"Islands of Risk": Subgroups of Adolescents at Risk for HIV

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Objective   To use cluster analysis to determine profiles of adolescents at risk for HIV.   **Methods**   Adolescents 15–21 years old ($N = 1153$) with a history of unprotected sex were assessed in five domains of risk (unprotected sex, alcohol/marijuana use, other drug use, mental health crises, and arrest/school dropout) as well as demographic, contextual, and behavioral variables.   **Results**   Cluster analysis revealed separate three-cluster solutions for males and females. Among males, clusters were characterized by (a) mental health crises and unprotected sex, (b) alcohol/marijuana use and unprotected sex, and (c) lower risk. Among females, clusters were distinguished by (a) unprotected sex, (b) substance use and mental health crises, and (c) lower risk. Cluster membership was associated with secondary variables related to sexual risk.   **Conclusions**   Even within populations of high-risk adolescents, subgroups exist for which specific risk factors co-occur, particularly unprotected sex, mental health crises, and substance use. These patterns suggest that effective HIV prevention interventions may need to target the association between mental health and/or substance abuse with sexual risk for some adolescents.

Key words   adolescents; HIV; sexual risk.

Unprotected sex places adolescents at great risk for contracting sexually transmitted infections (STIs). In fact, approximately 50% of new HIV infections and two thirds of new STIs each year are diagnosed among those 25 years or younger, and three million adolescents are infected yearly with STIs [Centers for Disease Control and Prevention (CDC), 2001]. Determining factors associated with unprotected sexual intercourse among adolescents is therefore critical to the development of appropriate and successful primary HIV/STI prevention interventions.

Sexual risk behavior has been associated with diverse behaviors, such as alcohol and/or drug use, school problems, delinquency, and suicidality (Abram, Teplin, McClelland, & Dulcan, 2003; Ary et al., 1999;

Bachanas et al., 2002; Burge, Felts, Chenier, & Parrillo, 1995; Zweig, Lindberg, & McGinley, 2001), although precise patterns or clusters of these behaviors have not been consistently identified among sexually risky youth. For instance, rates of adolescent unsafe sex (as measured by a lack of condom use and number of partners) increase substantially with the use of alcohol and other drugs (Tapert, Aarons, Sedlar, & Brown, 2001), particularly with use just before sex (Cooper, Peirce, & Huselid, 1994). Moreover, delinquent youth in substance use treatment are more likely than a community sample to have unprotected sex with multiple partners (Bryan & Stallings, 2002), suggesting that adolescent sexual risk increases when substance use and delinquency co-occur.

Mental health difficulties also commonly co-occur with multiple high-risk adolescent and young adult behaviors (Capaldi, Stoolmiller, Clark, & Owen, 2002; Tubman, Gil, Wagner, & Artigues, 2003). Capaldi et al. (2002) found that drug use, deviancy (e.g., disobediency, fighting, and theft), and sexual risk behavior (including frequency of intercourse, number of partners, and lack of condom use) were strongly associated with mental health issues in community adolescents. Indeed, adolescents and young adults with psychiatric disorders are at greater risk for HIV, substance use and delinquency (Baker & Mossman, 1991; Brown, Danovsky, Lourie, DiClemente, & Ponton, 1997), but to our knowledge only one prior study (Tubman et al., 2003) has examined the link between specific sexual risk patterns and psychiatric disorders, which demonstrated that psychiatric difficulties are associated with unprotected sex, multiple sex partners, and substance use at the time of sex.

In addition to behavioral and mental health risk factors, various demographic factors including gender, race, education, socioeconomic, and/or employment status, and sexual orientation have been associated with adolescent HIV risk. Some studies suggest that African American youth have distinct sexual risk profiles; they have higher prevalence rates of sexual activity than White adolescents, but are also much less likely to use substances before or during sex than White youth (Tubman et al., 2003). Low income, urban African American youth, particularly females, are disproportionately infected with STIs (CDC, 2002), and adolescent males of color who have sex with men are disproportionately infected with HIV (CDC, 2000). Thus, the extent to which adolescents of varying race, income, and sexual orientation engage in health-compromising behaviors such as substance use and sexual risk taking is gradually becoming more understood.

Risk profiles also differ according to gender (Krantz, Lynch, & Russell, 2002; Zweig et al., 2001). For instance, adolescent males have an earlier sexual debut, have a greater number of sexual partners, and are more likely to use substances before sex than females (CDC, 2004). Data from the National Longitudinal Study of Adolescent Health suggest that for both male and females, high-risk sexual activity co-occurs with multiple other risk behaviors, including increased fighting and substance use (especially marijuana and cigarette use); among females only, however, a high-risk sexual activity profile also includes increased suicidality (Zweig et al., 2001). Recent findings therefore suggest that profiles of adolescent sexual risk should be examined by gender.

Many previous risk studies have defined "sexual risk" as any sexual activity, including early sexual debut (e.g., Smith, 1997). Sexual debut is a useful and important proxy for HIV/STI risk, but studies that examine adolescent sexual activity without assessing frequency of condom use are perhaps not capturing risk patterns among already sexually active, "higher-risk" youth. Thus, findings presented here are intended to further inform adolescent HIV/STI prevention intervention development by examining demographic and behavioral risk factors associated with HIV risk, specifically among sexually active adolescents.

