SUBSTANCE USE AND ADVERSE CHILDHOOD EVENTS AMONG

SEXUAL MINORITY YOUNG ADULTS IN THE U.S.

by
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Abstract

Sexual minority people in the United States are at increased risk of tobacco, alcohol, and other substance use, increasing their exposure to negative sequelae such as injury, cancer, and overdose. Adverse childhood events (ACEs) (e.g. abuse and witnessing violence) are important correlates of later substance use and are prevalent among sexual minority people. Using data from the National Longitudinal Study of Adolescent Health, Waves I (ages 12-18) and III (ages 18-24), patterns of substance use (alcohol, tobacco, other drugs) and ACEs (abuse, neglect, social services involvement, witnessing and experiencing violence) were modeled with latent class analysis techniques. Transitions from ACEs to substance use patterns were modeled with latent transition analysis. Logistic regression was used to determine whether sexual minority (mostly heterosexual, bisexual, mostly homosexual, and homosexual) people were more likely to demonstrate particular patterns and transitions compared to heterosexual people. A normative substance use class and a poly-substance use class were identified. Sexual minority young adults had higher odds of inclusion in the poly-substance use class than in the normative substance use class (OR = 3.03, p < 0.001). A low ACEs class, an abuse and social services involvement class, and a witnessing and experiencing violence class were identified. Sexual minority young adults had higher odds of inclusion in the abuse and social services involvement class (OR = 1.61, p < 0.05) and bisexual young adults in particular had higher odds of inclusion in the witnessing and experiencing violence class (OR = 2.99, p < 0.01). Sexual minority young adults had lower odds of transitioning from the low ACEs class to the normative substance use class compared to heterosexual people (OR = 0.30, p < 0.001). Results indicate that sexual minority young adults are at high risk

of detrimental ACEs patterns and of demonstrating poly-substance use patterns in young

adulthood. Both ACEs and substance use prevention approaches tailored to the unique

needs of sexual minority people are indicated. Substance use treatment approaches

among sexual minority young adults could be most effective if they simultaneously

address concurrent physical and mental health issues and incorporate trauma-informed

care.

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1. Introduction

Lesbian, gay, and bisexual (LGB) people face an inordinate amount of discrimination and stigma in the U.S. and comprise a vulnerable population when it comes to multiple negative health behaviors and outcomes. LGB people have been shown to have higher prevalence of substance use, mental health symptoms, obesity, sexually transmitted infections, and behavioral adjustment problems (Schneeberger et al. 2014). It is an important duty of public health researchers to identify vulnerable populations and try to understand the health issues that they face and identify ways of effectively addressing these issues. Two areas in which LGB people have been shown to be disparate from heterosexual people are adverse childhood events (ACEs) (Anderson & Blosnich 2013; Friedman et al. 2011; McLaughlin et al. 2012; Roberts et al. 2010; Rothman et al. 2011; Schneeberger et al. 2014) and substance use later in life (Corliss, et al. 2008; Garofalo, et al. 1998; Marshal, et al. 2008; Marshal, et al. 2009; Marshal, et al. 2012; Mereish EH, et al. 2014; Pesola, et al. Ramo, et al. 2010; Reed, et al. 2010; Ziyadeh, et al. 2007). Both ACEs and substance use can have long-reaching negative effects on health and are thus key to understanding and reducing health disparities among LGB people (Anda et al. 2006).

Sexual identity can be defined and measured in many different ways. The traditional categories of lesbian, gay, and bisexual have been used extensively in survey research but different categorizations have been seen in the literature in recent years. The problem with restricting research participants' choices to lesbian, gay, or bisexual is that these categories a) are not inclusive of all types of sexual identity and b) may not align

with the terminology people use to express their sexual identity, particularly young people. A useful approach to the sexual identity question is to create more categories in an attempt to more fully cover the range of sexual identities present in the population. The National Longitudinal Study of Adolescent Health (Add Health) uses a six-part survey question with the following choices: 100% heterosexual, mostly heterosexual, bisexual, mostly homosexual, 100% homosexual, and unsure. This approach improves on the range of possible sexual identities and it does seem that there are meaningful differences between categories, including that of mostly heterosexual (non-heterosexual attraction and behavior but not to the extent seen among bisexual people), which has been shown to be associated with higher risk of substance use problems (Corliss 2009). However, this approach fails to take into account the many labels that sexual minority people use to identify themselves, which is something researchers need to explore more fully.

In general, sexual minority people have been shown to be at increased risk of alcohol and substance use (Corliss, et al. 2008; Garofalo, et al. 1998; Marshal, et al. 2008; Marshal, et al. 2009; Marshal, et al. 2012; McCabe et al. 2009; Mereish EH, et al. 2014; Pesola, et al. Ramo, et al. 2010; Reed, et al. 2010; Ziyadeh, et al. 2007) and problems related to substance use (King 2008). Differences between sexual minority and heterosexual people appear to be quite pronounced, with odds ratios of two or more comparing lesbian, gay, and bisexual people to heterosexual people on a number of alcohol, marijuana, and other substance use and dependence outcomes (McCabe et al. 2009).

Of particular concern when taking a life-course perspective is substance use that occurs among sexual minority people in young adulthood, between the ages of 18-24. Young adulthood is a time of life in which people put the building blocks of their adult lives in place, attending college or trade school and choosing partners and career paths (Arnett 2000) and it can be argued that sexual minority people have an added layer of complexity in their lives during this time. They may be negotiating the process of coming out to family, friends, and the wider community, they may have the desire to form romantic relationships that society deems to be inappropriate, and they may be barred from achieving milestones such as getting married and having children. Substance use can have a negative impact on educational attainment and future earnings (Silins et al. 2015) and the effects could be amplified among sexual minority people given their exposure to stress related to stigma and discrimination.

ACEs, including childhood maltreatment and exposure to violence, are highly prevalent among sexual minority people relative to heterosexual people (Anderson & Blosnich 2013; Friedman et al. 2011; McLaughlin et al. 2012; Roberts et al. 2010; Rothman et al. 2011; Schneeberger et al. 2014). Number of ACEs experienced in childhood shows a clear dose response with both mental and physical health symptoms in adulthood (Anda et al. 2006). Sexual minority people have higher rates of many sequelae of ACEs such as posttraumatic stress disorder (Roberts et al. 2010; Roberts et al., 2012), mental distress, and physical health problems (Blosnich et al. 2014). Given the relationship between ACEs and negative health outcomes, both of which are more

prevalent among sexual minority people, it is likely that ACEs have the potential to significantly impact health in young adulthood among sexual minority people.

The connection between ACEs and substance use in adolescence and young adulthood has been well established (Downs & Harrison 1998; Luk et al. 2010; Simpson & Miller 2002; Wiechelt 2013). What is less clear is the reason for the connection. One theory posits that children who experience adverse events such as maltreatment and witnessing violence develop PTSD, whether full-blown or at sub-clinical levels, and go on to use substances to cope with the anxiety, painful memories, trouble sleeping, and panic attacks that characterize the disorder (Wiechelt 2013). Another theory holds that there is a common variable that predisposes an individual to both development of PTSD and substance use (Leeies et al. 2010). When considering the relationship between ACEs and substance use among sexual minority people, the question of whether sexual identity confers additional vulnerability above and beyond that conferred by ACEs themselves is raised. In other words, does the stress of being a sexual minority person in our society have an additional impact on the link between ACEs and substance use?

The theory of minority stress posited by Ilan Meyer provides a framework for thinking about ACEs, substance use, and additional vulnerability conferred by sexual minority identity (Meyer 1995). According to the minority stress theory, lesbian, gay, and bisexual people experience three types of stressors related to their sexual identity. Internalized homophobia is the turning of negative societal attitudes towards oneself. Stigma is the expectation of negative societal treatment. Violence and discrimination are events that impact safety and day to day life. The minority stress theory helps to explain

the higher prevalence of ACEs among sexual minority children who may come out to parents and peers or show gender non-conforming behaviors. It also implies that there are stressors (internalized homophobia and stigma) above and beyond violence that could be associated with greater vulnerability to substance use. The question of whether sexual minority and heterosexual people differ in their young adulthood substance use given similar trauma histories is key to understanding the complex processes that result in higher prevalence of substance use among sexual minority people.

While we know that sexual minority people, in general, have higher prevalence of both ACEs and substance use relative to heterosexual people, less is known about whether sexual minority people demonstrate differing patterns of trauma history and substance use and whether important differences exist among sexual identity sub-groups. This knowledge can help us gain a more nuanced understanding of these two phenomena among sexual minority people and help to inform the development of effective prevention and treatment efforts. Latent class analysis is a person-centered rather than variable-centered approach to modeling. Unlike traditional analysis techniques in which each individual outcome variable is evaluated for its association to the predictor of interest separately, latent class analysis combines the outcome variables and, based on participants' response patterns, derives classes of people who are likely to display similar patterns (Tomczyk et al. 2016). For example, instead of assessing the relationship between sexual identity and alcohol, tobacco, marijuana and other substance use separately, it is possible to derive patterns of substance use and assign individuals to the most likely pattern given their responses. The relationship between an individual's

substance use pattern (assigned class) and covariates such as sexual identity can then be assessed using logistic regression. The same methods can be applied to ACEs in order to derive common patterns and evaluate whether there is an association with sexual identity. Taking these methods a step further, we can use latent transition analysis to model the transitions between particular patterns of ACEs and particular patterns of substance use and test whether sexual identity plays a role.

In this study, we first sought to derive patterns of substance use in the general U.S. population of young adults and test whether sexual minority identity in general was associated with particular substance use patterns and whether the association differed by sexual minority sub-group. Secondly, we sought to derive patterns of ACEs from the same population and test associations with sexual minority identity and sub-groups. Third, we sought to evaluate the probabilities of transitioning between particular patterns of ACEs and particular patterns of substance use and test whether sexual minority people were more or less likely to demonstrate particular transition patterns. Gaining a deeper understanding of differences in patterns of substance use and ACEs can help to inform prevention and treatment interventions among sexual minority young adults.

1.1 References

Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield C, Perry BD, Dube SR, Giles WH. The enduring effects of abuse and related adverse experiences in childhood: a convergence of evidence from neurobiology and epidemiology. Eur Arch Psychiatry Clin Neurosci. 2006;256:174-186.

Andersen JP, Blosnich J. Disparities in adverse childhood experiences among sexual minority and heterosexual adults: results from a multi-state probability-based sample. PLOS ONE. 2013;8(1):e54691.

Corliss HL, Austin SB, Roberts AL, Molnar BE. Sexual risk in "mostly heterosexual" young women: influence of social support and caregiver mental health. Journal of Women's Health. 2009;18(12):2005-2010.

Corliss HL, Rosario M, Wypij D, Fisher LB, Austin SB. Sexual orientation disparities in longitudinal alcohol use patterns among adolescents. Arch Pediatr Adolesc Med. 2008;162:1071-1078.

Friedman MS, Marshal MP, Guadamuz TE, Wei C, Wong CF, Saewyc EM, Stall R. A meta-analysis of disparities in childhood sexual abuse, parental physical abuse, and peer victimization among sexual minority and sexual nonminority individuals. American Journal of Public Health. 2011;101(8):1481-1494.

Garofalo R, Wolf RC, Kessel S, Palfrey J, DuRant RH. The association between health reisk behaviors and sexual orientation among a school-based sample of adolescents. Pediatrics. 1998;101:895-902.

King M, Semlyen J, Tai SS, Killaspy H, Osborn D, Popelyuk D, Nazareth I. A systematic review of mental disorder, suicide, and deliberate self harm in lesbian, gay and bisexual people. BMC Psychiatry. 2008;8:70-87.

Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, Bukstein OG, Morse JQ. Sexual orientation and adolescent substance use: a meta-analysis and methodological review. Addiction. 2008;103:546-556.

Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance use in lesbian, gay and bisexual youth and heterosexual youth. Addiction. 2009;104:974-981.

Marshal MP, King KM, Stepp SD, Hipwell A, Smith H, Chung T, Friedman MS, Markovic N. Trajectories of alcohol and cigarette use among sexual minority and heterosexual girls. Journal of Adolescent Health. 2012;50:97-99.

McLaughlin KA, Hatzenbuehler ML, Xuan Z, Conron KJ. Disproportionate exposure to early-life adversity and sexual orientation disparities in psychiatric morbidity. Child Abuse and Neglect. 2012;36:645-655.

Mereish EH, Bradford JB. Intersecting identities and substance use problems: sexual orientation, gender, race, and lifetime substance use problems. J Stud Alcohol Drugs. 2014;75:179-188.

Meyer I. Minority stress and mental health in gay men. *Journal of Health and Social Behavior*. 1995;36:38-56.

Pesola F, Shelton KH, van den Bree MBM. Sexual orientation and alcohol problem use among UK adolescents: an indirect link through depressed mood. Addiction. 2014: Accepted Online.

Ramo DE, Grov C, Delucchi K, Kelly BC, Parsons JT. Typology of club drug use among young adults recruited using time-space sampling. Drug Alcohol Depend. 2010;107:119.

Reed E, Prado G, Matsumoto A, Amaro H. Alcohol and drug use and related consequences among gay, lesbian and bisexual college students: role of experiencing violence, feeling safe on campus, and perceived stress. Addictive Behaviors. 2010;35:168-171.

Roberts AL, Austin SB, Corliss HL, Vandermorris AK, Koenen KC. Pervasive trauma exposure among US sexual orientation minority adults and risk of posttraumatic stress disorder. American Journal of Public Health. 2010;100(12):2433-2441.

Rothman EF, Exner D, Baughman AL. The prevalence of sexual assault against people who identify as gay, lesbian, or bisexual in the United States: a systematic review. Trauma, Violence, and Abuse. 2011;12(2):55-66.

Schneeberger AR, Dietl MF, Muenzenmaier KH, Huber CG, Lang UE. Stressful childhood experiences and health outcomes in sexual minority populations: a systematic review. Soc Psychiatry Psychiatr Epidemiol. 2014;49:1427-1445.

Silins E, Fergusson DM, Patton GC, Horwood LJ, Olsson CA, Hutchinson DM, et al. Adolescent substance use and educational attainment: an integrative data analysis comparing cannabis and alcohol from three Australasian cohorts. Drug and Alcohol Dependence. 2015;156:90-96.

Tomczyk S, Isensee B, Hanewinkel R. Latent classes of polysubstance use among adolescents: a systematic review. Drug and Alcohol Dependence. 2016;160:12-29.

Ziyadeh NJ, Prokop LA, Fisher LB, Rosario M, Field AE, Camargo CA, Austin SB. Sexual orientation, gender, and alcohol use in a cohort study of U.S. adolescent girls and boys. Drug and Alcohol Dependence. 2007;87:119-130.

