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Trajectories of HIV Risk Behavior from Age 15 to 25 in the National Longitudinal Survey of Youth Sample

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Abstract

This study utilized data from the National Longitudinal Survey of Youth to investigate youth risk trajectories for HIV and factors associated with different trajectories. The sample ($N = 8,208$) was 49.2% female, with a mean age of 14.31 ($SD = 1.48$). A group-based trajectory model was applied, which identified four distinct trajectories for both males and females: (1) consistently higher sexual risk levels, increasing to early adulthood followed by some decrease (“high”); (2) a short period of increase to late teens, followed by a longer period of decrease (“decreased”); (3) an initially slow increase, with the increase accelerating by late teens, and a slight decline beginning in early adulthood (“increased”); and (4) consistently lowest levels of sexual risk (“low”). More African Americans were found among the decreased trajectory group; among the low risk group a higher number of youth came from families with parents who spoke a language other than English. The high-risk group had a higher percentage of subjects in non-metropolitan areas and highest alcohol use. Among males, being employed and being in the military were associated with inclusion in the high-risk group. Results have implications for specializing prevention strategies for youth with different patterns of sexual risk.

Keywords

HIV; Youth; Sexual Risk; Trajectory

Adolescence is characterized by transitions in biological and psychosocial functioning, including the onset of sexual behavior. There has been increasing concern about the problem of HIV infection due to sexual risk in the adolescent population of the U.S. over the past 1 – 2 decades. Most young people in the U.S. begin having sexual intercourse during their teenage years (Moore et al., 2000; New York Academy of Medicine, 2006). The average age of first sexual intercourse is 16.9 years for boys and 17.4 years for girls, (Alan Guttmacher Institute, 2002). On average, males begin having sex at younger ages than females, and African-Americans begin at younger ages than whites or Hispanics (Johnson & Tyler, 2007; O'Donnell, Dash, JeanBaptiste, Stueve, & Wilson, 2002; Moore et al., 2000). Much of this sexual behavior includes unprotected sex and multiple partners. Moreover, there is evidence from early studies that individuals with an early onset of sexual behavior will show higher levels of sexual activity across the life course (Sandfort, Orr, Hirsch, & Santelli, 2008; Smith, 1997). It has been hypothesized that a trajectory of higher sexual activity may be identified early in an

adolescents' life (Udry & Campbell, 1994), in part by understanding the factors that are predictive of early sexual initiation and late sexual risk. The current study sought to identify different types of patterns of sexual risk from age 15 to 25, as well as factors associated with these different types of patterns. First, we briefly discuss previous research in terms of risk factors and patterns of sex behavior development that may result in different types of adolescent sex risk patterns.

In an effort to integrate theory and research related to HIV prevention among adolescents, Tinsley, Lees and Sumartojo (2004) conducted a review of individual factors and family level influences that converge to determine adolescents' HIV risk status. Consistent with family systems and family development theory, the authors presented a model in which child variables (e.g., cognitive and affective development), demographic indicators (e.g., acculturation, neighborhood risk, socioeconomic status), and family variables (e.g., parental support, strength of the parent-child relationship, family rituals) depicted the direct and indirect relations in family processes relevant to adolescent HIV risk. Tinsley et al. (2004) reported on several factors that predict adolescent high-risk sexual behavior, including low levels of parental involvement and support. Likewise, Kotchick, Shaffer, Forehand, & Miller (2001) examined adolescent sexual risk behavior from a multisystemic perspective, and concluded that numerous variables from the self, family and extra-familial systems were related to adolescent sexual behavior, including delinquency, substance use, and psychological distress, particularly when related to a history of victimization.

Alcohol and other substance use have been identified as having a strong correlation with teen sexual behavior, with 25% of teens reporting using alcohol or drugs at last sexual intercourse (Centers for Disease Control and Prevention, 2000). Other studies have documented an association between sexual risk behavior among teens with use of cigarettes, alcohol, marijuana, and other illicit drugs (Rashad & Kaestner, 2004; Rosenbaum & Kandel, 1990; Sen, 2002). For example, in a study of transition to university the use of alcohol to reduce inhibitions was common, and was often associated with risk taking (Farrow & Arnold, 2003). Studies investigating gender differences in risk and protective factors for initiation of sexual intercourse found cigarette smoking to be a predictor of higher risk among females, but not among male youth (Mott, Fondell, Hu, Kowaleski-Jones, & Menaghan, 1996; Paul, Fitzjohn, Herbison, & Dickson, 2000). Mott et al. (1996) found that children using a controlled substance at an early age were more than twice as likely to have sex early as those who do not, but the type of substance having an effect was different for girls (cigarettes) and boys (alcohol).

In addition to alcohol use, predictors of higher risk for males include not having outside home interests, lower religiosity, not being attached to school, and conduct disorder; for females, risk factors included socioeconomic status in the middle range, not being attached to school, being in trouble at school, and higher self-esteem (Paul et al., 2000). Other studies have reported that sexual risk is associated with: engagement with deviant peers or peers who are engaged in sexual behavior (Dishion, Capaldi, & Yoerger, 1999; Dishion, Spracklen, Andrews, & Patterson, 1996; Rodgers & Rowe, 1990); lower religiosity (Hardy & Raffaelli, 2003); and antisocial behavior, including conduct disorder symptoms such as running away from home and a slower rate of increase for school grades (Capaldi, Crosby, & Stoolmiller, 1996; Crockett, Bingham, Chopak, & Vicary, 1996; Kowaleski-Jones & Mott, 1998; Tubman, Windle, & Windle, 1996). As adolescent males age, increases in sexual activity and decreases in condom use have been found (Ku, Sonenstein, & Pleck, 1993). Thus, a number of variables have been associated with high-risk sexual behavior among adolescents and young adults.

