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Victimization, Substance Use, Depression, and Sexual Risk in Adolescent Males Who Have Sex with Males: A Syndemic Latent Profile Analysis

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Abstract

Adolescent males who have sex with males (AMSM) are at increased risk of HIV/STI acquisition compared to other adolescents, making sexual risk behaviors in this population a priority public health focus. AMSM experience more victimization (including sexual/partner violence), depression, and substance abuse than their heterosexual counterparts; these may form a syndemic associated with risky sexual behavior. We pooled data from the 2015 and 2017 Youth Risk Behavior Survey, restricted to male students who reported a previous male sexual partner (n = 448). Latent profile analysis was used to identify syndemic profiles, with log-binomial and cumulative complementary log–log models used to test associations with substance use at last intercourse, condomless sex at last intercourse, and the number of sexual partners. Nearly all measures of victimization, depression, and substance use had bivariate associations with greater substance use during sex and more sexual partners. We identified three profiles of AMSM: The profile (n = 55) with the greatest risk factors (evident of a syndemic) had substantially higher prevalence of substance use during sex (aPR = 4.74, 95% CI 3.02, 7.43) and more sexual partners (aPR = 2.45, 95% CI 1.39, 4.31) than the profile with the lowest risk factors (n = 326) after adjusting for confounders. This profile was not associated with condomless sex. We identified a syndemic characterized by victimization, depression, and substance use associated with risky sexual behaviors in a nationally representative sample of AMSM. Comprehensive sexual risk reduction interventions incorporating mental health and substance use are critically important in this population.

Keywords

Adolescents; MSM; Syndemic; Mental health; Sexual risk; Sexual orientation

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Compliance with Ethical Standards

Conflict of interest None of the named authors have any conflict of interest to report.

Introduction

Human immunodeficiency virus (HIV) and sexually transmitted infections (STIs) remain a substantial public health burden in the U.S., among adolescent males who have sex with males (AMSM) (CDC, 2017). In the U.S., youth (age 13 to 24) account for 22% of new HIV infections, and approximately 60% of youth with HIV are unaware they are HIV+ (CDC, 2017). MSM accounted for 81% of new HIV cases among these youth (CDC, 2017). Black and Hispanic/Latino AMSM are at a disproportionately greater risk of HIV when compared to their White counterparts as well, accounting for the majority of incident and prevalent HIV cases among AMSM (CDC, 2017, 2018). Major risk factors for HIV and other STIs in this population include condomless anal sex, substance use during sex, and having multiple sex partners (Hirshfield et al., 2015; Parsons, Rendina, Moody, Ventuneac, & Grov, 2015).

Several psychosocial risk factors are associated with sexual risk behavior and HIV/STI among MSM, including depression and substance use (Dyer et al., 2012; Ferlatte et al., 2018; Hirshfield et al., 2015; Martinez et al., 2016; Mimiaga et al., 2015; Wang et al., 2018b). These risk factors may form a syndemic, a collection of mutually reinforcing risk factors that cumulatively result in negative health outcomes (Singer, 2006; Singer & Clair, 2003). Syndemics-framed research has demonstrated that HIV incidence among MSM is partially driven by co-occurring conditions that interact and work together to impact HIV morbidity; this framework has been used in several studies of individual, social, and structural factors affecting HIV-related outcomes among MSM (Cleland, Lanza, Vasilenko, & Gwadz, 2017; Dyer et al., 2012; Starks, Millar, Eggleston, & Parsons, 2014). Having a syndemic characterized by depression symptoms, sexual compulsiveness, substance use, intimate partner violence, and stress was found to be associated with over three times the odds of condomless anal intercourse (OR: 3.46, 95% CI 1.4–8.3) compared to not having this syndemic among MSM (Starks et al., 2014). Higher levels of a syndemic of polysubstance use, depression, intimate partner violence, and childhood sexual abuse were associated with greater sexual compulsivity and hypersexuality among sexually active gay and bisexual men (Parsons et al., 2015). A syndemic of intimate partner violence, depression, illicit substance use, binge drinking, and suicidality was associated with greater odds of syphilis (aOR = 12.2, 95% CI 2.0–74.8) compared to not experiencing these factors among MSM (Ferlatte et al., 2018).

