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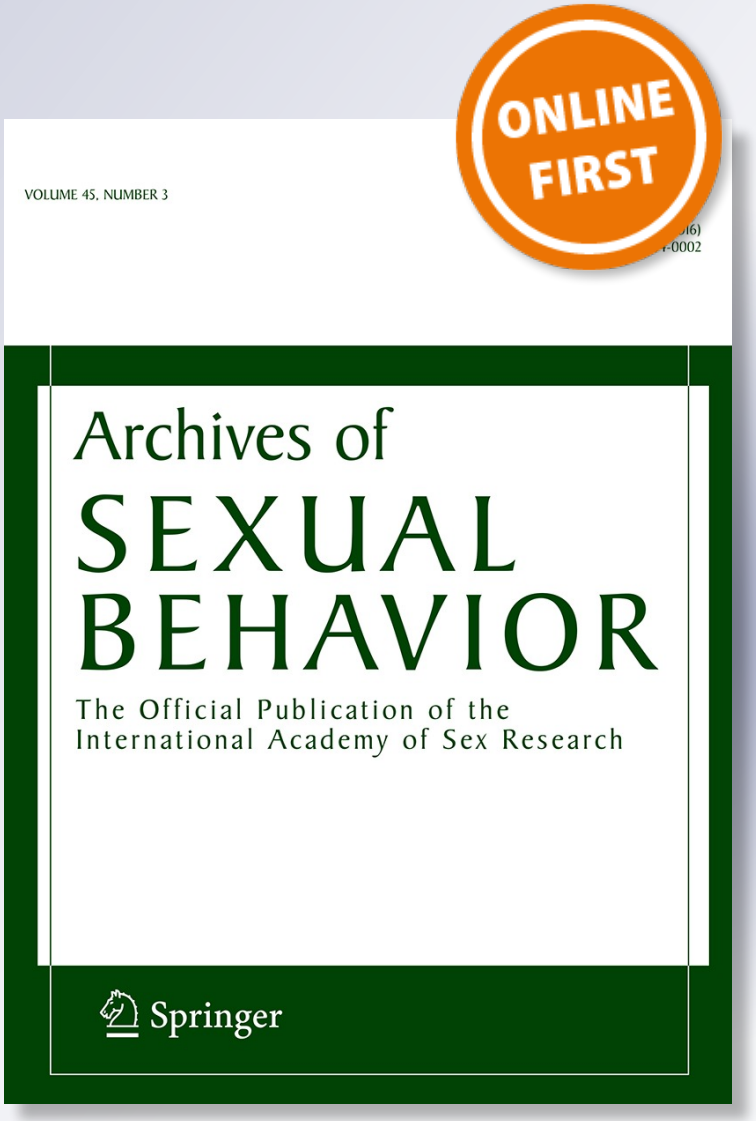


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ORIGINAL PAPER

# Number of Sexual Partners and Relationship Status Are Associated With Unprotected Sex Across Emerging Adulthood

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**Abstract** Sex with multiple partners, consecutively or concurrently, is a risk factor for contracting sexually transmitted infections (STIs) as multiple partner–partner contacts present increased opportunity for transmission. It is unclear, however, if individuals who tend to have more partners also use protection less reliably than those with sexual histories of fewer partners. Longitudinal data can elucidate whether an individual shows a consistent pattern of sex with multiple partners. We used latent class growth analyses to examine emerging adult survey data ($N = 2244$) spanning 10 waves of assessment across 6 years. We identified three trajectory classes described with respect to number of partners as (a) Multiple, (b) Single, and (c) Rare. Trajectory group, relationship status, and their interactions were tested as predictors of using protection against STIs and pregnancy at each wave. The Multiple Partners class had the greatest odds ratio of reporting sex without protection against STIs and pregnancy, followed by the Single and Rare classes. Exclusive relationship status was a risk factor for unprotected sex at earlier waves, but a protective factor at most later waves. There was no significant interaction between relationship status and trajectory class in predicting use of protection. The Multiple Partners class reported more permissive values on sex and an elevated proportion of homosexual behavior. This group overlaps with an already identified at-risk population, men who have sex with men. Potential mechanisms explaining the increased risk for sex without protection, including communication, risk assessment, and co-occurring risk behaviors are discussed as targets for intervention.

**Keywords** Unprotected sex · Emerging adults · Trajectory analysis · Multiple sex partners · Sexual risk behavior

## Introduction

Adolescents and emerging adults (ages 18–25; Arnett, 2000) are substantially more likely than adults from other age groups to acquire sexually transmitted infections (STIs), including chlamydia, gonorrhea, and human immunodeficiency virus (HIV; CDC, 2014a, 2014b). One explanation for the high prevalence of STIs in this age group is the inconsistent use of condoms to protect against STIs (Lewis, Miguez-Burbano, & Malow, 2009). Particularly problematic on college campuses, a survey of over 80,000 students on 113 campuses indicated that only 53.5 % of sexually active respondents used a condom during the last incidence of vaginal intercourse (American College Health Association, 2009). Although having multiple sex partners is a risk factor for STI transmission simply due to contact odds, it is unclear if youth who tend to have greater numbers of sex partners over time also use protection against STIs and pregnancy less reliably than youth with fewer numbers of sex partners. The current study used advanced modeling techniques and longitudinal data to examine the relation between having sex with multiple partners and failure to use protection.

### Number of Sexual Partners and Sex Without Protection Against STIs

More young adults report having had multiple partners in the last 12 months than do 30- and 40-year olds (Johnston et al.,

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2014). Adolescents who report a greater number of sex partners during the past 6 months, particularly those who have sex with multiple concurrent partners, have greater odds of STI diagnosis (Rosenberg, Gurvey, Adler, Dunlop, & Ellen, 1999). Nevertheless, it remains unclear if the link between sex with multiple partners and risk of infection is simply due to a greater number of unique person–person contacts, or if this association is also explained by differential odds of condom use between those who tend to have multiple sex partners and those who do not. If true, the combination of more unprotected sex with more partners could further compound the potential negative consequences of sex.

Cross-sectional analyses have largely found no association between having multiple sex partners or number of lifetime-sex partners and condom use, but interpretation of these data is often limited by the timespan under examination. For example, a study of adolescents and young adults (ages 14–22 years) from the 1992 National Health Interview Survey (NHIS) examined the 3-month window prior to survey collection. Individuals who had multiple sex partners during this window were no less likely than those with a single partner to have used a condom (Santelli, Brener, Lowry, Bhatt, & Zabin, 1998). In another study of adolescent boys (ages 15–19) from the National Survey of Family Growth, the number of lifetime sexual partners had no relation with (a) condom use during the most recent sexual encounter, (b) consistent use (100 % use) with the last partner, or (c) consistent use during the last 4 weeks (Manlove, Ikramullah, & Terry-Humen, 2008).

Although these results suggest that there is no link between sex with multiple partners and differential use of protection, these studies assessed sexual behavior histories cross-sectionally rather than longitudinally. Information is lost when using either lifetime totals or narrow assessment windows, potentially resulting in biases or errors in the estimated associations between number of partners and consistency of protection. For example, the longitudinal patterns between two individuals (Persons A and B) who both report five lifetime partners by age 25 could be quite different; Person A could have had two partners in 1 year and three in another, whereas Person B could have had one partner per year over 5 years. Although the lifetime total is the same, the rates of sex partners differ. Furthermore, if a 3-month window were examined between these individuals, the number reported could vary considerably depending on when the data happened to be gathered. Person A might report no partners, while Person B reports one. Thus, how number of sex partners is assessed critically influences how an individual is characterized or grouped. Repeated assessment methods in a longitudinal design is a more reliable method that can capture whether an individual shows a consistent pattern of sex with greater or fewer numbers of partners across a span of several years.

