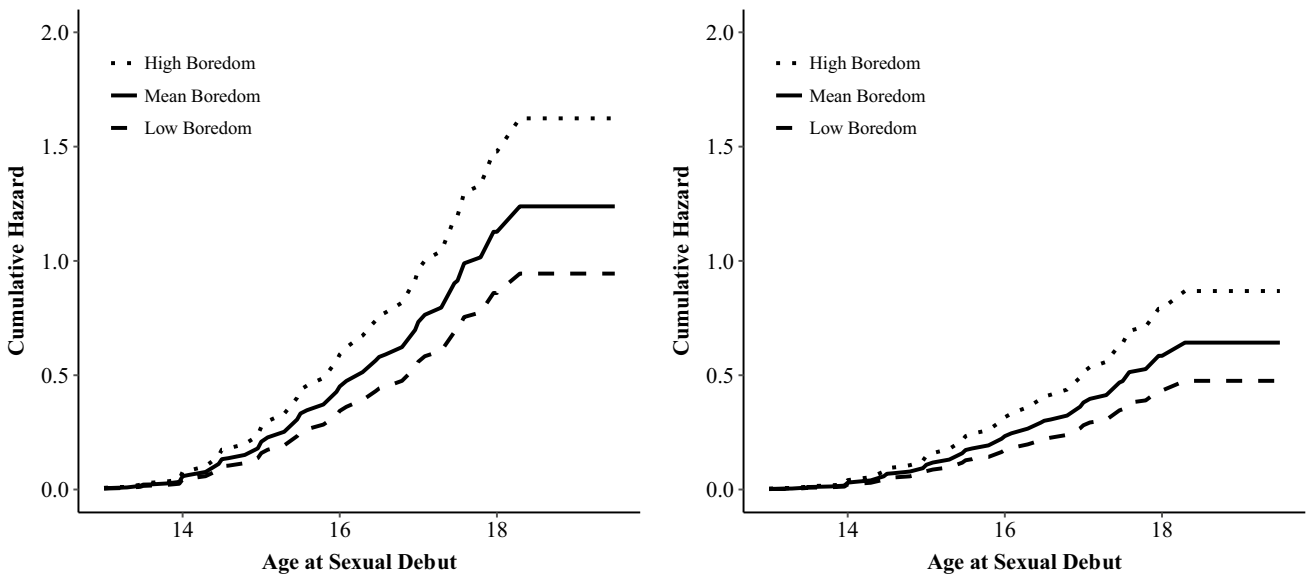

Fig. 1 Cumulative hazard of sexual debut across time predicted by leisure boredom. Curves for boys (left) and girls (right) were modeled together to test gender differences. Boys and girls effects are plotted separately to improve data visualization where lines for low boredom boys and high boredom girls overlap

Table 2 Logistic regression models examining association between safe and risky sex behaviors and leisure boredom and gender

	Main effects models	
	OR	*CI*
Safe sex		
Intercept	**1.612**	[1.050, 2.488]
Leisure boredom	**0.714**	[0.569, 0.892]
Girl	**1.732**	[1.301, 2.312]
Casual sex		
Intercept	**0.131**	[0.065, 0.256]
Leisure boredom	1.181	[0.829, 1.684]
Girl	**0.289**	[0.159, 0.495]
Alcohol with sex		
Intercept	**0.108**	[0.059, 0.193]
Leisure boredom	**1.643**	[1.228, 2.210]
Girl	**0.548**	[0.366, 0.809]
Marijuana with sex		
Intercept	**0.088**	[0.044, 0.169]
Leisure boredom	**1.508**	[1.080, 2.112]
Girl	**0.462**	[0.283, 0.732]
Transactional sex		
Intercept	**0.008**	[0.002, 0.030]
Leisure boredom	**2.424**	[1.298, 4.590]
Girl	0.349	[0.115, 0.875]
Sex with no condom		
Intercept	**0.287**	[0.176, 0.462]
Leisure boredom	1.110	[0.868, 1.422]
Girl	1.169	[0.851, 1.603]

$n = 804$; boldface odds ratios (*OR*) are significant at $p < .05$; *CI* = 95% confidence interval.