While adolescent sexual risk behavior has been studied for quite some time (Brooks-Gunn & Furstenberg, 1989), surprisingly there have not been a great number of longitudinal studies assessing multiple potential factors for the development of sexual risk behavior among

adolescents (Capaldi, Stoolmiller, Clark, & Owen, 2002). In a 10-year study spanning from early adolescence to young adulthood among a sample of young men, engagement in sexual risk behavior with female partners was examined (Capaldi et al., 2002). Age of onset of intercourse was associated with future sexual activity level, as indexed by the yearly average number of intercourse partners. Antisocial behavior and substance use were predictive of lifetime sexual risk behavior. Substance use was associated with contraction of an STD, as well as for a direct association of condom use. In a nationally representative sample of adolescent females who had never dated, which was designed to explore relationship trajectories, the transition to dating or romantic sexual intercourse was not found to be associated with depression or delinquency. However, casual sex was associated with significantly greater psychological distress and problem behaviors before and after transition (Grello Welsh, Harper, & Dickson, 2003). The current study seeks to provide a more comprehensive picture of factors associated with sexual risk behavior among adolescents, utilizing a very large, national sample of both females and male youth.

The Current Study

In the present study, data from the National Longitudinal Survey of Youth (NLSY; U.S. Department of Labor, 2008) were utilized to investigate youth sexual risk trajectories that may put them at risk for HIV, and factors associated with different risk trajectories. While a number of studies of sexual risk and sexual initiation have been conducted with the NLSY data (e.g., Crockett, Raffaelli, & Shen, 2006; Hardy & Raffaelli, 2003; Rashad & Kaestner, 2004; Rosenbaum & Kandel, 1990; Sen, 2002; Weden & Zabin, 2005), many of these studies were cross-sectional, or used different statistical techniques than those applied in this study to address sexual risk issues from a different perspective than that of the current study. The NLSY data provide the opportunity to investigate developmental trajectories of HIV sexual risk and their associations with drug use, delinquency, mental health status and criminality among adolescents because: (1) the large cohort was a comprehensive representation of adolescents and young adults in the U.S.; and (2) the sample was successfully followed to provide longitudinal data from which patterns can be assessed.

Because of the diverse sample and the apparent heterogeneity of risk behaviors among youth, the current study used group-based trajectory analyses to distinguish possible *multiple* latent classes or types of patterns of sexual risk level over time from age 15 to 25. A distinctive feature of this approach derives from its assumption that there may be numerous clusters or groupings of individuals within a population whose development on any given behavior of interest follows differing age-related patterns in its developmental course (Maughan, 2005). Then the study examined differences among the subsamples of youth belonging to these pattern classes in terms of potential risk or protective factors from prior to or at the beginning of these patterns, as well as subject characteristics from the later ages of these patterns. It was expected that youth who engaged in a pattern of high risk sexual behaviors would experience higher levels of psychological distress and delinquency, and lower levels of parental support than those who engaged in patterns of lower risk. In addition, it was expected that a pattern of elevated sex risk would be associated with a pattern of elevated alcohol and drug use. The identification of differential patterns and characteristics associated with them may assist in identifying particularly vulnerable subgroups of youth in need of specialized prevention or intervention efforts, critical age ranges for such interventions, protective factors that can form the basis for prevention strategies, or inform general strategies for sexual risk reduction.

Method

Data

Data for this study were drawn from the 1997 National Longitudinal Survey of Youth (NLSY97). The purpose of the NLSY97 was to longitudinally track adolescents ($N = 8,984$) as they transitioned from school to work. In addition to extensive education and employment measures, the survey included data on the youths' attitudes and behaviors, including sexual risk and delinquency behaviors, substance use, family background, and mental health variables. The NLSY97 is comprised of a nationally representative sample of youth ($n = 6,748$) and an oversample of Black and Hispanic youth ($n = 2,236$) who were born between 1980 and 1984.

NLSY Procedures

In the NLSY, nine rounds of adolescent interviews have been conducted annually from 1997 to 2005, and parent/guardian interviews were conducted in 1997 (U.S. Department of Labor, 2008). Sample attrition was fairly low, as 82% of the original sample of youth remained in the study at round 9. Prior to survey participation, potential respondents were informed of the risks and benefits of participating in the study, confidentiality, the estimated amount of time to complete the survey, and other relevant information. Parents/guardians who agreed to participate signed a consent form and adolescents signed an assent form; adolescents 18 and over signed a consent form. Participants were paid \$10 to \$20 for each interview. The interviews took approximately one hour to complete. Face to face interviews were conducted using computer-assisted personal interviewing (CAPI) system. Questions on sensitive topics such as sexual behavior, criminal activity and drug use are administered through the use of audio computer-assisted self-interview (ACASI) technology, allowing youth to self-administer these questions and enter responses directly into a computer without an interviewer knowing the responses. With the ACASI technology, respondents may be more likely to answer sensitive questions truthfully than if they were asked to report their answers to an interviewer (Bureau of Labor Statistics, 2005). Further description of the NLSY97 public use datasets, measures and procedures, along with the complete survey instruments is available (Bureau of Labor Statistics, 2008).

The present study examined baseline data from round one (1997), data from round 9 (2005), and sexual risk behaviors and substance use across seven time points, beginning with round 3 (1999) when all respondents were $\geq$ age 14, and continuing through round 9. The retention rate at round 3 was 91.4% of the full baseline sample of 8,984 youth; consequently 8,208 subjects who had completed the round 3 interview were included in this analysis.