## Longitudinal Analyses of Sexual Behavior

In an attempt to describe patterns of sexual risk behavior, including sex with multiple partners, across adolescence and emerging adulthood, several research groups have used advanced modeling techniques to capture longitudinal trends that refine understanding of at-risk groups. Developmental growth modeling strategies (Muthén & Muthén, 2000; Nagin, 2005) are used to identify distinct trajectories of some trait or behavior within a heterogeneous longitudinal sample. Previous models have typically examined sexual behavior by using composite measures comprising several risk behaviors. These composite measures have been defined by: (a) number of sexual partners, (b) number of incidents of sexual intercourse, and (c) percentage of condom use (Huang, Murphy, & Hser, 2012), or more simply by number of partners in the last 12 months and condom use at last intercourse (Moilanen, Crockett, Raffaelli, & Jones, 2010). Importantly, these risk scores are indexed by both the number of partners and by the use of protection, precluding the ability to test directly how one is correlated with the other.

A key question that remains, therefore, is whether individuals with consistently higher numbers of partners use protection less reliably than those who tend to have fewer partners over time. To our knowledge, there have been no published latent class growth analyses using only number of sex partners as an indicator variable. Thus, the primary aim of the current analysis is to describe trajectories of sexual behavior in terms of number of sexual partners from ages 18 to 24 and to examine if these groups exhibit differential odds of the use of protection. In order to further characterize the composition of these groups, we examined if factors including gender,[1] socioeconomic status, ethnicity, personal values, and homosexual behavior predict trajectories of sexual partners.

### *Moderation by Relationship Status*

Longitudinal data on the number of sex partners might fluctuate as a function of relationship status. Although the literature supports an increase in casual sex in recent decades (e.g., Bogle, 2008), studies have found that first-year college students had more oral and vaginal sex within relationships than within non-monogamous encounters (Fielder, Walsh, Carey, & Carey, 2013). Consequently, for some groups a monogamous relationship may lead to fewer partners, whereas for other groups relationship status may be the reason for having a sexual partner. Incorporating this information in a trajectory analysis is therefore critical for identifying distinct groups of individuals over time. We included relationship status at each assessment wave as a time-varying covariate, thus identifying different kinds of trajectories that may or may not be moderated by relationship exclusivity.

[1] As the topic of this article is sexual intercourse, often called simply "sex," we use the term "gender" rather than "biological sex" or "sex" when examining differences between males and females in order to avoid confusing and overlapping terminology. The reader should note that although "gender" is used, we mean biological sex.

### Relationship Status and Unprotected Sex in College Students

Relationship status also predicts using protection against STIs among youth. For example, among undergraduates, condom use is more common with casual sexual partners than with regular partners (Cooper & Orcutt, 2000), and one of the most common reasons for decreasing the use of condoms is transitioning into a monogamous relationship (Civic, 2000). Likewise, in a retrospective, cross-sectional study, women who were in shorter-term relationships used condoms more consistently than those with regular partners (Reisen & Poppen, 1995). As for men, an event-level study of college students showed that 63 % of casual sexual experiences involved condoms, compared to only 45 % of sexual activity with a regular partner (LaBrie, Earleywine, Schiffman, Pedersen, & Marriot, 2005).

Although there is a clear cross-sectional association between partner type and condom use, studies have yet to examine how the influence of partner type on unprotected sex might vary across emerging adulthood. The perceived seriousness, level of intimacy, and duration of exclusive relationships typically increases across this time period (Giordano, Manning, Longmore, & Flanigan, 2012), perhaps leading to a greater effect of exclusivity on unprotected sex at later years of emerging adulthood than at earlier ones. Therefore, a secondary aim of this study was to investigate if the effect of relationship status on unprotected sexual behavior differs across the span of emerging adulthood. Our hypothesis was that the positive effect of exclusive relationship status on incidence of unprotected sex would increase with advancing age.

#### *An Interaction Between Relationship Status and Trajectory Groups*

Relationship status may not have a uniform effect on unprotected sex across individuals who tend to have greater or fewer sex partners. Considering the diverse sexual and relational landscape, the third aim of this study was to consider whether or not relationship status significantly interacted with sexual partner trajectory group in predicting sex without protection. For example, young adults who consistently have a high number of sex partners may not moderate their use of protection against STIs in response to being in a relationship, whereas individuals who tend to have only one sex partner per study wave may be more likely to use protection in a casual encounter versus within the bounds of a relationship.

### Sexual Acts and Risk of Transmission

The risks of transmitting STIs and the use of protective barriers vary considerably by sexual act. Although unprotected anal and vaginal sex are the riskiest behaviors for HIV transmission, oral sex also carries risks (Edwards & Carne, 1998), including herpes, syphilis, pharyngeal gonorrhea, and chlamydia. Among college students in 2008, the mean percent using condoms during vaginal sex was 53.5 %, but during anal sex was 27.7 % and oral sex was 4.0 % (American College Health Association, 2009). Although our data does not include specific STI transmission information, respondents were asked about the occurrence of specific sex acts. Thus, in order to provide information about specific kinds of transmission risks that occurred across the sample, the final study aim was to examine whether groups that exhibit distinct patterns of sexual behavior in terms of numbers of partners over time also show differences in terms of sexual act diversity.

### The Present Study

The primary aim of this study was (a) to identify groups of individuals characterized by number of sexual partners across emerging adulthood, (b) to describe the demographic composition of these groups, and (c) to examine if groups who differed in number of sexual partners endorsed differential odds of using protection against STIs. The next study aim was to determine if the effect of relationship status on unprotected sexual behavior differs across the span of emerging adulthood, and if this effect might differ by trajectory group. The final study aim was to examine if the proportion of sexual encounters that included three types of sexual acts (vaginal, oral, and anal) differed by trajectory class and gender. These analyses advance the literature by determining if groups who tend to have greater or fewer partners over time, a more robust index of sex with multiple partners than has been examined in cross-sectional data, may partially explain elevated risk for STIs among emerging adults.

## Method

### Participants

Study participants were recruited from an entering freshman class at a large Southwestern university starting in 2004. Seventy-six percent of those invited to participate ($N = 6391$) agreed to complete survey data ($N = 4832$). A subset of individuals who agreed to participate were randomized to complete a series of surveys commencing during the summer after the end of high school and continuing over the following 6 years ($N = 3046$). All longitudinal participants were assessed, regardless of whether or not they left the university. The sample included in the present analysis comprises those who provided informed consent and agreed to participate ($N = 2245$), the majority of whom were female ($N = 1345$, 59.9 %). One individual reported 90 sex partners at Wave 10, and this extreme outlier was excluded from all analyses, resulting in a final analysis sample of $N = 2244$.

## Longitudinal Design

The current analysis includes data obtained over 10 assessment waves. The time point of each wave and the associated simple descriptive statistics are described in Table 1. Waves 1 through 8 were assessed biannually, whereas Waves 9 and 10 occurred 1 year after the previous assessment. Respondents were compensated $30 for completion of the Wave 1 survey, $20 for completing the fall college surveys (Waves 2, 4, 6), $25 for the spring college surveys (Waves 3, 5, 7), and $40 for the remaining Waves 8–10. The university Institutional Review Board approved all study surveys and procedures.