Table 3 Count of risky behaviors co-occurring at sexual debut predicted by leisure boredom and gender

	Moderation model	
	IRR	*CI*
Count model		
Intercept	0.691	[0.046, 1.055]
Leisure boredom	1.181	[0.966, 1.444]
Girl	**0.347**	[0.167, 0.721]
Girl*boredom	**1.506**	[1.048, 2.166]

$n = 804$; boldface incident rate ratios (*IRR*) are significant at the $p < .05$ level; *CI* = 95% confidence interval

differences across race groups in any health outcome should be interpreted with caution to avoid inadvertent pathologization of race, especially within a study where racial differences in health are not situated within the context of racism (Volpe et al., 2019). These differences, which were peripheral to our primary hypotheses, did not alter conclusions about the magnitude, direction, or significance of the gender or leisure boredom effects in any model.

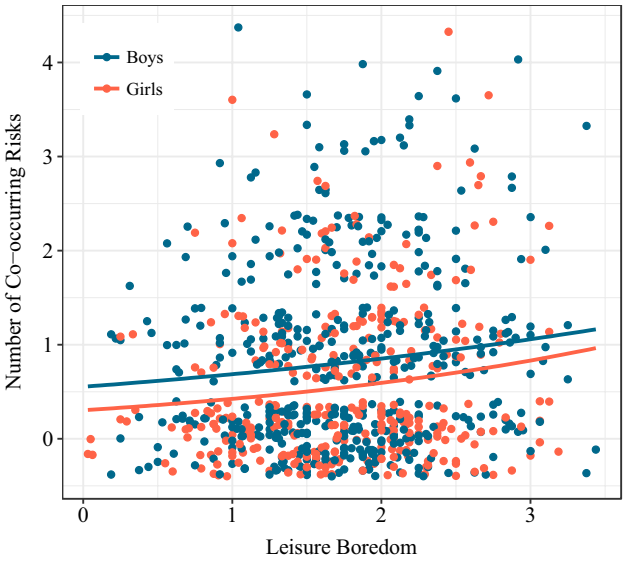

Fig. 2 Poisson regression modeling the incident rate ratio of co-occurring risks due to differences in the association between leisure boredom and gender

Discussion

This study contributes to adolescent sexual health literature by identifying associations between leisure boredom and the nature of sexual debut by examining the association of leisure boredom with cumulative likelihood of sexual debut during adolescence and association with safe sex, substance use, transactional sex, and the combined total of risky sexual behaviors accompanying debut. This study contributes to knowledge gaps by focusing on a longitudinal sample of predominantly mixed-race adolescents ($n = 3{,}088$) living in a low-resourced community in South Africa. In this region, rates of HIV transmission are high among adolescents, and identifying mechanisms underlying adolescent sexual behavior and debut can inform future intervention development. Our survival analysis demonstrated the association between leisure boredom and elevated hazard of sexual debut and further investigation with logistic and Poisson regression revealed specific risk behaviors related to leisure boredom among boys and girls.

Timing of Sexual Debut and Leisure Boredom

As a normative part of adolescent sexual development (Tolman & McClelland, 2011), sexual debut can be a positive, healthy experience. Sexual exploration during adolescent

development is common and an important part of exploring new roles and relationships (Harden, 2014). Progression through sexual exploration often includes sexual debut during adolescence (Peltzer, 2010), and although not inherently risky, consensual, early sexual debut during adolescence has been associated with later sexually risky behavior (e.g., sex without condoms and under the influence of substances; Kaplan et al., 2013).

Because sexual debut and sexual exploration are normative parts of adolescent development (Harden, 2014; Tolman & McClelland, 2011), it is important to distinguish between safe, healthy sex and sex accompanied by risky behaviors. Exploratory qualitative research and descriptive quantitative research point to leisure boredom as a potential motivator and correlate of sexual behavior (Edin et al., 2016; Miller et al., 2014). By considering associations between leisure boredom and sexual debut, we took steps toward identifying an underexplored, potential correlate of risk taking in adolescent sex. Associations between leisure boredom and some adolescent risk-taking behaviors have been documented (e.g., substance use, delinquency; Spaeth et al., 2015; Weybright et al., 2015), but the role of leisure boredom remains largely unexplored in adolescent sexual development. This is particularly important given the biological implications of the developing adolescent brain in relation to sensation seeking and impulsivity (e.g., Romer et al., 2017; Steinberg, 2016) during sexual maturation.

In the current study, results showed leisure boredom was associated with timing of sexual debut such that the hazard (cumulative risk) of sexual debut is greater when leisure boredom is high. That is, the likelihood an adolescent will engage in sex increases cumulatively with age, and higher levels of leisure boredom are associated with an elevated cumulative likelihood of engaging in first sex. Thus, at any given age in adolescence, the likelihood that an individual will have engaged in sex is greater for those with higher levels of leisure boredom in this sample. Although gender did not moderate this association, the baseline hazard level for sexual debut was higher for boys than girls, such that a girl with high boredom had a comparable sexual debut risk to a low boredom boy.

