

SMOKING IN A SEXUAL MINORITY POPULATION:
A COMPARISON OF TWO ADOLESCENT COHORTS

by

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DEDICATION

I would like to dedicate this dissertation to my grandmother, Bernice McCartin, who started me on my journey of discovery. She always encouraged me to ask questions and then made me find the answers. My pursuit of useful knowledge is in large part due to her encouragement.

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LIST OF ABBREVIATIONS

Add Health	National Longitudinal Study of Adolescent to Adult Health
CDC	Centers for Disease Control and Prevention
LGB	Lesbian, gay and bisexual
YRBS	Youth Risk Behavior Survey

ABSTRACT

Mortality related to smoking continues to be one of the foremost preventable public health issues. Smoking amongst sexual minorities (those who have a sexual attraction to or sexual contact with people of the same sex and/or of both sexes or a sexual identity of gay/lesbian or bisexual) remains significantly greater than the general population and those with only opposite sex attractions or sexual contacts. While smoking prevalence has dropped since the late 1990's in the general population, smoking among sexual minorities remains disproportionately greater than heterosexuals.

Methods: A secondary data analysis was completed using two United States data sets: the 2013 Youth Risk Behavior Survey (YRBS) and the first wave of the National Longitudinal Study of Adolescent to Adult Health (Add Health) dataset collected in 1994. The analyses focused on high school students, grades 9 – 12. The purpose was two-fold. First, the goal was to develop a profile of smoking indicators in sexual minority youth in the 1994 Add Health dataset and in the 2013 YRBS dataset. Profiles include six smoking-related indicators: 1) ever smoked; 2) age of first cigarette smoked; 3) current smoking; 4) frequent smoking; 5) daily smoking; and 6) attempts to quit smoking. Second, the goal was to compare sexual minority youth to their heterosexual peers within each data set to identify the scope of any disparities in smoking behaviors.

Results: Disparities in smoking behaviors were found in both comparisons between the heterosexual and sexual minority youth. Prevalence of all smoking behaviors was greater for sexual minority youth in both data sets. The smoking disparities were greater in the sexual minority youth in the 2013 YRBS sample. Between the 1994 Add

Health and 2013 YRBS samples, smoking behaviors in sexual minority youth showed a decrease in all smoking behaviors, but not as significant as their heterosexual peers.

Youth who are attracted to both sexes or identify as bisexual consistently have a greater prevalence in smoking behaviors.

Conclusion: A growing disparity exists between sexual minority youth and their heterosexual peers related to smoking behaviors. Public health policy and programming needs to focus on earlier prevention efforts related to psycho-sexual development with targeted policy and curriculum around the adoption of negative health behaviors in sexual minority youth, especially those who have both sex attractions, have sexual contact with both sexes or identify as bisexual.