## Measures

### *Demographics*

Demographic information was assessed at Wave 1. The following data were included in the analysis: Gender (coded 0 = female, 1 = male), Ethnicity (dummy coded as three variables: Asian = 1, Latino = 1, Black/Other/Multiethnic = 1, with White as the reference group coded 0), Family Income (coded 0 = under $20k, 1 = $20–30k, 2 = $30–40k, 3 = $40–50k, 4 = $50–60k, 5 = $60–70k, 6 = $70–90k, and 7 = over $100k), and parent's highest level of education (coded separately for mother/father as 0 = Did not complete high school, 1 = High School diploma, 2 = Some college, 3 = Junior College degree, 4 = College degree, 5 = Post-graduate degree).

### *Number of Sexual Partners*

The main variable used to estimate latent classes of sex behavior was number of sexual partners in the prior 3 months. Respondents were asked to provide an answer to the following open-ended question at each wave: "*During the past 3 months, with how many different partners did you have sex (i.e., vaginal intercourse, anal intercourse, or oral sex)?*"

### *Prevalence of Sex Acts*

Respondents were asked at each wave to provide three responses (one for each sex act) to an open-ended question: "*Of these sexual partners, with how many did you have… Vaginal intercourse? Oral sex? Anal intercourse?"* Summary scores that reflected the proportion of total sex partners with whom a participant engaged in a given sex act were calculated across all 10 waves for each sex act. For example, the number of oral sex partners at a given wave was divided by total sex partners for that wave. A score of 1 would mean that sex with all partners included oral sex, whereas a score of 0.5 would mean sex included oral sex with only half of reported partners. Then, we calculated a mean for each sex act across all waves for which data were available. Because of the way that the question was worded, we cannot determine if a respondent was a recipient or performer of a reported sex act. This is a limitation, as the chances of contracting a STI can differ between recipients versus performers.

### *Relationship Status*

Respondents reported if any of the following pertained to them in the previous 3 months: (A) not dating, (B) dating, but not exclusively, (C) dating exclusively, (D) engaged, (E) married, (F) divorced. As participants were allowed to indicate multiple statuses within each 3-month period, this variable was recoded into a categorical variable such that 0 = *Some non-exclusivity* and 1 = *Exclusive only*. Individuals who marked A or B in combination with any other categories or marked F only were scored as a 0, whereas individuals endorsing any C, D, or E, but *not* A or B were scored as 1.

**Table 1** Descriptive statistics of sexual behavior at each study wave

| Wave | Time point | *N* | % total *N* | Mean age (*SD*) | Mean number of sex partners[a] (*SD*; range) | Percent exclusive only |
|---|---|---|---|---|---|---|
| 1 | Summer 2004 | 2244 | 100.0 | 18.4 (.35) | 0.52 (1.04; 0–15) | 38.4 |
| 2 | Fall 2004 | 2076 | 92.5 | 18.8 (.35) | 0.62 (0.97; 0–12) | 31.1 |
| 3 | Spring 2005 | 2025 | 90.2 | 19.2 (.35) | 0.67 (0.99; 0–10) | 34.2 |
| 4 | Fall 2005 | 1895 | 84.4 | 19.8 (.35) | 0.72 (1.03; 0–10) | 35.0 |
| 5 | Spring 2006 | 1789 | 79.7 | 20.2 (.35) | 0.71 (0.98; 0–16) | 41.4 |
| 6 | Fall 2006 | 1674 | 74.6 | 20.8 (.36) | 0.78 (1.28; 0–28) | 40.4 |
| 7 | Spring 2007 | 1638 | 73.0 | 21.2 (.35) | 0.81 (1.27; 0–30) | 45.2 |
| 8 | Fall 2007 | 1538 | 68.5 | 21.8 (.35) | 0.78 (0.98; 0–10) | 46.3 |
| 9 | Fall 2008 | 1428 | 63.6 | 22.8 (.35) | 0.84 (0.99; 0–11) | 49.7 |
| 10 | Fall 2009 | 1406 | 62.7 | 23.8 (.35) | 0.93 (1.16; 0–20) | 54.9 |

[a] Number of sex partners was assessed during the past 3 months

*Sex Without Protection*

The primary outcome measure was sex without the use of protection. Respondents were asked two items, *"During the past 3 months, how many times did you have sex without protection against STDs and pregnancy with an* [*exclusive/non-exclusive*] *dating partner?"* These two questions had the following choices on Likert scales: 0 = *0 times*, 1 = *1 time*, 2 = *2 times*, 3 = *3–5 times*, 4 = *6–10 times*, 5 = *11–20 times*, 6 = > *20 times*. Item responses across both questions were summed, and then recoded into a dichotomous variable: 0 = *no sex without protection*, 1 = *at least one incident of sex without protection*. We summed across these items because relationship status is already indicated in the model, and we dichotomized this outcome variable to minimize potential confounding effects of sexual intercourse frequency (which was not assessed) on the odds of sex without protection.

*Sexual Values*

A five-item scale adapted from Perkins and Berkowitz (1986) measured permissiveness toward sexual behavior. At Wave 1, respondents were asked their agreement with statements such as "It is okay for me to have casual sex without being in a relationship" on a Likert scale ranging from 1 = *Disagree* to 5 = *Agree*. After reverse scoring of one item ("It is important for me to wait until marriage to have sex"), responses were then summed into a single score. Reliability of the items on this scale was good ($\alpha = 0.74$). For a more detailed description of the items in this scale, see Wetherill, Neal, and Fromme (2010).

*Same-Sex Sexual Behavior*

A minority of reported sexual activity was between members of the same sex. Current models of minority sexuality posit three distinct indices of sexual orientation: attraction, behavior, and self-reported identity (Savin-Williams, 2006). Although these components are highly correlated, the overlap is not complete. The current analyses focus on sexual behavior. In addition to reporting the number of sexual partners over the past three months (see above), respondents were asked to provide the sexes of these partners. We computed a new variable that indicated if an individual reported any same-sex behavior at any assessment wave (coded 0 = *no same-sex behavior,* 1 = *some same-sex behavior).*

**Statistical Analyses**

*Latent Growth Class Analysis (LGCA)*

Growth analysis of number of sexual partners over assessment Waves 1–10 was conducted in M*plus* version 7.2 (Muthén & Muthén, Los Angeles, CA). This analysis modeled trajectories of the number of sexual partners over time. This method uses structural equation modeling to estimate latent factors of intercept (*I*), linear slope (*S*), and quadratic slope (*Q*); these latent factors account for change in a variable measured repeatedly (McArdle & Nesselroade, 2003; Muthén & Muthén, 2000). The latent *I* factor estimates the mean level at the beginning of the time window examined, whereas the latent *S* factor estimates linear growth trends across all assessment waves. Lastly, the latent *Q* factor estimates non-linear change, because growth trends may decelerate or accelerate over time. The last two assessment waves were given after a year instead of 6 months. To account for this larger span of time, paths between *S* and the first eight waves increased by one unit ($t = 0$–7), but then by two units for Waves 9 and 10 ($t = 9$, 11). Similarly, the paths between *Q* and the first eight waves also increased by one unit squared ($t^2 = 0$–49), followed by two units squared for Waves 9 and 10 ($t^2 = 81$, 121). To determine if there are distinct groups within the sample, an additional categorical latent factor (*C*) with a given number of levels was added, and the means/intercepts of *I, S*, and *Q* were freely estimated for each level of *C* (Muthén & Muthén, 2000). Variances of *I, S,* and *Q,* were constrained to be zero within a given class. Details of the model fitting procedure and the resulting statistics are provided in the results section. An abbreviated model design is presented in Fig. 1.

*Incidence of Sex Without Protection by Latent Trajectory Class*

To determine the relative odds of unprotected sex by trajectory class, we conducted logistic regressions for each study wave. The occurrence of unprotected sex was the dependent variable. Sexual partner trajectory class, relationship status (purely exclusive or some nonexclusivity) at that wave, and their interaction were categorical independent variables. To account for the fact that individuals may have not had a sexual partner at a given wave (precluding the occurrence of unprotected sex), analyses conducted at each wave included only individuals who reported at least one sexual partner during the 3-month period under analysis.

