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ASSOCIATION OF LEISURE BOREDOM WITH RISKY SEXUAL DEBUT DURING

ADOLESCENCE

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ABSTRACT

Early sexual debut and accompanying risky sexual behaviors (e.g., casual sex, substance use, transactional sex, and condom non-use) are associated with increased risk of HIV transmission, unintended pregnancy, and risk taking in future sexual events. Leisure boredom is associated with risky behavior in adolescence, however, the connection between leisure boredom and risky sex is largely unexplored. The current study used survival analysis, logistic regression, and Poisson regression to examine relations between leisure boredom and timing of sexual debut, odds of risky sexual behaviors, and number of co-occurring sexual risks at debut. In this longitudinal sample of South African adolescents (N=3,088), leisure boredom had a multiplicative effect on the cumulative hazard of sexual debut during adolescence. Leisure boredom was also associated with odds of safe sex, sex under the influence of substances, and transactional sex, but not with casual sex or condom non-use at sexual debut. The relation of leisure boredom and the number of risks at sexual debut was moderated by gender with the effect of leisure boredom being stronger for girls. This study highlights relations between leisure boredom and sexual risk and suggests that leisure boredom may be an effective target for intervening on sexual debut risk but should be integrated with other intervention strategies.

Keywords: adolescence, leisure boredom, risky sexual behavior, sexual debut, South Africa

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Introduction

Adolescents often take risks and seek novelty and optimal arousal (Dahl, 2004; Steinberg, 2008). Leisure provides a unique context where adolescents can meet the need for optimal arousal and healthy risk taking (Coatsworth, Palen, Sharp, & Ferrer-Wreder, 2006; Sharp et al., 2011), and leisure can be an effective tool for reducing unhealthy risk behavior (Motamedi, Caldwell, Wegner, Smith, & Jones, 2016). However, the connection between leisure boredom— a lack of arousal or interest in leisure activities (Iso-Ahola & Weissinger, 1990)—and risk taking, especially substance use, is well documented (Iso-Ahola & Crowley, 1991; Sharp et al. 2011; Weybright, Caldwell, Ram, Smith, & Wegner, 2015). Boredom in leisure is also associated with risky sexual behavior in adolescence (Miller et al., 2014), yet this association is largely unexplored (Wegner & Flisher, 2009). In the current study, we examine the relation between leisure boredom and the timing of sexual debut (i.e., first coital experience) and accompanying risky behaviors.

Sexual debut in adolescence has the potential to be both normative and safe (Cavazos-Rehg et al., 2009; Kann et al., 2014; Tolman & McClelland, 2011), however, early sexual debut and accompanying risky behaviors prematurely expose adolescents to negative outcomes such as transmission of HIV and other sexually transmitted infections (Ghebremichael, Larsen, & Paintstil, 2009; Mavedzenge et al., 2011; Pettifor et al., 2004), spikes in internalizing disorders (Wesche, Kreager, Lefkowitz, & Siennick, 2017), and unwanted pregnancy (O'Donnell, O'Donnell, & Stueve, 2001). Early sexual debut is also associated with long term negative outcomes such as delinquency (Armour & Haynie, 2007) and higher rates of other sexual risk behavior (e.g., multiple partners; Zuma et al., 2010). At the time of debut, risk of adverse consequences may be reduced by safe sex (Center for Disease Control and Prevention [CDC],

2013) or exacerbated by additional risk behaviors including casual sex (Grello, Welsh, Harper, & Dickson, 2003), concurrent use of substances (e.g., alcohol, marijuana; Baliunas, Rehm, Irving, & Shuper, 2010; Hendershot, Magnan, & Bryan, 2010), transactional sex (Zuma et al., 2016), and sex without a condom (CDC, 2013). Risky behaviors accompanying sexual debut may have an additive effect on risk of negative outcomes.

In South Africa, where an estimated 6.4 million people are living with HIV (Zuma et al., 2016), early intervention to delay sexual debut and reduce risky behaviors is imperative. Indeed, delaying sexual debut is recommended as an effective way to reduce the risk of HIV transmission in South Africa (Zuma et al., 2016). Unpacking risky behaviors occurring at sexual debut and individual predictors of these behaviors can inform the design and tailoring of evidence based preventive interventions targeting sexual risk reduction and HIV prevention.

Background

Sexual debut

In 2012, at least 720,000 individuals between the ages of 15 to 24 years were living with HIV in South Africa (Zuma et al., 2016). Although sexual debut at any age introduces the risk of exposure to HIV and STIs, early sexual debut—sex prior to a normative age—was associated with increased risk of HIV infection (Ghebremichael, Larsen, & Paintsil, 2009; Pettifor, O'Brien, McPhail, Miller, & Rees, 2009). Definitions for normative and early sexual debut varied between studies and country, however, many studies of South African adolescents considered early sexual debut to be before age 15 (Harrison, Cleland, Gouws, & Frohlich, 2005; Pettifor et al., 2009; Zuma et al., 2016). Evidence suggested delaying sexual debut is an effective strategy for combatting the HIV epidemic in other African nations (Halperin et al., 2011; Stoneburner & Low-beer, 2004) and could be a useful strategy in South Africa, where rates of early sexual debut in adolescence remained stable for girls and increased for boys (Zuma et al., 2016).

Early sexual debut was associated with greater likelihood of additional risky sexual behavior than was sexual debut at a normative age or later. In a review of sexual debut in sub-Saharan Africa, researchers proposed two pathways by which early sexual debut may increase the risk for HIV infection: the first indicated direct exposure to HIV during early sexual debut as a primary risk factor, and the second suggested early sexual debut was indicative of later risk taking which then increases the likelihood of exposure to HIV (Stöckl, Kalra, Jacobi, & Watts, 2013). Early sexual debut was associated with increased likelihood of having an older partner and sex without a condom at the time of sexual debut (Pettifor et al., 2009). Other studies reported evidence that early sexual debut increases the likelihood of multiple partners in the future (Sandfort, Orr, Hirsch, & Santelli, 2008). In another study of boys in South Africa, early

sexual debut was associated with no condom use, casual sex, a feeling of not being ready for sex, and later reporting of multiple partners (Harrison et al., 2005). These findings supported both explanations connecting early sexual debut directly to HIV exposure and more distally through association with later risk taking.