Measures

The present study examined sexual risk behaviors over time, trajectories of the general level of sexual risk, and differences among subgroups with distinctive trajectories on several factors including substance use, sociodemographic characteristics, age of initiating dating and sexual activity, delinquent behaviors, mental health status, and parental support. Trajectory group differences were examined on characteristics from prior to or early in the trajectories (from round 1 of the NLSY or as early in the NLSY as the variable was measured) to see what characteristics might be predictive of the subsequent patterns. We also examine characteristics from later in the trajectory (from round 9 of the NLSY or as close to that as they were measured in the NLSY) to see what might be related to a preceding pattern of sexual risk. The following measures were examined in this study, and were youth-reported, with the exception of two parent-reported measures (i.e., parents' educational background, and primary language spoken at home). The NLSY97 restricted several measures to youth of specific age ranges (i.e., participation in religious activities; maternal supportiveness; perception of proportion of peers

who are sexually active) presumably as these items may be less applicable to respondents outside of the age ranges, as reported below.

Sexual risk behaviors—A sexual risk index was created using sexual behavior items at rounds 3 through 9. The sexual behavior items first asked the youth whether they ever had sexual intercourse, and if so, whether they had intercourse since the last interview. If the youth responded affirmatively, additional questions were asked with reference to the time since the last interview (approximately one year), including the number of times the youth had intercourse; the number of times the respondent and her/his partner(s) used condoms, (these two items were used to calculate a percentage of time condoms were used); and the number of partners with whom the respondent had intercourse. These sexual behavior items were then examined as a five-level variable, with higher scores equaling higher risk. No sexual activity since the last interview was scored as 0; always using a condom (regardless of number of partners) was scored as 1; sexual activity with one partner and occasionally (but not always) using a condom was scored as 2; sexual activity with multiple partners and occasional condom use was scored as 3; and sexual activity with multiple partners and no condom use was scored as 4.

Substance use—Substance use measures were examined over time in rounds 3 through 9 of the study (centered by subject age 15 – 25 as with sexual risk). Alcohol use was assessed as the number of days the youth reported drinking alcohol in the past 30 days. Heavy alcohol use was assessed as the number of days the youth reported having five or more drinks on one occasion in the past 30 days. Responses to both items at round 3 ranged from 0 – 30, with a mean of 2.15 ($SD = 4.49$) days in which youth drank alcohol, and 0.93 ($SD = 2.68$) days in which the youth had 5 or more drinks during in the past 30 days. In addition, the number of days the youth used marijuana in the past 30 days (mean [SD] = 1.51 [5.41] at round 3, and the number of times he/she used other substances (e.g., cocaine, heroin) since the last interview (mean [SD] = 1.68 [20.17] at round 3, were examined.

Background characteristics—Variables examined at round 1 included the youths' gender, race/ethnicity, age, participation in religious activities (this item was restricted to youth $\geq$ age 15 at round 1), urban/rural geographic region, and their parents' educational background and primary language spoken at home. In addition, the youths' age when they began dating and engaging in sexual activity was examined in relation to sexual risk behaviors.

Round 1 youth behaviors and perceptions—Delinquent behaviors by age 16 were examined as predictors of sexual risk behaviors, including whether the youth ran away from home, sold drugs, joined a gang, carried a hand gun, was arrested, or was incarcerated. In addition, the youths' perceptions of their parents and peers, assessed at round 1, were examined. The extent the youth reported their mothers were supportive (i.e., "When you were growing up, in general, was [your mother or mother figure] very supportive, somewhat supportive, or not very supportive of you?") was examined in relation to sexual risk behaviors (items related to parent helpfulness were restricted to youth $<$ age 15 at round 1). The youths' report of the percentage of their peers who were sexually active was also examined (this item was restricted to youth $\geq$ age 15 at round 1).

Round 9 sociodemographic variables—Variables examined at round 9 included the youths' educational level, whether they skipped or repeated grades, marital status, employment status, military service, the number of pregnancies reported during the course of the study, and whether the youth received government assistance (e.g., AFDC, food stamps; government assistance items were restricted to youth living independently of parents/guardians).

Round 8 mental health status—Mental health status in the past month was also examined as an outcome variable at round 8, using a five-item mental health scale from the Medical Outcomes Study Short Form 36 (MOS-SF36; Ware & Sherbourne, 1992). The MOS-SF36 has been found to be psychometrically sound and responsive to clinical change over time (Ware, Gandek and the IQOLA Project Group, 1994). Scale items included the extent the youth reported being a very nervous person, feeling calm and peaceful (reverse-coded), feeling downhearted and blue, and feeling “down in the dumps.” Cronbach’s alpha in this sample was .78.

Data analyses

Preliminary analyses calculated the sexual risk index score (described in an earlier section) at each age 15–25. Then the two-part primary analysis identified distinctive trajectory patterns for the level of sexual risk behavior (measured by the sexual risk index) and then compared subjects’ characteristics (e.g., demographics, substance use, delinquent behaviors) among subgroups with distinctive trajectory patterns. To prepare data for trajectory analyses, data were temporally arranged (or centered) by subject age. Thus, for trajectory analysis, age became the time variable, with no further re-centering. For the time point for age 15, all data for 15-year olds (from any NLSY wave) were included. Each subject contributed data at a specific age/time point if he/she was in the NLSY at that age (regardless of NLSY wave). As an example, a subject who was 12 years old at NLSY initiation could contribute data to the trajectories for ages 15 – 20 (corresponding to that subject’s NLSY waves 4 – 9) and would not contribute trajectory data for ages 21 – 25. A subject who began round 3 of the NLSY at age 17 would contribute data for trajectory ages 17–23 (but not ages 15 – 16). Analyses were based on all available data, with valid number of subjects with sexual risk data of: 1,760, 3,180, 4,765, 6,251, 7,402, 7,253, 6,961, 5,491, 3,983, 2,456, 1,135 for ages 15 through 25, respectively. The distribution of numbers of subjects primarily reflects the available subject ages, since not all ages were available at each NLSY wave.