## Results

### Respondent Demographics and Attrition

At Wave 10, 39.8 % of the original sample ($N = 895$) was lost to attrition. Full information maximum likelihood estimation was used in M*plus* to account for this missing data (Schafer & Graham, 2002). Attrition for each wave is presented in Table 1. Those lost to attrition by Wave 10 were no more likely to be a member of any given sex trajectory class, $\chi^2(2) = 4.06, p > 0.05$, or of any level of family income, $\chi^2(7) = 5.33, p > 0.05$. Attrition also did not differ by those who did or did not report homosexual behavior, $\chi^2(1) < 1, p > 0.05$, or by level of mother's highest

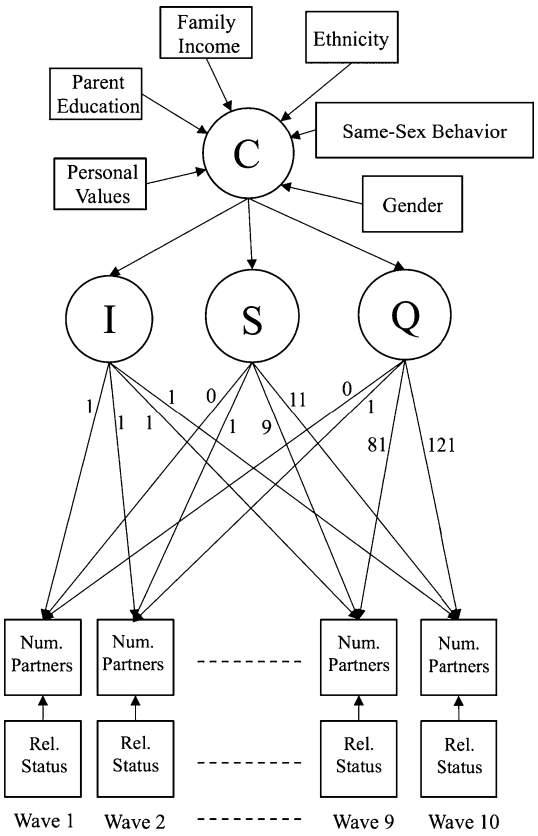


**Fig. 1** Latent class growth analysis model. Structural equation model used to assess longitudinal classes based on number of sex partners over 3 months. Included are data from waves 1 through 10, with relationship status (exclusive or some nonexclusivity) as a time-varying predictor of the number of sexual partners. Variables used as predictors of trajectory class membership (C) included gender, ethnicity, family income, and highest level parental education, personal values, and homosexual behavior

education, $\chi^2(5) = 3.52$, $p > 0.05$, or father's highest education, $\chi^2(1) = 2.4$, $p > 0.05$. Those lost to attrition were more likely to be male, $\chi^2(1) = 24.15$, $p < 0.001$. Lastly, attrition by ethnic category was significant, $\chi^2(3) = 8.22$, $p < 0.05$, with the greatest proportional loss among Latinos (45.0 %) versus Black/Multi-ethnic/Other (42.0 %), Whites (39.4 %), and Asians (35.1 %). Sample demographics are presented in Table 3. Men reported a higher proportion of homosexual behavior in the sample (8.7 %) than did women (3.9 %), $\chi^2(1) = 22.73$, $p < 0.001$.

## Trajectories of Sexual Behavior

The variable under study, number of sexual partners over the past 3 months, is a count variable with a non-normal distribution. Poisson distributions assume that the mean is equal to the observed variance, whereas negative binomial distributions allow for over-dispersion. The variance of the measure was indeed higher than the mean at every wave (means and SDs are in Table 1), indicating greater dispersion than would be present under a Poisson model; therefore, we ran all models using a negative binomial distribution.

As a first step, we ran models specifying two to five latent classes of *C,* with the number of partners over the 3-month window at each wave of assessment being the primary dependent variable, and relationship status as a time-varying covariate at each wave. In initial models, the effect of relationship status on number of partners was freely estimated across classes and across waves. To account for missing data about relationship status across the assessment waves, a second dummy category was coded Missing = 0 when relationship status data was present but Missing = 1 when absent. The effect of the Missing time-varying covariate was fixed to be equal at all waves and between all classes.

We selected the best-fitting model based on the following: Akaike Information Criterion (AIC; Akaike, 1987) and Bayesian Information Criterion (BIC; Schwarz, 1978; Sclove, 1987), both of which are sensitive to model parsimony and the likelihood of the data given the model. Lower values of both of these criteria are indicators of improved relative model selection. We also examined entropy, or the certainty of categorizing individuals between one class and another (Celeux & Soromenho, 1996). These entropy values range between 0 and 1, with values approaching 1 indicating a high degree of certainty in classification of individuals as belonging to a given level of *C*. Models with classes that did not capture a meaningful portion of the sample (at least 5 %) were also discarded (Nagin, 2005). Our last criterion was a Vuong–Lo-Mendell–Rubin likelihood ratio test (Vuong, 1989) to assess the likelihood ratio of the $k$ to $k-1$ class models; we assessed at what number of classes this statistic becomes non-significant ($p > 0.05$).

Selection criteria indicated that a three-class solution best fit the data (Table 2). Intercepts, and linear and quadratic slopes for each of the three latent classes are given in Supplemental Table 1. The latent trajectory classes showed low, moderate, and high sexual activity in terms of the number sexual partners across all waves (Fig. 2). These classes are termed Rare Partners, Single Partners, and Multiple Partners, respectively. Over time, all three classes showed a slow climb in the average number of partners, with a

**Table 2** Model fit indices for LCGA models

| Criterion[a] | One class | Two class | Three class | Four class |
|---|---|---|---|---|
| AIC | 38,612.38 | 33,412.90 | 32,577.47 | 32,320.81 |
| BIC | 38,749.56 | 33,631.09 | 32,874.70 | 32,698.03 |
| Entropy | N/A | 0.749 | 0.720 | 0.696 |
| LRT | N/A | $p < 0.001$ | $p < 0.001$ | $p = 0.48$ |
| Percent by class | 1 = 100 % | 1 = 58.9 % | 1 = 46.8 % | 1 = 36.8 % |
| | | 2 = 41.1 % | 2 = 43.9 % | 2 = 36.6 % |
| | | | 3 = 9.3 % | 3 = 22.7 % |
| | | | | 4 = 3.8 % |

*AIC* akaike information criterion, *BIC* Bayesian information criterion, *LRT* Vuong–Lo-Mendell–Rubin likelihood ratio test

more rapid increase in the Multiple Partners class. There was, however, indication of deceleration in this group toward the end of the window examined. A breakdown of the proportion of individuals in exclusive relationships by trajectory class is shown in Supplemental Fig. 1. Overall, there were more exclusive relationships with time, and the Single Partners class had the highest proportion followed by the Multiple Partners and Rare Partners classes.

The effect of relationship status on predicted number of partners varied by class. Those with low sexual activity increased toward one sexual partner when in an exclusive relationship (parameter range across waves 1.21 to 2.74, all $ps < 0.05$), whereas those with moderate sexual activity were largely unaffected by relationship status (parameter range −0.063 to 0.304, all but Waves 1 and 2 $ps > 0.05$). Those with high numbers of sex partners were predicted to have fewer partners when in an exclusive relationship (parameter range −1.146 to −0.468, all $ps < 0.05$).