Various risky behaviors accompanying sexual debut affect the immediate risk for negative outcomes. Sex with a stranger, or casual sex, at sexual debut introduced unwanted outcomes such as negative feelings about the sexual experience for adolescent females (Grello, Welsh, & Harper, 2006) and an increased likelihood of multiple partners in the future (Zuma et al., 2010). Engaging in casual sex was also predictive of depression, delinquency (Grello, Welsh, Harper, & Dickson, 2003), and a higher likelihood of using alcohol and drugs during sex in future sexual encounters (Grello et al., 2006). Adolescents who used alcohol or marijuana were more likely to have sex with a stranger (Palen, Smith, Flisher, Caldwell, & Mpofu, 2006). This link between substance use (e.g., alcohol and marijuana) and casual sex was supported in several other studies (Grello et al., 2006; White, Fleming, Catalano, & Bailey, 2009), suggesting multiple risky behaviors may co-occur during a single sexual experience. Likewise, alcohol consumption prior to sex reduced the likelihood of using a condom when having sex with a casual partner (Kiene, Barta, Tennen, & Armeli, 2008) and increased the risk for HIV infection (Baliunas et al., 2010). Transactional sex—sex in exchange for money, food, drugs, or other materials goods—was associated with an increased risk of STI, and adding alcohol use to transactional sex increased the STI risk even further (Norris, Kitali, & Worby, 2009). Transactional sex was also associated with higher risk for HIV infection, even when controlling for number of lifetime sexual partners (Dunkle et al., 2004).

Despite condom use being the most effective way to prevent HIV and other STI transmission (CDC, 2013), condom use at the most recent sex declined from 2008 to 2012 in South Africa (Zuma et al., 2016). In a study of South African adolescents, 46.1% of adolescents reported condom use at the last sex with boys being motivated by peer influence and girls by a perception that condoms are associated with multiple partners (Harrison et al., 2012). Additionally, condom use at sexual debut was a significant predictor of later condom use (Hendriksen, Pettifor, Lee, Coates, & Rees, 2007). This link between risk taking behavior at sexual debut and future risk taking makes the event of sexual debut a critical point for intervention where impacting the timing of and behavior at sexual debut could influence later risk taking behaviors and resultant exposure to HIV. Identifying significant predictors of sexual debut and risky sexual behavior that could be targeted in an intervention is a critical step predicating intervention design.

Leisure boredom

Leisure boredom stems from disinterest in a leisure experience and lack of intrinsic motivation to alleviate this disinterest (Iso-Ahola & Weissinger, 1987). Self-determination theory suggests that intrinsic motivation spurs goal oriented behavior toward intrinsically rewarding experiences (Deci & Ryan, 1985). Disruption in this goal oriented process contributes to an experience of boredom (Weissinger, Caldwell, & Bandalos, 1992) as demonstrated by research showing adolescents with lower intrinsic motivation were more likely to be bored (Caldwell, Darling, Payne, & Dowdy, 1999). Individual differences in intrinsic motivation partially explain leisure boredom, however, context influences how adolescents spend their free time and make choices regarding activity engagement in leisure.

Furthermore, when adolescents participated in activity out of obligation or because there is nothing else to do, their leisure boredom was higher and intrinsic motivation lower compared to individuals who participated of their own volition (Caldwell et al., 1999). In South Africa, adolescents experience high levels of boredom, especially Black and Colored (i.e., mixed race) youth (Wegner, Flisher, Muller, & Lombard, 2006), who often live in under resourced townships and communities. In a photo elicitation study from the same area as the current study, adolescents reported the main reason for experiencing leisure boredom was having nothing else to do (Wegner, 2011). Adolescents felt trapped in their low-socioeconomic context where unemployment was high, and they experienced an ample amount of free time. Parks and recreational space in the community were often no more than open fields with broken or stolen equipment, and the majority of free time was occupied by hanging out on street corners which inevitably led to boredom. Although participants perceived leisure boredom as a part of life, they also saw it as dangerous and connected to risky behaviors (Wegner).

Leisure boredom was previously linked to several risk-related outcomes. Evidence supported an association between leisure boredom and substance use (Iso-Ahola & Crowley, 1991; Weybright et al., 2015). Leisure boredom was a stronger predictor of substance use than the development of new leisure interests and healthy leisure across adolescence (Sharp et al., 2011). Research addressing the relation between leisure boredom and sex remains widely unexplored. One qualitative study of adults in a rural region of the United States reported a connection between boredom in recreation and sexual risk taking in under-resourced communities (Adimora et al., 2001). In a review of leisure boredom in adolescence, Wegner and Flisher (2009) reported no studies of leisure boredom and sex. Since the time of the review, one study by Miller et al. (2014) reported evidence of a relation between leisure boredom and sexual

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risk. Results of this study showed an association between high leisure boredom and sex under the influence of alcohol and inconsistent condom use for boys and casual sex and sex under the influence of marijuana for girls. Leisure boredom was also predictive of lifetime sex for both boys and girls. Although there are many factors that contribute to sexual behavior and risk taking, the relation between leisure boredom and sexual risk behavior warrants further investigation.

Gender differences

In a large study of 15 year olds in eight African nations using primarily national data sets, 38.1% of boys and 15.8% of girls experienced early sexual debut (Peltzer, 2010). This gender difference was supported by a study in South Africa where the hazard for early sexual debut was higher for boys in early adolescence and then leveled off to be equal with girls in middle and late adolescence (Zuma, Mzolo, & Makonko, 2011). Some qualitative differences in the experiences of boys and girls could explain how sexual experiences differ by gender. A qualitative study of sexual risk revealed boys and girls view sexual risk and safe sex differently (Harrison, Xaba, & Kunene, 2001). Among adolescents in that study, boys did not perceive themselves as at-risk but were more likely to use condoms, seeing condoms as useful for casual sex. Girls were fearful of unplanned pregnancy and risk of HIV/AIDS and wanted to delay having sex. Despite these fears and a belief that condoms were symbols of love and affection, girls reported less condom use. Boys and girls agreed that girls have a more difficult time initiating condom use. Indeed, evidence shows girls are less likely to use condoms at sexual debut (Zuma et al., 2011). Others have speculated sexual behavior differs based on pressure for boys to prove masculinity through sex (Selikow, Ahmed, Flisher, Mathews, & Mukoma, 2009) and girls to remain passive in their sexual behavior (Wood, Lambert, & Jewkes, 2007). Research on casual sex in the United States