It was hypothesized that the risk factors of substance use, arrest/school dropout, and mental health problems would cluster with frequent sexual risk activity. It was also hypothesized that there would be a distinct low risk profile of youth reporting relatively few risk factors/behaviors (e.g., substance use, mental health crises, and unprotected sex). Based on prior literature, it was expected that African American youth would be at increased risk for HIV and other STIs and therefore overrepresented in the cluster with higher sexual risk. Finally, it was hypothesized that HIV risk profiles would differ by gender, and as such, separate profiles for males and females were generated.

Methods
Study Sample and Design

Baseline data from a multisite, randomized trial of a brief HIV prevention program were collected from adolescents 15–21 years of age who were recruited from primary care clinics and through outreach activities (e.g., street outreach, posters, flyers, and referral from friends) in three US cities: Atlanta GA, Providence RI, and Miami FL (Brown et al., 2005; Crosby et al., in press). Adolescents and parents were approached separately, and the study was briefly described. After verbal consent from parents and adolescents, adolescents were administered a questionnaire focusing on study inclusion and exclusion criteria. The inclusion criterion was unprotected sexual activity (vaginal or anal intercourse) within the past 90 days. Adolescents who were knowingly HIV positive, currently pregnant, attempting to become pregnant, or who had delivered a baby within the past 90 days were excluded from the study.

The University or Hospital Institutional Review Boards, at the respective institutions, approved all study protocols. Written informed consent was obtained from adolescents 18 years of age or older. Written assent and parental consent were obtained for adolescents 15–17

years of age. Eligible adolescents ($n = 1867$) were invited to participate in the study. A total of 1412 adolescents enrolled and completed baseline assessments, yielding a participation rate of 76%. Despite the inclusion criterion of having had unprotected vaginal or anal sex in the past 90 days at the time of screening, 18% of the 1412 enrolled subjects indicated that they had not had sex in the past 90 days by the time of the baseline assessment. Of the remaining 1153 adolescents, males comprised 44.6% of the sample and females comprised 55.4%.

The baseline interview was administered by audio computer-assisted self-interview (ACASI). The assessment was largely derived from measures used in Project LIGHT, a NIMH/NIH-funded multisite prevention trial for young adults at high risk for HIV. These measures demonstrated good internal reliability and sensitivity to intervention impact over time in this project (NIMH Multisite HIV Prevention Trial Group, 1999). Urine assays were collected for research purposes to test for three STIs: chlamydia, gonorrhea, and trichomoniasis. Adolescents were compensated $50 for their participation in this assessment.

Measures

Factor Variables

Five factors were used to determine descriptive profiles of risk behaviors. The number of self-reported intercourse acts (vaginal and anal) and total number of times participants reported using condoms during those intercourse acts (asked for each partner) in the past 90 days were used to calculate a total number of self-reported unprotected sex acts. Alcohol and marijuana use was determined by asking how many days of the past 30 days participants drank alcohol and how many days of the past 30 they used any form of marijuana. These were added, thus scores ranged from 0 to 60. To determine other drug use, adolescents were asked four questions (0, no; 1, yes) related to lifetime use of (a) heroin or other narcotics, (b) cocaine or other stimulants, (c) inhalants, and (d) needles to inject drugs. A summed score, with a range of 0–4, was derived, with higher scores indicating greater drug use (Cronbach's α = .71). Two yes/no items assessed whether adolescents had experienced mental health crises: "Have you ever been hospitalized for emotional or psychological problems or problems with your nerves?" and "Have you ever attempted suicide, that is, tried to kill yourself?" A summed score, with a range of 0–2, was derived, with higher scores indicating more mental health crises. Two yes/no questions were asked regarding participants' histories of arrest/school dropout: "Have you ever been in juvenile detention, arrested, or charged with or convicted of a crime other than a minor traffic violation?" and "Have you dropped out of school?" A summed score, with a range of 0–2, was derived.

Secondary Variables

Demographic information gathered included gender, age, race, ethnicity, sexual orientation, employment status, education, and income. Information regarding the participants' social contexts was also gathered. Particular variables of interest were whether they were raising any children in their home (yes/no) and whether they were living with their partner (yes/no).

Sexual behavior items included whether the participant had tested positive for one of the three STIs (chlamydia, gonorrhea, and trichomoniasis) at baseline as well as their reports of the number of partners reported in the past 90 days, age at sexual debut, and whether they had ever gotten someone pregnant or been pregnant. A derived scale assessed adolescents' perceptions of their partners' risk status (Partner Risk scale; e.g., "In the past 90 days, did you have vaginal or anal sex with someone you knew or suspected had HIV or AIDS"), with higher scores indicating higher perceived partner risk (range 0–7; Cronbach's α = .41). Participants' frequency of negotiating condom use with partners (Condom Use Communication and Negotiation Checklist; e.g., "In the past 90 days, did you ever tell any partner you wanted to use a condom?") was also assessed, with higher scores indicating more acts of communication with partners (range 0–6).