To test if the model could be further simplified, we examined if the effect of relationship status on number of partners could be constrained to be equal across all waves within a given class using MODEL TEST specification in M*plus*. Model tests demonstrated that the effects of relationship status could be constrained to be equal across waves in the Multiple Partners class (Wald = 16.81, df = 9, $p = 0.052$), but not the Single Partners Class, (Wald = 49.94, df = 9, $p < 0.0001$), nor the Rare Partners Class (Wald = 51.29, df = 9, $p < 0.0001$). Lastly, simplifying the model to a linear rather than quadratic model resulted in significantly worse model fit, $\chi^2_{diff}(3) = 9.52$, $p = 0.023$. Fit indices for a final model with three latent classes, the effects of relationship status on number of partners constrained to be equal across waves in the Multiple class, but freely estimated across waves in the Single and Rare classes are as follows: AIC = 32,584.70; BIC = 32,830.49; Entropy = 0.72. All further results are with respect to this model. A comparison of model-implied and observed values by trajectory class and relationship status is provided in online supplement, Figs. S2 and S3.

## Predictors of Class Membership

Next, we sought to determine if demographic variables (gender, ethnicity, family income, mother's and father's highest education), personal values about sex, or homosexual behavior were significant predictors of latent class membership. These variables were entered as auxiliary (type R) in M*plus* so that all individuals were included in the LCGA analysis even if data were missing on demographic variables (Asparouhov & Muthén, 2013). This option examines these predictor variables separately from the estimation of the LCGA model.

The resulting odds ratios with reference to the Rare Partners class are presented in Table 4. Consistent with the demographics presented in Table 3, Asian individuals were considerably less likely to be in a class other than the Rare Partners class, but other ethnicities were not significantly associated with class memberships. Men were less likely to be in the Single Partners class relative to women, and individuals who reported homosexual behavior at any wave were much more likely to be in the Multiple Partners group, and also the Single Partners group, relative to the Rare Partners group. Parental education and family income were not associated with class membership, but individuals with more permissive personal values on sex were more likely to be in the higher partners classes than in the Rare Partners class.

## Sexual Partner Trajectory, Relationship Status, and Protection

Most likely class memberships were output from M*plus* into PASW 18.0 for subsequent testing. First, logistic regression

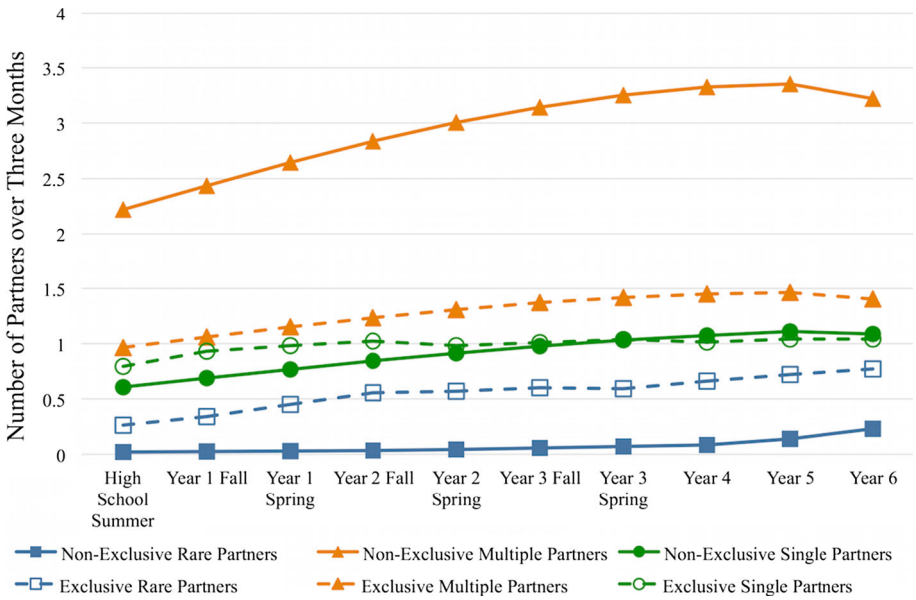


**Fig. 2** Predicted number of partners by sexual trajectory. Presented are the predicted number of partners in a 3-month period as determined by sexual trajectory class membership and the time-varying predictor of relationship status. Results showed three classes: a Rare partner class (*blue square*), a Single partner class (*green circle*), and a Multiple partner class (*orange triangle*). The effect of relationship status is indicated by the *solid* (some non-exclusive) versus *dotted* (exclusive) *lines*, which show that an exclusive relationship predicts values closer to one partner regardless of sexual trajectory (Color figure online)

**Table 3** Demographic representation by trajectory class

| | Rare partners | Single partners | Multiple partners | Total | Percent |
|---|---|---|---|---|---|
| Men | 45.6 % | 32.7 % | 48.0 % | 900 | 40.1 |
| Women | 54.4 % | 67.7 % | 52.0 % | 1344 | 59.9 |
| White | 52.3 % | 59.2 % | 54.0 % | 1245 | 55.5 |
| Asian | 26.1 % | 11.6 % | 7.1 % | 404 | 18.0 |
| Latino | 10.8 % | 18.4 % | 22.7 % | 342 | 15.2 |
| Black/other | 10.7 % | 10.9 % | 16.2 % | 253 | 11.2 |
| No homosexual behavior | 97.7 % | 94.0 % | 76.8 % | 2114 | 94.2 |
| Some homosexual behavior | 2.3 % | 6.0 % | 23.2 % | 130 | 5.8 |
| Total | 1052 | 994 | 198 | 2244 | |
| Percent | 46.8 % | 43.9 % | 9.3 % | | |

Demographic percentages are within-column (e.g., 52.3 % of those in the Rare Partners class were White and 45.6 % were men)

**Table 4** Relative odds of class membership by demographic and other predictors

| Measure[a] | Multiple partners | Single partners |
|---|---|---|
| Gender | 0.37*** | 0.42*** |
| Asian | 0.23*** | 0.43*** |
| Latino | 1.45 | 1.23 |
| Black/other | 1.17 | 0.86 |
| Family income | 1.04 | 1.04 |
| Mother's highest education | 0.97 | 0.95 |
| Father's highest education | 1.00 | 0.99 |
| Homosexual behavior | 6.77*** | 2.73** |
| Personal values on sex | 1.30*** | 1.17*** |

[a] Reference categories are rare partners, white ethnicity, female sex, and no homosexual behavior. Family income and education variables were quasi-continuous with 8 and 6 levels, respectively, with increasing values indicating greater income or education. Personal values on sex was a continuous variable with higher values indicating more liberal views. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

models were fit at each wave with sexual trajectory class membership, relationship status, and their interaction as independent variables, and at least one occasion of unprotected sex as the dependent variable. Analyses were conducted only among individuals who reported at least one sexual encounter at each wave and controlled for demographic variables. The interaction term between trajectory and relationship status was not significant at any assessment year (all $ps > 0.05$), and was therefore dropped to fit models with main effects only. Table 5 presents odds ratios of not using protection by trajectory class with reference to the Rare Partners class and by relationship status. At all assessment years, the Multiple Partners class was the most likely to report unprotected sex, with a peak relative risk occurring during Wave 6, corresponding to mean age 20.8. Similarly, the Single Partners