found that more young men than young women engage in casual sex (Grello et al., 2006) and that this difference can be explained by more emotional investment by young women during sexual encounters (Hill, 2002). Girls in South Africa are also 22 times more likely than boys to have a sexual partner more than six years older than them at sexual debut (Zuma et al., 2011). These age gaps may be explained by girls' engagement in transactional sex where they enter into partnerships with older men in exchange for money, food, or other material resources (Ott, Barnighausen, Tanser, Lurie, & Newell, 2011). These gender differences related to age gaps in partners are thought to explain the higher rate of HIV in girls compared to boys in South Africa (Zuma et al., 2016).

Literature contains inconsistent findings concerning gender differences in leisure boredom (Wegner & Flisher, 2009). Studies indicated that boys experience higher leisure boredom (Shaw, Caldwell, & Kleiber, 1996) and may be more prone to boredom (Newberry & Duncan, 2001). Alternatively, other studies showed higher leisure boredom among girls (Patterson, Pegg, & Dobson-Patterson, 2000; Wegner et al., 2006). Shaw et al. (1996) proposed that higher boredom in girls could be explained by the restrictions placed on girls to spend more time in obligatory activities compared to boys. Still other studies found no gender differences in leisure boredom (Miller et al., 2014; Spaeth, Weichold, & Silbereisen, 2015). Taken together, gender differences in sexual behavior and inconsistent gender differences in leisure boredom indicate a need for further investigation of the impact of gender on the relation between leisure boredom and sexual risk.

Current study

The current study examines whether leisure boredom is associated with the timing of sexual debt and risk-taking behavior at sexual debut. We examine three research questions. First,

does leisure boredom affect the timing of sexual debut? We hypothesized that leisure boredom would be associated with earlier sexual debut [H1]. Second, is leisure boredom related to the odds of having safe sex and engagement with additional risk behaviors (i.e., casual sex, alcohol use with sex, marijuana use with sex, transactional sex, sex without a condom) at sexual debut? We hypothesized that leisure boredom would be associated with lower odds of safe sex at sexual debut [H2] and higher odds of risky behaviors accompanying sexual debut [H3]. Third, is leisure boredom associated with the number of risky behaviors co-occurring at sexual debut? We hypothesized that individuals with higher leisure boredom would be more likely to have a higher number of risky behaviors co-occurring at sexual debut [H4]. Additionally, we examined whether the relations between leisure boredom and sexual debut behaviors were moderated by gender. All procedures in this study were carried out with the ethical approval of the institution's Internal Review Board for research with human subjects.

Methods

Sample

The study sample for this analysis was drawn from the control group of an effectiveness trial evaluating a leisure-based risk prevention program, HealthWise South Africa: Life Skills for Young Adults. Comprehensive information about the design and outcomes of the HealthWise trial can be found in Caldwell, Smith et al. (2008) and Smith et al. (2008). Details relevant to the present analysis are given below.

The study was conducted in Mitchell's Plain, South Africa, a low-income township near Cape Town with mostly Colored (i.e., those of mixed race ancestry) residents. From 19 schools eligible to participate in an effectiveness trial of HealthWise, four were randomly sorted into a treatment group, and five schools were selected as no-treatment, matched controls. Data were provided by three successive cohorts of adolescents that initiated study participation in Grade 8 (i.e., Cohort 1 in 2004, Cohort 2 in 2005, Cohort 3 in 2006) and were followed for between two and four years. Together, the control group consisted of 3,726 participants across all three cohorts. Participants completed a digital questionnaire (administered on handheld digital devices in either English or Afrikaans depending on student preference) in the classroom at roughly six-month intervals for up to four years.

Cohorts did not differ in demographic or behavioral distributions. Thus, for the present analysis all three cohorts are examined as a single sample, after removal of cases for the following reasons: individuals with missing data at every time point for gender, age, or treatment/control group ($n = 29$); individuals who reported sexual debut before the launch of the study ($n=338$); and individuals who provided data on only one occasion ($n=113$). Additionally, because forced sex is qualitatively different than consensual sex (Moore, Awusabo-Asare,

Madise, John-Langba, & Kumi-Kyereme, 2007), all individuals who reported forced sex at sexual debut (*n*=158) were excluded from this study of consensual sexual engagement. Models were tested with and without potential outliers, and no differences were detected.

The analysis sample included $N = 3,088$ (55.3% girls) participants (*M*=13.9 years, *SD*=0.8) at the baseline assessment. The majority of participants self-identified as Colored (87.1%) with the remaining students identifying as Black (4.2%), White (3.9%), and Indian or other (<1.0%; 3.9% not reporting race). The sample was relatively homogeneous with respect to socioeconomics, with 97.9% of participants having access to electricity, 94.8% with access to tap water, and 82.2% living in a brick home.

Measures

At each survey, participants reported demographics, behavior, knowledge, and attitudes regarding leisure, substance use, and sexual behavior. This study focuses on analysis of survey data drawn from questions regarding sexual debut, accompanying risk and safe behaviors at sexual debut, leisure boredom, and gender.

Sexual debut. At each wave, 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)." If a participant responded "yes," he or she was 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*. Specifically, *most recent sex* responses were 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,

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for 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* value of 13.79 years (*Wave3age* - [*most recent sex*/12]). Of note, because the structure of the items focused on most recent sexual event rather than the first lifetime sex, estimated age of sexual debut is accurate to within five months.

Notably, reporting about lifetime sex can, in samples such as this one, sometimes be inaccurate (Palen et al., 2008). For example, 12.8% of participants (*n*=193) in this sample reported "yes" at one wave, and "no" later on. There may also be instances where individuals reported "yes" when they had not actually had sex. Consistent with random error of measurement assumptions of the models, and the idea that the inaccuracies will balance, we always used the first report of sex as the indicator of sexual debut. Data collection followed best practices for reducing bias in sexual behavior reporting (e.g., Langhaug, Sherr, & Cowan, 2010). Follow-up analyses suggested the results were robust across a variety of inclusions/exclusions of potentially inaccurate cases.