The group-based trajectory model (Jones, Nagin & Roeder, 2001; Nagin, 1999) was applied to identify and estimate distinctive sexual risk trajectories among subjects. The analysis approach was adopted because if multiple different types of patterns exist across the subjects, the normality assumption for the random effects in the conventional growth model may not be applicable. The group-based trajectory approach is more flexible, approximating an unspecified continuous distribution of unobserved heterogeneity with a linear combination of discrete distributions. That is, different groups, each with its own growth trajectory, are used to capture the overall variation. Results thus allow subjects to be partitioned into latent classes determined by differences in their trajectory patterns. The sexual risk index score described in an earlier section, indicating general level of sexual risk, was used as the dependent variable (with age as the time variable).

Other details of modeling include the following. A censored normal distribution was assumed for analysis. Intercept, slope and quadratic parameters were included in the model. Trajectories were developed using SAS PROC TRAJ procedure (Jones et al., 2001). Estimation procedures allowed missing data, assuming missing at random (MAR) similar to assumptions for random effects growth modeling. A primary cause of missing data was the sample itself and its age availability across all NLSY waves, unlikely to violate the MAR assumptions; that is, the full sample could not contribute data at all ages 15–25 since many subjects were outside this age range in one or more NLSY waves. Time-varying covariates were not included since data were already in age order; and we wanted to identify extant patterns without a priori adjustment for other characteristics. Goodness of model fit was evaluated by Bayesian Information Criterion (BIC), with a higher BIC indicating a better model. Males and females were analyzed separately. The optimal models for males and for females were selected on the basis of a

reasonably high BIC value, coupled with substantive considerations of interpretability and implications of distinguishable trajectories.

The second part of analyses examined differences among the identified trajectory groups in terms of characteristics prior to or early in the trajectories and from late in the trajectories. Comparisons were made on subjects' characteristics from their round 1 interviews and their status on selected variables from the interviews at round 8 (mental health status) or round 9. Major explanatory variables included substance use, education, employment and mental health status. Differences among the groups were tested using chi-square for categorical variables and general linear models (SAS Proc GLM) for continuous variables.

Results

Sample characteristics at round 1

Of the 8,208 youth in the present analyses, 50.8% were male, with a mean age of 14.3 years ($SD = 1.5$; range = 12–18) at round 1. The racial composition of the analysis sample was 58.9% White, 26.8% African American, 1.8% Asian American, 0.7% American Indian, and 11.8% other race. About one-fifth (21.2%) reported their ethnicity as Hispanic; 19.4% of the youths' parents reported speaking a language other than English in their home; and 18.1% lived in a rural geographic location.

Sample characteristics at round 9

On average, the youth were 22.9 years old ($SD = 1.4$; range = 20–26) at round 9. They had completed an average of 12.9 years of education ($SD = 2.4$), and 16.5% were married, 2.2% were divorced or separated, and 81.3% had never married. Regarding employment, 11.8% of the youth reported not working any hours in 2005. No gender differences were observed regarding hours worked in 2005, however, racial differences were observed; 16.8% of African Americans were unemployed in 2005 compared to 9.0% of White and 11.3% of Hispanic youth ($p < .001$)

Sexual risk trajectories

For each gender subgroup, analyses identified four trajectory classes (see Table 1 and Figure 1), with similar patterns for both males and females. For males, one group (38.9% of sample) displayed a high level of sexual risk throughout, higher than other sex risk pattern groups all along the age range. Because of this predominant high risk level, for convenience we label this group "high." While remaining consistently higher than other groups, the pattern shows some increase in levels of sexual risk until about age 21 and then a slight decline. The rate of increase in the mid-to-late teens for this group was stronger than for any other group during this age period. A second group (11.9%) had similarly high risk levels at age 15 to that of the high group, with slight increases until about age 18; but then the pattern changed to one of substantial and continuing decline to near zero by age 25. Based on the long period of decreasing risk level, for convenience we label this group "decreased." A third group (34.1%) showed low risk levels at age 15, with a later-onset substantial and continuing increase from age 17 to 23 followed by a decline; for simplicity this group was labeled "increased." The fourth group (15.1%) maintained very low risk levels throughout the age range, exhibiting increases (delayed in comparison to other groups) beginning in their early 20's (labeled "low"). Estimated parameters for each of the male trajectory groups showed significant ($p < .01$) linear and quadratic terms (see the Technical Appendix). The fit indices for the 4-class model ($BIC = -34,394$) showed improvement over that of a 3-class model ($BIC = -34,738$), and convergence could not be achieved for a 5-class model. Trajectory class discrimination was high with assignment probabilities averaging from 0.76 to 0.91 for all trajectory classes (and less than 0.14 for non-assigned classes).

Similar trajectory pattern groups were found for females (see Figure 2), with high (42.4%), decreased (6.1%), increased (35.9%), and low (15.5%) risk pattern groups. The fit indices for the 4-class model ($BIC = -34,021$) showed improvement over that of a 3-class model ($BIC = -34,300$), and convergence could not be achieved for a 5-class model. Trajectory class discrimination was high with assignment probabilities averaging from 0.80 to 0.93 for all trajectory classes (and less than 0.1 for non-assigned classes).

While observed pattern groups appeared quite similar for males and females, there was a slightly larger observed percentage of females in the high trajectory group (42.4% vs. 38.9% of males). The observed pattern for the increased group of females had slightly stronger and earlier increases than for males such that their pattern crossed that of the decreased group slightly earlier (at about age 19) than for males (age 20). And the late increases for the low group of females were somewhat stronger at ages 21–23 than for males. Additional analyses examined selected specific sexual behavior components of the sexual risk index and found that an approximately equal proportion of males (1.85%) and females (1.83%) were in the high risk group at round 3. Among youth who reported having multiple sexual partners at round 3, males reported having a significantly higher mean number of partners (6.0, $SD=9.0$) than females (3.7, $SD=5.3$). Analysis of the sex risk index by race/ethnicity at round 3 indicates fewer African Americans abstained from sexual activity (46.9% vs. 60.4% of White and 58.5% for Hispanic youth); 32.1% of African Americans reported always using a condom, as did 17.8% of White and 17.6% of Hispanic youth ($p < .001$). Analysis of the sex risk index by age at round 3 shows the abstinent group has the lowest mean age (16.4, $SD = 1.4$), whereas the group reporting only one sexual partner and no or inconsistent condom use had the highest mean age (17.8, $SD = 1.2$); youth with multiple partners who did not consistently use condoms had a mean age of 17.6 ($SD = 1.3$).