**Table 5** Odds ratios of at least one instance of unprotected sex by study wave

| Wave[a] | *N* | Trajectory class: wald (df = 2) | Multiple partners | Single partners | Exclusive relationship |
|---|---|---|---|---|---|
| 1 | 802 | 19.50*** | 5.13*** | 2.59** | 1.29 |
| 2 | 843 | 23.63*** | 5.66*** | 2.29* | 2.02*** |
| 3 | 908 | 34.29*** | 6.46*** | 2.37** | 1.22 |
| 4 | 913 | 30.12*** | 5.74*** | 2.37** | 0.95 |
| 5 | 893 | 32.94*** | 5.03*** | 1.64* | 0.85 |
| 6 | 884 | 42.39*** | 7.55*** | 2.35*** | 0.98 |
| 7 | 908 | 30.46*** | 4.50*** | 1.67* | 0.72* |
| 8 | 861 | 13.51*** | 2.89*** | 1.60* | 0.67* |
| 9 | 878 | 8.61*** | 2.19** | 1.60* | 0.70* |
| 10 | 928 | 32.14*** | 5.02*** | 2.14*** | 1.77** |

[a] Analyses for each wave only included those who reported at least one sexual partner; thus, the sample size (N) and precise sample composition vary by wave. Reference categories are (1) Rare sex partners and (2) some non-exclusivity. Df = degrees of freedom. The following demographic variables were also included as covariates in these analyses: biological sex, ethnicity, family income, and mother and father's highest education. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

class was also more likely to report at least one instance of unprotected sex, although with lower odds ratios than those observed for the Multiple Partners class. The effect of relationship status, on the other hand, varied by time point. Being in an exclusive relationship was a risk factor at Wave 2, the beginning of college, and a protective factor at Waves 7, 8, and 9. Finally, at Wave 10, it was again a significant risk factor.

## Differences in Sexual Acts by Trajectory Class and Gender

In order to determine if the proportion of sexual encounters that included three sexual acts might differ by trajectory class and gender, we conducted three ANOVAs in PASW 18, one for each sex act category, with trajectory class and gender as independent variables. In cases where there was a main effect of trajectory class, we examined pair-wise differences in post hoc tests using the Bonferroni multiple comparisons correction. Means for each class, gender, and 95 % confidence intervals are provided below, and results are presented in Fig. 3.

### *Vaginal Sex*

For vaginal sex, the Single class reported the highest proportion of vaginal intercourse ($M = 78.6$ %, 76.4–80.8 %), followed by the Multiple class ($M = 77.0$ %, 72.3–81.6 %), and the Rare class ($M = 64.6$ %, 61.8–67.4 %). Overall, females reported more vaginal intercourse ($M = 78.8$ %, 76.2–81.3 %) than did males ($M = 68.0$ %, 65.1–70.9 %). There was a main effect of trajectory class, $F(2, 1755) = 30.81$, $p < 0.001$, and gender $F(1, 1755) =$

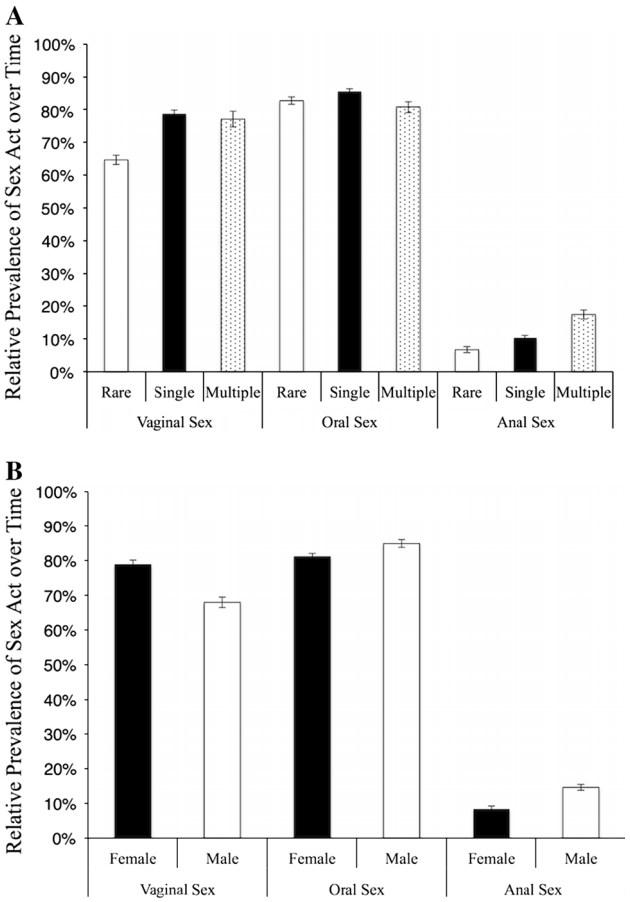


**Fig. 3** Prevalence of sex acts by sexual trajectory. Trajectory classes showed distinct prevalence of different sexual acts collapsed across time. The single and multiple classes reported more vaginal sex than did the rare partners class. Although there was a main effect of class on oral sex, pair-wise comparisons did not survive correction for multiple comparisons. The Multiple trajectory class reported the most anal sex, followed by the Single and Rare trajectories, with all means being significantly different in post hoc tests. *Error bars* are standard error of the mean

29.46, $p < 0.001$, and a significant interaction, F(2, 1755) = 6.63, $p < 0.01$. Females reported higher means than males in the Multiple $F(1, 1197) = 30.07$, $p < 0.001$ and Single classes $F(1, 1993) = 17.00$, $p < 0.001$, but not the Rare class, $F(1, 1568) = 0.36$, $p > 0.05$. Post-hoc tests showed that the Rare class was significantly different from the Multiple and Single class, but these latter two classes were not significantly different from each other.

*Oral Sex*

The Single class reported the highest prevalence of oral sex ($M = 85.6\,\%$, 83.9–87.3 %), followed by the Rare class ($M = 82.8\,\%$, 80.6–85.0 %), and the Multiple class ($M = 80.7\,\%$, 77.1–84.2 %). Males reported more oral sex overall ($M = 84.9\,\%$, 82.7–87.2 %) than did females ($M = 81.1\,\%$, 79.1–83.1 %). There was a main effect of trajectory class, $F(2, 1728) = 3.95$, $p < 0.05$, and gender $F(1, 1728) = 6.19$, $p < 0.05$, and but no significant interaction, $F(2, 1728) = 0.19$, $p > 0.05$. No pair-wise comparisons survived correction for multiple comparisons.

*Anal Sex*

The Multiple class reported the highest prevalence of anal intercourse ($M = 17.4\,\%$, 14.7–20.2 %), followed by the Single class ($M = 10.3\,\%$, 9.0–11.6 %), and the Rare class ($M = 6.7\,\%$, 5.1–8.4 %). Males reported more anal sex ($M = 14.6\,\%$, 12.8–16.3 %) than did females ($M = 8.4\,\%$, 6.9–9.9 %). There was again a main effect of trajectory class, $F(2, 1728) = 21.66$, $p < 0.001$, and gender $F(1, 1728) = 27.55$, $p < 0.001$, and a significant interaction, $F(2, 1728) = 7.51$, $p > 0.01$. The interaction was such that there was an effect of gender (with men reporting more anal sex than women) in the Multiple, $F(1, 1197) = 29.60$, $p < 0.001$, and Single classes, $F(1, 1992) = 4.25$, $p < 0.05$, but not the Rare class $F(1, 1542) = 1.27$, $p > 0.05$. All pair-wise class comparisons were significant differences ($ps < 0.05$).

## Discussion

The present study modeled the longitudinal patterns of sexual behavior of emerging adults, as measured by the number of sexual partners in 10 3-month windows over 6 years, between mean ages 18 and 24. The trajectory classes established by our analyses, combined with relationship status, were then used as predictors of unprotected sexual behavior in order to determine if having multiple sexual partners accompanied a greater likelihood of unprotected sexual encounters, and whether relationship status moderated this association with risky behavior. We subsequently examined the characteristics of these trajectory groups in terms of demographics, personal values, and sexual behavior.