2. Patterns of Substance Use Among Sexual Minority Young Adults in the U.S.

2.1 Introduction

Emerging adulthood, ages 18-25, is a transitional developmental period in which many young people put the building blocks of their lives in place, going to college or trade school, choosing career paths, and getting married and starting families (Arnett 2000). Emerging adulthood is characterized by heightened risk behaviors relative to other age groups including substance use, drunk driving, and unprotected sex (Arnett 2000). Lesbian, gay, and bisexual (LGB) young adults have an added layer of complexity in the process of becoming members of adult society, often navigating the process of coming out to family, friends, and the wider community during this period. In addition, sexual minority young adults often face marriage inequality and discrimination in the workplace and in the adoption of children.

Unhealthy alcohol, tobacco, and other substance use can be detrimental to young people's life trajectories at this critical stage of human development. Young adults who exhibit unhealthy substance use are at increased risk both short- and long-term consequences including injuries, cancer, or overdose (Krueger et al. 2016; Park et al. 2016; Suffoletto et al. 2015). Given the added burdens on LGB people in emerging adulthood, they may have higher prevalence of unhealthy substance use and/or may exhibit differing patterns of substance use relative to heterosexual emerging adults. The purpose of this article is too identify patterns of substance use in the general U.S. emerging adult population and test whether LGB people are more or less likely to display particular substance use patterns.

Lesbian, gay, and bisexual people are at increased risk of alcohol and substance use (Corliss, et al. 2008; Garofalo, et al. 1998; Marshal, et al. 2008; Marshal, et al. 2009; Marshal, et al. 2012; Mereish EH, et al. 2014; Pesola, et al. Ramo, et al. 2010; Reed, et al. 2010; Ziyadeh, et al. 2007) and alcohol and substance use disorders (King, et al. 2008). A study using data from the National Epidemiologic Survey on Alcohol and Related Conditions showed that lesbian women had more than three times the odds of past year marijuana use, other drug use, alcohol dependence, marijuana dependence, and other drug dependence compared to heterosexual women but did not differ on past year heavy drinking (McCabe et al. 2009). In addition, bisexual women had 1.6 times the odds of past year heavy drinking and more than twice the odds of past year marijuana use, other drug use, and alcohol dependence compared to heterosexual women but did not differ on past year marijuana or other drug dependence (McCabe et al. 2009). Gay men had at least three times the odds of past year marijuana use, other drug use, alcohol dependence, and other drug dependence compared to heterosexual men but did not differ on past year heavy drinking or marijuana dependence. Bisexual men had more than four times the odds of past year other drug use, alcohol dependence, and other drug dependence compared to heterosexual men but did not differ on past year heavy drinking, marijuana use, or marijuana dependence (McCabe et al. 2009).

The relationship between sexual minority status and substance use is not straightforward. Several variables have been shown to moderate the association, including those related to mechanisms of risk behavior such as gender and bisexual

orientation and those related to methodological issues such as definition of sexual orientation and recruitment source (Marshal 2008). One important reason for the variability in estimates of prevalence may be that studies tend to use different methods of measurement, particularly when it comes to measuring sexual orientation. Sexual orientation may be operationalized in several ways, including by self-described sexual identity, sexual attraction, and sexual behavior (Savin-Williams 2013). It is important that researchers not only select the sexual orientation domain of interest that appropriately matches their research questions, but that they include a sufficient number of categories to most accurately capture the range of identities, attractions, or behaviors that exist within each domain. In terms of sexual identity, it is no longer appropriate to limit research participants' choices to lesbian/gay or bisexual. The terms "mostly heterosexual" and "mostly homosexual" should also be included. In recent years, mostly heterosexual people have been considered as a non-heterosexual population and have been shown to be a group characterized by non-heterosexual attraction and behavior but not to the degree seen among bisexual people (Savin-Williams 2013). One study found that mostly heterosexual women were at higher risk of substance use problems than their heterosexual counterparts (Corliss 2009). Similar studies among mostly homosexual people were not found but it is possible that this group differs from other groups on measures of risk behaviors.

Although we know relatively little about substance use prevalence among LGB emerging adults specifically, information from adolescents may be instructive. LGB adolescents in general have higher prevalence of alcohol, tobacco, and other substance use compared to their heterosexual peers (Ziyadeh et al. 2007). Research suggests that

adolescents with only same-sex sexual partners do not exhibit higher rates of substance use but that those with partners of both sexes do (Udry et al. 2002). Given the higher prevalence of alcohol, tobacco, and other substance use among sexual minority adolescents, it stands to reason that the prevalence of use would be elevated among LGB young adults as well, and particularly among bisexual or mostly heterosexual adults. A study of college students supports this assertion, showing that sexual minority students in general, and bisexual students in particular, had significantly elevated prevalence of substance use (Kerr et al. 2014). A study of 15-24 year olds found similar results, with men and women with sexual experience with both sexes having higher odds of substance use (Brewster & Tillman 2012).

Theoretical Frameworks

Reasons for the heightened risk of alcohol, tobacco, and other substance use among sexual minority people are unclear but two major theories could help to explain the disparity. The first, the Minority Stress Model, developed by Ilan Meyer, contends that sexual minorities encounter discrimination and prejudice predicated on their stigmatized identities. Sexual minority people can in effect turn the wider community's negative attitudes in on themselves, creating an internalized homophobia (Meyer 1995). In addition, societal stigma can have the effect of creating strong and lasting feelings of vigilance among sexual minority people because they are exposed to the constant possibility of disrespectful behavior from others and, often, violence. Internalized homophobia and the perceived threat and real experience of prejudice and violence causes a level of stress that can lead to increased risk behaviors on the part of sexual

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minority people (Meyer 1995). In addition, sexual minority people are specifically targeted for advertising by the alcohol and tobacco industries, thus increasing their vulnerability to substance use (Dilley et al. 2008; Drabble 2000).

Latent Variable Models and Substance Use

In traditional substance use research, the relationship between research participants with particular characteristics (in this case, sexual minority identity) and each substance of interest (e.g. alcohol, marijuana, etc.) is evaluated separately, often leading to small cell sizes that limit the types of analyses that can be conducted (Tomczyk et al. 2016). Latent variable models provide a person-centered rather than a variable-centered approach to evaluating the relationship between sexual identity and substance use, such that we can learn from the data the number and characteristics of the classes (patterns) of substance use within the sample. A large number of studies of substance use have used latent variable modeling techniques and a systematic review of such studies among adolescent populations found that, typically, a no or low use class and a poly-substance use class are found (Tomczyk et al. 2016). Additional classes may also be identified comprised of mainly alcohol users. Sex, age, race, academic achievement, and peer or parent substance use have been found to be associated with membership in poly-substance use classes (Tomczyk et al. 2016).

Relatively little latent variable modeling research has been done with substance use among sexual minority people. Latent curve models have been used to compare the trajectories of substance use from adolescence to young adulthood using the Add Health data (Marshal 2009). Researchers found that, controlling for age, race, and gender, LGB

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people differed from heterosexual people in that they had higher rates of substance use at baseline and also increased substance use over time. In another study, latent class analysis was used with data from first-year college students to model patterns of alcohol use and adverse alcohol-related outcomes among sexual minority people and found that, while alcohol use patterns were similar among heterosexual and sexual minority groups, some sexual minority groups were at higher risk of negative consequences related to alcohol (Talley 2012).

Study Purpose

While previous studies have examined alcohol, tobacco, and other substance use among LGBs and established that the prevalence of substance use and dependence is in general higher than among heterosexuals, relatively little is known about patterns of alcohol and substance use/disorder among LGBs during the period of emerging adulthood. We sought to use latent class analysis to model substance use patterns in the general population of U.S. emerging adults and logistic regression to test whether sexual minorities (mostly heterosexual, bisexual, mostly homosexual, and homosexual people) have higher odds of being included in classes characterized by higher probabilities of substance use compared to classes characterized by low probabilities of substance use. If we find that sexual minority people (or particular sexual minority types) in the study are more likely to show poly-substance use patterns, this finding will have implications for identifying those who are potentially in need of treatment services and raise the question of whether treatment services tailored specifically for sexual minority people are warranted.

2.2 Methods

Data Source: National Longitudinal Study of Adolescent Health (Add Health)

The Add Health longitundinal school-based survey was first conducted among 20,745 7th - 12th graders in the 1994-1995 school year. Follow-up surveys were carried out 1, 6, and 13 years later, when respondents were aged 24-32 years. Surveys were conducted among adolescent respondents and their parents. School administrators, peers, siblings, friends, and romantic partners were also surveyed.

The Add Health study used a stratified, random sample of U.S. high school students. Feeder schools that had 7th grade students were also included. In Wave I, 90,118 adolescents were included in the sampling frame and 20,745 participated in the study. There was a 2-stage approach to sampling. First, schools were stratified by region, urbanicity, school size, school type, percent white, percent black, grade span, and curriculum (general, vocational/technical, alternative, special education) and randomly selected. Second, an in-home sample was comprised of 27,000 adolescents, who were oversampled to include more disabled, black, Chinese, Cuban, Puerto Rican, twin, full-sibling, half-sibling, non-related adolescents, and siblings of twins. The Wave III follow-up (emerging adulthood) sample consists of 15,197 subjects who were included in Wave I. This represents a response rate of 77% from Wave I. For our sample, we selected individuals for whom we had information about their age, sex, race, educational attainment, current cigarette, alcohol, marijuana, cocaine, methamphetamine, and other drug use, and who reported a heterosexual, mostly heterosexual, bisexual, mostly homosexual, or homosexual identity. Our final sample was comprised of 14,028 people.

Measures

     Sexual Orientation. Sexual orientation was measured differently in the Add Health Study than it has been in many other studies. Add Health uses a 6-part variable for sexual orientation. The survey question is, "Please choose the description that best fits how you think about yourself," and possible responses are: 1) 100% heterosexual (straight), 2) mostly heterosexual (straight), but somewhat attracted to people of your own sex, 3) bisexual that is, attracted to men and women equally, 4) mostly homosexual (gay), but somewhat attracted to people of the opposite sex, 5) 100% homosexual (gay), and 6) not sexually attracted to either males or females (this final category has a small sample size and thus will not be included in the analysis). The Add Health study in effect combined into one variable two self-described measures of sexual orientation: sexual identity and sexual attraction. In these analyses due to small sample size considerations, we first treat sexual identity as a binary variable (sexual minority) with heterosexual equal to 0 and mostly heterosexual, bisexual, mostly homosexual, and homosexual equal to 1. Then, we break these categories up into individual dummy variables in order to perform some exploratory latent class analyses by individual sexual orientation groups (heterosexual, mostly heterosexual, bisexual, mostly homosexual, homosexual).

Demographic Variables. <u>Sex</u> was measured as a dichotomous variable with categories for male and female. We included the covariates of sex, age, race, and highest educational attainment in the model. <u>Age</u> was measured as biological age at Wave III data collection. <u>Race</u> was categorized by White and non-White (Black, Hispanic/Latino, Asian/Pacific Islander, American Indian/Native American, and Other), with White as the

reference group, coded as 0, and all others coded as 1. Highest <u>educational attainment</u> was measured by self report and dichotomized with those graduating from high school coded as 0 and those with some or more college coded as 1.

Alcohol, Tobacco and Other Substance Use: In the Add Health Study, current alcohol use (e.g. past month or past two-week use) was not measured but current alcohol bingeing behavior was measured. Thus, in this study, a respondent was coded as being a <u>current heavy alcohol user</u> if they reported having five or more drinks on a single occasion (for men, 4 or more drinks for women) in the past two weeks. Those who did not report alcohol bingeing behavior were coded as non-heavy alcohol users. <u>Current cigarette smoking</u> was constructed as a dichotous variable with respondents who reported smoking on between 1 and 30 days in the past month being designated as current smokers and those who did not report regular smoking being designated as non-smokers. <u>Current marijuana</u> use was constructed as a dichotomous variable with respondents who reported any marijuana use in the past month being coded as current users and those who did not report use in the past month being coded as non-users. <u>Current cocaine use</u> (any kind of cocaine) was coded the same way as marijuana use. The Add Health Study combines other types of illegal drugs into one variable of current (past 30-day) other drug use. The questionnaire specifically mentions LSD, PCP, ecstasy, mushrooms, inhalants, smoked methamphetamine, heroin, and extra-medical use of prescription medicines as types of illegal drugs, but the question is worded in such a way that other illegal drugs could be reported. For this study, current other illegal drug use was constructed as a dichotomous

variable with those who reported using an illegal drug other than those already mentioned in the survey.

Statistical Analyses

Latent class analysis was conducted using current smoking, alcohol bingeing, marijuana use, cocaine use, and other drug use as latent class indicators. The R 3-step method in Mplus was used for the latent class analysis. This method avoids some of the less advantageous aspects of traditional 1-step LCA such as the ambiguity regarding whether the number of classes should be determined with covariates or before covariates are added to the model (Asparouhov 2014). In addition, with 1-step LCA, the measurement and prediction models are estimated all over again, which can cause the nature of the classes to change as covariates are added or taken away.

The number of classes that best fit the data was determined using just two fit indicators, the BIC and the sample size adjusted BIC. While several other fit indicators are typically available in latent class analysis, only the BIC and adjusted BIC are valid measures of fit in the case of weighted complex survey data (Mplus discussion board). Because a 1-class solution is not available using the 3-step method, the number of classes was determined using 1-step LCA. The BIC and the adjusted BIC were graphed and the "elbow" (i.e. the point at which the value appears to bottom out) was located in order to determine which class was favored. The R 3-step method automatically assigns the most likely class to each individual in the study and then regresses auxiliary variables (sexual identity, covariates) on class assignment. Statistically significant beta coefficients for this regression relationship would indicate that sexual identity was predictive of class

membership. We ran the regression analyses using both the binary sexual identity variable (to determine whether a significant difference was seen between heterosexual and non-heterosexual people) and the multi-category sexual identity variable (to explore whether significant differences could be determined by individual categories of sexual identity).

2.3 Results

Description of Sample

The sample used in the latent class analysis was comprised of 12,625 heterosexual people and 1,403 sexual minority people (14,028 total) (Table 2.1). The heterosexual group was split fairly evenly between men and women but the mostly heterosexual and bisexual groups were predominantly women. The mostly homosexual group was evenly split and the homosexual group was predominantly men. The mostly heterosexual, bisexual, and homosexual groups had a higher percentage of white people than the heterosexual group. Mostly heterosexual, mostly homosexual, and homosexual people were more likely to have attended college than heterosexual people while bisexual people were less likely to have attended college.