Trajectory group differences in subject characteristics

Males and females were similar in showing significant differences on several background characteristics and risk-related behaviors (see Table 1). In terms of ethnicity, Blacks were overrepresented in the decreased trajectory group (males: 42.5% in the decreased group vs. 16.6%–27.2% in other trajectory groups; females: 52.0% vs. 22.8%–27.5% in the other groups). Whites were substantially underrepresented in the decreased group (males: 33.2% vs. 48.3%–55.5% in other groups; females: 30.2% vs. 47.0%–53.3%). The low group had the greatest percentage of language other than English spoken at home (males: 23.7% vs. 18.1%–19.7% for other pattern groups; females, 24.1% vs. 17.1%–19.9%) and the highest level of mother's education (males: average grade 13.2 vs. 12.0–12.8 for other pattern groups; no significant differences were observed for females). The high risk level group had the highest percentage of subjects living in non-metropolitan areas (males: 20.6% vs. 16.6%–17.1% for other groups; females: 19.9% vs. 14.3%–18.4%). The low risk pattern group reported the highest number of days per week of religious activities (males: 2.0 vs. 1.4–1.6 for other pattern groups; females: 2.2 vs. 1.4–1.8).

Significant differences were observed between pattern groups for both males and females for youth perception of mother's support and for their perception of the proportion of their peers who had initiated sex. A larger percentage of the low risk group perceived their mothers as very supportive, with substantially lower percentages for the high risk group (males: 86.3% [low group] vs. 75.6% [high group]; females: 80.4% [low group] vs. 71.0% [high group]).

In terms of risk-related behaviors, the low risk pattern groups reported the oldest ages for starting dating as well as for initiating sexual activity, and the increased pattern group also had relatively high ages of initiating sex (males: dating 14.9 vs. 13.0–13.9, sex 17.0 [low group] and 16.5 [increased group] vs. 14.2–14.6; females: dating 15.5 vs. 14.1–14.8, sex 18.7 [low group] and 16.9 [increased group] vs. 15.2). Notice that ages both for dating and sex initiation

were somewhat lower among males than females. The low risk groups were more likely to perceive their peers as reporting no sexual activity, while the high risk group had substantially lower number of peers reporting no sexual activity (males: 40% [low group] vs. 14.4% [high group]; females: 30.4% [low group] vs. 8.4% [high group]). The high and decreased risk pattern groups reported the highest levels of delinquent behaviors by age 16 (males: 58.4% [high group] and 57.4% [decreased group] vs. 21.0%–31.7% for other groups; females: 43.5% [high] and 40.7% [decreased] vs. 9.9%–19.5%).

When considering round 8 mental health status and round 9 sociodemographic variables (see Table 2), we again observed several differences among the pattern groups. Both males and females in the high and increased pattern groups were more likely to be married than those in the decreased or low risk groups (males: 17.4% [high group] and 14.3% [increased group] vs. 3.0% – 3.9% in other groups; females: 26.5% [high group] and 21.0% [increased group] vs. 3.6% – 8.8%). While reported pregnancy (or getting someone pregnant) was low in the sample, the high pattern group showed the highest number of pregnancies (males: 0.9 vs. 0.1–0.6 for other groups; females: 1.7 vs. 0.3–1.1). The low pattern group reported the highest education levels (males: average grade 13.7 vs. 11.6–13.2; females: 14.4 vs. 12.1–13.6). For males (but not for females) there were also significant differences among pattern groups in terms of employment status and military service: the lowest percentages of those employed were observed for the decreased group (77.7% vs. 88.2%–90.6% in other pattern groups); the lowest percentage of those having joined the military was for the low pattern group (3.5% vs. 7.2%–9.2% for other groups). No significant differences among pattern groups were observed either for males or females in mental health or ever having repeated a grade, but for females, the high risk pattern group had slightly lower scores on the mental health scale than the other pattern groups (14.9 vs. 15.3 – 15.5).

Patterns of alcohol use were also examined among the sex risk pattern groups (see Figures 3–6). Among both males and females, the high sex risk group also exhibited the highest levels of alcohol use, and the low sex risk group exhibited the lowest levels of alcohol use. The decreased and increased sex risk groups showed alcohol use patterns mid-way between those of the high and low sex risk group. The relative ordering of alcohol patterns was similar for both males and females, but with considerably higher levels overall among males than females. Patterns for marijuana and other substance use were also examined and, while at lower levels than for alcohol, found to be similar to alcohol patterns in relative ordering among sex risk groups (thus are not reported in detail).

Discussion

The present study identified patterns of sexual risk behaviors among male and female youth, and examined factors associated with various sex risk patterns. The NLSY97 dataset allowed for numerous background and demographic variables, and variables measuring youth behaviors and perceptions, to be examined in relation to patterns of sexual risk from mid-adolescence (age 15) through young adulthood (age 25). Results indicate that a large subgroup of youth (39% of males and 42% of females) have established a relatively early pattern of sexual-risk behaviors that extends into adulthood, placing them at increased risk for HIV and other sexually transmitted diseases as well as unintended pregnancies and other health risks.