Data Analysis

A cluster analysis approach that grouped participants on the basis of similarity for five component factors (i.e., unprotected sex acts, alcohol/marijuana use, other drug use, mental health crises, and arrest/school dropout) was employed, using z scores to represent the factors. Descriptive profiles were constructed via K-means cluster analysis, an iterative partitioning method. This analysis was selected to create profiles within the sample (for males and females separately) because "the properties of this technique include non-overlapping clusters, distance rather than correlational measure, preservation of unequal cluster sizes, and maximization of within-cluster homogeneity"(Tubman et al., 2003; p. 481). Using a heuristic procedure, a three-cluster solution was chosen after examining two-, four-, and five-cluster solutions for between-cluster distinctions on component variables, cluster size, and the magnitudes of related F tests (Aldenderfer & Blashfield, 1984). These analyses were conducted using the QUICK CLUSTER procedure in

SPSS for Windows 10.0 (SPSS Inc., 1999). The cluster solution was further examined using chi-square analyses or analyses of variance (ANOVAs) to understand significant differences in proportions or means of other variables (grouped by demographic, contextual, and behavioral categories) by cluster membership. Significant omnibus tests ($p < .05$) were followed with appropriate pairwise post hoc analyses.

Results
Determining the Cluster Solution

Separate cluster solutions were derived for males and females using standardized K-means. Mean responses or percent endorsement for the nine variables comprising the five cluster-defining factors are presented in Tables I (males) and II (females) in unstandardized form for ease of interpretation. Within gender analyses, ANOVA and chi-square statistics were used to determine the presence

of significant between-cluster differences on the component variables. Significant differences existed on all component variables.

Clusters are described based on differences noted on the five defining factors. Ten percent ($n = 52$) of the male sample composed Cluster 1 (mental health crises/unprotected sex), which was defined by a history of a mental health crisis and the largest number of self-reported unprotected sex acts. In fact, 98% of males who reported a mental health crisis (psychiatric hospitalization or suicide attempt) were included in this single cluster. This group also reported moderate marijuana and alcohol use, and a significant proportion described other drug use and a history of arrest or school dropout. Cluster 2 (alcohol and marijuana use/unprotected sex) comprised the largest subgroup with 49% of the adolescent males ($n = 251$) and was defined primarily by significantly higher levels of alcohol consumption and marijuana use relative to the other clusters. They also

Table I. Descriptive Statistics for Factor Variables—Males

	Cluster 1	Cluster 2	Cluster 3	Total
	MH/US ($n = 52$)	AM/US ($n = 251$)	Lower risk ($n = 205$)	$N = 508$
	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)
US acts	26.92$_a$ (32.99)	18.92$_b$ (24.91)	7.05$_c$ (11.71)	14.95 (22.77)
AM—number of days—alcohol	8.00$_a$ (9.53)	10.29$_b$ (7.86)	1.74$_c$ (3.13)	6.61 (7.75)
AM—number of days—marijuana	12.75$_a$ (12.54)	17.40$_b$ (12.11)	2.96$_c$ (6.82)	11.09 (12.39)
OD—% ever used heroin	27%$_a$ (14)	16%$_a$ (40)	2%$_b$ (4)	11% (58)
OD—% ever used cocaine	35%$_a$ (18)	25%$_a$ (62)	2%$_b$ (5)	17% (85)
MH—psych hospital	44%$_a$ (23)	0%$_b$ (0)	0%$_b$ (0)	5% (23)
MH—suicide attempt	77%$_a$ (40)	0%$_b$ (0)	1%$_b$ (1)	8% (41)
ASD—arrest history	48%$_a$ (25)	63%$_a$ (158)	11%$_b$ (22)	40% (205)
ASD—school dropout	19%$_a$ (10)	22%$_a$ (56)	2%$_b$ (5)	14% (71)

AM, alcohol/marijuana use; ASD, arrest/school dropout; MH, mental health crises; OD, other drug use; US, unprotected sex.
Means in the same row that do not share subscripts differ at $p < .05$.

Table II. Descriptive Statistics for Factor Variables—Females

	Cluster 1	Cluster 2	Cluster 3	Total
	US ($n = 89$)	SU/MH ($n = 72$)	Lower risk ($n = 484$)	$N = 645$
	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)
US acts	64.22$_a$ (19.65)	13.40$_b$ (18.59)	7.99$_c$ (9.13)	16.35 (22.88)
AM—no. of days—alcohol	5.34$_a$ (7.09)	8.85$_b$ (8.08)	3.22$_c$ (5.12)	4.14 (6.09)
AM—no. of days—marijuana	9.83$_a$ (11.50)	12.77$_b$ (11.43)	3.99$_c$ (8.17)	5.79 (9.63)
OD—% ever used heroin	5%$_a$ (4)	65%$_b$ (47)	1%$_a$ (4)	9% (55)
OD—% ever used cocaine	15%$_a$ (13)	75%$_b$ (54)	2%$_a$ (11)	12% (78)
MH—psych hospital	9%$_a$ (8)	36%$_b$ (26)	4%$_a$ (18)	8% (52)
MH—suicide attempt	26%$_a$ (23)	54%$_b$ (39)	12%$_c$ (60)	19% (122)
ASD—arrest history	35%$_a$ (31)	54%$_a$ (39)	14%$_b$ (66)	21% (136)
ASD—school dropout	21%$_{a,b}$ (19)	28%$_a$ (20)	13%$_b$ (63)	16% (102)

AM, alcohol/marijuana use; ASD, arrest/school dropout; MH, mental health crises; OD, other drug use; SU, substance use; US, unprotected sex.
Means in the same row that do not share subscripts differ at $p < .05$.

reported many unprotected sex acts (significantly more than Cluster 3 but significantly fewer than Cluster 1). Although there were no reports of mental health crises in this group, a significant number reported problems with arrest or school dropout as well as other drug use. However, they were not significantly different from those in Cluster 1 on these variables. Cluster 3 (lower risk) represented 40% of the sample (n = 205) and was characterized by less frequent unprotected sex, little substance use, and few histories of arrest, school dropout, or mental health crisis.