Sexual minority people in the sample were more likely to report daily cigarette smoking and heavy drinking compared to heterosexual people (Figure 2.1). Mostly heterosexual, bisexual, and mostly homosexual people but not homosexual people were more likely to report past month marijuana use. All sexual minorities were more likely to

report past month cocaine, methamphetamine, and other drug use compared to heterosexual people.

Class Identification

The BIC and the adjusted BIC pointed to a two-class solution because when graphed, the "elbow" occurred at class 2 (Table 2.2/Figures 2.2 and 2.3) and therefore a two-class solution was selected. The "elbow" indicates the point at which the value of the BIC or adjusted BIC levels out and is preferred over selecting the absolute lowest value.

Conditional Probabilities

In class 1, which we named the "poly-substance use" class, the probability of daily cigarette smoking was 50.4%, that of binge drinking was 71.8%, that of current marijuana smoking was 88.4%, that of current cocaine use was 17.4%, that of current methamphetamine use was 7.0%, and that of current other drug use was 24.6% (Figure 2.4). In class 2, which we named the "normative substance use" class, the probability of daily smoking was 18%, that of binge drinking was 25.5%, that of current marijuana use was 7.3%, and probabilities of current cocaine, methamphetamine, or other drug use were zero or close to zero.

Logistic regression analyses showed that, after controlling for sex, race, education, and age, non-heterosexual people were significantly more likely to be included in the poly-substance use class than in the normative substance use class (OR 3.03; 95% CI 2.43, 3.75; p<0.0001) (Table 2.3). When logistic regression analyses were conducted using the multi-category sexual identity variable (heterosexual, mostly heterosexual,

bisexual, mostly homosexual, homosexual), results showed that each of the sexual minority groups except for the 100% homosexual group had higher odds of inclusion in the poly-substance use class than in the normative substance use class (Table 2.4). Mostly heterosexual people had 2.99 times the odds of inclusion in the poly-substance use compared to the odds of inclusion in the normative use class (95% CI 2.31, 3.86; p<0.0001). Bisexual people had 4.24 times the odds of inclusion in the poly-substance use class compared to their odds of inclusion in the normative use class (95% CI 2.68, 6.72; p<0.0001). Mostly homosexual people had 4.21 times the odds of inclusion in the poly-substance use class compared to their odds of inclusion in the normative use class (95% CI 2.09, 8.49; p<0.0001). Homosexual people had elevated odds of inclusion in the poly-substance use vs. normative substance use class but the ratio was not statistically significant (OR 1.34, 95% CI 0.60, 2.98; p=0.474).

2.4 Discussion

This study sought to determine classes of alcohol, tobacco, and other substance use in a nationally representative population of U.S. emerging adults and test whether differences in class membership were seen among non-heterosexual participants. In our sample, sexual minority people were more likely to be female, white, to have attended some college, and to have reported daily cigarette smoking, current heavy drinking, and past month use of marijuana, cocaine, methamphetamine, and other drugs. Based on an algorithm that allowed patterns to emerge from the data, we identified two distinct classes of substance use that we named, "poly-substance use" and "normative use." We found elevated prevalence of alcohol, tobacco, and other substance use among mostly

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heterosexual, bisexual, mostly homosexual, and homosexual participants. Non-heterosexual people were significantly more likely to be included in the poly-substance use vs. the normative use class. Mostly heterosexual, bisexual, and mostly homosexual people were more likely to be included in the poly-substance use class compared to the normative use class. Given that the odds of membership in the high risk vs. low risk class were elevated among homosexual people, the relatively small sample size for this group likely played a role in the failure to achieve statistical significance for the comparison. Thus, the findings for this group should be interpreted with caution.

Our findings regarding sexual minority people are for the most part consistent with the existing literature on these groups in that there does seem to be consensus that these groups are at higher risk of alcohol, tobacco, and other substance use compared to heterosexual people (Corliss, et al. 2008; Garofalo, et al. 1998; Marshal, et al. 2008; Marshal, et al. 2009; Marshal, et al. 2012; Mereish EH, et al. 2014; Pesola, et al. Ramo, et al. 2010; Reed, et al. 2010; Ziyadeh, et al. 2007). Our findings go on to show that mostly heterosexual, bisexual, and mostly homosexual people in the study are more likely than not to display a pattern of polysubstance use with relatively high probabilities of concurrent use of alcohol, tobacco, marijuana, and other substances. This lines up with the higher prevalence of substance use among mostly heterosexual, bisexual, and mostly homosexual people in our sample relative to heterosexual and homosexual people.

The results of our study beg the question of whether people with both same- and opposite-sex attractions are for some reason more vulnerable to risk behaviors than people with either same-sex attraction only or opposite-sex attraction only. It could be

that minority stress is greater among these groups of people because of societal misunderstanding and non-acceptance of their life-style. It could be that, for mostly heterosexual, bisexual, and mostly homosexual people, finding a sense of belonging in an established community of people is more difficult than it is for heterosexual and homosexual people, leading to feelings of isolation and disenfranchisement. Tonda Hughes et al., in considering the high risk of substance use among mostly heterosexual women, distinguish between minority stress factors and "risks of a non-heterosexual lifestyle (Hughes et al. 2015)." Peer influence could play a role in the heightened risk of substance use, given the tradition of spending time in gay bars. However, as Hughes et al. point out, mostly heterosexual people are not necessarily likely to identify with gay culture and so the non-heterosexual lifestyle risk explanation may not hold up in this group.

An alternative explanation that may apply to mostly heterosexual as well as bisexual, mostly homosexual, and homosexual people can be found in the idea of concealable stigmatized identities (CSIs), or identities that are not readily apparent but are nonetheless stigmatized by the community (Hughes et al. 2015). Fear of discovery of one's concealed identity causes mental health problems such as anxiety, depression, and psychological distress (Hughes et al. 2015). Self-medication with alcohol, tobacco, and other substances may help to alleviate symptoms of mental health problems. Weber et al. (2008) posit that minority stress puts people at risk of substance use through "heightened emotional regulation demands (in Flentje)." It may be the case that the stress of

concealing a stigmatized identity among mostly heterosexual, bisexual, and mostly homosexual people involves the same psychological mechanisms.

Our findings have implications for our understanding of substance use treatment need and approaches to treatment among sexual minority people as well. We know that lesbian, gay, and bisexual people use treatment services more than their heterosexual counterparts (Cochran et al. 2003) and that they present to treatment with higher rates of comorbid mental disorders, higher severity of substance use, and even higher rates of physical health problems (Flentje et al. 2015). Given these factors, integrated care could be particularly effective for sexual minority people, providing treatment services in conjunction with mental and physical health services. Senreich has demonstrated the potential effectiveness of such services among lesbian, gay, and bisexual people (Senreich 2010). Relevant information about mostly heterosexual and mostly homosexual people and their use of treatment services and mental health status when seeking treatment is not readily available and, given our findings showing a robust association between these sexual identities and patterns of poly-substance use, it is imperative that research efforts be undertaken in this direction.

Our findings underscore the importance of treating homosexual identity and bisexual identity as distinct categories of sexuality when estimating prevalence of alcohol, tobacco, and other substance use and predicting class membership on that basis. Current best practice requires an even more nuanced categorization method, with additional categories for mostly heterosexual and mostly homosexual. It may be that going a step further and treating sexual identity as a continuous variable rather than a

categorical variable would better capture the fluid concept of sexual identity (Savin-Williams & Vrangalova 2013).

Limitations

While these analyses were conducted using a large, nationally representative dataset, the numbers of non-heterosexual people in the sample were relatively small. In order to preserve as much statistical power as possible given the small sample size of sexual minority young adults, potential confounding covariates included in the model were kept to a minimum. In addition, the categories of sexual identity were limited to heterosexual, mostly heterosexual, bisexual, mostly homosexual and homosexual, which may not have encompassed all the terms that young people use to self-identify in terms of sexuality. The alcohol measure used in the Add Health survey was that of binge drinking rather than any alcohol use, which differed from the measures of use of marijuana, cocaine, methamphetamine, and other drugs. However, binge drinking can be a useful measure in that it conveys the extent to which an individual engages in unhealthy alcohol use rather than moderate use.

2.5 Conclusion

Sexual minority young adults, including those who self-identify as mostly heterosexual, are at increased risk of polysubstance use compared to their heterosexual peers. Sexual minority young adults are likely to experience minority stress and those who are mostly heterosexual, bisexual, and mostly heterosexual may be particularly vulnerable since they may not feel as though they fit into either the 100% heterosexual or 100% homosexual

communities. Given that young adulthood is an important transitional time in a young

person's life, efforts should be made to prevent and treat alcohol, tobacco, and other

substance use disorders in this population in an effort to reduce existing health disparities.

Treatment programs with integrated mental and physical health services and tailored

specifically to the needs of sexual minority people may be warranted.

Table 2.1: Demographic Characteristics and Prevalence of Substance Use Indicators (Number, Weighted Percentage) by Sexual Identity

	Heterosexual n=12,706	Mostly Heterosexual n=961	Bisexual n=227	Mostly Homosexual n=93	Homosexual n=122
Age (mean)(SE)	21.8 (0.12)	21.8 (0.15)	21.3 (0.21)	22.0 (0.25)	22.3 (0.25)
Sex					
Male	6,262 (53.4%)	205 (23.7%)	42 (18.9%)	48 (48.5%)	84 (72.3%)
Female	6,363 (46.6%)	756 (76.3%)	185 (81.2%)	45 (51.5%)	38 (27.7%)
Race					
White	7,254 (68.5%)	632 (75.8%)	148 (79.9%)	54 (65.9%)	72 (75.4%)
Other race	5,371 (31.5%)	329 (24.2%)	79 (20.1%)	39 (34.1%)	50 (24.6%)
Educational attainment					
High school or below	5,703 (47.6%)	379 (40.5%)	116 (51.8%)	43 (44.1%)	41 (32.4%)
Some college or above	6,922 (52.4%)	582 (59.5%)	111 (48.2%)	50 (55.9%)	81 (67.6%)
Substance use					
Daily cigarette smoking	2,575 (23.7%)	243 (29.4%)	71 (35.3%)	29 (33.5%)	37 (33.0%)
Past 2-week binge drinking	4,983 (34.2%)	354 (37.0%)	81 (41.6%)	42 (52.8%)	44 (44.5%)
Past 30-day marijuana use	2,482 (21.4%)	322 (35.0%)	94 (43.2%)	39 (42.0%)	33 (22.0%)
Past 30-day cocaine use	340 (3.1%)	54 (5.7%)	18 (6.3%)	6 (7.9%)	4 (5.7%)
Past 30-day methamphetamine use	169 (1.2%)	25 (2.5%)	11 (2.8%)	5 (5.7%)	5 (1.7%)
Past 30-day other drug use	469 (4.3%)	79 (8.5%)	31 (15.3%)	13 (15.0%)	9 (6.4%)

Figure 2.1: Substance Use Prevalence by Sexual Identity
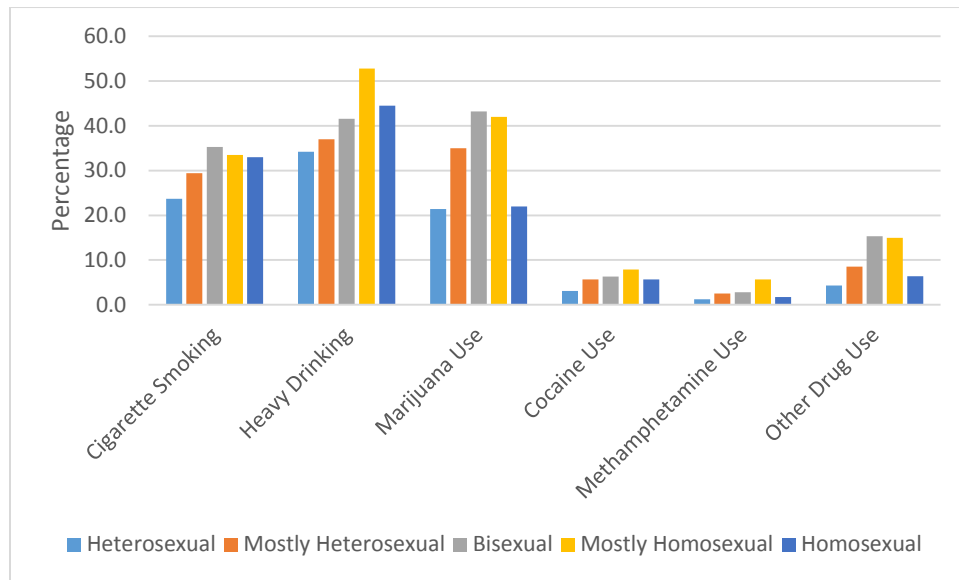
Table 2.2: Latent Class Fit Indicators

Number of Classes	BIC	Adj. BIC
1-class	61264.738	61245.670
2-class	56185.636	56144.323
3-class	55859.008	55795.450
4-class	55851.410	55765.606
5-class	55895.692	55787.643
6-class	55945.550	55815.255