Specific to adolescents and young adults, syndemic frameworks have been used effectively in studying young MSM; a study of AMSM by Mustanski et al. (2017) found that a syndemic of substance use, experiences with violence, and mental health was strongly predictive of the number of sexual partners for White AMSM, but not Black AMSM. In another study of young Black transgender women and MSM, higher levels of a syndemic of substance use, depression, community violence, poverty, and justice system involvement were associated with greater odds of condomless anal sex, group sex, and HIV infection (Teixeira da Silva et al., 2020). The intersectional identities of Black MSM make factors related to homophobia and racism (e.g., criminal justice involvement, poverty) more salient syndemic components in this population. Still, research on syndemics among AMSM of color is relatively limited, though extant research on AMSM broadly indicates that

syndemics are a relevant framework to understanding HIV/STI-related outcomes in this population. Victimization, depression, and substance use are mutually reinforcing risk factors that may form a syndemic (Barzilay et al., 2017; Gaete et al., 2017; Kindrick, Castro, & Messias, 2013; Langer, Aguilar-Parra, Ulloa, Carmona-Torres, & Cangas, 2016; Luk, Wang, & Simons-Morton, 2010; Priesman, Newman, & Ford, 2018; Van Ouytsel et al., 2017; Williams, Langhinrichsen-Rohling, Wornell, & Finnegan, 2017). Examination of this syndemic is particularly warranted among AMSM due to the homophobic stigma and victimization many members of this population experience (Birkett, Newcomb, & Mustanski, 2015; Earnshaw, Bogart, Poteat, Reisner, & Schuster, 2016; Johns et al., 2018; Luk et al., 2010; Rimes et al., 2019; Spriggs, Iannotti, Nansel, & Haynie, 2007; Wang et al., 2018a).

Minority stress theory posits that stigma toward sexual minorities like AMSM contributes to mental health challenges that increase vulnerability to psychosocial and behavioral risks and health disparities such as HIV/STI acquisition (Meyer, 1995). Specifically, homophobia increases stress and risk factor vulnerability among AMSM (Meyer, 1995, 2016). Homophobia may be enacted as harassment, maltreatment, discrimination, and victimization among AMSM (Mueller, James, Abrutyn, & Levin, 2015; Wang et al., 2018a; Wong, Schrager, Holloway, Meyer, & Kipke, 2014). AMSM may respond to homophobia and the resulting stress by using substances to cope, as well as engaging in risky sexual behaviors that increase the chances of contracting HIV (Van Ouytsel et al., 2017). Minority stress theory is applicable to victimization as a stressor, and both depression and substance use as outcomes of stress. Each of these factors disproportionately impact sexual minorities compared to their heterosexual peers. Sexual minority adolescents experience more bullying, intimate partner violence, depression, and substance use compared to their heterosexual peers (Barzilay et al., 2017; Birkett et al., 2015; Earnshaw et al., 2016; Gaete et al., 2017; Johns et al., 2018; Mustanski, Van Wagenen, Birkett, Eyster, & Corliss, 2014c; Priesman et al., 2018; Van Ouytsel et al., 2017; Wang et al., 2018a; Williams et al., 2017). Sexual minorities can also include those with same-sex attractions and behaviors who do not self-identify as gay, bisexual, or another sexual minority identity (National Institutes of Health, 2019). Minority stress theory is relevant to this population, as literature indicates that heterosexual identifying MSM experience more victimization, depression, and substance use compared to heterosexual men who have sex with women only (MSMWO) (Harawa et al., 2008; Krueger, Meyer, & Upchurch, 2018; Turpin, Boekeloo, & Dyer, 2019).

Built upon these frameworks, the purpose of our study is to test for a syndemic of victimization (including sexual/partner violence), depression, and substance and its association with sexual risk behaviors for HIV/STI among AMSM using a nationally representative sample. We hypothesize that victimization, depression, and substance use will be associated with greater prevalence of sexual risk behaviors among AMSM. We also hypothesize that using latent profile analysis (LPA), a syndemic profile characterized by these factors will be associated with a greater prevalence of sexual risk behaviors among AMSM. It is hoped that this research will further understanding of risk behaviors impacting HIV/STI disparities among AMSM.

Method

Sample

We conducted a cross-sectional study using data from the 2015 and 2017 Youth Risk Behavior Survey (YRBS) (CDC, 2015). The YRBS is a nationally representative school-based survey of 9th through 12th grade students in schools throughout the U.S. This dataset has been used in several studies of social determinants of health outcomes among adolescents, including bullying (Foti, Balaji, & Shanklin, 2011; Kindrick et al., 2013; Mustanski et al., 2014c). Data are collected using a three-stage, cluster sample design. Metropolitan areas are used to define strata, while primary sampling units are defined as large counties or groups of small adjacent counties. Data are weighted based on grade, sex, and race of participants. While repeat participation is possible, evidence indicates that repeat participation across waves is sufficiently low (< 0.5%) to not compromise validity when pooling data (Corliss, Goodenow, Nichols, & Austin, 2011; Goodenow, Netherland, & Szalacha, 2002).

We restricted our sample to male participants who reported having at least one same-sex sexual partner in their lifetime (n = 448). Having a same-sex sexual partner was assessed with the question “During your life, with whom have you had sexual contact?” Response choices included “Females,” “Males,” “Females and males,” and “I have never had sexual contact.” We include all AMSM, irrespective of sexual identity, in our research guided by minority stress theory.