For females, Cluster 1 (unprotected sex) was comprised of 14% of the sample (n = 89) who reported numerous unprotected sexual acts. This subgroup described moderate amounts of alcohol and marijuana use, whereas heroin and cocaine use were less common. Several of the females in this cluster had experienced psychiatric crises, though fewer than in Cluster 2, and they reported similar rates of arrest and school dropout to those in Cluster 2. Cluster 2 (substance use/mental health crises) included 11% of the sample (n = 72) and was distinguished by significantly higher levels of alcohol, marijuana, cocaine, and heroin use as well as more psychiatric crises relative to the other clusters. They reported moderate sex risk, falling in between the other two clusters. Cluster 3 (lower risk) represented the largest subgroup of females, 75% (n = 484), and was characterized by levels of risk across all behaviors that were lower than the average of the total sample of females.

Confirming Cluster Distinctions

To further assess cluster characteristics and the validity of the solution, ANOVA and chi-square statistics were conducted to examine differences between clusters on demographic, contextual, and behavioral variables. Significant omnibus tests ($p < .05$) were followed with appropriate pairwise post hoc analyses (Tables III and IV).

Significant differences on demographic characteristics were noted for males (Table III). Age was significantly related to cluster membership, $F(2, 492) = 21.95$, $p < .001$, with the mean age of the lower risk cluster (Cluster 3) being younger than the other two. Differences by race also emerged; most notably those in the lower risk cluster were also more likely to identify as Black/African American, $\chi^2(2, N = 508) = 37.13$, $p < .001$. Males in the alcohol and marijuana use/unprotected sex cluster (Cluster 2) were most likely to have graduated high school, $\chi^2(2, N = 508) = 7.68$, $p = .02$. Contextually, clusters differed on the frequency of living with their sexual partners, $\chi^2(2, N = 508) = 6.11$, $p = .047$, with males in the alcohol and marijuana use/ unprotected sex cluster (Cluster 2) more likely than those in the lower risk cluster (Cluster 3) to be living with a partner.

There were differences between the clusters of males on two of the six behavioral items. The male lower risk cluster (Cluster 3) had lower scores on the Partner Risk scale, $F(2, 500) = 7.52$, $p = .001$, and was also significantly less likely to have gotten a partner pregnant than members of the alcohol and marijuana use/unprotected sex cluster (Cluster 2), $\chi^2(2, N = 508) = 24.41$, $p < .001$. No significant differences by cluster were detected for the number of sexual partners in the last 90 days, age at sexual debut, frequency of negotiating condom use, or presence of a STI by urine screening.

Significant differences between clusters were found on demographic variables for females as well (Table IV). Race differences were identified; members of the lower risk cluster (Cluster 3) were more likely than those in other clusters to identify as Black/African American, $\chi^2(2, N = 644) = 87.52$, $p < .001$. Those in the substance use/mental health crises cluster (Cluster 2) were less likely to identify as heterosexual, $\chi^2(2, N = 644) = 73.75$, $p < .001$. Contextually, adolescent females in the unprotected sex cluster (Cluster 1) were more likely to be raising children at home than females in the substance use/ mental health crises cluster (Cluster 2), $\chi^2(2, N = 644) = 7.76$, $p = .02$. They also were more likely to be living with a partner than those in other clusters, $\chi^2(2, N = 645) = 38.16$, $p < .001$. It should be noted that females who lived with a partner tended to be older (18.72 years) than those who did not (18.18 years), $t(600) = -3.13$, $p = .002$.

The female clusters differed on all behavioral variables assessed except for presence of a STI. Females in the lower risk subgroup (Cluster 3) reported significantly fewer partners in the last 90 days, $F(2, 642) = 10.49$, $p < .001$, and a later sexual debut, $F(2, 640) = 5.97$, $p = .003$, than those in the other clusters. Members of the unprotected sex group (Cluster 1) described significantly less frequent negotiation of condom use than the lower risk group (Cluster 3), $F(2, 633) = 5.51$, $p = .004$ and were also more likely than females in the other clusters to have been pregnant, $\chi^2(2, N = 645) = 12.46$, $p = .002$. Finally, females in the substance use/ mental health crises cluster (Cluster 2) were significantly more likely than those in the other clusters to report having been with a partner with HIV/STI risks, $F(2, 633) = 18.51$, $p < .001$.