Figure 2.2: BIC Graph
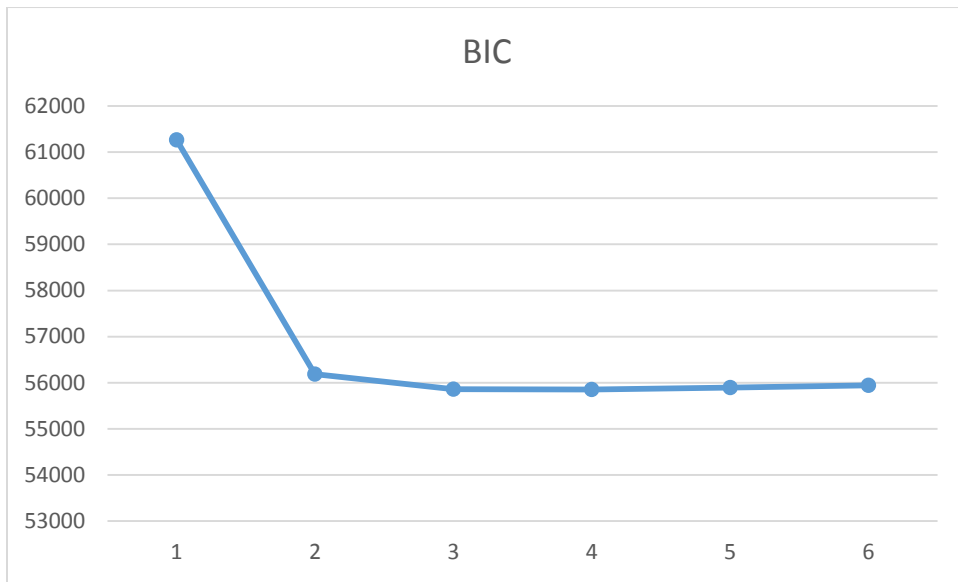
Figure 2.3: Adjusted BIC Graph
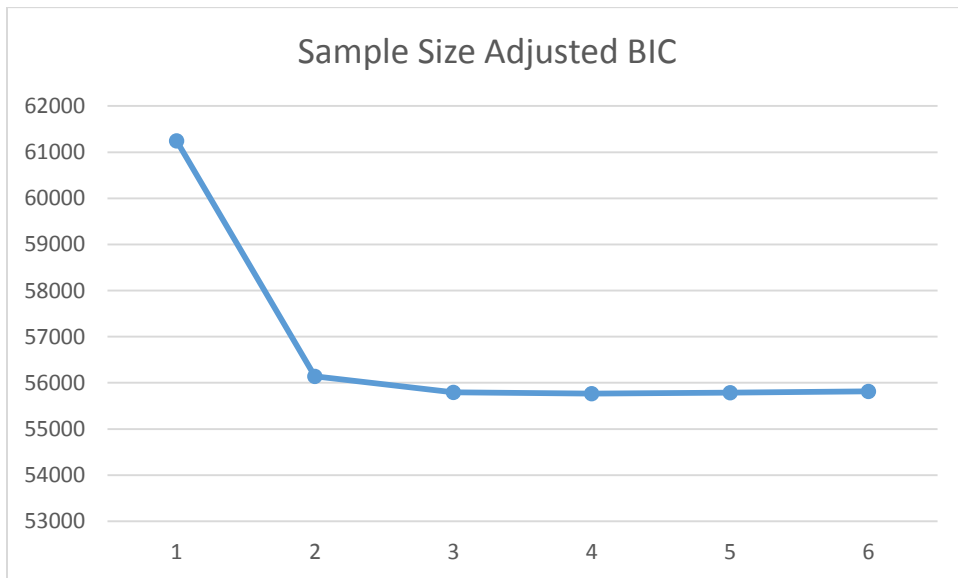
Figure 2.4: Conditional Probabilities of Alcohol, Tobacco, and other Substance Use
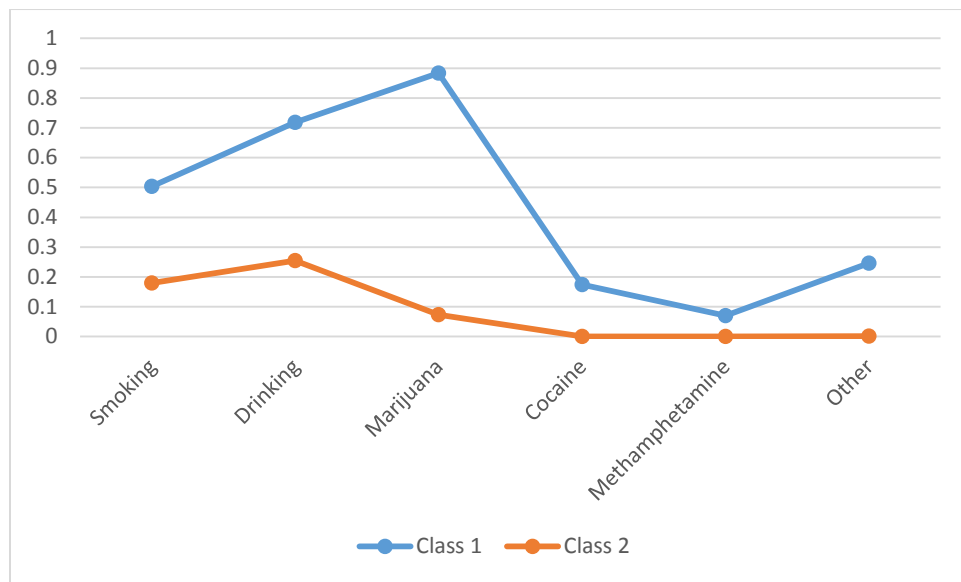
Table 2.3: Latent Class Logistic Regression Results Comparing the Odds of Inclusion in the Poly-Substance Use Class vs. the Normative Use Class by Sexual Minority Identity

Poly-substance use vs. normative use	Beta	Standard Error	Odds Ratio	95% Confidence Interval	P-value
Sexual identity	1.107	0.110	3.03	2.43, 3.75	0.000
Sex	-0.876	0.079	0.42	0.35, 0.48	0.000
Race	-0.812	0.091	0.44	0.37, 0.53	0.000
Education	-0.186	0.077	0.83	0.71, 0.97	0.015
Age	-0.146	0.021	0.86	0.83, 0.90	0.000

Table 2.4: Latent Class Logistic Regression Results Comparing the Odds of Inclusion in the Poly-Substance Use Class vs. the Normative Use Class by Type of Sexual Minority Identity

Poly-substance use vs. normative use	Beta	Standard Error	Odds Ratio	95% Confidence Interval	P-value
Mostly heterosexual	1.094	0.131	2.99	2.31, 3.86	0.000
Bisexual	1.445	0.235	4.24	2.68, 6.72	0.000
Mostly homosexual	1.437	0.358	4.21	2.09, 8.49	0.000
Homosexual	0.292	0.408	1.34	0.60, 2.98	0.474
Sex	0.899	0.081	0.41	0.35, 0.48	0.000
Race	-0.812	0.091	0.44	0.37, 0.53	0.000
Education	-0.177	0.077	0.84	0.72, 0.97	0.021
Age	-0.144	0.022	0.87	0.83, 0.90	0.000

2.6 References

Arnett JJ. Emerging adulthood: a theory of development from the late teens through the twenties. American Psychologist. 2000;55(5):469-480.

Asparouhov T, Muthen B. Auxiliary variables in mixture modeling: 3-step approaches using Mplus. Mplus Web Notes: No. 4. 2014.

Blosnich J, Bossarte R. Drivers of disparity: differences in socially based risk factors of self-injurious and suicidal behaviors among sexual minority college students. 2012;60:141-149.

Brewster KL, Tillman KH. Sexual orientation and substance use among adolescents and young adults. American Journal of Public Health. 2012;102(6):1168-1176.

Cochran SD, Mays VM, Sullivan JG. Prevalence of mental disorders, psychological distress, and mental health services use among lesbian, gay, and bisexual adults in the United States. Journal of Consulting and Clinical Psychology. 2003;71(1):53-61.

Corliss HL, Rosario M, Wypij D, Fisher LB, Austin SB. Sexual orientation disparities in longitudinal alcohol use patterns among adolescents. Arch Pediatr Adolesc Med. 2008;162:1071-1078.

Corliss HL, Austin SB, Roberts AL, Molnar BE. Sexual risk in "mostly heterosexual" young women: influence of social support and caregiver mental health. Journal of Women's Health. 2009;18(12):2005-2010.

Dilley JA, Spigner C, Boysun MJ, Dent CW, Pizacani BA. Does tobacco industry marketing excessively impact lesbian, gay and bisexual communities? Tobacco Control. 2008;17:385-390.

Drabble L. Alcohol, tobacco, and pharmaceutical industry funding: considerations for organizations serving lesbian, gay, bisexual and transgender communities. Journal of Lesbian and Gay Social Services. 2000;11(1):1-26.

Flentje A, Livingston NA, Roley J, Sorensen JL. Mental and physical health needs of lesbian, gay, and bisexual clients in substance abuse treatment. Journal of Substance Abuse Treatment. 2015;58:78-83.

Garofalo R, Wolf RC, Kessel S, Palfrey J, DuRant RH. The association between health reisk behaviors and sexual orientation among a school-based sample of adolescents. Pediatrics. 1998;101:895-902.

Hughes TL, Wilsnack SC, Kristjanson AF. Substance use and related problems among U.S. women who identify as mostly heterosexual. BMC Public Health. 2015;15:803-811.

Kerr DL, Ding K,. Chaya J. Substance use of lesbian, gay, bisexual and heterosexual college students. American Journal of Health Behavior. 2014;38(6):951-962.

King M, Semlyen J, Tai SS, Killaspy H, Osborn D, Popelyuk D, Nazareth I. A systematic review of mental disorder, suicide, and deliberate self harm in lesbian, gay and bisexual people. BMC Psychiatry. 2008;8:70-87.

Krueger H, Andres EN, Koot JM, Reilly BD. The economic burden of cancers attributable to tobacco smoking, excess weight, alcohol use, and physical inactivity in Canada. Curr Oncol. 2016;23(4):241-249.

Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, Bukstein OG, Morse JQ. Sexual orientation and adolescent substance use: a meta-analysis and methodological review. Addiction. 2008;103:546-556.

Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance use in lesbian, gay and bisexual youth and heterosexual youth. Addiction. 2009;104:974-981.

Marshal MP, King KM, Stepp SD, Hipwell A, Smith H, Chung T, Friedman MS, Markovic N. Trajectories of alcohol and cigarette use among sexual minority and heterosexual girls. Journal of Adolescent Health. 2012;50:97-99.

McCabe SE, Hughes TL, Bostwick WB, West BT, Boyd CJ. Sexual orientation, substance use behaviors and substance dependence in the United States. Addiction. 2009;104:1333-1345.

Mereish EH, Bradford JB. Intersecting identities and substance use problems: sexual orientation, gender, race, and lifetime substance use problems. J Stud Alcohol Drugs. 2014;75:179-188.

Meyer I. Minority stress and mental health in gay men. *Journal of Health and Social Behavio*r. 1995;36:38-56.

Park TW, Lin LA, Hosanagar A, Kogowski A, Paige K, Bohnert AS. Understanding risk factors for opioid overdose in clinical populations to inform treatment and policy. J Addict Med. 2016;Epub ahead of print.

Pesola F, Shelton KH, van den Bree MBM. Sexual orientation and alcohol problem use among UK adolescents: an indirect link through depressed mood. Addiction. 2014: Accepted Online.

Ramo DE, Grov C, Delucchi K, Kelly BC, Parsons JT. Typology of club drug use among young adults recruited using time-space sampling. Drug Alcohol Depend. 2010;107:119.

Reed E, Prado G, Matsumoto A, Amaro H. Alcohol and drug use and related consequences among gay, lesbian and bisexual college students: role of experiencing violence, feeling safe on campus, and perceived stress. Addictive Behaviors. 2010;35:168-171.

Savin-Williams RC, Vrangalova Z. Mostly heterosexual as a distinct sexual orientation group: A systematic review of the empirical evidence. Developmental Review. 2013;33:58-88.

Senreich E. Are specialized LGBT program components helpful for gay and bisexual men in substance abuse treatment? Substance Use & Misuse. 2010;45:1077-1096.

Suffoletto B, Kristan J, Chung T, Jeong K, Fabio A, Monti P. An interactive text message intervention to reduce binge drinking in young adults: a randomized controlled trial with 9-month outcomes. PLOS One. 2015;10(11):e0142877.

Talley AE, Sher KJ, Steingley D, Wood PK, Littlefield AK. Patterns of alcohol use and consequences among empirically derived sexual minority subgroups. Journal of Studies on Alcohol and Drugs. 2012;73(2):290-302.

Tomczyk S, Isensee B, Hanewinkel R. Latent classes of polysubstance use among adolescents: a systematic review. Drug and Alcohol Dependence. 2016;160:12-29.

Udry JR, CHantala K. Risk assessment of adolescents with same-sex relationships. Journal of Adolescent Health. 2002;31:84-92.

Weber GN. Using to numb the pain: substance use and abuse among lesbian, gay, and bisexual individuals. Journal of Mental Health Counseling. 2008;30(1):31-48.

Ziyadeh NJ, Prokop LA, Fisher LB, Rosario M, Field AE, Camargo CA, Austin SB. Sexual orientation, gender, and alcohol use in a cohort study of U.S. adolescent girls and boys. Drug and Alcohol Dependence. 2007;87:119-130.

3. Patterns of Adverse Childhood Events among Sexual Minority Young Adults in the U.S.

3.1 Introduction

Adverse events in childhood (ACEs) are events in the lives of children that have the potential to cause a great deal of stress such as abuse, witnessing violence, loss of a parent, and numerous others. ACEs occur in the lives of many children and can have long-reaching effects, having been linked to various negative outcomes in adulthood (Anda et al. 2006). Number of ACEs experienced shows a dose response with both mental and physical health outcomes, including depressed affect, anxiety, poor sleep, obesity, and multiple somatic symptoms (Anda et al. 2006). Lesbian, gay, and bisexual people have been shown to be a particularly vulnerable population when it comes to ACEs, with studies showing that LGBs experience more childhood maltreatment and exposure to violence as young people than heterosexual youth (Anderson & Blosnich 2013; Friedman et al. 2011; McLaughlin et al. 2012; Roberts et al. 2010; Rothman et al. 2011; Schneeberger et al. 2014).

The disparity between heterosexual and sexual minority youth in prevalence of ACEs is a cause for great concern, given the link between ACEs and both short- and long-term health consequences. The sequelae of exposure to ACEs include the development of post-traumatic stress disorder (PTSD), which is a disorder characterized by intense memories of the event, avoidance of particular situations, and hyper-arousal, which has also been shown to be elevated among sexual minorities (Roberts et al. 2010; Roberts et al. 2012). It seems likely that the increased prevalence of trauma exposure and PTSD would account for at least some of the marked physical and mental health

disparities between sexual minority and heterosexual people. The experience of ACEs has been shown to mediate the relationship between sexual identity (lesbian, gay, and bisexual) and frequent mental distress (Blosnich & Anderson 2015). In addition, exposure to violence and homelessness has been shown to account for 10-20% of the disparity between sexual minority and heterosexual people in terms of suicide risk, depression, and drug and alcohol use (McLaughlin et al. 2012). A recent systematic review of the relationship between stressful childhood experiences (SCEs) and mental and physical health outcomes showed that sexual minority people had an elevated prevalence of SCEs and many of the sequelae known to follow such exposures including mental health symptoms, drug and alcohol use, behavioral adjustment problems, revictimization, obesity, and sexually transmitted infections (Schneeberger et al. 2014).

Increased prevalence of traumatic stress, coupled with the discrimination and internalized homophobia that many LGBs experience, make up the three components of the Minority Stress Model (Meyer 1995) that has been used to help explain the physical and psychological health disparities seen among sexual minorities when compared to the heterosexual population. In theory, traumatic stress leads to neurobiological changes resulting in more pronounced reactions to stress (Nemeroff 2004). Childhood maltreatment in the form of maternal rejection, harsh discipline, disruptive caregiver changes, physical abuse, and sexual abuse has been shown to be associated with inflammation in adulthood (Danese et al. 2007). It is clear that ACEs in general have a negative effect on health and are more prevalent among sexual minority people than

among heterosexual people but little is known about differences in prevalence of particular patterns of ACEs.