Risky behaviors. Participants who reported having had sex were asked a battery of questions regarding behaviors that accompanied their most recent sexual activity, including whether they had *casual sex*, used *alcohol with sex,* used *marijuana with* sex, had *transactional sex,* or had *sex without a condom*. *Casual sex* was measured by asking "Thinking about the last time you had sex, how would you describe your relationship with that person?" (just met that day, I've known them for a while, serious dating partner). Responses were recoded into a binary risk variable (0=I've known them for a while or serious dating partner; 1=just met that day). *Alcohol with sex* was measured by asking "The last time you had sex, did you use alcohol?" (0=no, 1=yes). *Marijuana with sex* was measured with the item "The last time you had sex, did

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you use dagga?" (0=no, 1=yes). *Transactional sex* was measured by asking "The last time you had sex did you do it for money, drinks, or food?" (0=no, 1=yes). *Sex without a condom* was measured with the item "The last time you had sex, did you or your partner use a condom?" (0=no, 1=yes; reverse coded). An additional variable, *safe sex*, was created that indicated *sexual debut* without any reported risk behaviors (0=no risks, 1=any risks behavior).

Leisure boredom. *Leisure boredom* was measured at each wave using three items from the Leisure Experience Battery for Adolescents (LEBA, Caldwell, Smith, & Weissinger, 1992; "For me, free time just drags on and on;" "Free time is boring;" "I usually don't like what I'm doing in my free time, but I don't know what else to do.") and an additional item framing leisure boredom as a lack of interest (see Caldwell, Baldwin, Walls, & Smith, 2004; "I do a lot of activities even though I'm not interested in them."), all answered on a five-point Likert scale (0=*strongly disagree* to 4=*strongly agree*). This four-item scale demonstrated adequate reliability (Cronbach's α=0.67) similar to the standard used by other studies of leisure boredom (e.g., Caldwell et al., 1992). A person-level *leisure boredom* score was calculated as the average across the four items 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 coded as a binary variable with boys as the reference group (0=boy, 1=girl) and entered into the models as *girl*. Multi-category variables for race (0=Colored, 1=White, 2=Black, 3=Indian, 4=other), cohort, access to electricity (0=no, 1=yes), access to tap water (0=no, 1=yes), and home type (0=shack, 1=backyard dwelling, 2=tent, 3=brick house, 4=other) were included as covariates in follow-up tests of model robustness. Age at sexual debut was included as an additional continuous covariate for testing robustness in logistic and Poisson regressions.

Data Analysis

Three sets of analysis were used to examine the research questions and hypotheses. First, survival analysis was used to model the impact of boredom on the cumulative hazard of sexual debut over time. Second, using logistic regression, we examined the relation between leisure boredom and the odds that individuals engaged in a variety of risky behaviors at the time of sexual debut. Third, using zero-inflated Poisson regression we examined the relation between leisure boredom and the number of risky behaviors that accompanied sexual debut.

Leisure boredom and timing of sexual debut. To examine the influence of leisure boredom on timing of sexual debut, we used survival analysis. Specifically, Cox proportional-hazards regression (Cox, 1972) was used to examine the relation between leisure boredom and timing of sexual debut and assess whether that relation was moderated by gender. The resulting equation was

$$h_i(t) = h_0(t)exp(\beta_1 leisureboredom_i + \beta_2 girl_i + \beta_3(leisureboredom_i * girl_i)),$$

where $h_i(t)$, individual i's hazard of sexual debut at age t is modeled as a function of a baseline hazard function, $h_0(t)$, leisure boredom, and gender. The parameter β_1 indicates how the hazard differs in relation to leisure boredom, β_2 indicates differences in hazard between boys and girls, and β_3 indicates how the relation between leisure boredom and hazard of sexual debut differs by gender. When there was no evidence of gender as a moderator, interpretation focused on a more parsimonious model wherein the interaction term was removed.

Leisure boredom and safe and risk behaviors. The sexually active subsample ($n = 804$) provided opportunity to examine how leisure boredom was related to risks that accompanied the sexual debut event. Logistic regression models were used to examine relations between leisure boredom and the odds of each of six potentially occurring behaviors: safe sex,

casual sex, alcohol with sex, marijuana sex, transactional sex, and sex with no condom. Models were specified as

$$logit(\text{behavior}) = \beta_0 + \beta_1(leisureboredom_i) + \beta_2(girl_i) + \beta_3(leisureboredom_i*girl_i),$$

such that the odds of an individual's behavior at sexual debut, $logit$(behavior), are modeled as a function of the baseline odds, β_0, the difference due to the individual's *leisure boredom*, β_1, the difference indicated by the individual's gender, β_2, and the difference due to the relation between leisure boredom and gender, β_3. More positive values of each parameter indicate higher odds of the risky behaviors.

Leisure boredom and the number of co-occurring risks. We used a Poisson regression to model the relation between leisure boredom and the number of risk behaviors co-occurring at sexual debut, using the sexually active subsample. Because of the high prevalence of zeros (0=no risks OR safe sex) in the subsample, a zero-inflated Poisson regression was used to separately model the impact of leisure boredom for odds of staying in the zero group and the incident rate ratio (IRR) for number of risks co-occurring at sexual debut in the count group. This model was specified as

$$log_e(totalrisks_i) = \beta_0 + \beta_1(leisureboredom_i) + \beta_2(girl_i) + \beta_3(leisureboredom_i*girl_i)),$$

such that the IRR, $log_e(totalrisks_i)$, was modeled as a function of the baseline incident rate ratio of risks co-occurring at sexual debut, β_0, differences due to individual i's *leisure boredom* score, differences due to individual i's gender, and differences due the relation between leisure boredom and gender. The OR for the zero group indicates the likelihood of remaining in the safe sex group, and the IRR for the count group indicates the likelihood of increasing the total number of risks. Model parameters with more positive values indicate higher odds of remaining

in the no risks category for the zero group and a higher rate of total risks co-occurring at sexual debut for the count group.