Measures

Victimization and Sexual/Partner Violence—Victimization and sexual/partner violence were measured with nine items, using questions such as “During the past 12 months, have you ever been bullied on school property?” Non-sexual/partner victimization measures included ever being bullied on school property (Yes, No), ever being bullied electronically (Yes, No), number of days absent from school due to fear of safety (0, 1, 2–3, 4–5, 6 +), number of times threatened with a weapon, number of fights, and number of fights on school property (all 0, 1, 2–3, 4–5, 6–7. 8–9, 10–11, 12 +). Sexual/partner victimization measures included ever being forced to have sexual intercourse (Yes, No), number of times physically hurt by a dating partner, and number of times forced to perform sexual acts (both 0, 1, 2–3, 4–5, 6 +).

Substance Use—Substance use was measured with eight items, using questions such as “during your life, how many times have you used any form of cocaine, including powder, crack, or free-base?” The substances measured included lifetime number of times using marijuana (0, 1–2. 3–9, 10–19, 20–39, 40–99, 100 +), cocaine, heroin, methamphetamine, ecstasy, synthetic marijuana, prescription pain medication without a doctor’s prescription (all 0, 1–2, 3–9, 10–19, 20–39, 40 +), and injecting substances (0, 1, 2 +).

Depression—Depression was measured with the question “During the past 12 months, did you ever feel so sad or hopeless almost every day for 2 weeks or more in a row that you stopped doing some usual activities?” (Yes, No).

Sexual Risk Behavior Measures—Three sexual risk behavior outcomes were used. Substance use at last sexual intercourse, measured with the question “Did you drink alcohol or use drugs before you had sexual intercourse the last time?” (Yes, No), condomless sex at last sexual intercourse, measured with the question “The last time you had sexual intercourse, did you or your partner use a condom?” (Yes, No), and number of sexual partners in the past 3 months, measured with the question “During the past 3 months, with how many people did you have sexual intercourse?” (0, 1, 2, 3, 4, 5, 6 +).

Statistical Analyses

Bivariate analyses were conducted to test all victimization, depression, and substance use measures for associations with sexual risk behaviors. Based on the data type (binary, ordinal) of each exposure and outcome, we conducted Rao–Scott chi-square tests (binary exposures to binary outcomes), Cochran–Armitage Trend tests (binary exposures to ordinal outcomes), Spearman rank-sum correlations (ordinal exposures to ordinal outcomes), and point-biserial rank-sum correlations (binary exposures to ordinal outcomes). Nonparametric tests were used with ordinal measures since these variables may not have equal-appearing intervals and were not normally distributed. All analyses accounted for the sample weighting and complex survey design effects. Descriptive analyses were conducted in SAS 9.4 (SAS Institute Inc., 2014).

Latent Profile Selection—LPA is a useful analytic approach to identify syndemics, as it allows for the identification of several combinations of risk factors that characterize latent profiles without the need for pooled indices. Unlike the use of interaction terms in multivariate regression, the statistical power of LPA does not decrease with an increasing number of syndemic factors. LPA is analogous to latent class analysis (LCA) but can utilize continuous and ordinal predictors with several values. LCA has been used to study syndemics of risk factors affecting HIV- and STI-related outcomes (Bourey, Stephenson, & Bautista-Arredondo, 2018; Cleland et al., 2017; Starks et al., 2014; Turpin et al., 2019). All individual items for victimization, substance use, and depression were included in the LPA. To decide the number of latent profiles, two-, three-, four-, and five-class models were compared. The Bayesian information criterion (BIC) and entropy were compared across models. The BIC is an adjusted measure of information lost by using the model, with lower BIC representing better fit. Entropy reflects certainty of latent profile classification, with greater entropy representing better class separation and higher classification certainty. Additionally, an adjusted Vu-Lo–Mendel–Ruben likelihood ratio test was used to compare model fit across classes. Latent profile analyses were conducted in R, as this allows for the use of clustered and weighted data (R Core Team, 2013).

Latent Profile Analyses—Bivariate analyses for latent profiles across all exposures and outcomes were conducted using Rao–Scott chi-square tests (binary variables) and Kruskal–Wallis tests (ordinal variables). Unadjusted and adjusted log-binomial models were used to generate prevalence ratios, comparing the prevalence of condomless sex and substance use during sex across each latent profile. Unadjusted and adjusted cumulative complementary log–log models were used to compare the number of sexual partners across each model. Adjusted models included terms for age, race, and survey year. We also generated a figure

showing percentages of each profile having experienced victimization (including forced sexual acts and forced sexual intercourse), substance use, depression, and each sexual risk outcome. For the purposes of concise presentation, any bullying at school and any electronic bullying were combined for this figure, fights at school were omitted (as a subset of general fights, which is presented), absences due to fear of safety was omitted, and we used a combined measure of polysubstance use (use of three or more substances) for substances other than alcohol and marijuana. Since variables were all dichotomized for figure presentation, we used a chi-square test for all variables presented. Regression analyses were conducted in SAS 9.4, with statements to account for the sample weights and complex survey design effects (SAS Institute Inc., 2014).