In order to be more specific in our identification of the links between particular patterns of ACEs and sexual identity, we need an approach that goes beyond measurement of the association between individual ACEs and sexual identity and tells us more about which ACEs are of particular concern among people of various sexual identities. Latent class analysis has been used to model various forms of childhood maltreatment (Berzenski & Yates 2011) and psychological trauma (Ford et al. 2010) and offers a person-centered approach to exploring patterns of ACEs among lesbian, gay, and bisexual young people. Rather than modeling the association between sexual identity and each ACE individually or number of ACEs experienced overall, latent class analysis allows for patterns of ACEs to emerge from the data. These patterns (or classes) of ACEs can show how various ACEs tend to co-occur and allow us to determine the association between certain classes and various groups of people, in this case, people who self-identify as sexual minorities. This information can inform prevention and treatment approaches in this population that attempt to alleviate the health consequences of ACEs in adulthood.

Despite the fact that childhood maltreatment incidence has shown a downward trend in recent years (Finkelhor & Jones 2006), the burden of ACEs remains an important public health issue, particularly among vulnerable groups of people such as sexual minorities. Using data from the National Longitudinal Study of Adolescent Health (Add Health) we 1) modeled the patterns of ACEs in the survey population with latent class

analysis techniques and 2) used logistic regression to determine whether links exist between a) sexual minority status and b) mostly heterosexual, bisexual, mostly homosexual, and homosexual identity and particular patterns of ACEs. This information has the potential to tell us which ACEs tend to co-occur and are likely to adversely affect the lives of sexual minority people. In addition, this information can be used to target prevention and treatment approaches among sexual minority people.

3.2 Methods

Data Source

Add Health is a restricted use dataset with four survey waves beginning when participants were between the ages of 12 and 18 and continuing into the participants' early 30's. The Johns Hopkins Bloomberg School of Public Health's Institutional Review Board determined that this research study involving a secondary data analysis did not warrant human subjects oversight. For these analyses, we used information from participants who completed the survey in both waves I and III and provided information about sexual identity, age, sex, race, and educational attainment (n = 14,028).

Measures

Adverse Childhood Events: Experience of adverse childhood events were measured by self-report at survey Waves 1 and 3, when the participants were 12-18 and 18-24 years old respectively. In Wave 1, participants were asked about fighting and violence. Participants were asked whether, in the past 12 months, he or she had seen someone shoot or stab another person, someone had pulled a knife on him or her,

someone shot him or her, or someone cut or stabbed him or her. Participants who indicated they had seen someone shoot or stab another person were coded as having witnessed violence. Participants who reported having had a knife pulled on him or her, or having been shot, cut, or stabbed were coded as having experienced violence.

In Wave 3, participants were asked about childhood mistreatment by adults by the time they had started 6th grade. Participants were asked how many times their parents or adult care-givers had not taken care of their basic needs such as keeping them clean or providing food or clothing. Participants who indicated that this had happened to them three or more times were coded as having experienced neglect and those who indicated that this had happened two or fewer times were coded as 0. Participants were asked how often their parents or other adult care-givers slapped, hit or kicked them and those who indicated that this had happened three or more times were coded as having experienced childhood physical abuse and those who indicated that this had happened two or fewer times were coded as 0. Participants were asked whether their parents or other adult care-givers touched them in a sexual way, forced them to touch him or her in a sexual way, or forced them to have sexual relations. Participants who indicated that this had happened one or more times were coded as having experienced childhood sexual abuse and those who indicated it had never happened were coded as 0. Participants were also asked about Social Services investigation and intervention. Respondents who indicated that Social Services had investigated how they were taken care of or tried to take them out of their living situation one or more times were coded as having experienced social services investigation and others were coded as 0. Participants who said that they had actually

been taken out of their living situation by Social Services one or more times were coded as having experienced <u>social services removal</u> and others were coded as 0.

Statistical Analyses

Latent class analysis was conducted using the adverse childhood event variables (neglect, physical abuse, sexual abuse, social services investigation, social services removal, witnessing violence, and experiencing violence) as latent class indicators. The number of classes was determined by estimating latent class models without covariates. The BIC and adjusted BIC were graphed and the "elbow" (i.e. the point at which the value levels out) was located, which indicated the optimal number of classes. The BIC and adjusted BIC are the only appropriate indicators of model fit when working with complex survey data.

Once the preferred number of classes was selected, covariates were added to the model and the model was estimated using an R 3-step procedure, which took into account both the latent class indicators and covariates including sexual identity, age, sex, race, and educational attainment. In the R 3-step method, most likely class membership is assigned to each individual and auxiliary variables (e.g. sexual identity) are regressed on class membership. Significant beta coefficients that are statistically significant for the relationship between sexual identity and class membership would indicate that class is associated with sexual identity. Regression analyses were carried out in two separate latent class models, one in which sexual minorities were grouped together and one in which mostly heterosexual, bisexual, mostly homosexual, and homosexual groups were treated separately.

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3.3 Results

When comparing sexual minority people as a group to the heterosexual people in the survey, the two groups were similar in age (Table 3.1). Sex differences were pronounced, with 46.6% of heterosexual people reporting their sex as female and 71.3% of sexual minority people reporting their sex as female. The sexual minority group had a higher percentage of people of white race compared to the heterosexual group (68.5% vs. 75.5%). In addition, the sexual minority group was, on average, more likely to have acquired some college education compared to the heterosexual group (58.2% vs. 52.4%). Compared to heterosexuals, sexual minority people were more likely to have been neglected, physically abused, and sexually abused. Sexual minority people were also more likely to have been the subject of a social services investigation during childhood. Heterosexual and sexual minority people were equally likely to have been removed from the home by social services and to have witnessed violence while sexual minority people were slightly less likely to have experienced violence than heterosexual people.

When considering sexual minority sub groups (mostly heterosexual, bisexual, mostly homosexual, homosexual) in comparison to the heterosexual group, various differences in demographic characteristics and exposure to adverse childhood events were seen (Table 3.1). Average age was similar across groups. Mostly heterosexual and bisexual people were much more likely to be female and homosexual people were much more likely to be female compared to heterosexual people. All of the sexual minority groups except mostly homosexuals were more likely to be white than were heterosexuals. Mostly heterosexuals, mostly homosexuals, and homosexuals were more likely than

heterosexuals to have acquired some college education while bisexual people were less likely to have done so. All of the sexual minority groups were more likely to have experience neglect or physical abuse compared to the heterosexual group. All of the sexual minority groups except the homosexual group were more likely to have experienced childhood sexual abuse compared to the heterosexual group. With the exception of homosexual people, sexual minority people were more likely to have been the subject of a social services investigation during childhood. Bisexual people were more likely and homosexual people were less likely to have been removed from the home by social services than heterosexual people. Bisexual people were more likely to have witnessed violence and experienced violence than heterosexual people while other sexual minority groups were either equally or less likely to have reported these events.

Both the BIC and the adjusted BIC (Table 3.2) indicated a 3-class solution given that, when graphed, the "elbow" occurred at 3 classes (Figures 3.1 and 3.2). The "elbow" is the point at which the BIC and the adjusted BIC bottom out, indicating the effective lowest value. We named Class 1 the "abuse and social services involvement class" and 474 people (3.4% of the total sample) were assigned to this class. Individuals within the abuse and social services involvement class had a 26.1% probability of experiencing neglect, 42.7% probability of experiencing physical abuse, 28.8% probability of experiencing sexual abuse, 100% probability of having been the subject of a social services investigation in childhood, 47.7% probability of being removed from the home, 16.1% probability of witnessing violence, and 26.5% probability of experiencing violence (Table 3.3) (Figure 3.3). We named Class 2 the "witnessing and experiencing

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violence class" and 997 people (7.1% of the total sample) were assigned to this class. Individuals within the witnessing and experiencing violence class had a 16.9% probability of experiencing neglect, 21.3% probability of experiencing physical abuse, 5.9% probability of experiencing sexual abuse, 3.7% probability of being the subject of a social services investigation during childhood, 0% probability of being removed from the home, 63.9% probability of witnessing violence, and 78.5% probability of experiencing violence. We named Class 3 the "low ACEs class" and 12,557 people (89.5% of the total sample) were assigned to this class. Individuals within the no violence class had a 7.7% probability of experiencing neglect, 11.8% probability of physical abuse, 2.8% probability of sexual abuse, 0.6% probability of having been the subject of a social services investigation during childhood, 0% probability of having been removed from the home by social services, 3.2% probability of witnessing violence, and 11.1% probability of experiencing violence.

In logistic regression analyses, sexual minority identity was statistically significantly associated with membership in the abuse and social services involvement class (Table 3.4). As a group, sexual minority people in the survey had 1.61 times the odds of membership in the abuse and social services involvement class compared to membership in the low ACEs class. The logistic regression results for an association between sexual minority identity and membership in the witnessing and experiencing violence class approached but did not reach significance. When sexual minority groups were included in the model individually, bisexual people had increased odds of

membership in the abuse and social services involvement class and the witnessing and experiencing violence class compared to the low ACEs class.

3.4 Discussion

In this study, we used adverse childhood events as indicators of latent classes and found that three distinct classes emerged from the Add Health data. Most of the survey population was assigned to the low ACEs class and small minorities of the population were assigned to an abuse and social services involvement class and a witnessing and experiencing violence class. Sexual minority identity was associated with membership in the abuse and social services involvement class but not the witnessing and experiencing violence class. Sexual minority people had 1.61 times the odds of being included in the abuse and social services involvement class compared to the odds of being included in the low ACEs class. Bisexual people had 2.53 times the odds of being included in the abuse and social services involvement class compared to odds of being included in the low ACEs class and they had 2.99 times the odds of membership in the witnessing and experiencing violence class compared to their odds of membership in the low ACEs class.

This study shows that sexual minority people, and bisexual people in particular, are at increased risk of experiencing patterns of violence above and beyond the low ACEs pattern experienced by the vast majority of the young adults in our sample. Because the Add Health sample is generalizable to the U.S. population of young adults as a whole, this means that a substantial number of sexual minority people are likely to experience patterns of violence during childhood that can result in neurobiological changes

(Nemeroff 2004), increased substance use (McLaughlin et al. 2012), and increased risk of physical and mental health problems including PTSD (Anda et al. 2006; Roberts et al. 2010). Our findings are consistent with existing literature showing that sexual minority people are at greater risk of adverse childhood events compared to heterosexual people but adds information about distinct patterns of events.

It stands to reason that risk of neglect, physical, and sexual abuse is associated with social services investigation and removal from the home in one of the distinct patterns of events that we found. The association between sexual minority and bisexual identities and this latent class of adverse childhood events is consistent with literature that shows that sexual minority identity disclosure and gender non-conforming behavior are associated with family discord and rejection (Keuroghlian et al. 2014; Roberts et al. 2012). In addition, sexual minority people are over-represented among homeless and juvenile justice-involved youth and youth in foster care (Keuroghlian et al. 2014).

There is a number of implications relevant to clinical and social service care providers based on these findings. The American Academy of Pediatrics issued a statement regarding office-based care for sexual minority youth in which they recommended that pediatric primary care physicians play a role in providing support to their adolescent patients and their families who are coming out or questioning their sexuality (Levine & the Committee on Adolescence 2013). It is recommended that the pediatrician be in touch regularly with parents (while taking care to protect youth's confidentiality) who may not have an easy time accepting their child's sexual identity.

This may be particularly beneficial for bisexual youth, who were shown in our study to be especially vulnerable to this pattern of adverse events.

Sexual minority young adults in general were not more likely than heterosexual young adults to be included in the witnessing and experiencing violence class but bisexual people were at increased odds of inclusion in this latent class. Reasons for this are not well understood but may be related to bisexual people having relatively high risk of family rejection due to sexual identity disclosure or assumptions made on the part of family members. Bisexual people may not be welcomed into either the heterosexual or homosexual communities, thus increasing their sense of social isolation and their vulnerability to experiencing and witnessing violence. Family rejection can lead to violence within the home, homelessness, foster care placement, and juvenile justice involvement for bisexual adolescents, thus increasing their risk of witnessing and experiencing violence. Best practices for working with homeless sexual minority youth include respectful treatment, working to provide a safe environment, training staff and volunteers on cultural competency, and striving to protect clients' confidentiality (Keuroghlian et al. 2014).

Family acceptance is key to preventing exposure to adverse events in childhood among sexual minority people. Whereas family rejection leads to negative health and social outcomes (Ryan et al. 2009), family acceptance of a child or adolescent's sexual minority identity is associated with several positive outcomes, including higher self-esteem and more social support and lower risk of developing depression, substance abuse disorders, and suicidality (Ryan et al. 2010). It is possible that family acceptance could

have a positive influence on the victimization and internalized homophobia that make up two out of the three components of the Minority Stress theory, thus mitigating much of the apparent association between sexual minority identity, adverse childhood events, and negative health sequelae. Interventions designed to increase rates of family acceptance among families of sexual minority children, adolescents, and young adults are needed, both within and outside of pediatric primary care.

Limitations

Limitations of this study include the relatively small number of sexual minority people in the sample population and the fact that the Add Health survey restricts answers to the question on sexual identity to "heterosexual, mostly heterosexual, bisexual, mostly homosexual, and homosexual," which may not encompass all of the preferred terms for self-identification among young adults. Given the relatively small sample size of sexual minority young adults, the potentially confounding covariates included in the model were kept to a minimum. In addition, some adverse childhood events (e.g. having been shot) were quite rare and thus had to be combined into the "experiencing violence" variable.

3.5 Conclusion

Rates of adverse childhood events and risk of experiencing unhealthy patterns of violence, abuse, neglect, and witnessing violence are unacceptably high among sexual minority people in general, and bisexual people in particular. Exposure to such patterns of adverse events in childhood can lead to various negative outcomes in young adulthood and beyond and preventing these sequelae should be a public health priority. Pediatric

primary care physicians, nurses, and social workers can play a role in reducing the

incidence of family rejection and increasing the prevalence of accepting behaviors on the

part of family members of sexual minority people, which may help to alleviate some of

the health disparities seen between sexual minority people and their heterosexual peers.