Models were estimated using the *survival* (Therneau, 2015), *lme4* (Bates, Maechler, Bolker & Walker, 2015), and *pscl* (Zeileis, Kleiber, & Jackman, 2008) packages in R version 3.4.0 (R CoreTeam, 2016). 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). Any differences due to these covariates were peripheral to our hypotheses and did not impact the magnitude, direction, or significance of gender or leisure boredom. The most parsimonious models including coefficients for leisure boredom, gender, and the interaction between leisure boredom and gender are reported in the results. All models were built using the moderation models specified previously and compared to a reduced model including only the main effects of leisure boredom and gender. When the moderating effect of gender did not significantly explain model outcomes, the reduced model was interpreted.

Results

Boredom and Sex-related Behaviors

On average, this sample of 3,088 adolescents had leisure boredom scores of 1.61 (SD=0.62). Boys' average leisure boredom (M=1.64, SD=0.64) was significantly higher than girls' (M=1.59, SD=0.64; F=4.99, p<0.05). Over the course of the study, 804 (26.0%) participants reported sexual debut, with the event occurring, on average, at age 15.22 years (SD=1.06). There were significant differences in level of leisure boredom between those who reported sexual debut during the study (M=1.74, SD=0.63) and those who did not (M=1.56, SD=0.61; t(5231)=93.28, p<0.001). A greater percentage of boys (36.4%, n=470) than girls (20.7%, n=334) reported sexual debut during the study. There was a significant difference in the mean age of sexual debut for boys (M=15.1 years, SD=1.1) and girls (M=15.4 years, SD=1.0; t(1133)=358.3, p<0.001. Of the (n = 804) sexual debut subsample, 53% (n=426) reported no risk behaviors at sexual debut. Of participants who reported one (29.0%, n=239) or more (18.0%, n=139) risk behaviors at sexual debut, 10.8% (n=87) reported casual sex, 17.4% (n=140) reported alcohol with sex, 12.3% (n=99) reported marijuana with sex, 3.1% (n=25) reported transactional sex, and 26.7% (n=216) reported sex without a condom.

Sexual debut survival analysis

Does leisure boredom affect the timing of sexual debut?

Results from the survival analysis are shown in Table 1. Gender did not significantly moderate the leisure boredom-hazard ratio (HR) relation (see Moderation Model in Table 1), thus, the reduced models without the interaction term are interpreted. The HR can be interpreted as the risk of sexual debut occurring.

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Leisure boredom was associated with sexual debut over time, such that every one unit difference in individuals' leisure boredom was associated with a 1.575 greater cumulative hazard of sexual debut. In other words, holding all other factors constant, an individual with a leisure boredom score of 3 was 1.575 times more likely to experience sexual debut than an individual with a leisure boredom score of 2. The cumulative hazard for sexual debut was dampened for girls such that the hazard was 0.522 lower for girls than boys. As illustrated in Figure 1, individuals with high boredom (one standard deviation above the mean) had an elevated cumulative risk of sexual debut, and individuals with low leisure boredom (one standard deviation below the mean) had a dampened cumulative risk of sexual debut. The roughly equivalent levels of low leisure boredom boys and high leisure boredom girls illustrates gender differences in the baseline risk for sexual debut.

Effects were robust to inclusion of other covariates (e.g., cohort, SES), but did reveal differences in cumulative hazard due to race. Upon further probing, we determined that the race differences, which were peripheral to our primary hypotheses, did not alter general conclusions about the magnitude, direction, or significance of the gender or leisure boredom effects, and were driven in part by unequal group sizes.

Safe and risky behavior at debut

Is leisure boredom related to the odds of safe sex and risk behaviors at sexual debut?

Results from six logistic regression models examining relations between leisure boredom and behavior at sexual debut are shown in Table 2. The first model examines odds of safe sex and the other five models examine odds of each risky behavior. Gender was tested as a moderator in all models by adding an interaction between gender and leisure boredom. Gender

did not significantly moderate the leisure boredom-behavior relations, thus, the reduced models without the interaction term are interpreted.

As seen in the *Safe Sex* reduced model in Table 2, the odds of safe sex at sexual debut were higher for girls than boys and, as hypothesized [H2], inversely related to leisure boredom. A one unit greater leisure boredom was associated with 0.714 lower odds of safe sex.

Alcohol with sex, marijuana with sex, and transactional sex were each related to leisure boredom, as hypothesized [H3]; however, casual sex and sex with no condom were not related to leisure boredom. Casual sex was significantly less likely for girls than boys and was not associated with leisure boredom. The odds of using alcohol at sexual debut and the odds of using marijuana at sexual debut were both lower for girls than boys and associated with leisure boredom. A one unit greater in leisure boredom increased the odds of using alcohol with sex by 1.643 and the odds of using marijuana with sex by 1.508. Additionally, a one unit greater leisure boredom was associated with a 2.424 higher odds of transactional sex. Gender was not associated with the odds of transactional sex. Odds of sex without a condom were not associated with leisure boredom or gender.

Cohort differences were detected for the odds of transactional sex, however, these differences were peripheral to our hypotheses and did not impact the magnitude, direction, or significance of gender effects or leisure boredom effects. Race, age at sexual debut, and SES variables were not related to odds of risky behavior in any of the logistic regression models.

Number of co-occurring risks at sexual debut

Is leisure boredom associated with the number of risky behaviors co-occurring at sexual debut?

Results from the zero-inflated Poisson regressions modeled leisure boredom and gender associations with total number of risky behaviors co-occurring at sexual debut are shown in

Table 3. The significant interaction between gender and leisure boredom in the count model indicated that the relation between leisure boredom and incident rate of co-occurring risky behaviors is stronger for girls than boys. As illustrated in Figure 2, each additional unit of leisure boredom was associated with the IRR of co-occurring risks more for girls than for boys – as evident in the narrowing distance between the boys and girls curves from low to high leisure boredom values. Differences due to gender and leisure boredom were not related to the odds of remaining in the zero risk group.

Effects were robust to inclusion of other covariates (e.g., cohort, SES, age at first sex), but did reveal differences in incident rate ratio for the count model due to race. Upon further probing, we determined that the race differences, which were peripheral to our primary hypotheses, did not alter general conclusions about the magnitude, direction, or significance of the gender or gender-by-leisure boredom interaction effects, and were driven in part by unequal group sizes.