It should be noted that adolescent boys tend to over report while girls under report sexual behaviors, thus introducing a possible gender bias (Bordini & Sperb, 2013; Reid et al., 2011) that could not be unpacked in this study. The baseline risk differences by gender, taken together with the greater proportion of boys who reported sexual debut and their earlier average age of debut, build on previous research showing higher risk for early sexual debut among boys (Zuma et al., 2011) and a greater portion of boys reporting sex than girls during adolescence (Peltzer, 2010) in South Africa.

Leisure Boredom and Sexual Debut Behavior

Results were somewhat mixed for associations between leisure boredom and behaviors accompanying sexual debut. Higher levels of leisure boredom were related to lower odds of safe sex (i.e., no reported risk behavior) and higher odds of sex under the influence of substances (e.g., alcohol, marijuana) at sexual debut. These findings regarding substance related-risk extend previous literature suggesting a general link between substance use and leisure boredom (Iso-Ahola & Crowley, 1991; Wegner et al., 2006; Weybright et al., 2015) by demonstrating an association between leisure boredom and event-specific (i.e., sexual debut) substance use.

The effect of leisure boredom had greater magnitude for transactional sex compared to all other risk behaviors, such that a higher leisure boredom score was associated with greater odds of transactional sex than for sex under the influence of alcohol or marijuana. Because individuals often engage in transactional sex in exchange for money or other materials, it is possible they are seeking material gain in response to the low stimulus and high boredom they experience. Both leisure boredom and transactional sex are interlocked with complex economic and social contexts that guide availability and access to leisure programs and resources (Stoebenau et al., 2016; Wegner, 2011). Further investigation is needed to understand the mechanisms linking leisure boredom to transactional sex and should be examined with regard to structural context (Edin et al., 2016).

Gender, Sexual Behavior, and Leisure Boredom

Although our findings did not indicate an association between gender and condom use alone, as suggested in other studies (Harrison et al., 2011), results provided insight into a more complex profile of gender and safe sex behaviors. Framing safe sex as the absence of many risks rather than condom use only suggests that compared to boys, girls in this study have higher odds of having a safe sex profile, despite no gender differences in condom use alone. This framing of safe sex as more than condom use is reflected in other studies suggesting evolving definitions of safe sex to encompass many different behaviors that contribute to safe and healthy sexual experiences (Bourne & Robson, 2009; Harden, 2014; Klassen et al., 2019).

The association between leisure boredom and number of risky behaviors was stronger for girls than boys. Compared to boys, girls who experienced sexual debut were more likely to report safe sex at debut; however, for those who reported any risks at debut, leisure boredom was a stronger predictor of a number of risks for girls than it was for boys. These results could be explained by two subgroups of girls characterized by either safe sex at sexual debut or risky sex at sexual debut and a stronger association between leisure boredom and number

of risks. Further exploration of these two outcomes could help differentiate girls who engage in safe sex at sexual debut and those endorsing one or more risks.

Importantly, experiences of leisure boredom may be heterogeneous. For example, greater levels of increased parental monitoring for adolescent girls (Petersen et al., 2005) than boys in South Africa could restrict access to positive, stimulating leisure experiences. Thus, it is important to consider context of and precursors to high leisure boredom, especially in terms of gender differences (Miller et al., 2014). It could be that girls and boys with especially high leisure boredom are experiencing this leisure boredom in vastly different contexts, and thus, their motivation and access to health resources, safe sexual behavior, and positive leisure experiences may differ.

Implications for Intervention and Prevention

Understanding the association between leisure boredom and risky sexual debut may be useful in designing preventative interventions targeting support for safe, healthy sex behaviors and, distally, preventing HIV transmission. The HealthWise South Africa curriculum includes lessons aimed at teaching adolescents restructuring skills for coping with boredom in low stimulus contexts (see Weybright et al., 2015). Likewise, evidence suggests increasing adolescent awareness of leisure opportunities in under-resourced communities can effectively reduce substance use (Motamedi et al., 2016). It is possible similar program elements could help adolescents engage in healthy free time activities rather than "passing the time" with sex (Edin et al., 2016).