CHAPTER 1: INTRODUCTION

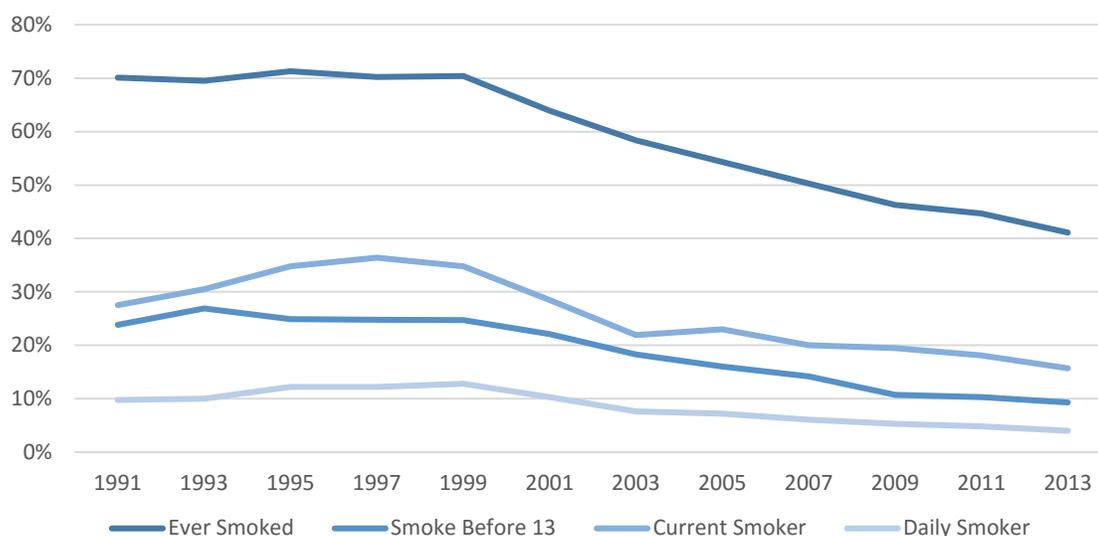
Purpose

The purpose of this dissertation is descriptive in nature with no attempt to find causal links or associations. A unique opportunity arose to examine two large adolescent datasets collected 20 years apart. The datasets included variables that could be used to create profiles of adolescent smokers who fall outside of the heterosexual majority in relation to sexual orientation and identity. While the datasets are not ideally matched, they are large enough that a subpopulation of non-heterosexual adolescents can be coded for analysis in each of the two datasets. The datasets both include variables for smoking behaviors collected by asking the same or similar questions that allow for comparison of smoking behaviors between the two groups. This dissertation aims to highlight, at two time points (1994 and 2013) smoking disparities between sexual minority youth and their heterosexual peers. This dissertation then examines the smoking behaviors of sexual minority youth between the two samples to see if there are any differences between the two groups following significant implementation of policies and practice focused on reducing adolescent smoking over the 20 year period between the two datasets. Following the descriptive analysis, recommendations are presented for policy and practice opportunities that can address any disparities that may continue between the sexual minority youth and their heterosexual peers.

The Problem

Tobacco related mortality continues to be a public health challenge with more than 400,000 deaths a year attributed to tobacco related illness in the United States.¹ In 2011 the Centers for Disease Control and Prevention (CDC)² and the Institute of Medicine (IOM)³ recognized that tobacco use in populations identified as lesbian, gay, and bisexual (LGB) is significantly greater than among heterosexuals. The IOM conducted a review of literature and points out that studies on smoking within this population are limited with a better understanding of smoking amongst females in this population than amongst males. Smoking amongst adolescents has dropped significantly according to the findings from the CDC (see Figure 1).⁴ However, little is known about the smoking behaviors of sexual minority youth or whether the trend over time in adolescent smoking is reflected in sexual minority youth.^{2,5}

Figure 1 - Adolescent Smoking Behaviors 1991-2013



Source: CDC, Trends in the Prevalence of Tobacco Use National YRBS: 1991—2013

Sexual minority youth as a classification usually includes adolescents that fall outside the heterosexual majority. The heterosexual majority would include those youth who consistently identify as heterosexual and whose attractions and sexual behaviors reflect that identification; that being sexual attraction only to the opposite sex and sexual contacts only with the opposite sex. In samples where sexual identity is unknown, the assumption is made that those who are only attracted to or have sexual contact with the opposite sex are part of the sexual majority. Sexual minority youth include not only those who identify as lesbian, gay or bisexual, but also includes those who identify in any other way than heterosexual. Also, a large portion of the sexual minority youth is adolescents who identify as heterosexual but report sexual attractions and sexual behaviors that include the same-sex and/or both sexes.⁶ Research has helped identify increased risks for sexual minority youth in several psycho-social areas including substance use and abuse.⁷ Smoking behaviors in sexual minority youth is an area that needs further research particularly to understand the characteristics of these smokers and their smoking behaviors compared to their sexual majority peers.

Research Questions and Hypotheses

The overall goal of this study is to develop a better understanding of smoking behaviors over time in subpopulations of sexual minority youth in two large adolescent surveys of high school students conducted 20 years apart. This study will use data from two national datasets: 1) the 1994 first wave of the National Longitudinal Study of

Adolescent to Adult Health (Add Health), and 2) the Centers for Disease Control and Prevention 2013 Youth Risk Behavior Survey.

The specific aim is to analyze smoking behaviors of sexual minority youth compared to their heterosexual peers from the 1994 Add Health dataset and the 2013 YRBS data set.

Research question 1: Are the smoking behaviors of sexual minority youth different from their heterosexual peers within the two data sets?

Smoking behaviors in sexual minority youth in the Add Health sample are compared to heterosexual peers on six items asked on the survey. A dual comparison is completed for sexual minority youth and heterosexual peers in the YRBS sample 20 years later to explore any possible differences.