Table III. Descriptive Statistics for Secondary Variables—Males

	1-MH/US ($n = 52$)	2-AM/US ($n = 251$)	3-Lower risk ($n = 205$)	$N = 508$
	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)	M (SD) or % (n)
Demographic				
Age**	20.46ₐ (1.94)	20.90ₐ (1.59)	19.79_b (1.89)	20.41 (1.82)
Race[a]				
African American**	27%ₐ (14)	43% (109)	66%_b (136)	51% (259)
American Indian	17% (9)	12% (30)	9% (19)	11% (58)
Asian[b]	6% (3)	4% (9)	0% (0)	2% (12)
White**	52%ₐ (27)	36%ₐ (91)	14%_b (29)	29% (147)
Pacific Islander[b]	6% (3)	1% (2)	3% (6)	2% (11)
Other*	17% (9)	8% (21)	7% (14)	9% (44)
Latino	27% (14)	27% (68)	25% (52)	26% (134)
Sexual orientation				
Homosexual[b]	4% (2)	1% (2)	.5% (1)	1% (5)
Bisexual[b]	4% (2)	0% (0)	.5% (1)	1% (3)
Heterosexual	90% (47)	97% (243)	97% (196)	96% (486)
Undecided[b]	2% (1)	2% (5)	3% (5)	2% (11)
Employed	48% (25)	51% (129)	43% (89)	48% (243)
Education (HS grad)**	42%ₐ (22)	59%_b (147)	48%ₐ (98)	53% (267)
Income (<$20,000)*	52% (24)	39% (90)	50% (83)	45% (197)
Contextual				
Parenting	6% (3)	10% (26)	5% (10)	8% (39)
Living with partner**	15%_{a,b} (8)	19%ₐ (48)	11%_b (22)	15% (78)
Behavioral				
STI	12% (6)	10% (24)	8% (16)	9% (46)
Partners last 90 days	2.44 (2.45)	2.51 (2.01)	2.63 (4.21)	2.55 (3.12)
Age at sexual debut*	13.94 (2.46)	13.98 (2.23)	14.44 (2.08)	14.16 (2.20)
Gotten partner pregnant**	27%_{a,b} (14)	33%ₐ (83)	13%_b (27)	24% (124)
Partner risk scale**	1.15ₐ (.16)	1.11ₐ (.14)	1.08_b (.11)	1.10 (.14)
Condom use communication	2.02 (1.25)	2.24 (1.36)	2.25 (1.35)	2.23 (1.34)

AM/US, alcohol and marijuana use/unprotected sex; MH/US, mental health crises/unprotected sex; STI, sexually transmitted infection.

Means in the same row that do not share subscripts differ at $p < .05$.

[a]Participants were permitted to select all race categories that applied.

[b]Chi-square statistics not reported for categories containing cells with $n < 5$ (Agresti & Finlay, 1986).

*Omnibus test, $p < .10$. **Omnibus test, $p < .05$.

Discussion

This study identified meaningful clusters of adolescents based on risk characteristics among a community sample of sexually active teens. Risk behaviors were not evenly distributed among adolescents, suggesting that even within high-risk populations, there are significant subgroups of adolescents creating "islands of risk." Indeed, most of the sexual risk behavior was accounted for by less than 50% of the participants. There appear to be distinct groups whose high risk occurred in conjunction with a history of mental health crises and/or substance abuse. Consistent with previous findings (Brown et al., 1997), mental health problems and substance use, including alcohol, marijuana, and other drugs, were associated with HIV risk behavior. For example, among males, a cluster emerged defined by mental health crises and unprotected sex. To some extent, these results support Jessor and Jessor's (1977) conceptualization of "problem behavior" syndrome, the co-occurrence of "deviant behaviors" among adolescents. Significant rates of arrest and school dropout were present in both of the highest risk male groups, for example. On the other hand, these clusters suggest that not all adolescents engaging in problem behaviors do so at the same frequencies, thus the distinctions between clusters. For instance, a cluster emerged among females (Cluster 1, unprotected sex) that was characterized by a high number of unprotected sex acts but moderate levels of other risk behaviors relative to the sample.