Because leisure boredom was associated with some risky behaviors (e.g., alcohol, marijuana, transactional sex) and not others (e.g., casual sex, condom non-use), it may be best to integrate leisure boredom components into interventions addressing other mechanisms for preventing sexual risk. For example, leisure boredom could be an effective target for influencing substance use at sexual debut but may not necessarily directly affect condom use. Targeting the inverse relationship between leisure boredom and safe sex (i.e., no risk related behaviors) may also be effective, as low leisure boredom appears to be a protective factor for promoting safe sex behavior.

The HealthWise program also includes discussions about when a situation might turn risky. Greater emphasis could be given to this type of lesson and include concrete examples that help adolescents identify impulsivity and learn how to curb their impulses and unplanned behavior (particularly around sexual activity), while also supporting healthy sensation seeking activities. Specifically, the program might include elements focused on teaching adolescents to plan for and anticipate sexual experiences and intended healthy, safe sex behaviors. Finally, although other researchers have identified delaying first sex as an effective mechanism for reducing HIV transmission risk in South Africans, the impact is diminished if other sexual behaviors do not also change (e.g., condom use; Hallett et al., 2007; McGrath et al., 2009).

Although this study does not investigate the critical time to intervene, results suggest early intervention is critical, with 250 participants reporting sexual debut at the start of a study that began when participants were, on average, aged 13.9 years old. Among adolescents in the United States, researchers find many adolescents anticipate and approach their first sexual experiences with forethought and intention and suggest the time period just prior to sexual debut may be when adolescents are most receptive to messages regarding sexual health and safe sex behaviors (Lieberman et al., 2017). South African adolescents may also be receptive to messages regarding sex-positivity, safe sex, sexual health, and planning for sexual behavior; however, South African-based exploratory research and pilot programs should precede implementation of findings from studies of U.S. adolescents. In addition, early intervention may be especially critical for boys, given their earlier and higher rates of sexual debut, and girls who report above average leisure boredom, given their higher number of risk behaviors at sexual debut.

Limitations

The associations between leisure boredom and sexual debut should be interpreted within study limitations. Population inference is somewhat compromised because the sample was largely homogenous with respect to race and SES. Furthermore, procedures for this study were not designed for survival analysis; thus, time between waves of data collection introduced some error into estimates of event timing. Increased density, and earlier start (e.g., at age 11 years) of the repeated measures, could improve the accuracy of data about the timing of sexual debut and whether the very early initiators have a different profile of risk than those who reported sexual debut during this study. However, our tests of robustness, done for every model, offered strong support for the associations between leisure boredom and both sexual debut and accompanying sexual behaviors.

Although effects examined here covered many sexual debuts and were robust across bi-yearly and monthly calculations, data analyses suggest that monthly, weekly, and even daily measurement (e.g., experience sampling study designs) would provide further opportunity to examine complex within-person associations between, for instance, daily boredom and risky behavior. Future research in this population should include dyadic data or, minimally, more data regarding sexual partners of adolescents. This additional data would allow further investigation of gender differences in rates of sexual engagement and co-occurring risk behaviors. Taking a dyadic approach can also reveal ways in which adolescent boys and girls even in the same event may view sexual

encounters and risk differently, thus providing insight for how to tailor sexual education and intervention for boys and girls.

Finally, leisure boredom was operationalized as a stable, individual level trait in this study. To investigate whether context related variation in leisure boredom predicts sexual risk taking, leisure boredom could be modeled via state variations over time (Weybright et al., 2015). Intervention approaches to trait and state leisure boredom may require different program components and mechanisms.

Conclusion

Sexual debut is a normative part of adolescent sexual development; however, when risky behaviors co-occur with adolescent sex, likelihood of adverse health consequences increases. By investigating the association between timing of sexual debut and likelihood of both safe sex and risky behaviors, we provide new insight into how leisure boredom may help differentiate adolescents who are initiating sex in a safe and healthy manner versus those who are engaging in a variety of risk behaviors. Study results suggest that timing, comprehensive safe sex, risk behaviors (e.g., substance use during sex and transactional sex), and total number of risk behaviors at sexual debut are related to leisure boredom in adolescence.

In South Africa where HIV rates are high, and in a community where adolescent leisure resources and opportunities are limited and intermingled with high risk activities, investigation of leisure boredom and sexual debut risk identifies a potential indicator of risk behavior and provides a target for preventative intervention during adolescence. We recommend integrating leisure boredom components into intervention programs addressing multiple predictors of sexual risk, both at individual and structural levels that together promote safe sex broadly and target diverse sexual risk behaviors and different needs of girls and boys.

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All study procedures were conducted in accordance with the ethical standards of the Institutional Review Boards at The Pennsylvania State University and Stellenbosch University and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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