Hypothesis 1a: Sexual minority youth in both samples will show significant disparity in the six smoking behaviors measured compared to heterosexual peers within their own sample. Sexual minority youth will begin smoking at a younger age, smoke more frequently, and have a greater incidence of daily smoking than their heterosexual peers.

Hypothesis 1b: The disparity in smoking behaviors between the sexual minority and heterosexual youth in the 2013 YRBS will be greater than the disparity in smoking behaviors between the sexual minority and heterosexual youth in the 1994 Add Health survey.

Hypothesis 1c: For youth who are regular (current) smokers the smoking behaviors of sexual minority youth will not be significantly different from their heterosexual peers within the same cohort.

Research question 2: Are smoking behaviors between the two samples different for sexual minority youth and heterosexual youth?

Tobacco policy related to preventing the initiation of smoking over this 20 year period (1994 – 2013) demonstrated a dramatic reduction in smoking in the overall high school population,⁸⁻¹⁰ yet little is known about the change in the subpopulation of sexual minority youth.

Hypothesis 2a: Smoking behaviors among heterosexual youth will be different from the Add Health sample in 1994 to the YRBS sample in 2013. Fewer heterosexual smokers will have reported initiating smoking before age 13 in 2013 and the YRBS sample of heterosexual smokers will have fewer reported frequent smokers, heavy smokers and daily smokers.

Hypothesis 2b: Smoking behaviors among sexual minority youth will not be significantly different from the Add Health sample in 1994 to the YRBS sample in 2013. Sexual minority youth will have reported initiating smoking before age 13 in 2013 at the same rates as those in 1994, and the YRBS sample of sexual minority youth will no statistical difference in reported frequent smokers, heavy smokers and daily smokers.

Hypothesis 2c: Smoking behaviors in sexual minority youth who are current smokers will not be significantly different between the Add Health and YRBS samples.

Those initiating smoking before the age of 13 will not be different between 1994 and 2013, and the proportion of current sexual minority smokers who are frequent smokers, heavy smokers and daily smokers will not be statistically different between the two samples.

Significance

The human and societal costs of smoking are well known and include elevated cancer risk, cardiovascular and respiratory disease, and early mortality. Smoking is the leading preventable cause of death in the United States. Currently, 8.6 million people in the United States are afflicted with tobacco-related illnesses, and more than 400,000 people die of tobacco-related illnesses annually.¹ Smoking leads to increased hospitalization and immense costs to the health care system as well as a decrease in workplace productivity. Total annual health care expenditures and loss in productivity due to smoking is estimated at \$180 to \$280 billion in the United States.¹

Sexual minority youth comprise an especially vulnerable subset of the general population and are susceptible to increased health risks compared with youth in the general population.^{2,3} Because the majority of daily smoking habits begin in adolescence, it is critical to find innovative and engaging ways to prevent and intervene in adolescent smoking.¹¹ Youth smoking rates have been declining, attributable in part to campaigns targeting young people; however, the continued greater rates among sexual minority youth are frequently overlooked in the overall downward youth trend.^{12,4}

Because greater smoking rates among sexual minority youth are understudied and inadequately understood, prevention efforts specifically targeting sexual minority adolescent tobacco use have been scarce or have relied on very small samples.¹³ Causes of disproportionate tobacco use among sexual minority youth have been hypothesized to include: unique stigma related to being outside the sexual norm (heterosexual), few non-heterosexual role models for healthy behaviors, and smoking as a dominant part of available social settings sought out by youth who do not feel like they fit into the majority heterosexual culture.¹⁴ The design and implementation of appropriate intervention programs is currently limited by a minimal understanding of the personal and contextual factors driving sexual minority youth to use tobacco at greater rates than heterosexual peers as well as within their own cohort.¹⁵ Having a better understanding of the smoking behaviors of sexual minority youth needs to help guide research, practice and policy to eliminate disparity in smoking behaviors in sexual minority youth.