Table IV. Descriptive Statistics for Secondary Variables—Females

	1-US (*n* = 89)	2-SU/MH (*n* = 72)	3-Lower risk (*n* = 484)	*N* = 645
	M (*SD*) or % (*n*)	*M* (*SD*) or % (*n*)	*M* (*SD*) or % (*n*)	*M* (*SD*) or % (*n*)
Demographic				
Age	20.58 (1.80)	20.44 (1.73)	20.31 (1.78)	20.36 (1.77)
Race[a]				
African American**	38%$_a$ (34)	11%$_a$ (8)	65%$_b$ (316)	56% (358)
American Indian	11% (10)	17% (12)	12% (60)	13% (82)
Asian[b]	1% (1)	3% (2)	2% (8)	2% (11)
White**	37%$_a$ (33)	72%$_b$ (52)	16%$_c$ (78)	25% (163)
Pacific Islander[b]	1% (1)	1% (1)	3% (12)	2% (14)
Other	10% (9)	10% (7)	9% (43)	9% (59)
Latino*	30% (27)	15% (11)	21% (101)	22% (139)
Sexual orientation				
Homosexual[b]	1% (1)	0% (0)	0% (0)	.2% (1)
Bisexual**	7%$_a$ (6)	39%$_b$ (28)	5%$_a$ (24)	9% (58)
Heterosexual**	87%$_a$ (77)	57%$_b$ (41)	93%$_a$ (446)	88% (564)
Undecided[b]	6% (5)	4% (3)	3% (12)	3% (20)
Employed	42% (37)	54% (39)	46% (220)	46% (296)
Education (HS grad)	52% (46)	43% (31)	48% (234)	48% (311)
Income (<$20,000)	64% (54)	56% (33)	60% (244)	60% (331)
Contextual				
Parenting**	33%$_a$ (29)	14%$_b$ (10)	23%$_{a,b}$ (113)	24% (152)
Living with partner**	43%$_a$ (38)	21%$_b$ (15)	15%$_b$ (71)	19% (124)
Behavioral				
STI	16% (14)	11% (8)	19% (91)	18% (113)
Partners last 90 days**	2.21$_a$ (3.56)	2.01$_a$ (1.36)	1.48$_b$ (.86)	1.64 (1.6)
Age at sexual debut**	14.42$_a$ (1.78)	14.51$_a$ (1.58)	15.02$_b$ (1.82)	14.88 (1.80)
Ever been pregnant**	57%$_a$ (51)	33%$_b$ (24)	39%$_b$ (188)	41% (263)
Partner risk scale**	1.07$_a$ (.11)	1.17$_b$ (.21)	1.07$_a$ (.12)	1.08 (.13)
Condom use communication**	1.70$_a$ (1.56)	1.94$_{a,b}$ (1.42)	2.22$_b$ (1.42)	2.12 (1.45)

Means in the same row that do not share subscripts differ at *p* < .05.

STI, sexually transmitted infection; SU/MH, substance use/mental health crises; US, unprotected sex.

[a]Participants were permitted to select all race categories that applied.

[b]Chi-square statistics not reported for categories containing cells with *n* < 5 (Agresti & Finlay, 1986).

*Omnibus test, *p* < .10. **Omnibus test, *p* < .05

Cluster features differed by gender, which was consistent with previous research demonstrating that males and females engage in different risk behaviors at different frequencies (CDC, 2004). For females, there appears to be a subset whose risk profile is primarily characterized by high-risk sexual behavior and another characterized by a history of mental health crises, substance use, and arrest or school dropout. Comparatively for males, a cluster defined by unprotected sex and marijuana/alcohol use emerged along with a separate one in which unprotected sex and mental health crises co-occurred. This may suggest that the influence of psychiatric problems, although certainly a risk factor for both males and females, may be more closely related to risky sexual decision making for males than females. It should be noted that the association of these clusters with secondary variables assessing sexual risk varied depending on

the measure of sexual risk (e.g., perceptions of partner HIV/STI risk vs. number of partners). For example, females in the substance use/mental health cluster (Cluster 2) exhibited greater degrees of sexual risk on some variables, whereas on others they were similar to the lower risk cluster (Cluster 3), emphasizing the need to examine multiple behaviors when assessing sexual risk.

In contrast to the hypothesis, African Americans did not represent the greatest proportion of the clusters characterized by sexual risk. In fact, both male and female lower risk clusters had greater proportions of African Americans than of other races. Although previous studies document that African American adolescents' sexual risk co-occurs with other risk factors (Bachanas et al., 2002; Smith, 1997), the lower risk clusters in this study that included large numbers of African

American adolescents suggest that there are subgroups of African Americans with fewer risk behaviors. These divergent findings may be attributable to different outcome measures (i.e., self-reported condom use vs. sexual debut) and/or different sampling strategies (i.e., this study may have recruited a disproportionate number of high-risk White and Latino youth). Additionally, culturally congruent HIV prevention efforts may have led more African American youth to avoid risk behaviors, although the investigators were unaware of any specific programs operating in the communities at the time of this study.

Although no hypotheses regarding secondary variables were generated, significant findings emerged. Sexual orientation distinguished clusters, with significantly more females in the substance use/mental health crises cluster (Cluster 2) reporting being bisexual. This cluster, characterized by high rates of substance use and mental health crises, may also reflect outcomes of stress secondary to "coming out" issues or rejection by family and peers, issues commonly experienced by lesbian, bisexual, or undecided adolescents (Hunter & Schaecher, 1987). A similar trend emerged within the mental health crises/unprotected sex cluster (Cluster 1) for males, with fewer heterosexual males in this cluster than the others. Further research is needed to understand how sexual identity might be associated with mental health issues and sex risk, as gay/bisexual/questioning youth comprised a small percentage of this sample.

A noteworthy contextual factor that differed between clusters was the impact of living with a sexual partner. For both genders, clusters defined by risky sexual behavior were more likely to be cohabiting with a partner. This was particularly true for the female unprotected sex cluster (Cluster 1), which exhibited twice as many unprotected sex acts as any other cluster, male or female. Over 40% of this group reported that they lived with their partner. For these adolescents, practicing safer sexual behavior may take a secondary role to establishing perceived trust or intimacy brought about by unprotected sex. Living with a partner may also raise the number of opportunities for unprotected sex by increasing the amount of time spent together. Understanding the contextual differences among adolescent relationships is crucial to understanding their risk behavior, and interventions should be tailored to the context in which audiences live. Programs may need to target couples or emphasize STI prevention as an element of a caring, trusting, and healthy relationship to reach youth who may not otherwise change their behavior and who may be living with partners for the first time in their lives.