Sexual Risk Trajectories

Among youth who were a mean age of 14.3 at the beginning of the study and 22.9 at the end of the study, four distinct sexual risk trajectories were identified for both males and females: high; decreased; increased; and low. There were a number of demographic differences that distinguished the four subgroup trajectories. While the overall trajectory patterns for the high-risk sex score looked similar for males and females, among females who had multiple partners

the number of partners they had was fewer than the number of partners males with multiple partners had. More African Americans were found among the decreasing trajectory group amongst both males and females. And among the lowest risk trajectory groups, a higher number of youth came from families with parents who may have been less acculturated, as it was more likely that a language other than English was spoken in those homes. Previous research has shown that among Hispanic adolescent females who are high-risk (parenting) and low-risk (non-parenting), high-risk subjects had higher levels of acculturation than low-risk subjects (Sandoval, 1997). Upchurch, Aneshensel, Mudgal, & McNeely (2001) investigated sociocultural contexts of time to first sex among Hispanic adolescents and found that family acculturation, as measured by generational nativity status, did not independently contribute to Hispanic teen's risk of sex but operated through the language of the interview. Our study findings suggest it is plausible, though uncertain, that lower levels of acculturation are related to lower levels of sexual risk behavior.

Contrary to previous literature, the high-risk level group had a higher percentage of subjects in non-metropolitan areas. While early studies centered on urban populations due to the higher prevalence rates of AIDS there, some research in this area has been mixed. For example, one study found no differences in factors favoring rate of infection and level of spread of HIV/AIDS among urban and rural communities (Williams, Ekundayo, Udezulu, & Omishakin, 2003). However, rural areas may be slower to adopt HIV risk-reduction approaches (Oser et al., 2006), thus resulting in rural residents not being protected from engaging in HIV risk behaviors. One study of adolescents found that even though rural adolescents' HIV knowledge about risk-reduction strategies was high, they also reported higher rates of sexual risk behaviors (DiClemente, Brown, Beausoleil, & Lodico, 1993). The authors suggested that the slower adoption rate of safe-sex approaches may be due to rural adolescents not perceiving the personal salience of practicing HIV risk-reduction behavior.

Consistent with previous literature, the low risk pattern group was among the groups with most frequent religious activities. Religiosity has been found to predict past condom use (Villarruel, Jemmott, Jemmott, & Ronis, 2007), and to be associated with initiation sex at a later age (McCree, Wingood, DiClemente, Davies, & Harrington, 2003). In a nationally representative sample of adolescent girls, frequent attendance of religious events was positively associated with a responsible and planned use of birth control and greater perception of risk of HIV (Miller & Gur, 2002). Thus, this study confirms findings from previous research.

Interestingly, rather than providing a protective factor for males, both being employed and being in the military resulted in a higher likelihood of being in the highest risk group. Being in the military and employment may provide more opportunities for male youth to meet potential partners and engage in high-risk behaviors. In addition, unsafe sexual practices in the military are rooted in localized socially constructed meanings of sex, risk and relationships (Whitehead & Carpenter, 1999), and military prevention programs may not be sufficient to change these behaviors (Nannis et al., 1998). Regarding employment, some studies are consistent with these findings. For example, employment has been associated with higher levels of unprotected sex among Puerto Rican women (Dixon, Antoni, Peters, & Saul, 2001). However, current study findings related to employment were not significant for women, and are contradictory to other study findings. Among older women, being employed has been found to be associated with safer sex (Sormanti & Shibusawa, 2007), and yet other studies have found no differences among participants who did and did not practice safer sex and employment (Paranjape et al., 2006) among women. The current findings indicate more African Americans were unemployed. Thus, employment findings may be very specific to the age of the population, gender, and particularly race/ethnicity, and much further in-depth study may be necessary to determine all of the potential effects of employment on safe-sex outcomes.

Alcohol Use

Consistent with previous research (e.g., Rashad & Kaestner, 2004; Rosenbaum & Kandel, 1990; Sen, 2002), the high sex risk group also exhibited the highest levels of alcohol use, and the low sex risk group exhibited the lowest levels of alcohol use. It should be mentioned that for both males and females, even among the low risk groups, alcohol use shows a developmental increase over time. This would be expected as adolescents transition to late adolescence and early adulthood, and move to college or out on their own. Among the females, all of the trajectory groups are at a higher level of drinking (in terms of drinks per day) at a mean age of 25 than they were at the beginning of the study, and for the males all of the trajectory groups except the decreasing group are at a noticeably higher level of drinking. Similarly, there is a developmental increase in binge drinking (days had 5 or more drinks per day) for both males and females in three of the four trajectory groups. Only the decreasing trajectory groups wind up at a lower binge drinking level at age 25 than the level at which they began at age 15.

Study Limitations

The risk indicator used for trajectory analysis was ordinal in nature and analyzed as a censored normal distribution. Future analyses should examine the consistency of patterns based on alternative definitions and measurement characteristics, as well as examine the patterns of specific contributing behaviors. While the analysis sample varied in size across the age continuum, the minimum sample size for any specific age was still quite large (1,135). Results may not be generalizable to the U.S. youth population, since the sample was not weighted to adjust for oversampling of Blacks and Hispanics; however, the sample as utilized provides a comprehensive perspective of youth with large enough Black and Hispanic subsamples for valid comparison of trajectory groups on ethnicity. Since age was used as the time variable in trajectory analysis with no further recentering, intercepts cannot be interpreted as sexual risk level at age 15; further analyses could focus on evaluating additional details of each latent trajectory identified.

Study Implications

The identification of distinguishable sexual risk trajectories may be a step in a more comprehensive understanding of adolescent risk behavior over time. These results have shown that subgroups of adolescents do exhibit clearly decreasing patterns of sexual risk and of alcohol use, and further analysis should explore facilitating factors within this subgroup. Results also show subgroups who maintain high risk behavior. Factors associated with continuing high sexual risk are less easy to characterize and warrant further study of additional family and personal characteristics as potential inhibiting factors for change.