Table 3.1: Demographic Characteristics and Prevalence of Adverse Childhood Events (Number, Weighted Percentage) by Sexual Minority Identity and Sexual Identity Type

	Heterosexual n=12,625	Sexual Minority n=1,403	Mostly Heterosexual n=961	Bisexual n=227	Mostly Homosexual n=93	Homosexual n=122
Age (mean)	21.8	21.7	21.8	21.3	22.0	22.2
Sex						
Male	6,262 (53.4%)	379 (28.7%)	206 (23.7%)	42 (18.8%)	48 (48.5%)	86 (72.2%)
Female	6,363 (46.6%)	1,024 (71.3%)	762 (76.3%)	187 (81.3%)	45 (51.5%)	39 (27.8%)
Race						
White	7,254 (68.5%)	906 (75.7%)	632 (75.8%)	148 (79.9%)	54 (65.9%)	73 (75.5%)
Non-white	5,371 (31.5%)	497 (24.3%)	329 (24.2%)	79 (20.1%)	39 (34.1%)	50 (24.5%)
Educational attainment						
High school or below	5,703 (47.6%)	579 (41.8%)	384 (40.5%)	117 (51.6%)	43 (44.1%)	42 (32.3%)
Some college or above	6,922 (52.4%)	824 (58.2%)	584 (59.6%)	112 (48.4%)	50 (55.9%)	82 (67.7%)
Adverse Childhood Events						
Neglect	1,151 (9.1%)	190 (12.4%)	121 (11.6%)	32 (13.4%)	15 (11.5%)	22 (17.5%)
Physical Abuse	1,729 (13.4%)	295 (19.6%)	201 (19.5%)	43 (16.8%)	23 (24.2%)	28 (21.8%)
Sexual Abuse	479 (3.8%)	101 6.1%)	59 (5.6%)	24 (8.1%)	10 (11.0%)	8 (1.8%)
Social Services Investigation	503 (4.1%)	103 (6.8%)	64 (6.5%)	23 (10.5%)	7 (5.7%)	9 (3.4%)
Social Services Removal	203 (1.6%)	33 (1.8%)	18 (1.6%)	10 (4.0%)	---	3 (0.2%)
Witness to Violence	1,504 (10.6%)	165 (10.5%)	104 (9.8%)	35 (14.1%)	14 (11.1%)	12 (9.4%)
Experience of Violence	2,479 (19.7%)	246 (16.3%)	168 (16.6%)	53 (23.9%)	12 (7.7%)	13 (6.1%)

Table 3.2: Latent Class Fit Indicators

Number of classes	BIC	Adj. BIC
1-class	55524.534	55502.289
2-class	53272.726	53225.057
3-class	51944.395	51871.303
4-class	51545.615	51447.100
5-class	51574.794	51450.855

Figure 3.1: BIC Graph

Figure 3.2: Adjusted BIC Graph
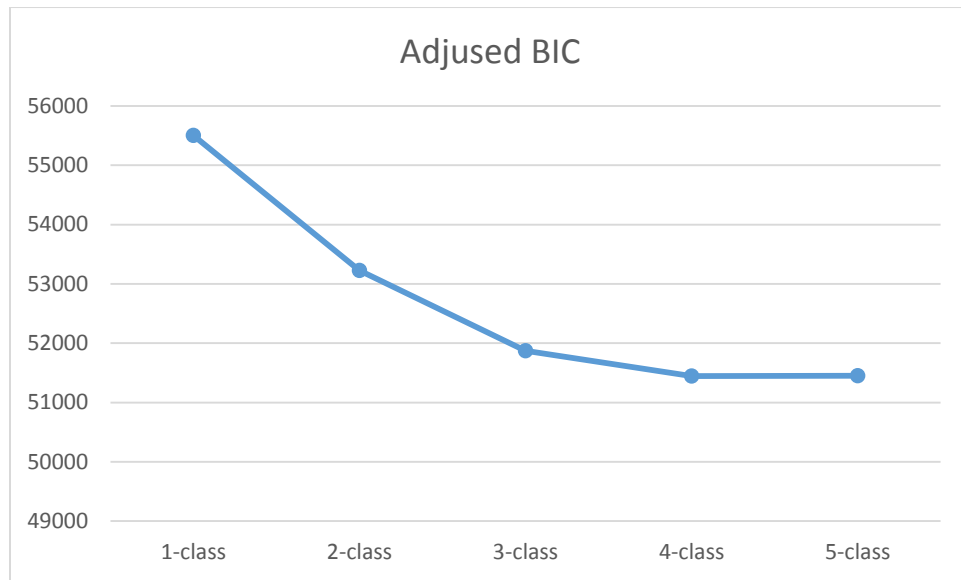
Table 3.3: Conditional Probabilities of Experiencing Adverse Childhood Events

	Class 1	Class 2	Class 3
Neglect	0.261	0.169	0.077
Physical Abuse	0.427	0.213	0.118
Sexual Abuse	0.288	0.059	0.028
SS Investigation	1.000	0.037	0.006
SS Removal	0.477	0.000	0.000
Witness Violence	0.161	0.639	0.032
Experience Violence	0.265	0.785	0.111

Figure 3.3: Conditional Probabilities of Experiencing Adverse Childhood Events

Table 3.4: Latent Class Logistic Regression Results Comparing the Odds of Inclusion in the Abuse and Social Services or the Witnessing and Experiencing Violence Classes vs. the Low ACEs Class by Sexual Minority Identity and Sexual Minority Identity Type

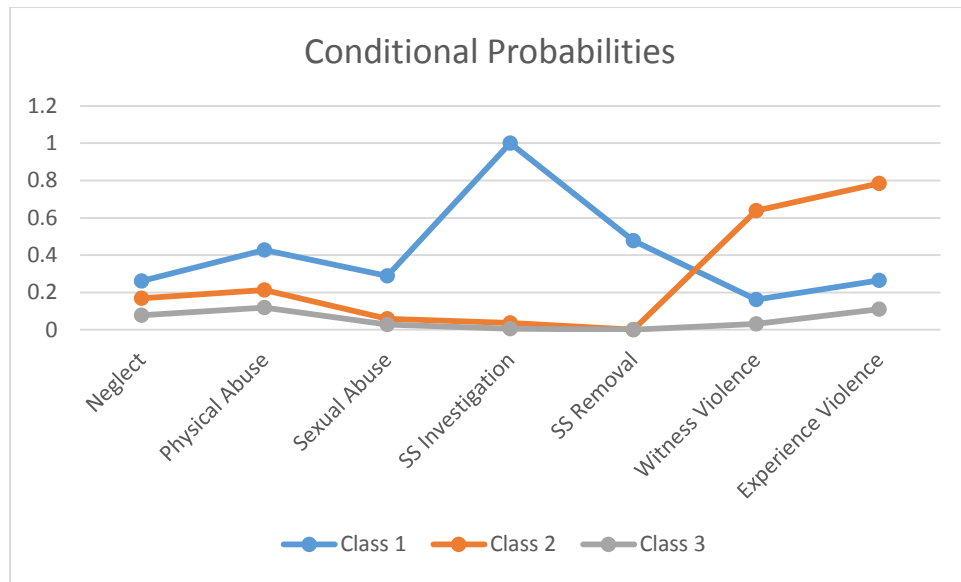|	Beta	Standard Error	Odds Ratio	95% Confidence Interval	P-value
Abuse and social services involvement vs. low ACEs					
Sexual identity	0.473	0.196	1.61	1.09, 2.36	0.016
Sex	0.184	0.152	1.20	0.89, 1.62	0.225
Race	0.265	0.150	1.30	0.97, 1.75	0.078
Education	-1.298	0.173	0.27	0.20, 0.38	0.000
Age	-0.009	0.039	0.99	0.92, 1.07	0.817
Witnessing and experiencing violence vs. low ACEs					
Sexual identity	0.351	0.198	1.42	0.96, 2.09	0.077
Sex	-0.980	0.120	0.38	0.30, 0.48	0.000
Race	1.177	0.114	3.25	2.60, 4.06	0.000
Education	-0.665	0.114	0.51	0.41, 0.64	0.000
Age	0.138	0.028	1.15	1.09, 1.21	0.000
Abuse and social services involvement vs. low ACEs					
Mostly heterosexual	0.416	0.238	1.52	0.95, 2.42	0.080
Bisexual	0.928	0.376	2.53	1.21, 5.29	0.014
Mostly homosexual	0.091	0.175	1.10	0.78, 1.54	0.899
Homosexual	0.148	0.657	1.16	0.32, 4.20	0.822
Sex	0.172	0.154	1.19	0.88, 1.61	0.265
Race	0.273	0.151	1.31	0.98, 1.77	0.070
Education	-1.288	0.172	0.28	0.20, 0.39	0.000
Age	-0.007	0.039	1.01	0.92, 1.07	0.857
Witnessing and experiencing violence vs. low ACEs					
Mostly heterosexual	0.401	0.248	1.49	0.92, 2.43	0.106
Bisexual	1.096	0.360	2.99	1.48, 6.06	0.002
Mostly homosexual	-0.046	0.590	0.96	0.30, 3.04	0.938
Homosexual	-1.835	1.146	0.16	0.02, 1.51	0.109
Sex	-1.016	0.122	0.36	0.29, 0.46	0.000
Race	1.183	0.115	3.26	2.61, 4.09	0.000
Education	-0.655	0.115	0.52	0.42, 0.65	0.000
Age	0.142	0.029	1.15	1.09, 1.22	0.000

3.6 References

Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield C, Perry BD, Dube SR, Giles WH. The enduring effects of abuse and related adverse experiences in childhood: a convergence of evidence from neurobiology and epidemiology. Eur Arch Psychiatry Clin Neurosci. 2006;256:174-186.

Andersen JP, Blosnich J. Disparities in adverse childhood experiences among sexual minority and heterosexual adults: results from a multi-state probability-based sample. PLOS ONE. 2013;8(1):e54691.

Berzenski SR, Yates TM. Classes and consequences of multiple maltreatment: a person-centered analysis. 2011;16(4):250-261.

Blosnich JR, Andersen JP. Thursday's child: the role of adverse childhood experiences in explaining mental health disparities among lesbian, gay, and bisexual US adults. Soc Psychiatry Psychiatr Epidemiol. 2015;50:335-338.

Danese A, Pariante CM, Caspi A, Taylor A, Poulton R. Childhood maltreatment predicts adult inflammation in a life-course study. PNAS. 2007;104(4):1319-1324.

Finkelhor D, Jones L. Why have child maltreatment and child victimization declined? Journal of Social Issues. 2006;62(4):685-716.

Ford JD, Elhai JD, Connor DF, Frueh BC. Poly-victimization and risk of posttraumatic, depressive, and substance use disorders and involvement in delinquency in a national sample of adolescents. Journal of Adolescent Health. 2010;46:545-552.

Friedman MS, Marshal MP, Guadamuz TE, Wei C, Wong CF, Saewyc EM, Stall R. A meta-analysis of disparities in childhood sexual abuse, parental physical abuse, and peer victimization among sexual minority and sexual nonminority individuals. American Journal of Public Health. 2011;101(8):1481-1494.

Keuroghlian AS, Shtasel D, Bassuk EL. Out on the street: a public health and policy agenda for lesbian, gay, bisexual, and transgender youth who are homeless. American Journal of Orthopsychiatry. 2014;84(1):66-72.

Levine DA, Committee on Adolescence. Office-based care for lesbian, gay, bisexual, transgender, and questioning youth. Pediatrics. 2013;132;e297-e313.

McLaughlin KA, Hatzenbuehler ML, Xuan Z, Conron KJ. Disproportionate exposure to early-life adversity and sexual orientation disparities in psychiatric morbidity. Child Abuse and Neglect. 2012;36:645-655.

Nemeroff CB. Neurobiological consequences of childhood trauma. J Clin Psychiatry. 2004;65(Supplement 1):18-28.

Roberts AL, Austin SB, Corliss HL, Vandermorris AK, Koenen KC. Pervasive trauma exposure among US sexual orientation minority adults and risk of posttraumatic stress disorder. American Journal of Public Health. 2010;100(12):2433-2441.

Roberts AL, Rosario M, Corliss HL, Koenen KC, Austin SB. Elevated risk of posttraumatic stress in sexual minority youths: mediation by childhood abuse and gender nonconformity. American Journal of Public Health. 2012;102(8):1587-1593.

Rothman EF, Exner D, Baughman AL. The prevalence of sexual assault against people who identify as gay, lesbian, or bisexual in the United States: a systematic review. Trauma, Violence, and Abuse. 2011;12(2):55-66.

Ryan C, Huebner D, Diaz RM, Sanchez J. Family rejection as a predictor of negative health outcomes in White and Latino lesbian, gay, and bisexual young adults. Pediatrics. 2009;123:346-352.

Ryan C, Russell ST, Huebner D, Diaz R, Sanchez J. Family acceptance in adolescence and the health of LGBT young adults. Journal of Child and Adolescent Psychiatric Nursing. 2010;23(4):205-213.

Schneeberger AR, Dietl MF, Muenzenmaier KH, Huber CG, Lang UE. Stressful childhood experiences and health outcomes in sexual minority populations: a systematic review. Soc Psychiatry Psychiatr Epidemiol. 2014;49:1427-1445.

4. Transitions from Adverse Childhood Event Patterns to Substance Use Patterns Among Sexual Minority Young Adults in the U.S.

4.1 Introduction

Adverse childhood events (ACEs) such as abuse, neglect, witnessing violent acts, and many others, can have long-reaching mental and physical health consequences in adulthood (Anda et al. 2006). Self-reported history of ACEs has been linked to depressed affect, panic reactions, anxiety, hallucinations, poor sleep, obesity, somatic symptoms, substance use, and injection drug use, with a clear dose response relationship between these outcomes and the number of ACEs experienced (Anda et al. 2006). The link between adverse childhood events and substance use in adolescence and adulthood has been well established (Downs & Harrison 1998; Luk et al. 2010; Simpson & Miller 2002; Wiechelt 2013).

The question of why people who experienced adverse events in childhood demonstrate higher levels of alcohol, tobacco, and other substance use later in life has been debated in the literature. It may be that children who experience ACEs develop PTSD (even at sub-clinical levels) and use alcohol, tobacco, and other substances to manage symptoms such as anxiety, panic attack, poor sleep, and painful memories (Wiechelt 2013). On the other hand, it has been posited that there is a "common variable" that causes both the development of PTSD and the development of substance use (Leeies et al. 2010). This raises the question of whether some groups of people are particularly vulnerable to developing substance use given a history of adverse childhood events. Sexual minority people have been shown to have relatively high prevalence of childhood maltreatment and bullying (Andersen & Blosnich 2013; Friedman et al. 2011;

McLaughlin et al. 2012; Roberts et al. 2010; Rothman et al. 2011; Schneeberger et al. 2014) and substance use (Corliss, et al. 2008; Garofalo, et al. 1998; Marshal, et al. 2008; Marshal, et al. 2009; Marshal, et al. 2012; Mereish EH, et al. 2014; Pesola, et al. Ramo, et al. 2010; Reed, et al. 2010; Ziyadeh, et al. 2007) but whether they are more vulnerable to developing substance use subsequent to adverse childhood events is unclear.