Although it is reassuring that this study is consistent with other profiles of adolescent risk behavior (Jessor & Jessor, 1977; Tubman et al., 2003; Zweig et al., 2001), limitations should be noted. The cross sectional nature of these data do not allow for causal relationships between risk behaviors to be examined. Also, the self-report method used may have contributed to biases in the data, such as underreporting of arrest histories. In addition, sexual behavior was self-reported, and its exact relationship to actual behavior is unknown. However, previous research suggests that self-reports in this area are reliable (Romer et al., 1997). Nonetheless, perspectives on risk behavior from other informants (e.g., parents, teachers) may lead to different cluster solutions. Other clusters may also have emerged had a more comprehensive array of risk factors been included in the analysis, such as behaviors contributing to accidental injury, violence, or self-mutilation. In addition, the risk factors in this study were based on one or two variables, which may not fully represent targeted constructs. More comprehensive assessments of mental health issues or conduct problems would have allowed for more complete conclusions to be drawn but were not the focus of the sexual health intervention conducted. As a result, measures of these risk factors identified only those with severe difficulties and likely missed those with significant, but less extreme, problems. Finally, conclusions drawn from any single cluster analysis can be limited, as the nature of cluster analytic techniques dictates that the procedure will always yield some clusters. These analyses should be viewed as exploratory and used primarily for generating hypotheses for future studies. However, it is encouraging that the clusters obtained were interpretable and generally similar to those of other studies.

Implications

The clusters described here and the variables associated with cluster membership have several implications for interventions aimed at changing adolescents' sexual risk behaviors. Foremost, these analyses suggest that all "risky" adolescents are not the same and may require diverse intervention strategies to reduce risk behavior. For example, clinicians should be aware that adolescents with a history of mental health crises are likely to be at sexual risk and may benefit from prevention efforts. Second, the ways in which risk behaviors co-occur differ between males and females, thus separate interventions may be needed. A recent HIV prevention intervention study with African American females supported this notion, emphasizing culture and gender themes in their

program with successful outcomes (DiClemente et al., 2004).

Third, HIV prevention programs should address other risk behaviors, and the focus of interventions may differ based on the nature of risk co-occurrences. These data can help inform the development of programs that meet the unique needs of adolescents with distinct risk profiles who may not be as amenable to traditional interventions. For example, the finding of the existence of a cluster defined by mental health crises and unprotected sex in males and substance use and mental health crises among females suggests that curricula targeting the relationship between mental health issues and sexual risk behavior may be needed for some adolescents. Other work (e.g., Zweig et al., 2001) also documents that those with mental health issues are more likely to abuse substances, and these groups require an intervention addressing these comorbid issues as well as their sexual risk.

Within intervention programs, these relationships can be addressed in several ways. In the most basic form, programs may need to identify clinical referrals for adolescents. In addition, comprehensive interventions may provide greater impact by addressing the "bigger picture" of adolescents' lives. For example, adolescents can be encouraged to adhere to prescribed psychiatric medications. Moreover, specific mental health issues may dictate differences in clinical intervention efforts. Programs for adolescents with a history of psychiatric crises may require greater focus on identifying strategies that decrease emotional distress and enhance social support, whereas those targeting teens with arrest or truancy histories might focus on helping young adults identify more options for their futures or strategies for reducing impulsive behavior that may lead to arrest. Comprehensive interventions that convey an understanding of adolescents' situations, including acknowledging the complex reasons for engaging in risk, appear to be the next step in adolescent HIV prevention efforts.

Finally, it should not be overlooked that clusters labeled "lower risk" included large numbers of adolescents. This is similar to the findings of Tubman et al. (2003), who saw their largest cluster as having relatively fewer risk behaviors. Yet also like that study, these data found that this subgroup still engaged in behaviors that put them at significant risk for HIV and STIs. Unlike with other clusters that exhibited co-occurring risks (e.g., substance use, mental health crises), identifying factors contributing to sexual risk as targets for intervention among this subsample proves more difficult, but nonetheless critical, to public health initiatives.

Prevention efforts are most successful when they are compatible with their target audiences. Understanding those audiences and tailoring interventions to the subgroups within them may increase the effectiveness of health prevention work. In the field of HIV prevention, the challenge of addressing adolescents within the context of other risk behaviors and life circumstances provides an opportunity to increase the relevance of intervention approaches to reduce the transmission of HIV.

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References

Abram, K. M., Teplin, L. A., McClelland, G. M., &
Dulcan, M. K. (2003). Comorbid psychiatric
disorders in youth in juvenile detention. *Archives of
General Psychiatry, 60*, 1097–1108.

Agresti, A., & Finlay, B. (1986). *Statistical methods for
the social sciences* (2nd ed.). San Francisco, CA:
Collier Macmillan Publishers.

Aldenderfer, M. S., & Blashfield, R. K. (1984). *Cluster
analysis*. Beverly Hills, CA: Sage.

Ary, D. V., Duncan, T. E., Biglan, A., Metzler, C. W.,
Noell, J. W., & Smolkowski, K. (1999).
Development of adolescent problem behavior.
Journal of Abnormal Child Psychology, 27,
141–150.