Data from this study, particularly data on the sexual risk trajectories, could be used in motivational interventions for adolescents to reduce HIV sexual risk behaviors. Risk scores similar to those used here could be calculated for adolescents in HIV-prevention programs. The current data could be utilized to show them how they compare to a national sample, and specifically how they compare to high, decreased, increased, and low risk groups. Moreover, the data presented here allows tailoring to specific ages from 15 through 25.

In sum, this longitudinal study contributes to the existing literature by providing a better understanding of the characteristics, behaviors and perceptions adolescents and young adults have experienced in relation to varying patterns of sexual risk. The large national sample of youth and multiple time points provided rich data on variables occurring prior to, or early in youth trajectories, lending insight into factors predictive of the subsequent patterns. The study also allowed for examination of characteristics occurring later in the trajectory, to better understand factors related to a preceding pattern of sexual risk. Prevention strategists should

be aware of specific ages at which adolescents with differing patterns of sexual risk are amenable to change in risk trajectories, and factors (e.g., substance use, perceptions of parental support) influencing those trajectories.

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Biographies

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Figure 1.
Estimated Score of Sexual Risk Behavior over Age for Males

Figure 2.
Estimated Score of Sexual Risk Behavior over Age for Females

Figure 3.
Averaged Days of Alcohol Drinks over Age for Males

Figure 4.
Averaged Days of Alcohol Drinks over Age for Females

Figure 5.
Averaged Days had Five or More Drinks per Day over Age for Males

Figure 6.
Averaged Days had Five or More Drinks per Day over Age for Females

Table 1
Background Characteristics and Youth Behaviors and Perceptions by Gender and Trajectory Groups

	Males				Females			
	High (N = 1623)	Decreased (N = 498)	Increased (N = 1420)	Low (N = 628)	High (N = 1712)	Decreased (N = 248)	Increased (N = 1451)	Low (N = 628)
Ethnicity (%)	$\chi^2_{(9)} = 175.2, p < .0001^{**}$				$\chi^2_{(9)} = 117.4, p < .0001^{**}$			
Black	27.2	42.5	21.7	16.6	22.8	52.0	27.5	24.8
Hispanic	22.8	21.5	18.8	21.1	21.1	15.7	21.9	22.0
White	48.3	33.2	55.5	54.9	53.3	30.2	47.3	47.0
Other	1.7	2.8	4.1	7.4	2.9	2.0	3.3	6.2
Language other than English spoken at home (%)	$\chi^2_{(3)} = 8.1, p = .04^*$				$\chi^2_{(3)} = 14.1, p = .003^{**}$			
Mother's highest grade completed (M, SD)	19.2	19.7	18.1	23.7	17.1	17.1	19.9	24.1
	$F_{(3,3716)} = 18.2, p < .0001^{**}$				$F_{(3,3607)} = 2.1, p = .09$			
Residence in metropolitan statistical area (MSA, %)	12.4 (2.8)	12.0 (2.8)	12.8 (3.1)	13.2 (2.9)	12.4 (2.8)	12.2 (2.3)	12.6 (3.0)	12.7 (3.5)
	$\chi^2_{(3)} = 8.8, p = .03^*$				$\chi^2_{(3)} = 10.6, p = .01^*$			
Not in MSA	20.6	16.6	17.1	16.7	19.9	18.4	17.2	14.3
In MSA	79.4	83.4	82.9	83.3	80.1	81.6	82.8	85.7
Days per week involved in religious activities (M, SD)	$F_{(3,2581)} = 7.9, p < .0001^{**}$				$F_{(3,2419)} = 15.1, p < .0001^{**}$			
	1.4 (1.9)	1.5 (2.0)	1.6 (2.0)	2.0 (2.3)	1.4 (1.9)	1.6 (1.9)	1.8 (2.0)	2.2 (2.3)
Youth report of mother's support (%)	$\chi^2_{(6)} = 50.5, p < .0001^{**}$				$\chi^2_{(6)} = 41.1, p < .0001^{**}$			
Very supportive	75.6	76.0	83.2	86.3	71.0	66.2	77.8	80.4
Somewhat supportive	22.7	21.7	15.9	12.4	25.8	30.8	20.0	16.4
Not very supportive	1.8	2.3	0.9	1.3	3.2	3.0	2.1	2.9
Proportion peers youth reported had sex (%)	$\chi^2_{(12)} = 139.8, p < .0001^{**}$				$\chi^2_{(12)} = 124.5, p < .0001^{**}$			
Almost none	14.4	15.3	25.4	40.3	8.4	7.7	14.6	30.4
25%	19.6	20.9	25.7	25.7	18.1	18.7	24.5	26.3
50%	30.5	27.6	26.6	25.3	30.3	33.0	31.0	23.9
75%	20.0	16.6	13.2	5.1	24.8	19.8	16.8	13.0
Almost all	15.4	19.6	9.1	3.6	18.4	20.9	13.1	6.5