Literature Review

The lesbian, gay and bisexual (LGB) community in the United States has disparately greater rates of tobacco use than the general population.^{2,3,16} The Centers for Disease Control and Prevention (CDC) Adult Tobacco Survey indicates that while tobacco prevalence in the general population is just over 25%, the prevalence of tobacco use in those identifying as LGB is 37%.¹⁷ Research with youth in the United States shows that smoking is markedly greater for LGB youth than for their heterosexual

peers.^{2,11,13-15,18-30} Smoking prevalence ranged from 38% to 59% among LGB youth, notably greater than the estimated 20% among the general youth population.^{2,13}

Three reviews of literature have been conducted over the last three decades examining tobacco use amongst sexual minorities, primarily focused on LGB individuals. Heather Ryan and associates conducted their survey²⁸ in 2001 with a focus on smoking rates for sexual minorities in studies from 1987-2000. They looked at studies of youth and adults and reviewed 12 studies with 1/3 of the reviewed studies being youth only. They found sexual minority youth smoking prevalence at 36% greater than the general population of adolescents. Joseph Lee and his associates conducted a review of studies examining sexual minority youth and smoking for the period 1987-2007.¹⁵ The final analysis consisted of 41 studies. They concluded that a disparity exists in smoking for sexual minorities, with a greater prevalence of smoking ranging from 1.5 to 2.5 times greater for sexual minorities than for heterosexuals.

A third structured review by Blosnich, Lee and Horn examined studies up to January 2011 that included smoking, sexual minority definitions and an examination of risk factors.³¹ They concluded that risk factors associated with smoking do not differ for sexual minority youth. The common factors included lower educational attainment, alcohol use and depression. These common factors, present in both heterosexuals and sexual minorities, seem to show stronger association with sexual minority smoking than with heterosexual smoking. The common recommendation of all three reviews was to develop and fund programming targeted at sexual minority youth to reduce the disparity in smoking behaviors compared to heterosexual peers.

Joseph Lee and associates also conducted a structured review of studies that examined the effectiveness of tobacco cessation programs in sexual minority subpopulations, but studies were nearly all adult populations.³² The review included peer reviewed articles and items from grey literature up to April 2014. In all, 51 manuscripts were reviewed. The findings reported community and funding support for tailored group cessation programs. Little difference in effect was found of tailored clinical interventions when compared to non-tailored programs. The community-based interventions often did not have evaluation components built into them. Those that did conduct evaluations failed to collect data that could be used to evaluate the effectiveness of the programs in helping people quit smoking. The recommendation from this review was aimed at increased government funding to examine policy, media campaigns and interventions targeted at the LGB population as well as people in the transgender community.

Defining Sexual Minorities and Tobacco Use

A challenge addressed by the all the reviews was defining sexual minority and defining tobacco use. While research has focused on the lesbian, gay and bisexual orientation labels in the past, more often in recent literature the term sexual minority has been used. Sexual minority is used to capture those who have an attraction to same-sex and/or both sexes, those who identify as gay, lesbian or bisexual, and those who have sexual relations with same sex and/or both sexes.^{6,33,34} Adolescent sexual identity is not a clearly identified concept for many youth and focusing on attraction and behavior provides the opportunity to include those who may not yet identify with one of the

traditional sexual orientation labels. While the ideal survey would ask about sexual attraction, sexual behavior and sexual identity, very few surveys of adolescents include questions focused on all three.³⁵ This leads to comparisons and meta-analysis being less than ideal. A report in 2001 to the Department of Health and Human Services for Health People 2010 recommended standardizing survey questions to reduce the inconsistency in current survey methods.³⁶

The National Survey of Family Growth (NSFG) asked questions related to sexual identity, sexual attraction and sexual behavior and found risk in sexual behaviors varied based on the three different variables.³⁷ A recent study used the NSFG to examine substance use, including tobacco, in a sub-population of sexual minority youth and found differences in smoking rates depending on the variable used to categorize sexual minority.³⁸ Those who identified as lesbian or bisexual had a smoking prevalence twice that of heterosexuals (44% vs. 22%). When using attraction as the indicator for sexual minority, those with any same-sex attraction had a greater prevalence than those with only opposite-sex attractions (37% vs. 20%).

The most comprehensive results of the YRBS and the sexual identity and sexual contact questions were published in 2011 in a CDC report entitled, "Sexual identity, sex of sexual contacts, and health-risk behaviors among students in grades 9-12: Youth risk behavior surveillance, selected sites, United States, 2001-2009."² Due to fewer states using the sexual identity and sexual contacts questions, the report combined data over the first ten (10) year period in which the questions were asked. A total of nine (9) sites asked both questions (sexual identity and sexual contacts) for the report including four

(4) states and five (5) large urban school districts. The authors only reported median values and ranges for each of the questions on the YRBS survey for those youth they coded as sexual minority youth.