Discussion

Findings in this study contribute to adolescent health and risk literature by offering additional evidence that leisure boredom is related to risky sexual behavior. The current study identified associations between leisure boredom and risk of early sexual debut, substance use at debut, transactional sex at debut, and the number of risky sexual behaviors co-occurring at debut. Results also added insight into gender differences in both leisure boredom and sexual debut. By identifying a significant association between leisure boredom and several sexual risk behaviors, this study supports future research testing the utility of an intervention based on mitigating leisure boredom as a tool for sexual risk and HIV prevention.

At a time during development when adolescents are prone to seek arousing experiences and novelty (Dahl, 2004; Steinberg, 2008), it is especially important to understand what individual differences may be associated with risk taking behaviors. This study extended previous research on leisure boredom and risky behavior (Iso-Ahola & Crowley, 1991; Sharp et al., 2011; Weybright et al., 2015) by demonstrating a significant link between leisure boredom and risky behaviors at sexual debut. Considering the sample in this study emanated from a country with high rates of HIV (Zuma et al., 2016) and in a community with shallow leisure resources (Wegner, 2011), this finding is critical for identifying targets for risk reduction via evidence-based preventive interventions.

This research provides insight into the relation between early sexual debut and later sexual risk taking (Zuma et al., 2010). Our results indicate leisure boredom is associated with timing of sexual debut such that the risk of early sexual debut is higher when leisure boredom is high. Although gender did not moderate this association, it was evident that 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. These baseline risk differences, taken together with the higher 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). Although sexual debut in adolescence can be a normative, healthy, and safe experience (Cavazos-Rehg et al., 2009; Kann et al., 2014; Tolman & McClelland, 2011), this research uncovered the relation between leisure boredom and timing of sexual debut and indicated the higher baseline risk for early sexual debut among boys compared to girls.

Results were mixed for associations between leisure boredom and behaviors accompanying sexual debut. Safe sex was inversely related to leisure boredom, suggesting that higher levels of leisure boredom are related to lower odds of safe sex. Being a girl was a protective factor. Girls had higher odds of safe sex at sexual debut than did boys and lower odds of casual sex and substance use at debut. Although our findings did not indicate an association between gender and condom use alone, as suggested in other studies (Harrison et al., 2012), 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 alone suggests that girls in this study have higher odds of having a safe sex profile compared to boys, despite no significant gender differences in condom use only.

The results of the Poisson regression modeled the association between leisure boredom and the number of risks at sexual debut. The zero-inflated model was the only model in this study to indicate gender as a moderator of the relation between leisure boredom and risky sexual behavior. This moderation effect can be interpreted to mean that the relation between leisure boredom and number of risky behaviors was stronger for girls than boys. Together with results of

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the safe sex logistic model, the moderating effect of gender in the Poisson model suggests divergent behaviors at sexual debut for girls. Compared to boys, girls who experienced sexual debut during the study 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. These two outcomes are worthy of further exploration and may be necessary to understand what differentiates girls who engage in safe sex at sexual debut and those who endorse one or more risks.

To our knowledge, the absence of research on leisure boredom and sexual debut documented by Wegner and Flisher (2009) was addressed by only one study (Miller at el., 2014). The current study builds on the major findings of Miller and colleagues by providing additional insight about the relation between leisure boredom and sex. Like Miller et al., we found evidence that higher levels of leisure boredom are linked to substance use during sex (i.e., alcohol and marijuana) and transactional sex. By modeling additional sexual risk behaviors and treating boredom continuously, we extend support for the relation between leisure boredom and risky sex in adolescence. Still more research is needed to understand this relation.

Implications for Intervention

Understanding the association between leisure boredom and risky sexual debut is useful insomuch as it informs the design of evidence based preventive interventions targeting reduction of risky sexual behavior and prevention of HIV and other STI transmission. By providing basic evidence for a relation between leisure boredom and early sexual debut, this study supports the inclusion of leisure boredom components in interventions, especially those implemented with

adolescents younger than the normative age of sexual debut (i.e., 15 years old). Although this study does not indicate the critical time to intervene, it does suggest that early intervention is critical as 250 participants had already initiated sexual debut at the start of this study when participants were 13.9 years old on average. Early intervention may be especially critical for boys who reported earlier and higher rates of sexual debut than girls.

Because the association between leisure boredom and different risk behaviors at sexual debut was inconsistent, it may be best to integrate leisure boredom components into interventions addressing other mechanisms for preventing sexual risk. For example, the results of this study suggest leisure boredom could be an effective target for influencing substance use or transactional sex at sexual debut but not casual sex or condom use. The inverse relationship between leisure boredom and safe sex (i.e., no risk related behaviors) is also promising, and low leisure boredom appears to be a protective factor for promoting safe sex behavior.

Gender should be considered when targeting leisure boredom in an intervention program. Although the association between leisure boredom and sexual debut and accompanying risk behaviors was the same for boys and girls, the level of risk differed. Understanding that boys are at a higher baseline risk than girls for early sexual debut and casual sex, alcohol use, marijuana use, and transactional sex at sexual debut should encourage consideration of gender differences in both leisure boredom and sexual risk taking. Additional research exploring theoretical and qualitative explanations for gender differences in motivations for sexual behavior (Selikow et al., 2009; Wood et al., 2007) and experiences of leisure boredom (Shaw et al., 1996) may further inform the integration of leisure boredom components into interventions.

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,

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leisure boredom could be modeled via state variations over time (see Weybright et al., 2015, for a study of trait and state leisure boredom and substance use). Intervention approaches to trait and state leisure boredom may require different program components and mechanisms.