### Changes in Number of Sexual Partners Across Time

The results of the trajectory class analyses indicated that three distinct classes (Multiple, Single, and Rare Sex Partners) best explained how the number of sexual partners changed across emerging adulthood (Fig. 2). Starting with zero partners at the end of high school and comprising the highest proportion of the sample (47 %), the Rare Partners class demonstrated slow growth in the number of sexual partners across time, remaining the group with the fewest sexual partners by the end of data collection. Including individuals with missing data, 48.2 % of the Rare Partners class never reported a sex partner throughout the duration of the study (this was 22.9 % of the full sample). The Single Partner trajectory group, the second largest group (44 %), remained stable with about one sexual partner during the 3-month assessment across the scope of emerging adulthood. Finally, the Multiple Partner trajectory class (9 %) consistently had more than

one partner across all assessments, and was characterized by an increase in sex partners during the developmental span of emerging adulthood (Fig. 2).

Our results clearly support relationship status as an important contributing factor to participation in sexual encounters with varying numbers of partners. More specifically, we found that having an exclusive partner predicted fewer sexual partners for the Multiple Partners trajectory class, whereas those in the Rare Partners trajectory class were more likely to have had sex when they were in an exclusive relationship. Relationship status does not moderate the number of sexual partners for everyone, however, as can be seen in the Single Partner class; this group was predicted to have about one partner, regardless of relationship status. Taken together, including relationship status as a moderator of risky sexual behavior warrants further attention as it confers differential effects on the likelihood of having one or more sexual partners on distinct groups of individuals.

## Odds of Unprotected Sex

The major study aim was to determine whether trajectory class membership and relationship status predicted engagement in sex without protection against STIs or pregnancy among those who reported being sexually active. We found that those in the Multiple Partner and Single Partner trajectory classes were at increased odds of engaging in this risky behavior relative to the Rare Partner class. The peak relative odds were quite high, being over 750 % for the Multiple group compared to the Rare group at a mean age of 20. Collectively, these results indicate that those who tend to have multiple sexual partners over time are at increased risk for having sex without protection against STIs and pregnancy, suggesting targeted interventions may be indicated for these individuals during college. Our results stand in contrast to cross-sectional analyses that have not found an association between having multiple partners and using protection (Manlove et al., 2008; Santelli et al., 1998). As the present data included multiple assessments over a span of several years, we were able to identify groups of individuals who tended to have greater or fewer partners over time, which cannot be reliably achieved when relying on a single narrow time frame or lifetime totals. The increased odds of not using protection in combination with having multiple partners present a problematic compounding risk of STI transmission for the Multiple Partners group.

### *Relationship Status*

The association between trajectory class and unprotected sex was not moderated by relationship status, but being in an exclusive relationship was a risk factor for unprotected sex at Wave 2 and Wave 10 but a protective factor at Waves 7, 8, and 9. Although the increased odds ratio of unprotected sex at Wave 2 for those in exclusive relationships is perplexing, it may be that first year college students are more likely to engage in unprotected sexual behavior with exclusive partners they have maintained since high school, or may lack knowledge about using protection with newly established partners. Alternatively, being away from home and having less parental monitoring during the first year of college contributes to elevated risk behaviors overall (e.g., drinking, drug use; Wetherill & Fromme, 2007), which could include sex without condoms. By the final wave, being in a relationship was again associated with increased odds of unprotected sex. Participants were about 24 years old, and 55 % were in a committed exclusive relationship by this time (Table 1; Fig. S1), which fits with a developmental trend toward more serious relationships during later emerging adulthood compared to adolescence (Giordano et al., 2012). Perhaps the greater intimacy and trust between partners (Marston & King, 2006) contributed to having more sex without protection in an established, likely longer, relationship at this later assessment wave.

In contrast, exclusive relationship status appears to confer a protective effect during the spring of junior year (Wave 7), the last year of college (Wave 8), and during the first year out for most of the sample (Wave 9). These results may be due to the higher prevalence of exclusive relationships overall (Table 1), many of which may be relatively new. Thus, individuals in these relationships may be taking protective measures in the context of these (new) exclusive relationships. Alternatively, perhaps sex at these ages occurs more often in the context of alcohol use (bars, Greek organization events) as alcohol can be procured legally; perhaps, as has been previously shown, alcohol is contributing to increased risky sex behavior (Lewis et al., 2009), and this effect is more pronounced in casual relationships (Brown & Vanable, 2007). This would result in exclusive relationships appearing to be protective (Table 5). Nevertheless, as multiple tests were conducted across waves and with samples that do not perfectly overlap (analyses included only individuals who reported sex at each wave) we must interpret these results with caution.

## Predictors of Trajectory Class Membership

In order to better characterize the trajectory classes, we examined demographic characteristics, personal values, and same-sex behavior as predictors of sexual trajectory classes. Asian participants were less likely than other ethnicities to be in the Single and Multiple Partners trajectory classes, but being a member of other ethnic categories (Black, Latino) did not predict class membership relative to being White. Women were considerably overrepresented in the Single Partners class, whereas the other classes were more evenly split by gender (Table 3). Another way to distinguish the classes was through differences in sexual values. Those with more permissive values about sexual behavior were more likely to be in the Multiple and Single Partners trajectory classes compared to the Rare Partners trajectory class, which follows previous research that indicates those with more permissive views about casual sex report having more sexual

partners (Hall & Pichon, 2014; Ostovich & Sabini, 2004; Townsend & Wasserman, 2011). Additionally, and consistent with the prevalence of Asian individuals in the Rare Partners class, Asians tend to report more conservative sexual attitudes and behaviors (Meston & Ahrold, 2010; Okazaki, 2002). Lastly, reporting any homosexual behavior increased the likelihood of being in the Multiple and Single Partners classes relative to the Rare class. This is consistent with prior findings indicating that individuals who identify as homosexual have more lifetime and past 6-month sex partners than those who identify as bisexual or heterosexual (Breyer et al., 2010).

### Trajectory Classes and Specific Sexual Acts

Beyond just capturing the number of sexual partners, we also sought to highlight differences that may exist related to the types of sexual behavior typical of those in specific trajectory classes (Fig. 3). Our results indicated that oral sex was the most prevalent sex act, consistent with prior reports (Brewster & Tillman, 2008), followed by vaginal and (relatively rare) anal sex; the prevalence of oral sex did not significantly differ by trajectory class (Fig. 3), indicating overall equivalent levels of engagement across the sample. Individuals in the Rare Partners class reported a significantly smaller proportion of vaginal sex than the other classes, suggesting that the most common behavior within this Rare Partners group is oral sex. Although oral sex carries less risk of STI transmission than do anal and vaginal sex (Edwards & Carne, 1998), oral sex is often the first sexual encounter experienced in youth (Schwartz, 1999). Furthermore, around a third of coital virgins at age 21 endorse having had oral sex (Brewster & Tillman, 2008). Being the most common act and the only kind of sexual contact for some, oral sex may be an important intervention target among emerging adults. The differences between the proportions of encounters that included oral versus vaginal sex were less pronounced in the other two groups (Fig. 3), and vaginal sex was equally prevalent between the Single and Multiple partners groups.