Ilan Meyer's minority stress theory posits that sexual minority people experience three types of stressors based on their minority identities (Meyer 1995). These include internalized homophobia (the turning of negative attitudes towards oneself), stigma (the expectation of negative societal treatment), and violence (Meyer 1995). Large, population-based surveys do not generally include questions about internalized homophobia or stigma but some do measure sexual identity, experience of adverse childhood events, and substance use. The question of whether internalized homophobia and stigma convey increased risk of substance use among sexual minority people in young adulthood given experiences of adverse childhood events is pertinent to our understanding of substance use risk in this population.

Substance use puts young adults at risk of both short- (development of STDs through decreased vigilance when it comes to safe sex) and long-term consequences (development of lung cancer from years of tobacco smoking). Preventing and treating substance use among young adults therefore should be a priority. Although we know generally that ACEs are associated with later alcohol, tobacco, and other substance use, less is known about whether links exist between particular patterns of ACEs and patterns of substance use and whether sexual minority people are more vulnerable in that regard

than heterosexual people. This type of information could help in the development of more effective prevention and intervention efforts among sexual minority people.

We sought to determine patterns (classes) of ACEs and young adult substance use separately using latent class analysis and then to model the transition from particular classes of ACEs to particular classes of substance use using Add Health data. We then used logistic regression to test whether sexual minority people were more likely to demonstrate particular transition patterns compared to heterosexual people. If we were to find that sexual minority people were more likely to transition from patterns characterized by high levels of ACEs to patterns characterized by high levels of substance use, it would indicate that sexual minority people in the sample have an added vulnerability to substance use above and beyond the ACEs included in our analyses, perhaps having to do with internalized homophobia, stigma, or other factors.

4.2 Methods

Data Source

Data from the National Longitudinal Study of Adolescent Health (Add Health) were used in these analyses. Add Health is a population-based survey of U.S. adolescents ages 12-18 who were followed into their early 30's in four waves of data collection.

Measures

Sexual Identity: Sexual identity was measured using six categories: 100% heterosexual, mostly heterosexual, bisexual, mostly homosexual, 100% homosexual, and unsure. People who reported a sexual identity of mostly heterosexual, bisexual, mostly

homosexual, and homosexual were coded together as sexual minority and people who reported heterosexual identity were included in their own category.

Adverse Childhood Events: Experience of adverse childhood events were measured by self-report at survey Waves 1 and 3, when the participants were 12-18 and 18-24 years old respectively. In Wave 1, participants were asked about fighting and violence. Participants were asked whether, in the past 12 months, he or she had seen someone shoot or stab another person, someone had pulled a knife on him or her, someone shot him or her, or someone cut or stabbed him or her. Participants who indicated they had seen some shoot or stab another person were coded as having witnessed violence. Participants who reported exposure to any type of violence one or more times were coded as having experienced violence and those who indicated they had never had exposure to any type of violence were coded as 0.

In Wave 3, participants were asked about childhood mistreatment by adults by the time they had started 6th grade. Participants were asked how many times their parents or adult care-givers had not taken care of their basic needs such as keeping them clean or providing food or clothing. Participants who indicated that this had happened to them three or more times were coded as having experienced neglect and those who indicated that this had happened two or fewer times were coded as 0. Participants were asked how often their parents or other adult care-givers slapped, hit or kicked them and those who indicated that this had happened three or more times were coded as having experienced physical abuse and those who indicated that this had happened two or fewer times were coded as 0. Participants were asked whether their parents or other adult care-givers

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touched them in a sexual way, forced them to touch him or her in a sexual way, or forced them to have sexual relations. Participants who indicated that this had happened one or more times were coded as having experienced sexual abuse and those who indicated it had never happened were coded as 0. Participants were also asked about Social Services investigation and intervention. Respondents who indicated that Social Services had investigated how they were taken care of or tried to take them out of their living situation one or more times were coded as having experienced social services investigation and others were coded as 0. Participants who said that they had actually been taken out of their living situation by Social Services one or more times were coded as having experienced social services removal and others were coded as 0.

Substance Use: Current substance use was measured in Wave 3. A respondent was coded as being a current heavy alcohol user if they reported having five or more drinks on a single occasion in the past two weeks (4 drinks for women). Those who did not report heavy alcohol use were coded as non-drinkers. Current cigarette smoking was constructed as a dichotous variable with respondents who reported smoking on between 1 and 30 days in the past month being designated as current smokers and those who did not report regular smoking being designated as non-smokers. Current marijuana use was constructed as a dichotomous variable with respondents who reported any marijuana use in the past month being coded as current users and those who did not report use in the past month being coded as non-users. Current cocaine use (any kind of cocaine) was coded the same way as marijuana use. The Add Health Study combines other types of illegal drugs into one variable of current (past 30-day) other drug use. The questionnaire

specifically mentions LSD, PCP, ecstasy, mushrooms, inhalants, ice, heroin, and prescription medicines as types of illegal drugs but the question is worded in such a way that other illegal drugs could count. For this study, <u>current other illegal drug</u> use was constructed as a dichotomous variable with those who reported using an illegal drug other than those already mentioned in the survey (marijuana, cocaine, crystal methamphetamine).

Statistical Analyses

Latent class analysis was used to model patterns of adverse events in childhood, with each of the adverse event variables described above included in the analysis as latent class indicators. The BIC was the only fit indicator used to evaluate model fit because it is the only indicator that is suitable for use with complex survey data. The optimal number of classes of adverse events was determined and the same procedure was used to determine the optimal number of classes of types of alcohol, tobacco, and other substance use (methods described in detail elsewhere). Then, a latent transition analysis was conducted in which the transition between classes of adverse events in childhood and classes of substance use in young adulthood was modeled. Probabilities of transitioning from one particular class to another particular class were obtained. Logistic regression analysis was then used to assess whether sexual minority people in the sample were more likely than heterosexual people to belong to particular transition patterns. Mplus version 7 was used for the analysis.

4.3 Results

Demographic characteristics and prevalence of adverse childhood events and substance use indicators (Table 4.1) and methods used to model and select the appropriate number of classes of ACEs and substance use and discussion of the resulting patterns are described elsewhere. Briefly, latent class analysis was used to model patterns of ACEs in the general population and the BIC pointed to a 3-class solution. The three patterns of ACEs included "low ACEs," "abuse and social services involvement," and "witnessing and experiencing violence." People in the low ACEs class had low probabilities of experiencing any of the ACEs included in the model. People in the abuse and social services involvement class had moderate probabilities of experiencing physical abuse, sexual abuse, and neglect and relatively high probabilities of social services involvement in childhood. People in the witnessing and experiencing violence class had low probabilities of abuse, neglect, and social services involvement but relatively high probabilities of witnessing and experiencing violence.

Latent class analysis was used to model patterns of substance use and a two-class solution was selected based on the BIC. The two patterns of substance use included "normative substance use" and "poly-substance use." People in the normative substance use class were moderately likely to binge drink, smoke cigarettes, and smoke marijuana and had low probabilities of use of cocaine, methamphetamine, and other drugs. People in the poly-substance use class had relatively high probabilities of use of all substance types.

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Latent transition probabilities (Table 4.2) show that people who were in the low ACEs class were highly likely to be in the normative substance use in young adulthood class (Probability(P)=0.838) and had a low probability of transitioning to the poly-substance use class in young adulthood (P=0.162). People in the abuse and social services involvement in childhood class were less likely to transition into the normative substance use in young adulthood class (P=0.707) and more likely to transition into the poly-substance use in young adulthood class (P=0.293). Similarly, people in the witnessing and experiencing violence in childhood class were less likely than those in the low ACEs class to be in the normative substance use in young adulthood class (P=0.695) and more likely to be in the poly-substance use in young adulthood class (P=0.305). Logistic regression analyses showed that people in the low ACEs class were significantly more likely to transition to the normative substance use class compared to people in the witnessing and experiencing violence class (p<0.001) (Table 4.3). People in the abuse and social services involvement class were not more likely than people in the witnessing and experiencing violence class to transition to the normative substance use class (p=0.569).

Having established that, in the general population, negative adverse childhood event patterns are associated with a poly-substance use pattern, logistic regression was used to test whether sexual minority people were more likely than heterosexual people to be included in particular classes and transition patterns. We found that sexual minority people had 0.79 times the odds of being included in the low ACEs class but the association was not significant. Sexual minority people had 1.46 times the odds of being

included in the abuse and social services involvement class but the association was not significant. Sexual minority people had 0.30 times the odds of transitioning from the low ACEs to the normative substance use class compared to heterosexual people. Sexual minority people had 0.57 times the odds of transitioning from the abuse and social services involvement class to the normative substance use class compared to heterosexual people but the association was not significant. Sexual minority people had 0.77 times the odds of transitioning from the witnessing and experiencing violence class to the normative substance use class but the association was not significant.

4.4 Discussion

In this paper, we sought to determine probabilities of transitioning from particular patterns of adverse childhood events to particular patterns of substance use and whether sexual minority people were more likely to demonstrate particular patterns than heterosexual people. We found that a large majority of people in the low ACEs class were likely to transition to the normative substance use class while people in the abuse and social services involvement and the witnessing and experiencing violence classes were more likely to transition to the poly-substance use class. Logistic regression analyses confirmed these findings, showing that people in the low ACEs class had 2.61 times the odds of transitioning to the normative substance use class compared to people in the witnessing and experiencing violence class (p<0.0001).

Among sexual minority people, the only statistically significant finding was that they had 0.30 times the odds of transitioning from the low ACEs class to the normative substance use class (p<0.0001). Sexual minority people were not more likely than

heterosexual people to transition from the abuse and social services class or the witnessing and experiencing violence class to the poly-substance use class.

Our findings confirm what we already know about the strong relationship between ACEs and substance use and go a step further by showing that two very different patterns of ACEs put people at similar risk of demonstrating poly-substance use patterns in young adulthood. One explanation for this is that different types of ACEs have similar effects on the developing brains of children and adolescents such that they are rendered more vulnerable to poly-substance use (Anda et al. 2005; Nemeroff 2004).

We sought to answer the question of whether sexual minority people, who have been shown to be more vulnerable to both ACEs and substance use, are more likely, given particular patterns of ACEs, to transition to potentially problematic substance use patterns. In other words, does sexual minority identity and the exposure to added stressors that may go along with that identity confer a greater risk, given negative patterns of ACEs, of transitioning to a poly-substance use pattern? According to our results, sexual minority people in the negative ACEs classes were no more or less likely than heterosexual people to transition to poly-substance use.

We did, however, find that sexual minority people in the low ACEs class were more likely to transition to the poly-substance use class and the implication is that, among people with low probabilities of experiencing the ACEs included in our study, there is something about being a sexual minority that confers greater risk of transitioning to poly-substance use in young adulthood. It is possible that the sexual minority people who transitioned to poly-substance use experienced ACEs that were not included in our

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analyses. It is also possible that experiences that do not necessarily reach the threshold of seriousness that ACEs do, such as systemic discrimination and micro-aggression, are associated with similar neurobiological effects that then result in risk of poly-substance use. Another potential explanation is that sexual minority people are exposed to higher levels of acceptance of substance use in their peer networks, resulting in higher risk of poly-substance use.

Our findings imply that prevention of ACEs could result in lower prevalence of poly-substance use among both heterosexual and sexual minority people. Further, even sexual minority people without histories of childhood physical or sexual abuse, neglect, social services involvement, or witnessing or experiencing violence are at higher risk of poly-substance use in young adulthood than heterosexual people with similar histories. The literature highlights the potential for sexual minority-specific substance use treatment services to more effectively address problem substance use in this group (Senreich 2010). In addition, it may be that prevention of ACEs among sexual minority children and adolescents should be approached differently than it typically is among heterosexual young people. More research needs to be done to determine whether motivations for childhood physical and sexual abuse and neglect differ according to the sexual identity of the child. It may be that gender non-conforming behavior or divulging sexual minority identity put young people at risk of specifically discrimination-oriented violence. This suggests that prevention programs that specifically target family acceptance (Ryan et al. 2009) could help to reduce the harms to sexual minority youth.

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Limitations

One limitation to this study is that a wider range of ACEs was not measured in the Add Health survey. In addition, stressors unique to sexual minority people such as internalized homophobia and stigma were not measured and could not be taken into account in our analyses. Another limitation is that we did not have sufficient power to explore differences in ACEs to substance use transition patterns among sub-groups of sexual minorities. In addition, potential confounders included in the model were kept to a minimum in order to preserve statistical power.

4.5 Conclusion

Sexual minority people are at higher risk of both ACEs and young adult substance use and we found that those without histories of ACEs were more likely to transition to poly-substance use compared to heterosexual people with similar histories. Poly-substance use exposes sexual minority young adults to increased risk of injury, chronic disease, and overdose. Prevention and treatment efforts should target both ACEs and substance use among sexual minority people and it may be that programs specifically tailored to this population will be more effective than those developed for use in the general population.

Table 4.1: Demographic Characteristics and Prevalence of Adverse Childhood Events and Substance Use Indicators (Number, Weighted Percentage) by Sexual Minority Identity

	Heterosexual n=12,625	Sexual Minority n=1,403
Age (mean)	21.8	21.7
Sex		
Male	6,262 (53.4%)	379 (28.7%)
Female	6,363 (46.6%)	1,024 (71.3%)
Race		
White	7,254 (68.5%)	906 (75.7%)
Non-white	5,371 (31.5%)	497 (24.3%)
Educational attainment		
High school or below	5,7303 (47.6%)	579 (41.8%)
Some college or above	6,922 (52.4%)	824 (58.2%)
Substance use		
Daily cigarette smoking	2,586 (23.7%)	380 (30.9%)
Past 2-week binge drinking	4,002 (34.2%)	521 (39.4%)
Past 30-day marijuana use	2,498 (21.4%)	488 (35.6%)
Past 30-day cocaine use	341 (3.1%)	82 (5.9%)
Past 30-day methamphetamine use	170 (1.2%)	46 (2.7%)
Past 30-day other drug use	474 (4.3%)	132 (9.8%)
Adverse childhood events		
Neglect	1,151 (9.1%)	190 (12.4%)
Physical abuse	1,729 (13.4%)	295 (19.6%)
Sexual abuse	479 (3.8%)	101 (6.1%)
Social services investigation	503 (4.1%)	103 (6.8%)
Social services removal	203 (1.6%)	33 (1.8%)
Witness to violence	1,504 (10.5%)	165 (10.5%)
Experience of violence	2,479 (19.7%)	246 (16.2%)

Table 4.2: Latent Transition Probabilities: ACEs Patterns to Substance Use Patterns

	Normative Substance Use	Poly-substance Use
Low ACEs	0.838 (n=8,844)	0.162 (n=1,835)
Abuse and Social Services Involvement	0.707 (n=358)	0.293 (n=132)
Witnessing and Experiencing Violence	0.695 (2,080)	0.305 (n=779)

Table 4.3: Latent Transition Logistic Regression Results

Logistic Regression	Odds Ratio (p-value)
Normative substance use on low ACEs (witnessing and experiencing violence is the reference group)	2.61 (0.000)
Normative substance use on abuse and social services involvement (witnessing and experiencing violence is the reference group)	1.14 (0.569)
ACEs on sexual minority identity (heterosexual is the reference group)	0.79 (0.117)
Abuse and social services involvement on sexual minority identity (heterosexual is the reference group)	1.46 (0.086)
Transition from normative substance use to low ACEs on sexual minority identity (heterosexual is the reference group)	0.30 (0.000)
Transition from abuse and social services involvement to low ACEs on sexual minority identity (heterosexual is the reference group)	0.57 (0.171)
Transition from witnessing and experiencing violence to low ACEs on sexual minority identity (heterosexual is the reference group)	0.77 (0.342)

4.6 References

Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield C, Perry BD, Dube SR, Giles WH. The enduring effects of abuse and related adverse experiences in childhood: a convergence of evidence from neurobiology and epidemiology. Eur Arch Psychiatry Clin Neurosci. 2006;256:174-186.