Missing Data—Missingness across all variables was low (no more than 7% for any variable). Intrascale stochastic imputation was used to impute missing values within groups of variables. Groups of variables included non-sexual victimization, sexual/partner violence, substance use, and sexual risk behaviors. Each group of variables demonstrated good internal consistency (Cronbach's alpha > 0.70), supporting the validity of this means of imputation. For five observations that were missing all sexual/partner victimization data, other victimization measures were used to impute sexual/partner victimization, as there was still sufficient internal consistency (Cronbach's alpha = 0.76) among all victimization measures in total.

Quality Assurance—Outliers were assessed by comparing the leverages of each data point across all models. There were no overly influential data points, so no individual outliers were removed. The sample size of latent profiles was also assessed; latent profiles with unreasonably small samples sizes ($n < 10$) were dropped from all analyses other than the initial descriptive analysis, as this represented a collective outlier. This is similar to the approach in "Linking of Clusters after Removal of a Residue" (LICUR), adapted for latent profiles (Bergman, 1988). We dropped one profile with eight observations, as this was too small to analyze. Multicollinearity was assessed by examining the variance inflation factor (VIF) for each model, no model displayed evidence of multicollinearity (All VIF < 5). Our final analytic sample size was $n = 448$ for descriptive analyses, and $n = 440$ for latent profile analyses.

Results

Sample Characteristics

Our sample (Table 1) was approximately 54% non-Hispanic White, 22% Hispanic/Latino, and 15% non-Hispanic Black. The median age was 16 years. About a third of the sample reported being bullied both at school (39%) and electronically (33%). Other forms of non-sexual victimization were uncommon. Approximately 21% of the sample reported being forced to have sexual intercourse. Half the sample had been depressed for 2 weeks or more. Drinking alcohol (median 1 drink in past 30 days) and marijuana use (median one lifetime use) were more common than the use of other substances. Among our sample of AMSM, 57% also reported having a female sexual partner in their lifetime.

Bivariate Analyses

Every measure of victimization, depression, and substance use was significantly positively associated with substance use at last intercourse. In contrast, the only exposure associated with condomless sex at last intercourse was ever having been forced to have sexual intercourse. Race was not associated with any of the measures, while younger age was only associated with condomless sex at last intercourse.

Latent Profile Selection

Table 2 shows model fit comparisons for two-, three-, four-, and five-profile models. Models above five profiles did not demonstrate a notable improvement in fit compared to a five-profile model. All models demonstrated exceptionally high entropy (> .95). The largest improvement in model fit, based on both the BIC and the Vu-Lo–Mendel–Ruben likelihood ratio test, was observed comparing a four-profile model to a three-profile model. The four-profile model was used for all subsequent analyses, though one of the profiles was unreasonably small ($n = 8$). This outlier profile was different enough not to combine with the others, but too small to report meaningful results on. It was dropped from all analyses as a residual outlier, resulting in three profiles being compared for subsequent analyses. This resulted in greater fit (lower BIC, lower −2 log-likelihood, entropy closer to 1) compared to our original three-profile model.

Latent Profile Bivariates

Every exposure was associated with the latent profiles (Table 3), with the exception of being bullied electronically. Substance use at last intercourse and number of sexual partners was also associated with profiles, but condomless sex was not. Age and race were not associated with latent profiles. Profile 1 was characterized by low proportions of all measures of victimization, depression, substance use, and sexual risk behaviors. Profile 2 was characterized by low-to-moderate victimization, depression, and substance use, with the exception of moderately high proportions of having been forced to have sexual intercourse and very high marijuana use. Profile 3 was characterized by the highest victimization, depression, substance use, substance use at last intercourse, and number of sexual partners (Fig. 1).

Latent Profile Regression

Table 4 shows unadjusted and adjusted prevalence ratios for each of the sexual risk behaviors. While there was evidence of confounding toward the null, statistical significance of estimates did not change between unadjusted and adjusted models. After adjusting for age, race, and survey year, profile 3 had nearly five times the prevalence of substance use at last intercourse and nearly 2.5 times the number of sexual partners compared to profile 1. Profile 2 had just over three times the prevalence of substance use at last sexual intercourse, but no significant difference in number of sexual partners compared to profile 1. None of the profiles had significantly different prevalence of condomless sex.

Discussion

Our latent profile analysis identified a syndemic of victimization, sexual/partner violence, depression, and substance use (Profile 3) that was strongly associated with substance use during sex and a greater number of sexual partners. Approximately one-eighth of the sample was characterized by this syndemic. Experiences of victimization, including sexual/partner violence can exacerbate depression and lead to maladaptive coping through substance use. As each of these factors is associated with sexual risk, AMSM affected by all of these factors are especially vulnerable to sexual risk behavior. This can translate to HIV and STI acquisition, so these adolescents should be especially prioritized in HIV/STI interventions. Our findings are consistent with syndemics literature, as victimization, depression, and substance use have been demonstrated as components of syndemics adversely affecting health outcomes among sexual minority men (Hirshfield et al., 2015; Mustanski, Andrews, Herrick, Stall, & Schnarrs, 2014a; Starks et al., 2014). The large proportions of victimization, particularly sexual/partner victimization (i.e. intimate partner violence), are indicative of major challenges faced by AMSM; nearly a quarter of this young sample (all between 12 and 18 years of age) had been forced to have sexual intercourse before.