The tables in the CDC report for each of the tobacco related questions showed greater risk associated with sexual minorities on every question about smoking and tobacco use except two. When reporting on the question about current use, the median rate was very similar for those who had sexual contact with only opposite sex partners and those who had sexual contact with only same-sex partners. The question about quitting smoking showed the highest rate of quit attempts in the youth who marked their sexual identity as “not sure,” while the sexual minority youth tended to quit at similar rates to the heterosexual youth. While the information provided in the report was a great step forward in outlining health risk behaviors in sexual minority youth, challenges exist in the combining of data over a ten (10) year period. The biggest challenge is having to set aside that youth may have been duplicated in more than one survey. While the survey is administered every two years in high school, the chance remains that even with random sampling, some youth might be included in at least two surveys. The second challenge is having to accept the notion that youth behaviors over ten (10) years were not affected by social changes and that the youth in 2001 were essentially the same as the youth in 2009.

Heather Corliss and her associates conducted several analyses of the combined data from the 2005 and 2007 YRBS.^{18,39} The researchers combined the two years but did not limit their sample to sites that asked both questions. They included all sites that asked either question or both questions to increase the size of their sample. When

looking at sexual minority youth compared to heterosexual peers, they found that the sexual minority youth smoked and used other tobacco products at greater rates than their peers, and this held in a breakdown by gender, age group and race.³⁹ When looking at smoking behaviors and age, gender and race, the researchers found those who responded to the sexual identity question in a category that was considered a sexual minority started smoking at an earlier age, smoked more often and were more likely to be daily smokers. When looking at the gender of sexual partners, the disparity in smoking between sexual minority youth and heterosexual youth persisted but at a lower magnitude than those categorized as sexual minority using identity.¹⁸

Studies related to adolescent smoking using the National Longitudinal Study of Adolescent to Adult Health (Add Health) datasets have demonstrated key demographics for adolescent smoking overall, that include social and peer effects,⁴⁰⁻⁴⁷ family structure effects,^{48,49} and school effects.^{50,51} O'Loughlin et. al. conducted a secondary analysis of a similar dataset in Canada and found many of the same effects in relation to initiation of smoking including family factors, smoking amongst family and friends, smoking policy at schools and alcohol use.⁵² Studies related to sexual minority youth and smoking is limited in the depth of understanding of smoking behaviors² and those that have used the Add Health datasets are most often limited to the first two waves.²⁵⁻²⁷

While the body of literature related to adolescents and smoking is broad, little is yet known about smoking behaviors of sexual minority youth. Many advisory bodies suggest tailored programming for sexual minority youth around substance use including tobacco, but key elements related to the disparity in smoking are not clear. The results of

this project seek to fill a gap in the literature regarding sexual minority youth and smoking; more specifically, whether reported smoking behaviors in sexual minority youth are different over time compared to their heterosexual peers. This dissertation develops a more complete picture of the smoking behaviors of sexual minority youth compared to their heterosexual peers and examines changes in smoking behaviors at two points separated by two decades. Secondly, the dissertation examines whether the smoking behaviors of current sexual minority youth are significantly different between two populations twenty years apart compared to the difference in smoking behaviors of heterosexual current smokers twenty years apart.

Having a more detailed understanding of this group as youth will help target specific areas for further research and allow for more clarity in developing targeted policy and programming for youth. While recommendations for targeted prevention programs abound, evidence needs to be examined to determine if changes in smoking behaviors have occurred. This dissertation focuses on a narrow sub-population that has a demonstrated greater risk for smoking and will refine findings within the broader adolescent research on smoking. This can further guide policy and practice that contributes to reducing disparities in smoking behaviors in sexual minority youth.

Theoretical Framework

Social ecological models posit that risky behaviors, such as smoking, are behaviors influenced by the interplay of complex interactions across multiple domains of influence, including intra- and inter-personal factors, as well as larger contextual social

and environmental factors.⁵³⁻⁵⁷ Several studies using the Add Health dataset have used this model to identify key variables across all adolescents in the study, but none specific to sexual minority youth.⁵⁸⁻⁶¹ For example, one study used an ecological model to assess the contextual influence on smoking in adolescents. The researchers found that the more proximal factors of family and friends were influential, but the neighborhood and state factors were insignificant unless the populations were smaller.⁶¹ Given the subpopulation of sexual minorities in this cohort is relatively small, the more distal contexts related to policy, programming and media may be significant.