	Males				Females			
	High (<i>N</i> = 1623)	Decreased (<i>N</i> = 498)	Increased (<i>N</i> = 1420)	Low (<i>N</i> = 628)	High (<i>N</i> = 1712)	Decreased (<i>N</i> = 248)	Increased (<i>N</i> = 1451)	Low (<i>N</i> = 628)
Age started dating (<i>M, SD</i>)	$F_{(3,4062)} = 131.0, p < .0001^{**}$ 13.2 (1.8)	13.0 (1.7)	13.9 (1.9)	14.9 (2.5)	$F_{(3,3966)} = 114.7, p < .0001^{**}$ 14.1 (1.6)	14.2 (1.9)	14.8 (1.7)	15.5 (2.2)
Age first had sex (<i>M, SD</i>)	$F_{(3,3642)} = 195.7, p < .0001^{**}$ 14.6 (2.3)	14.2 (2.6)	16.5 (2.7)	17.0 (3.9)	$F_{(3,3454)} = 306.9, p < .0001^{**}$ 15.2 (1.5)	15.2 (2.0)	16.9 (2.3)	18.7 (3.0)
Engaged in delinquent behaviors by age 16 (%) ^a	$X^2_{(3)} = 395.7, p < .0001^{**}$ 58.4	57.4	31.7	21.0	$X^2_{(3)} = 361.7, p < .0001^{**}$ 43.5	40.7	19.5	9.9
Age started dating (<i>M, SD</i>)	13.2^{**} (1.8)	13.0 (1.7)	13.9 (1.9)	14.9 (2.5)	14.1^{**} (1.6)	14.2 (1.9)	14.8 (1.7)	15.5 (2.2)
Age first had sex (<i>M, SD</i>)	14.6^{**} (2.3)	14.2 (2.6)	16.5 (2.7)	17.0 (3.9)	15.2^{**} (1.5)	15.2 (2.0)	16.9 (2.3)	18.7 (3.0)
Engaged in delinquent behaviors by age 16 (%) ^a	58.4^{**}	57.4	31.7	21.0	43.5^{**}	40.7	19.5	9.9

*
 $p < .05$.

**
 $p < .01$.

^a Delinquent behaviors included selling drugs, gang involvement, carrying a hand gun, running away, or having been arrested.

Table 2
Round 9 Sociodemographic variables and Round 8 Mental Health Status by Gender and Trajectory Groups

	Males				Females			
	High (<i>N</i> = 1623)	Decreased (<i>N</i> = 498)	Increased (<i>N</i> = 1420)	Low (<i>N</i> = 628)	High (<i>N</i> = 1712)	Decreased (<i>N</i> = 248)	Increased (<i>N</i> = 1451)	Low (<i>N</i> = 628)
Employed (%)	$X^2_{(3)} = 55.7, p < .0001^{**}$ 90.6	77.7	89.9	88.2	$X^2_{(3)} = 3.7, p = .29$ 87.2	86.0	88.9	89.5
Marital status (%)	$X^2_{(6)} = 120.6, p < .0001^{**}$				$X^2_{(6)} = 155.0, p < .0001^{**}$			
Never married	80.1	95.6	84.3	95.9	69.0	93.3	77.5	90.3
Married	17.4	3.0	14.3	3.9	26.5	3.6	21.0	8.8
Separated/divorced	2.5	1.4	1.4	0.2	4.5	3.1	1.5	1.0
Mental health scale (<i>M</i> , <i>SD</i>)	$F_{(3,3370)} = 2.3, p = .07$				$F_{(3,3478)} = 9.9, p < .0001^{**}$			
	15.8 (2.5)	15.9 (2.4)	16.0 (2.3)	15.9 (2.3)	14.9 (2.5)	15.3 (2.8)	15.3 (2.4)	15.5 (2.4)
Joined military (%) ^a	$X^2_{(3)} = 20.1, p = .002^{**}$ 9.2	7.2	9.0	3.8	$X^2_{(3)} = 7.7, p = .052$ 2.9	1.2	2.3	1.1
Ever repeated a grade (%)	$X^2_{(3)} = 82.9, p < .0001^{**}$ 25.7	42.6	19.0	17.1	$X^2_{(3)} = 23.7, p < .0001^{**}$ 15.7	28.4	14.8	12.3
Highest grade completed (<i>M</i> , <i>SD</i>)	$F_{(3,3437)} = 107.4, p < .0001^{**}$				$F_{(3,3457)} = 107.5, p < .0001^{**}$			
	12.3 (2.3)	11.6 (2.1)	13.2 (2.2)	13.7 (2.3)	12.6 (2.4)	12.1 (2.6)	13.6 (2.2)	14.4 (2.0)
Number of times pregnant/got someone pregnant (<i>M</i> , <i>SD</i>)	$F_{(3,4036)} = 146.1, p < .0001^{**}$ 0.9 (1.2)	0.6 (1.0)	0.4 (0.7)	0.1 (0.4)	$F_{(3,3669)} = 157.4, p < .0001^{**}$ 1.7 (1.6)	1.1 (1.4)	0.8 (1.2)	0.3 (0.6)

* $p < .05$.

** $p < .01$

^a Military service included Army, Navy, Air Force, Marine Corps, Coast Guard, Reserves, or National Guard.

Technical Appendix

Group-based trajectory group model for Males and Females

Trajectory Group	Males	Females
Estimate (SE)		
High		
Intercept	-17.87 (1.26) **	-16.51 (0.88) **
Linear	1.87 (0.12) **	1.77 (0.09) **
Quadratic	-0.04 (0.002) **	-0.04 (0.002) **
Decrease		
Intercept	-26.34 (3.84) **	-19.78 (4.37) **
Linear	2.99 (0.39) **	2.30 (0.45) **
Quadratic	-0.08 (0.01) **	-0.06 (0.01) **
Increase		
Intercept	-39.47 (1.94) **	-42.03 (1.55) **
Linear	3.54 (0.18) **	3.89 (0.14) **
Quadratic	-0.07 (0.004) **	-0.09 (0.003) **
Low		
Intercept	5.14 (3.45)	-59.00 (11.61) **
Linear	-1.00 (0.33) **	4.74 (1.03) **
Quadratic	0.03 (0.008) **	-0.09 (0.02) **
Sigma	1.28 (0.009) **	1.17 (0.007) **
Group membership		
Observed (Estimated)		
High	38.9% (38.0 %)	42.4% (41.4 %)
Decrease	12.0% (13.9 %)	6.1% (7.1 %)
Increase	34.0% (32.8 %)	35.9% (36.1 %)
Low	15.1% (15.3 %)	15.6% (15.4 %)
BIC	-34394.25	-34020.49

**
p < .01