Similarly, our findings align with minority stress theory as well, as evident by the high proportions of depression, victimization, and substance use in the highest risk profile. The presence of clustering of high proportions of these factors in a single latent profile demonstrates their interassociations. As victimization is a minority stressor that can lead to substance use and depression, these interassociations are consistent with minority stress theory. Our results are also generally consistent with the well-documented associations among victimization, depression, substance use, and sexual risk-related outcomes among MSM (Ferlatte et al., 2018; Hirshfield et al., 2015; Huebner, Thoma, & Neilands, 2015; Johns et al., 2018; Kim-Spoon et al., 2019; Krueger et al., 2018; Martinez et al., 2016; Mimiaga et al., 2015; Parsons et al., 2015; Priesman et al., 2018; Van Ouytsel et al., 2017; Wang et al., 2018b). The notable exception was the lack of association between any of the measures and condomless sex at last intercourse, with the exception of ever having been forced to have sex. This may be due to a combination of limited condom use knowledge, a lack of perceived STI risk, relations and limited access to condoms; these are well-documented barriers to condom use among sexual minority adolescents (Mustanski, DuBois, Prescott, & Ybarra, 2014b). These factors may play a much larger role in condom use than victimization does. Additionally, overall condom use in the sample was very low (less than 20%), which may make detecting condom use differences more difficult. We also did not detect significant associations between race; this may be due to the moderately small proportions of each racial minority group in our sample.

The findings regarding latent profile 2 in our analysis highlight differences in the association of marijuana use with sexual risk behaviors compared to other substances. This profile, accounting for nearly one-seventh of the sample, had remarkably high marijuana use and low frequency of all other substances and had distinctly lower prevalence of substance use during sex and a lower number of sexual partners than profile 3, which had overall high substance use. The distinct separation of these two profiles suggests that marijuana has a

weaker association with these sexual risk behaviors than other substances and that its usage is inconsistent with usage of other substances. Substances other than marijuana are likely more critically important targets of sexual risk reduction intervention among this population than marijuana use is. This may be due to differences in effects of substances other than marijuana; methamphetamine use, in particular, has been associated with especially large increases in sexual risk behaviors in MSM (Halkitis, Mukherjee, & Palamar, 2009). This also highlights the relevance of syndemics here, as compared to this profile with just one risk factor, and we see much larger associations with a larger number of sexual partners and substance use during sex in the profile where additional syndemic factors are present.

Our results illustrate critical needs for sexual health promotion among AMSM. Profile 3, in particular, represents a subpopulation of AMSM at increased need of sexual risk prevention programming. Reaching these AMSM often requires directing promotion efforts outside of school settings; in one study of adolescents in California, over five times as many high-need participants were served in targeted-sexual risk prevention settings compared to traditional schools (Campa, Leff, & Tufts, 2018). Utilizing community-based organizations dedicated to serving AMSM populations can be an effective approach to outreach. Sexual risk behavior research and interventions among AMSM must incorporate depression, victimization, and substance use as key considerations, given their high prevalence in this population and their relevance to sexual risk outcomes. Similarly, in developing policy related to sexual education and risk reduction for AMSM, depression, victimization, and substance use are core risk factors that should be included in any comprehensive sexual health policy. Treatment for depression and substance use may be particularly salient to sexual risk reduction in this population.

Strengths

First, this study utilizes AMSM from a nationally representative sample of adolescents. This adds a dimension of generalizability not present in many studies of adolescent MSM, which often rely on convenience sampling. Second, we are among the first to use latent profile analysis to study victimization, depression, and substance use in this population, guided by syndemic theory. The use of latent profile analysis was especially valuable here, given its utility in detecting syndemics consisting of large numbers of factors. We also utilized a wide range of measures of victimization and substance use, covering several dimensions. The inclusion of both sexual and non-sexual measures of victimization is especially relevant here, especially considering the high proportions of having been forced to have sexual intercourse and sexual/partner violence.

Limitations

First, this was a cross-sectional study, so we cannot assess temporality. Second, the measure of depression was limited to a single item. While the number of fights an individual has been in is a non-specific measure of victimization (as it does not specify who started the fight), it did behave remarkably similarly to the other non-sexual victimization measures. Social desirability bias is likely to impact both our inclusion criteria (males who report having at least one male sexual partner) as well as all reported measures, though it is likely the

reported proportions of victimization, depression, substance use, and sexual risk behavior are underestimates, despite how large many of them are.