More remarkably, trajectory class was significantly stratified by proportion of anal sex, with the Multiple Partners group reporting a significantly greater proportion of anal sex than the other classes. The Multiple trajectory class can also be differentiated from the other trajectory classes by more reports of homosexual behavior. Specifically, nearly a quarter of this trajectory class reported an instance of sexual behavior with someone of the same sex, which is much higher than national estimates (Gates, 2011). Those who report homosexual sexual behaviors, especially men who have anal sex with men, are at increased risk for STIs and HIV (CDC, 2015), and both of these risk factors are overrepresented in the Multiple Partners trajectory class (within this class, 51 % of male–male dyads and 10–15 % of male–female dyads included anal sex; Supplemental Table 2); these results further support extension of targeted interventions to the Multiple Partners trajectory class with some emphasis on the greater STI risks associated with unprotected anal intercourse for both men and women.

### Intervention Implications and Future Directions

These results have important intervention implications for individuals across the span of emerging adulthood. Our results indicate that those individuals who are part of the Multiple Partners sexual trajectory class were, as a whole, at greater risk for engaging in unprotected sex. As a result of having multiple sex partners in combination with reporting greater odds of not using protection against STIs, seemingly these individuals have increased opportunity to contract STIs. Moreover, the Multiple Partners class also had an overrepresentation of men who have anal sex with other men. Thus, targeted interventions are needed for those in the Multiple Partner class.

One intervention strategy could be focused on decreasing the number of sexual partners, which would contribute to fewer new opportunities to contract STIs. A meta-analysis found, however, that behavioral interventions targeted at decreasing number of sexual partners had much smaller effect sizes compared to those focused on increasing condom use, indicating that trying to change number of sexual partners may not be an effective way to target STI-related behavior (Noar, 2008). Additionally, we advocate for a sex-positive approach (Harden, 2014). From this perspective, sexual activity among adolescents and young adults is viewed as normative, consistent with the fact that about 70 % of individuals in the U.S. have had sexual intercourse by the age 19 (Martinez, Copen, & Abma, 2011). Whereas the risk-perspective presumes that eliminating *all* risk for negative health outcomes is desirable, the sex-positive framework proposes that sexual experiences can have benefits in terms of psychological outcomes and sexual well-being (Harden, 2014). Ultimately, people must balance risk with the benefits when deciding whether or not to engage in sex. The sex-positive perspective does not, however, ignore the very real health consequences of sex, and seeks to minimize risks by advocating the use of condoms and other forms of protection.

#### *Targeting Mechanisms of Elevated Risk*

Selection of methods to diminish unprotected sexual behavior of those individuals in the Multiple and Single Partners trajectory classes would be informed by determining which mechanism(s) specifically produce an elevated odds of unprotected sex. These could include communication, attitudes or beliefs about the risks of sex, or co-occurring substance use (Lewis et al., 2009). Future investigations should include additional survey items or event-level assessments in order to examine which of the above might explain why individuals who tend to have more sex partners are also more likely to fail to use protection.

Casual partners are less likely to communicate about the use of protection than are romantic partners (Lehmiller, VanderDrift, & Kelly, 2014). Consequently, those in the Multiple and Single Partners trajectory classes may be communicating less about safe-sex practices with their partners relative to the Rare Partners group, resulting in greater risk behavior. Second, it could be that these trajectory groups differ in terms of how they assess the risks of unprotected sex, as indicated by "perceived susceptibility" in the Health Belief Model (Janz & Becker, 1984). Indeed, many studies have found that individual differences in attitudes about the risk of HIV transmission predicted condom usage in college students (e.g., Boone & Lefkowitz, 2004; as reviewed in Lewis et al., 2009). Thus, future studies could evaluate whether perceived susceptibility differs between these trajectory groups, indicating that intervention efforts might place emphasis on education about susceptibility of STI and HIV transmission. Finally, alcohol or drug use during sexual encounters may also differ by trajectory classes, moderating the odds of unprotected sex. About 30 % of college students reported drinking alcohol prior to sex (Brown & Vanable, 2007), and one of the strongest correlates of frequency of unprotected sex is alcohol use (Gullette & Lyons, 2005). Although it is beyond the scope of the current analysis to also examine alcohol use, our data indicate that Multiple and Single partner classes reported greater alcohol consumption, particularly binge drinking, which may contribute to their increased risk of not using condoms or other forms of protection. Intervention strategies could emphasize the risks associated with alcohol use in the context of sexual encounters for individuals reporting a history of sex with multiple partners.

### *Timing and Targeting*

Current educational programs on college campuses are typically given to all incoming students and promote safer sexual practices. Based on differing risks of our trajectory groups, interventions tailored to students based on the number of sexual partners could be a beneficial augmentation to current safe sex education modules, and could be delivered in the later years of college in addition to at matriculation. For example, students who self-report having had multiple partners or having sex with same-sex partners during the past 3 months could be provided with modules that include tailored information about the increased importance of using condoms based on their reported sexual behaviors. The information could focus on communication about sex among casual partners, on perceived susceptibility of risk of STI transmission, or could educate about the added risks of sex in the context of alcohol or drug use. The substantial overlap between the population of men who have sex with men (MSM) and our Multiple Partners class also supports continued efforts to target MSM and perhaps to extend these interventions to heterosexual individuals. Follow up modules in the later college years could reinforce safe-sex strategies, and evaluation studies could determine the efficacy of such tailored interventions for those who report multiple sex partners. To reach non-college samples, similar types of information might also be distributed in primary health care settings or MSM support groups.

## Limitations

This study should be interpreted in light of several limitations. First, our assessment of protection was for both pregnancy and STIs, which means we were unable to discern if the sexual behavior may have included another form of birth control, but not a condom or vice versa. Next, we were unable to determine the stability of relationships or sex partners across the waves of data, as we did not ask if a given partner at one wave was the same or different as a previous wave. Additionally, we only asked about number of sexual partners during the past 3 months, which may not capture the total number of sexual partners during the semi-annual (years 1–3) and annual (years 4–6) assessments. We also cannot determine if multiple reported partners were concurrent or serial. Given that homosexual behavior, rather than identity, was used as a predictor of trajectory class, endorsement of this item would necessarily bias categorization away from the Rare Partner class. Similarly, 47 % of the Rare Partner class indicated no sexual activity across all available waves, making it considerably less likely that this group would have engaged in any type of sexual behavior and may have remained abstinent. However, all surveys only asked about the past 3-month behavior; therefore, we are unable to make conclusions about the proportion of true abstinence in our sample. This study included a sample recruited at entry of college, limiting the generalizability to non-college populations. Although we had information about specific sex acts, we could not determine who was the receptive partner, or if protection was used for a specific sex act. Finally, we did not have information about acquisition of STIs, so we cannot determine if these unprotected sexual encounters resulted in any new infections.

## Conclusions

The purpose of this study was to describe longitudinal trajectories of sexual behavior in terms of number of sex partners reported over the past 3 months, and to examine relationship status as a moderator at every assessment wave. We identified three distinct groups of individuals: (1) a Multiple Partners class characterized by sex with multiple partners unless constrained by a relationship, (2) a Single Partners class that has about one partner per 3 months regardless of relationship status, and (3) a Rare Partners class that is unlikely to report any sex unless they are in an exclusive relationship. The Multiple Partners group exhibited an elevated proportion of homosexual behavior, and reported more permissive values about sex. The Single Partners group was predominantly female. The Multiple Partners class was most likely to report an instance of not using protection against STIs or

pregnancy, followed by the Single Partners group. The effect of relationship status on the use of protection varied by wave, such that being in an exclusive relationship was a risk factor at the earlier and last wave after college, but a protective factor toward the end of college. The proportion of specific sex acts differed by class, with notably greater frequencies of anal sex in the Multiple Partners class. Our results support continued efforts to tailor some interventions to men who have anal sex with men, and to extend targeted interventions to also include heterosexual students who report sex with multiple partners.

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**Conflicts of interest** The authors declare no conflicts of interest pertaining to the data or analysis presented herein.

**Ethical Approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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