Policies that restrict access to tobacco have been shown to be effective with LGB populations as well as the general population.^{62,63} Research also demonstrates the effect of tobacco marketing both directly and indirectly increases the use of tobacco in the LGB population.⁶⁴⁻⁶⁶ However, a recent focus group project found that most of those included in the groups did not believe that tobacco companies target the LGB community, and more surprisingly, group members associated smoking with positive life outcomes.⁶⁷ With media being a distal contextual factor for adolescents, the influence of smoking in movies and smoking in marketing campaigns can be significant.⁶⁸ The landmark case against the tobacco industry in 1998⁶⁹ restricted marketing to youth; however, adolescents are not immune to adult advertising and tobacco companies continue to market heavily to the LGB adult communities.^{64,70}

Most research focused on LGB smoking recommends further research, policy and programming. However, a recent review of funding for research focused on lesbian, gay, bisexual and transgender issues showed a significantly low commitment to fund research

focused on health issues related to the LBG community.⁷¹ This dissertation aims to demonstrate whether the overall decrease in smoking behaviors among all adolescents over a 20-year period is reflected in sexual minority youth and whether the disparity in smoking behaviors continues between sexual minority youth and their heterosexual peers.

Challenges and Limitations

Even with large samples for the full cohort, both the YRBS and the Add Health dataset have small sub-populations for the sexual minority youth categories. While a sexual minority cohort overall should provide sufficient size for analysis, analysis of the subgroups within the sexual minority population may yield small sample sizes not sufficient to be confident in the findings past these sexual minority subgroups in this dataset. Survey data for all instruments is self-reported and without verification may lead to some bias. Smoking is an illegal behavior for adolescents, which may lead to underreporting among adolescents. However, honesty studies of adolescents in reporting risk behaviors demonstrate that adolescents, in general, are extremely honest when answering survey questions about risk behaviors.⁷²

The coding of sexual minority in the two datasets is slightly different. While both surveys include questions about the gender of sexual partners, the Add Health survey asks about sexual attraction while the YRBS survey asks about sexual identity. While there is an assumption that sexual identity includes attraction, we cannot assume that youth who are sexually attracted to the same or both sexes will necessarily identify as

gay, lesbian or bisexual.⁷³ This may lead to a more conservative number of sexual minority youth in the YRBS subpopulation.

Inconsistencies in tobacco reporting in the Add Health data found some evidence of recanting on smoking behaviors across waves, but found that there were no same-sex attraction or same-sex contact effects.^{74,75} Reliability testing on the YRBS questionnaires, however, do show that reliability on the tobacco, sexual behavior and sexual activity to be very high.^{76,77} The YRBS as a full cohort was designed to be a national representative sample of adolescence; however, the questions related to sexual orientation and sexual contacts are optional questions that not all states chose to use in surveys. Each state conducted their own random sampling to be representative of its own state allowing the analysis of sub-populations that do not include all states. This may create a sample that is large enough for analysis, but not fully representative of sexual minority youth as we do not have any clear evidence that regional differences in sexual minority youth might exist.

CHAPTER 2: METHODOLOGY

Approach

The overall goal of this dissertation is to develop a more detailed picture of sexual minority youth and their smoking behavior at two time points 20 years apart and compare those smoking behaviors with their heterosexual peers. For this study, two national datasets were used with questions that allow for the creation of a sexual minority variable. The Longitudinal Study of Adolescent to Adult Health and the Youth Risk Behavior Survey are both surveys conducted with youth from high schools. This study conducted a secondary data analysis of the two national datasets. A dual cross-sectional analysis is conducted in a sub-population of each dataset that includes high school students. Both datasets asked questions related to smoking behaviors including age of first cigarette, frequency of smoking, number of cigarettes smoked and attempts to quit smoking.