Andersen JP, Blosnich J. Disparities in adverse childhood experiences among sexual minority and heterosexual adults: results from a multi-state probability-based sample. PLOS ONE. 2013;8(1):e54691.

Corliss HL, Rosario M, Wypij D, Fisher LB, Austin SB. Sexual orientation disparities in longitudinal alcohol use patterns among adolescents. Arch Pediatr Adolesc Med. 2008;162:1071-1078.

Downs WR, Harrison L. Childhood maltreatment and the risk of substance problems in later life. Health and Social Care in the Community. 1998;6(1):35-46.

Friedman MS, Marshal MP, Guadamuz TE, Wei C, Wong CF, Saewyc EM, Stall R. A meta-analysis of disparities in childhood sexual abuse, parental physical abuse, and peer victimization among sexual minority and sexual nonminority individuals. American Journal of Public Health. 2011;101(8):1481-1494.

Garofalo R, Wolf RC, Kessel S, Palfrey J, DuRant RH. The association between health risk behaviors and sexual orientation among a school-based sample of adolescents. Pediatrics. 1998;101:895-902.

Leeies M, Pagura J, Sareen J, Bolton JM. The use of alcohol and drugs to self-medicate symptoms of posttraumatic stress disorder. Depression and Anxiety. 2010;27(8):731-736.

Luk JW, Wang J, Simons-Morton BG. Bullying victimization and substance use among U.S. adolescents: mediation by depression. Prevention Science. 2010;11:355-359.

Marshal MP, Friedman MS, Stall R, King KM, Miles J, Gold MA, Bukstein OG, Morse JQ. Sexual orientation and adolescent substance use: a meta-analysis and methodological review. Addiction. 2008;103:546-556.

Marshal MP, Friedman MS, Stall R, Thompson AL. Individual trajectories of substance use in lesbian, gay and bisexual youth and heterosexual youth. Addiction. 2009;104:974-981.

Marshal MP, King KM, Stepp SD, Hipwell A, Smith H, Chung T, Friedman MS, Markovic N. Trajectories of alcohol and cigarette use among sexual minority and heterosexual girls. Journal of Adolescent Health. 2012;50:97-99.

McLaughlin KA, Hatzenbuehler ML, Xuan Z, Conron KJ. Disproportionate exposure to early-life adversity and sexual orientation disparities in psychiatric morbidity. Child Abuse and Neglect. 2012;36:645-655.

Mereish EH, Bradford JB. Intersecting identities and substance use problems: sexual orientation, gender, race, and lifetime substance use problems. J Stud Alcohol Drugs. 2014;75:179-188.

Meyer I. Minority stress and mental health in gay men. *Journal of Health and Social Behavio*r. 1995;36:38-56.

Nemeroff CB. Neurobiological consequences of childhood trauma. J Clin Psychiatry. 2004;65(Supplement 1):18-28.

Pesola F, Shelton KH, van den Bree MBM. Sexual orientation and alcohol problem use among UK adolescents: an indirect link through depressed mood. Addiction. 2014: Accepted Online.

Ramo DE, Grov C, Delucchi K, Kelly BC, Parsons JT. Typology of club drug use among young adults recruited using time-space sampling. Drug Alcohol Depend. 2010;107:119.

Reed E, Prado G, Matsumoto A, Amaro H. Alcohol and drug use and related consequences among gay, lesbian and bisexual college students: role of experiencing violence, feeling safe on campus, and perceived stress. Addictive Behaviors. 2010;35:168-171.

Roberts AL, Austin SB, Corliss HL, Vandermorris AK, Koenen KC. Pervasive trauma exposure among US sexual orientation minority adults and risk of posttraumatic stress disorder. American Journal of Public Health. 2010;100(12):2433-2441.

Rothman EF, Exner D, Baughman AL. The prevalence of sexual assault against people who identify as gay, lesbian, or bisexual in the United States: a systematic review. Trauma, Violence, and Abuse. 2011;12(2):55-66.

Ryan C, Huebner D, Diaz RM, Sanchez J. Family rejection as a predictor of negative health outcomes in White and Latino lesbian, gay, and bisexual young adults. Pediatrics. 2009;123:346-352.

Schneeberger AR, Dietl MF, Muenzenmaier KH, Huber CG, Lang UE. Stressful childhood experiences and health outcomes in sexual minority populations: a systematic review. Soc Psychiatry Psychiatr Epidemiol. 2014;49:1427-1445.

Senreich E. Are specialized LGBT program components helpful for gay and bisexual men in substance abuse treatment? Substance Use & Misuse. 2010;45:1077-1096.

Simpson TL, Miller WR. Concomitance between childhood sexual and physical abuse and substance use problems: a review. Clinical Pscyhology Review. 2002;22:27-77.

Wiechelt SA. Intersection between trauma and substance misuse: implications for trauma-informed care. In: Clinical Work with Substance-Abusing Clients, Third Edition. New York: Guildfor Publications, 2013.

Ziyadeh NJ, Prokop LA, Fisher LB, Rosario M, Field AE, Camargo CA, Austin SB. Sexual orientation, gender, and alcohol use in a cohort study of U.S. adolescent girls and boys. Drug and Alcohol Dependence. 2007;87:119-130.

5. Public Health Significance

In this study, we sought to derive patterns of alcohol, tobacco, marijuana, cocaine, methamphetamine, and other substance use among young adults in the general U.S. population using latent class analysis and test whether sexual minority people in general and sexual minority sub-groups in particular were more or less likely to demonstrate particular patterns. We identified two distinct classes or patterns of substance use including a "normative use" class characterized by moderate probabilities of alcohol, tobacco, and marijuana use, and low probabilities of other drug use, and a "poly-substance use" class characterized by relatively high probabilities of use of all substances. Sexual minority people were more likely to belong to the poly-substance use class than to the normative use class. When we looked at the association by sexual minority sub-groups (mostly heterosexual, bisexual, mostly homosexual, homosexual), we found that mostly heterosexual, bisexual, and mostly homosexual but not 100% homosexual people were more likely to belong to the poly-substance use class than to the normative use class.

These findings carry the implication that people with both same- and opposite-sex attraction are at higher risk of poly-substance use in young adulthood in comparison to 100% heterosexual or 100% homosexual people and highlights the need for more and better prevention and treatment strategies targeting these groups. Applying minority stress theory (Meyer 1995) to this issue, it may be that people who are neither heterosexual nor homosexual but somewhere in between face increased levels of stress due to their marginalized status. Mostly heterosexual, bisexual, and mostly homosexual

people may not perceive the heterosexual and homosexual communities as entirely welcoming and this may translate into less social support, more internalized homophobia, and greater perception of stigma.

How to approach substance use treatment among mostly heterosexual, bisexual, and mostly homosexual people is an important consideration. Given that bisexual people use treatment services more often (Cochran et al. 2003) and present with higher rates of mental disorder, more severe substance use problems, and concomitant physical health problems (Flentje et al. 2015), it is likely that mostly heterosexual and mostly homosexual people do as well. This suggests that treatments that use an integrated care approach, combining mental and physical health services with substance use treatment services, could be particularly effective. This type of treatment program has been found to be effective among lesbian, gay, and bisexual people (Senreich 2010). Adaptation may be required to make such treatments relevant and effective among mostly heterosexual and mostly homosexual people, who may have differing needs, attitudes to and motivations for substance use, and substance use environments.

We also sought to derive classes of ACEs in the general U.S. population of young adults and test whether sexual minority people in general and by sub-group were more or less likely to demonstrate particular patterns. We found evidence for a "low ACEs" class, an "abuse and social services involvement" class, and a "witnessing and experiencing violence" class. Sexual minority people were more likely to be included in the abuse and social services involvement class than in the low ACEs class but did not differ in their odds of membership in the witnessing and experiencing class. Bisexual people but not the

other sexual minority groups were more likely to belong to the abuse and social services involvement class or the witnessing and experiencing violence class than to the low ACEs class.

While the majority of young adults in our sample that was representative of the general U.S. young adult population belonged to the low ACEs class, bisexual people had elevated probabilities of experiencing a pattern of physical abuse, sexual abuse, neglect, and social services involvement in childhood. They also had elevated probabilities of experiencing a pattern of witnessing and experiencing violence. This may be due to displays of gender non-conforming behavior or disclosure of sexual identity to parents, peers, and others that result in episodes of violence, lack of parental care, or outright ejection from the family (Keuroghlian et al. 2014; Roberts et al. 2012). Family rejection and running away can result in homelessness, entry into foster care, and juvenile justice involvement, and sexual minority people are at elevated risk of all three (Keuroghlian et al. 2014), putting them at increased risk of exposure to violence.

Programs that foster increased family acceptance of sexual minority and gender non-conforming children and adolescents may be among the most important interventions we can implement because they could potentially prevent parental rejection of the child, time spent on the streets, in foster care or juvenile detention, and patterns of abuse and neglect. Ryan et al.'s work on family acceptance shows that family acceptance not only prevents negative outcomes, it also fosters positive ones such as higher self-esteem, more social support, and lower risk of mental health disorders (2010). In addition, primary care providers' screening for traumatic stress among children and adolescents is feasible

(Flynn et al. 2015) and could help to prevent ACEs among sexual minority children and ensure that if ACEs have occurred, children receive referral to appropriate mental health services. Trauma treatment services that are specifically tailored to sexual minority people's needs may help to alleviate some of the internalized homophobia and perceived stigma that result from ACEs related to sexual identity.

We also sought to determine the probability of transitioning from particular ACE patterns to particular substance use patterns and test whether sexual minority people had higher odds of demonstrating particular transition patterns. This information could inform us as to whether sexual identity conveyed increased vulnerability above and beyond trauma history to young adult substance use. We found that the majority of people in the low ACEs class transitioned to the normative substance use class and that people in both the abuse and social services involvement class and the witnessing and experiencing violence class had twice the probability of transitioning to the poly-substance use class. Given what we already know about links between ACEs and substance use, this was an expected result. We found that sexual minority people had significantly decreased odds of transitioning from the low ACEs class to the normative substance use class, indicating that sexual minority people without a history of the ACEs measured in our study are at higher risk of substance use than heterosexual people with similar trauma histories. Sexual identity did not appear to convey elevated risk of poly-substance use given membership in the other two ACE classes.

Our findings indicate that we should be concerned about sexual minority substance use regardless of trauma history. In addition, prevention of ACEs should

decrease the incidence of poly-substance use among both heterosexual and sexual minority people. Our finding about sexual minority people being less likely to transition from low ACEs to normative substance use is in line with the minority stress theory in that sexual minority identity is associated with higher risk of demonstrating poly-substance use patterns, possibly due to internalized homophobia and perceptions of stigma. More research needs to be done on the relationship between perceived stigma, internalized homophobia, and violence so that we can get a more complete picture of the causal mechanisms underlying sexual minority poly-substance use.

People of various sexual minority identities may differ in their levels of "outness", societal respect and understanding, potential for community and fellowship, trauma history, and substance use and this implies that a one size fits all approach to prevention and treatment is likely to fall short. While there may be some universal aspects of prevention and treatment, we need to do better in terms of identifying and serving sexual minority people in need of trauma and substance use treatment. Treatment programs tailored as much as possible to the individual's needs may be the most effective method. Prevention approaches too need to be cognizant of the differing situations, levels and types of stress, and needs of sexual minority people. Taking a life-course perspective, the solution to the increased risk of substance use among sexual minority people begins in early childhood with ACEs prevention and mitigation (through parental education and family acceptance approaches) and continues into adolescence and young adulthood with substance use prevention (that may involve trauma treatment) and treatment designed to reach and effectively treat sexual minority people. Studying ACEs and substance use

among sexual minority people highlights the need for prevention and treatment programs that take individuals' unique circumstances into account.

5.1 References

Cochran SD, Mays VM, Sullivan JG. Prevalence of mental disorders, psychological distress, and mental health services use among lesbian, gay, and bisexual adults in the United States. Journal of Consulting and Clinical Psychology. 2003;71(1):53-61.

Flentje A, Livingston NA, Roley J, Sorensen JL. Mental and physical health needs of lesbian, gay, and bisexual clients in substance abuse treatment. Journal of Substance Abuse Treatment. 2015;58:78-83.

Flynn AB, Fothergill KE, Wilcox HC, Coleclough E, Horwitz R, Ruble A, Burkey MD, Wissow LS. Primary care interventions to prevent or treat traumatic stress in childhood: a systematic review. Academic Pediatrics. 2015;15:480-492.

Keuroghlian AS, Shtasel D, Bassuk EL. Out on the street: a public health and policy agenda for lesbian, gay, bisexual, and transgender youth who are homeless. American Journal of Orthopsychiatry. 2014;84(1):66-72.

Meyer I. Minority stress and mental health in gay men. *Journal of Health and Social Behavio*r. 1995;36:38-56.

Roberts AL, Rosario M, Corliss HL, Koenen KC, Austin SB. Elevated risk of posttraumatic stress in sexual minority youths: mediation by childhood abuse and gender nonconformity. American Journal of Public Health. 2012;102(8):1587-1593.

Senreich E. Are specialized LGBT program components helpful for gay and bisexual men in substance abuse treatment? Substance Use & Misuse. 2010;45:1077-1096.

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Flynn AB, Johnson RM, Bolton SL, Mojtabai R. Victimization of lesbian, gay, and bisexual individuals in childhood: associations with attempted suicide. Suicide and Life-Threatening Behavior. Published online January 27, 2015.

Flynn AB, Fothergill KE, Wilcox HC, Coleclough E, Horwitz R, Ruble A, Burkey MD, Wissow LS. Primary care interventions to prevent or treat traumatic stress in childhood: a systematic review. Academic Pediatrics. 2015;15:480-492.

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