Bachanas, P. J., Morris, M. K., Lewis-Gess, J. K.,
Sarett-Cuasay, E. J., Flores, A. L., Sirl, K. S., et al.
(2002). Psychological adjustment, substance abuse,
HIV knowledge, and risky sexual behavior in at-risk
minority females: Developmental differences during
adolescence. *Journal of Pediatric Psychology, 27*,
373–384.

Baker, D. G., & Mossman, D. (1991). Potential HIV
exposure in psychiatrically hospitalized adolescent
girls. *American Journal of Psychiatry, 148*, 528–530.

Brown, L. K., Danovsky, M. B., Lourie, K. J.,
DiClemente, R. J., & Ponton, L. E. (1997).
Adolescents with psychiatric disorders and the risk
of HIV. *Journal of the American Academy of Child and
Adolescent Psychiatry, 36*, 1609–1617.

Brown, L. K., DiClemente, R. J., Fernandez, I.,
Pugatch, D., Cohn, S., Crosby, R., et al. (2005).
Condom use by high-risk adolescents/young adults:
The influence of demographics, attitudes, and context.
Manuscript submitted for publication.

Bryan, A., & Stallings, M. C. (2002). A case control
study of adolescent risky sexual behavior and its
relationship to personality dimensions, conduct
disorder, and substance use. *Journal of Youth and
Adolescence, 31*, 387–396.

Burge, V., Felts, M., Chenier, T., & Parrillo, A. V.
(1995). Drug use, sexual activity, and suicidal
behavior in U.S. high school students. *Journal of
School Health, 65*, 222–227.

Capaldi, D. M., Stoolmiller, M., Clark, S., & Owen, L. D.
(2002). Heterosexual risk behaviors in at-risk
young men from early adolescence to young
adulthood: Prevalence, prediction, and association
with STD contraction. *Developmental Psychology,
38*, 394–406.

Centers for Disease Control and Prevention. (2000).
HIV/AIDS among racial/ethnic minority men who
have sex with men-United States, 1989–1998.
Morbidity and Mortality Weekly Report, 49, 4–11.

Centers for Disease Control and Prevention. (2001).
*Tracking the hidden epidemics: Trends in STDs in
the United States*. Atlanta, GA: Centers for Disease
Control and Prevention.

Centers for Disease Control and Prevention. (2002).
*Sexual behavior and HIV risk among African
American adolescents*. Atlanta, GA: Centers for
Disease Control and Prevention.

Centers for Disease Control and Prevention. (2004).
Youth risk behavior surveillance-United States,
2003. *Morbidity and Mortality Weekly Report, 53*,
1–96.

Cooper, M. L., Peirce, R. S., & Huselid, R. F. (1994).
Substance use and sexual risk taking among black
adolescents and white adolescents. *Health Psychology,
13*, 251–262.

Crosby, R., DiClemente, R. J., Wingood, G. M., Salazar,
L. F., Rose, E., Levine, D., Brown, L., Lescano, C.,
Pugatch, D., Flanigan, T., Feranndez, I., Schlenger, W.,
& Silver, B. (2005). Condom failure among adoles-
cents: Implications for STD prevention.
Journal of Adolescent Health, 36, 534–536.

DiClemente, R. J., Wingood, G. M., Harrington, K.,
Lang, D. L., Davies, S., Hook, E. W. I., et al. (2004).
Efficacy of an HIV prevention intervention for
African American adolescent girls. *Journal of the
American Medical Association, 292*, 171–179.

Hunter, J., & Schaecher, R. (1987). Stresses on lesbian
and gay adolescents in schools. *Social Work in
Education, 9*, 180–190.

Jessor, R., & Jessor, S. L. (1977). *Problem behavior and psychosocial development: A longitudinal study of youth*. New York: Academic Press.

Krantz, S. R., Lynch, D. A., & Russell, J. M. (2002). Gender-specific profiles of self-reported adolescent HIV risk behaviors. *Journal of the Association of Nurses in AIDS Care, 13*, 25–33.

NIMH Multisite HIV Prevention Trial Group. (1999). The NIMH multisite HIV prevention trial: Reducing HIV sexual risk behavior. *Science, 280*, 1889–1894.

Romer, D., Hornik, R. C., Stanton, B., Black, M., Li, X. M., Ricardo, I., et al. (1997). "Talking" computers: A reliable and private method to conduct interviews on sensitive topics with children. *Journal of Sex Research, 34*, 3–9.

Smith, C. A. (1997). Factors associated with early sexual activity among urban adolescents. *Social Work, 42*, 334–346.

SPSS Inc. (1999). *SPSS for windows, release 10.0*. Chicago: SPSS Inc.

Tapert, S. F., Aarons, G. A., Sedlar, G. R., & Brown, S. A. (2001). Adolescent substance use and sexual risk-taking behavior. *Journal of Adolescent Health, 28*, 181–189.

Tubman, J. G., Gil, A. G., Wagner, E. F., & Artigues, H. (2003). Patterns of sexual risk behaviors and psychiatric disorders in a community sample of young adults. *Journal of Behavioral Medicine, 26*, 473–500.

Zweig, J. M., Lindberg, L. D., & McGinley, K. A. (2001). Adolescent health risk profiles: The co-occurrence of health risks among females and males. *Journal of Youth and Adolescence, 30*, 707–728.