Conclusion

We identified a clear syndemic of several forms of sexual and non-sexual victimization, depression, and substance use impacting sexual risk behavior in AMSM from a nationally representative sample. We observed more substance use during sex and a larger number of sexual partners associated with this syndemic. The large proportions of depression and victimization (especially sexual/partner victimization) are critical needs to be addressed in this population. Future research should consider these factors in the development of sexual risk behavior interventions. Additional study into the mechanisms of this syndemic (i.e., mediation analyses using longitudinal data) can further inform how this syndemic develops over the adolescent life course.

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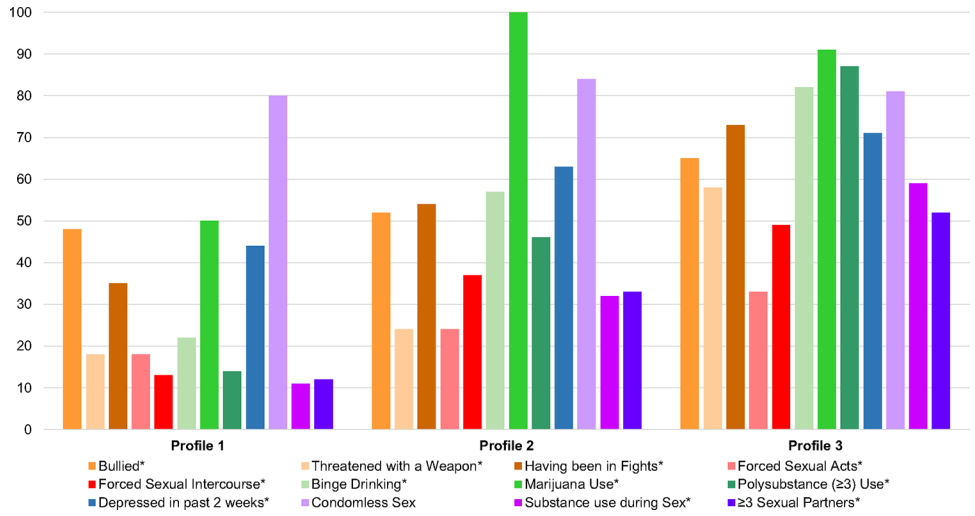

Fig. 1.

Proportions (%) of experienced victimization, substance use, and depression across latent profiles among adolescent males who have sex with males (n = 440). *Statistically significant (p < .05) difference between profiles using chi-square test. For the purpose of concise presentation, any bullying at school and any electronic bullying were combined for this figure, fights at school were omitted (as a subset of general fights, which is presented), absences due to fear of safety was omitted, and we used a combined measure of polysubstance use (use of three or more substances) for substances other than alcohol and marijuana. Number of times threatened with a weapon, having been in fights, times forced sexual acts, and sexual partners in the past 3 months were dichotomized for presentation consistency with other variables

Table 1

Victimization, mental health, and substance use across sexual risk behavior among adolescent MSM (n = 448)