Limitations

The associations between leisure boredom and risky sexual debut should be interpreted within the limitations of this study. Although inconsistencies in recalled self-report of sexual behavior are common (Palen et al., 2008), these discrepancies may introduce some measurement bias. Inaccuracies were detectable among participants who switched from lifetime sex to no lifetime sex, however, error cannot be detected for individuals mistakenly reporting a switch from no lifetime sex to lifetime sex. Removing participants with detectable inconsistent reports could stretch the model curve right, making the HR too liberal. Even among participants with no detectable reporting inconsistency, missing values and drop-out rates were high. Individuals who dropped out before the final wave of data collection in their cohort without reporting sexual initiation may have introduced a bias into the study. If many of these individuals participated in their first sexual event shortly after dropping out of the study, the survival curve would be biased and considered noninformative (Fox & Weisberg, 2010), but only if the sexual debut after drop out was systematic. In addition, over 250 adolescents reported sexual debut occurring prior to the start of the study. In order to model the entire survival curve of adolescent sexual debut inclusion of sexual debut initiators in earlier waves of data collection would be necessary. Because early sexual debut is especially risky (Ghebremichael et al, 2009; Mavedzenge et al., 2011; O'Donnell et al., 2001; Pettifor et al., 2004), these early initiators reporting sexual debut by or before age 13.9 may be among the most at risk adolescents. Collecting earlier longitudinal data regarding sexual behavior and leisure boredom would be needed to investigate their risk.

More data collection time points improve the accuracy of survival analysis by precisely identifying when the event (e.g., sexual debut) occurred. Because this study was not designed for survival analysis, time between waves of data collection introduced error into estimates of event timing. Collecting data more frequently and asking participants about the timing of first sex rather than most recent sex would reduce the event timing estimation error.

Conclusion

The association between leisure boredom and risky sexual debut is supported by findings in this study. The timing, risk behaviors (e.g., substance use during sex and transactional sex), and total number of risk behaviors at sexual debut are all related to leisure boredom in adolescence. In South Africa where HIV rates are high and in a community where adolescent leisure is limited and intermingled with high risk activities, understanding this connection between leisure boredom and sexual debut risks is critical. Delay of sexual debut was an effective strategy for HIV reduction in other African nations (Halperin et al., 2010; Stoneburner & Low-beer, 2004) and has been proposed as an approach for use in South Africa (Zuma et al., 2016). We recommend integrating leisure boredom components into intervention programs addressing multiple predictors of sexual risk that may together meet the different needs of girls and boys and to address the sexual debut risk behaviors not associated with leisure boredom.

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Table 1

Results from Cox Proportional Hazards Models examining relation between Sexual Debut and Leisure Boredom and Gender

	Reduced Model		Moderation Model	
	HR	CI	HR	CI
Leisure Boredom	**1.575**	[1.404, 1.766]	**1.544**	[1.331, 1.792]
Girl	**0.522**	[0.454, 0.601]	**0.480**	[0.312, 0.739]
Girl*Boredom			1.050	[0.831, 1.327]
R^2	0.049		0.049	

Note. *N*=2883 (185 missing); boldface hazard ratios (HR) indicate significance at *p*<0.001; CI = 95% confidence interval
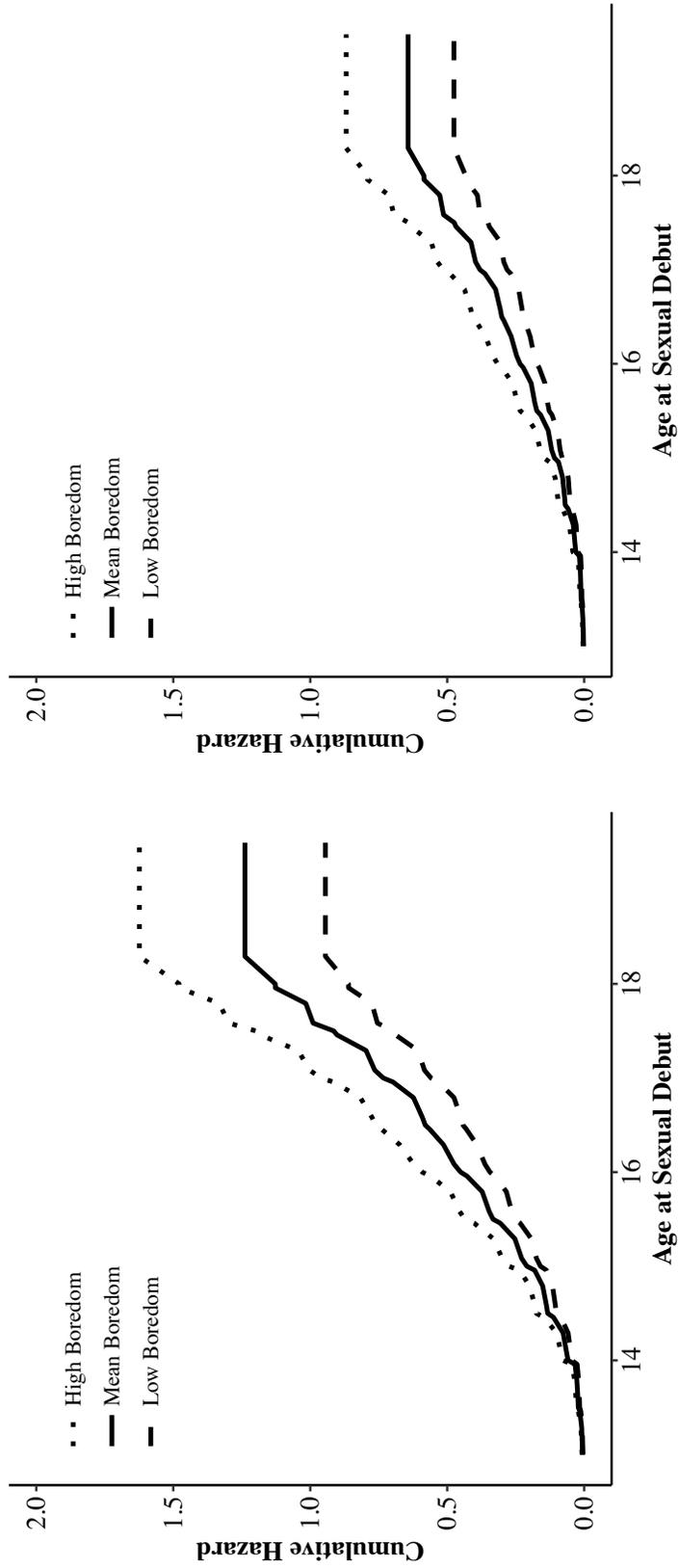
Appendix B-Figure 1

Figure 1. Cumulative hazard of sexual debut across time predicted by leisure boredom. Curves for boys (left) and girls (right) are modeled together and plotted separately for the purpose of data visualization.