	Total	Substance use at last intercourse		Condomless sex at last intercourse		Number of recent sex partners
		No (n = 357)	Yes (n = 91)	No (n = 85)	Yes (n = 363)	Rank-sum correlation coefficient (ρ)
Percentage non-Hispanic White[a,b]	54.0%	56.5%	34.7%	48.7%	55.3%	Reference
Percentage non-Hispanic Black[a,b]	15.0%	15.3%	13.9%	21.6%	13.4%	.09
Percentage Hispanic[a,b]	21.5%	19.7%	27.7%	20.1%	21.7%	−.09
Percentage other race[c]	9.5%	8.5%	23.7%	9.6%	9.6%	N/A
Median age[d,e]	16 (15, 17)	16 (15, 17)	16 (15, 17)	**17 (16, 18)**	**16 (15, 17)**	.09
Percentage bullied on school property in past year[a,b]	39.3%	**35.8%**	**52.9%**	42.0%	38.7%	.00
Percentage bullied electronically in past year[a,b]	32.7%	**31.4%**	**37.6%**	37.8%	31.4%	.03
Median days absent from school due to fear of safety[d,e]	0 (0, 0)	**0 (0, 0)**	**0 (0, 1)**	0 (0, 0)	0 (0, 0)	**.24**
Median number of times threatened with a weapon[d,e]	0 (0, 0)	**0 (0, 0)**	**0 (0, 2)**	0 (0, 0)	0 (0, 0)	**.29**
Median number of fights[d,e]	0 (0, 2)	**0 (0, 2)**	**1 (0, 8)**	0 (0, 2)	0 (0, 2)	**.32**
Median number of fights on school property[d,e]	0 (0, 0)	**0 (0, 0)**	**0 (0, 4)**	0 (0, 0)	0 (0, 0)	**.28**
Percentage ever forced to have sexual intercourse[a,b]	21.3%	**15.1%**	**45.3%**	**12.4%**	**23.3%**	**.26**
Median number of times physically hurt by dating partner[d,e]	1 (0, 1)	**1 (0, 1)**	**1 (1, 2)**	1 (0, 1)	1 (0, 1)	**.31**
Median number of times forced to perform sexual acts[d,e]	0 (0, 0)	**0 (0, 0)**	**0 (0, 2)**	0 (0, 0)	0 (0, 0)	**.36**
Percentage depressed for 2 weeks or more in past year[a,b]	49.7%	**48.0%**	**62.1%**	48.0%	51.6%	.06
Median number of drinking days in past 30 days[d,e]	1 (0, 3)	**1 (0, 3)**	**1 (0, 5)**	1 (0, 4)	1 (0, 3)	**.45**
Median number of binge drinking days in past 30 days[d,e]	0 (0, 2)	**0 (0, 1)**	**2 (0, 6)**	0 (0, 2)	0 (0, 2)	**.49**
Median number of times used marijuana[d,e]	0 (0, 40)	**1 (0, 20)**	**10 (0, 100)**	3 (0, 40)	3 (0, 40)	**.32**
Median number of times used cocaine[d,e]	0 (0, 0)	**0 (0, 0)**	**1 (0, 40)**	0 (0, 0)	0 (0, 0)	**.39**
Median number of times used heroin[d,e]	0 (0, 0)	**0 (0, 0)**	**0 (0, 12)**	0 (0, 0)	0 (0, 0)	**.45**
Median number of times used methamphetamines[d,e]	0 (0, 0)	**0 (0, 0)**	**1 (0, 20)**	0 (0, 0)	0 (0, 0)	**.41**
Median number of times used ecstasy[d,e]	0 (0, 0)	**0 (0, 0)**	**1 (0, 20)**	0 (0, 0)	0 (0, 0)	**.39**
Median number of times used synthetic marijuana[d,e]	0 (0, 0)	**0 (0, 0)**	**1 (0, 20)**	0 (0, 0)	0 (0, 0)	**.41**

	Total	Substance use at last intercourse		Condomless sex at last intercourse		Number of recent sex partners
		No (*n* = 357)	Yes (*n* = 91)	No (*n* = 85)	Yes (*n* = 363)	Rank-sum correlation coefficient (ρ)
Median number of times abused prescription drugs[d,e]	0 (0, 3)	**0 (0, 1)**	**3 (0, 40)**	0 (0, 3)	0 (0, 3)	**.27**
Median number of times injected substances[d,e]	0 (0, 0)	**0 (0, 0)**	**0 (0, 2)**	0 (0, 0)	0 (0, 0)	**.44**

Significant values bolded ($p < .05$)

[a]Association with substance use during sex and condomless sex tested using Rao-Scott chi-square test. Column percentages are presented

[b]Association with recent sex partners tested using point-biserial rank-sum correlation coefficient. For multicategory race, variable pairwise correlations were conducted (using White as the reference group)

[c]Other racial groups include Asian, American Indian, Alaska Native, Native Hawaiian, or other Pacific Islander. These individual groups not reported or tested due to insufficient sample size (< 5% for each group). Column percentages are presented

[d]Association with substance use during sex and condomless sex tested using Cochran-Armitage test of trend; interquartile range interval is provided in parentheses

[e]Association with recent sex partners tested using Spearman's rank-sum correlation coefficient

Table 2

Comparisons of models with fixed numbers of latent profiles (n = 448)

Number of profiles	2	3	4	5
Log-likelihood	19,772.876	19,634.616	19,465.385	19,377.087
Difference in log-likelihood	-	**138.26**	**169.231**	88.298
Bayesian information criterion	41,364.98	41,228.872	41,030.82	40,994.634
Difference in BIC	-	136.108	198.052	36.186
Entropy	0.999	0.998	0.995	0.989

Significant results (p < .05) using the Vu-Lo-Mendel-Rubin adjusted likelihood ratio test bolded. A four-class model was used in all subsequent analyses, removing one outlier profile (n = 8)

Table 3

Victimization, mental health, and sexual risk behavior across latent profiles among MSM (n = 440)