Appendix C-Table 2

Table 2
Results from Logistic Models examining relation Between Safe and Risky Sex Behaviors and Leisure Boredom and Gender

	Reduced Model		Moderation Model	
	OR	CI	OR	CI
Safe Sex				
Intercept	**1.612**	[1.050, 2.488]	1.599	[0.941, 2.732]
Leisure Boredom	**0.714**	[0.569, 0.892]	**0.717**	[0.536, 0.954]
Girl	**1.732**	[1.301, 2.312]	1.773	[0.755, 4.211]
Girl*Boredom			0.987	[0.622, 1.563]
Casual sex				
Intercept	**0.131**	[0.065, 0.256]	0.151	[0.070, 0.312]
Leisure Boredom	1.181	[0.829, 1.684]	1.091	[0.735, 1.618]
Girl	**0.289**	[0.159, 0.495]	0.133	[0.019, 0.743]
Girl*Boredom			1.523	[0.616, 3.883]
Alcohol with Sex				
Intercept	**0.108**	[0.059, 0.193]	**0.131**	[0.065, 0.254]
Leisure Boredom	**1.643**	[1.228, 2.210]	**1.482**	[1.048, 2.107]
Girl	**0.548**	[0.366, 0.809]	0.282	[0.073, 1.008]
Girl*Boredom			1.420	[0.746, 2.750]
Marijuana with Sex				
Intercept	**0.088**	[0.044, 0.169]	**0.109**	[0.050, 0.228]
Leisure Boredom	**1.508**	[1.080, 2.112]	1.340	[0.909, 1.978]
Girl	**0.462**	[0.283, 0.732]	**0.190**	[0.036, 0.875]
Girl*Boredom			1.594	[0.738, 3.532]
Transactional Sex				
Intercept	**0.008**	[0.002, 0.030]	**0.007**	[0.001, 0.029]
Leisure Boredom	**2.424**	[1.298, 4.590]	**2.630**	[1.319, 5.342]
Girl	0.349	[0.115, 0.875]	0.862	[0.021, 18.176]
Girl*Boredom			0.638	[0.130, 3.378]
Sex with No Condom				
Intercept	**0.287**	[0.176, 0.462]	**0.289**	[0.156, 0.525]
Leisure Boredom	1.110	[0.868, 1.422]	1.106	[0.801, 1.527]
Girl	1.169	[0.851, 1.603]	1.147	[0.447, 2.917]
Girl*Boredom			1.011	[0.613, 1.670]

Note. N=804; boldface odds ratios (OR) are significant at $p<0.05$; CI = 95% confidence interval.

Appendix D-Table 3

Table 3

Count of Risks Co-occurring at Sexual Debut Predicted by Leisure Boredom and Gender

	Reduced Model		Moderation Model	
	IRR	CI	IRR	CI
Count model				
Intercept	**0.639**	[0.416, 0.982]	0.691	[0.046, 1.055]
Leisure Boredom	1.229	[0.999, 1.512]	1.181	[0.966, 1.444]
Girl	0.790	[0.587, 1.065]	**0.347**	[0.167, 0.721]
Girl*Boredom			**1.506**	[1.048, 2.166]
Zero-inflated model				
Intercept	-1.486	[0.025, 2.017]	0.269	[0.031, 2.307]
Leisure Boredom	-0.288	[0.254, 2.213]	0.696	[0.228, 2.122]
Girl	0.831	[0.561, 9.381]	0.050	[0.000, 9.781]
Girl*Boredom			5.829	[0.666, 51.015]

Note. *N*=804; boldface incident rate ratios (IRR) are significant at the *p*<0.05 level; CI = 95% confidence interval
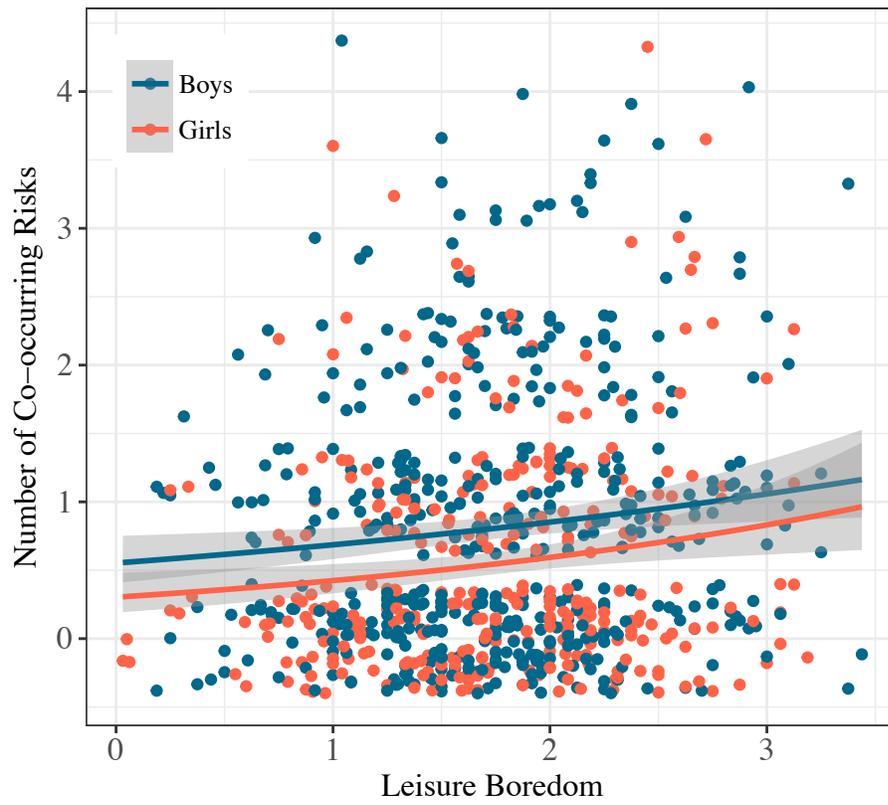
Appendix E-Figure 2

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