	Total	Latent profile		
		1 (n = 326)	2 (n = 59)	3 (n = 55)
Percentage non-Hispanic White[a]	53.4%	50.2%	65.2%	45.1%
Percentage non-Hispanic Black[a]	15.1%	16.5%	9.9%	8.3%
Percentage Hispanic[a]	21.2%	21.4%	14.7%	28.1%
Percentage other race[b]	10.3%	11.9%	10.2%	18.5%
Median age[c]	16 (15,17)	16 (15,17)	16 (15,18)	16 (15,17)
Percentage bullied on school property in past year[a]	39.0%	**35.8%**	**33.8%**	**63.3%**
Percentage bullied electronically in past year[a]	32.1%	29.2%	36.4%	43.7%
Median days absent from school due to fear of safety[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 0)**	**0 (0, 2)**
Median number of times threatened with a weapon[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 0)**	**1 (0, 12)**
Median number of fights[c]	0 (0, 2)	**0 (0, 2)**	**1 (0, 4)**	**8 (0, 12)**
Median number of fights on school property[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 0)**	**1 (0, 12)**
Percentage forced to have sexual intercourse[a]	21.4%	**13.3%**	**37.2%**	**48.8%**
Median number of times physically hurt by dating partner[c]	1 (0, 1)	**1 (0, 1)**	**1 (0, 1)**	**1 (0, 3)**
Median number of times forced to perform sexual acts[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 0)**	**0 (0, 4)**
Percentage depressed for 2 weeks or more[a]	50.4%	**44.2%**	**63.0%**	**71.4%**
Median number of drinking days in past 30 days[c]	1 (0, 3)	**0 (0, 2)**	***3 (1, 6)***	**12 (6, 30)**
Median number of binge drinking days in past 30 days[c]	0 (0, 2)	**0 (0, 0)**	***2 (0, 3)***	**6 (2, 20)**
Median number of times used marijuana[c]	1 (0, 40)	**1 (0, 10)**	**100+ (100+, 100+)**	**100+ (50, 100+)**
Median number of times used cocaine[c]	0 (0, 0)	**0 (0, 0)**	***0 (0, 3)***	**40+ (3, 40+)**
Median number of times used heroin[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 1)**	**20 (0, 40+)**
Median number of times used methamphetamines[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 1)**	**20 (1, 40+)**
Median number of times used ecstasy[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 1)**	**20 (1, 40+)**
Median number of times used synthetic marijuana[c]	0 (0, 0)	**0 (0, 0)**	***1 (0, 3)***	**20 (0, 40+)**

	Total	Latent profile		
		1 (*n* = 326)	**2 (*n* = 59)**	**3 (*n* = 55)**
Median number of times abused prescription drugs[c]	0 (0, 3)	**0 (0, 0)**	***1 (0,10)***	**40+ (40+, 40+)**
Median number of times injected substances[c]	0 (0, 0)	**0 (0, 0)**	**0 (0, 1)**	**2 (0, 2)**
Median substance use frequency index[c]	0 (0, 4)	**0 (0, 0)**	***4 (0,18)***	**130 (21,200)**
Substance use at last intercourse[a]	20.5%	**11.3%**	***32.6%***	**58.9%**
Condomless sex at last intercourse[a]	81.0%	80.2%	84.1%	81.8%
Recent sex partners[c]	1 (0, 2)	**1 (0, 1)**	**1 (0, 4)**	**3 (0, 6)**

Significant values bolded ($p < .05$)

Underlined estimates are significantly higher than non-underlined and dotted-underlined estimates

Italic values indicate significantly higher than non-underlined estimates

[a]Association tested using Rao-Scott chi-square test

[b]Other racial groups include Asian, American Indian, Alaska Native, Native Hawaiian, or other Pacific Islander. These individual groups not reported or tested due to insufficient sample size (< 5% for each group)

[c]Association tested using Kruskal-Wallis test. Interquartile range interval is provided in parentheses

Table 4

Prevalence ratios and cumulative prevalence ratios for sexual risk behavior outcomes among adolescent MSM ($n = 440$)

	Substance use at last intercourse[a]		Condomless sex at last intercourse[a]		Recent sex partners[b]	
	Crude	Adjusted[c]	Crude	Adjusted[c]	Crude	Adjusted[c]
Profile 1	Reference	Reference	Reference	Reference	Reference	Reference
Profile 2	**2.89 (1.48, 5.65)**	**3.33 (1.80, 6.13)**	1.05 (0.91, 1.21)	1.03 (0.88, 1.21)	1.22 (0.75, 1.99)	1.17 (0.71, 1.93)
Profile 3	**5.24 (3.29, 8.33)**	**4.74 (3.02, 7.43)**	1.02 (0.85, 1.22)	1.03 (0.87, 1.21)	**2.16 (1.17, 3.99)**	**2.45 (1.39, 4.31)**
Age (continuous)		1.04 (0.91, 1.19)		0.92 (0.80, 1.07)		1.02 (0.88, 1.17)
Non-Hispanic White		Reference		Reference		Reference
Non-Hispanic Black		1.23 (0.62, 2.43)		0.87 (0.66, 1.16)		1.66 (0.88, 3.13)
Hispanic		1.41 (0.86, 2.31)		0.99 (0.89, 1.11)		1.16 (0.70, 1.93)
Survey Year 2015		Reference		Reference		Reference
Survey Year 2017		0.99 (0.89, 1.13)		0.98 (0.86, 1.17)		1.01 (0.88, 1.31)

Significant values bolded ($p < .05$)

[a] Prevalence ratios calculated using log-binomial models

[b] Prevalence ratios calculated using cumulative complementary log-log models

[c] Adjusted models adjusted for age, race/ethnicity, and survey year