The Data Sources

The National Longitudinal Study of Adolescent to Adult Health (Add Health)

The National Longitudinal Study of Adolescent to Adult Health is a longitudinal cohort that was recruited during the 1994-1995 school year.⁷⁸ The study was created in response to a Congressional desire to research adolescent health and contextual factors that might influence development. The sample was selected to be a national representation of adolescents in the United States in grades 7 – 12. The sample is made up of 132 schools representing 80 communities stratified by size, urbanicity, racial mix, school type and size. Sampling started with 90,000 in-school surveys. Researchers

pulled a sample from the in-school surveys for an in-home interview. The surveys were stratified by grade and sex to identify a core sample that was representative of each strata. Oversampling was conducted for several groups: Cuban, Puerto Rican, Chinese, High-Education Black, and Disabled. The dataset also included sibling data that represents Full Biological Siblings, Half Biological Siblings, Non-related (step) Siblings, Adopted Siblings, and Twin Siblings. The final cohort for in-home interviews included 20,745 adolescents.

In addition to the adolescent interviews, each family was asked to have one parent complete a questionnaire. Over 85% of the adolescents had a parent complete a survey. The first wave of data collection also included a questionnaire filled out by a school administrator about the characteristics of the school, including policies and health services. Global Positioning System (GPS) devices were used to record student locations and were used to link several databases for neighborhood contextual data. To date three additional data collection efforts were completed.

A second wave of data was completed in 1996 and included the core sample of those who were in grades 7 – 11, plus 12th graders who were part of a genetic matched sample of siblings or a twin sibling. Each adolescent completed another in-home questionnaire (N=14, 738). The matched genetic sample of over 3000 adolescents provided an opportunity to monitor the family environment more closely with groups of siblings with varying degrees of genetic match.

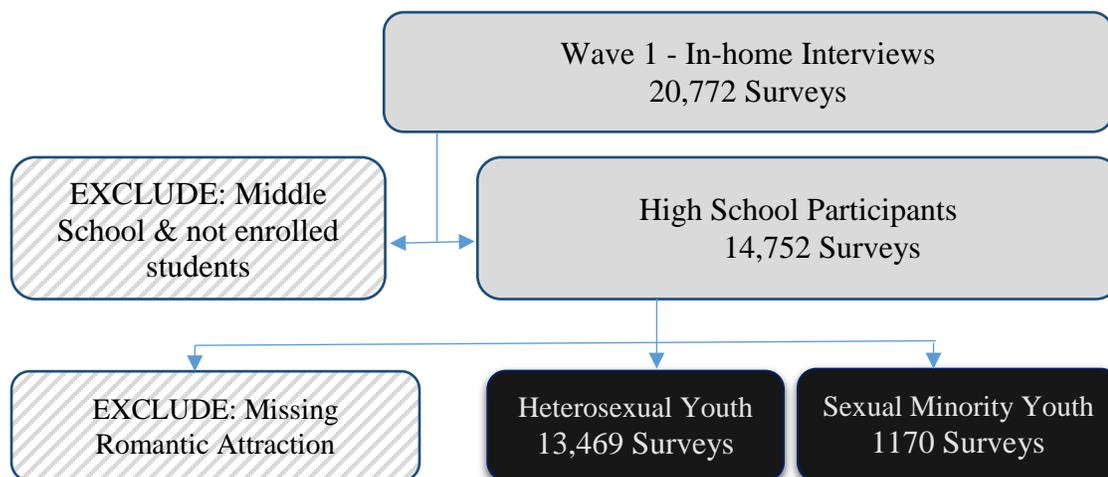
The third wave of data was collected five years later in 2001 with a 76% response rate from those who participated in the first wave. Another questionnaire was completed

and biological samples were collected to test for sexually transmitted diseases and DNA genotyping. The fourth wave of data collection was started in 2008 when all the participants of the first wave were adults with a response rate of over 80% of respondents from the first wave completing a questionnaire. A fifth wave of data collection began in 2015.

Add Health Sexual Minority Subpopulation

For this dissertation, only the first wave of data collected for the school year 1994 – 1995 was used. The only questionnaire used for analysis was the in-home questionnaire that includes questions related to smoking and questions that can be used to create a sexual minority variable. The sample is weighted based on the entire cohort, so no surveys will be eliminated from the study, however to match the YRBS dataset, only high school participants in grades 9 through 12 will be used in the analyses (Figure 2).

Figure 2 - Add Health Dataset Preparation



After excluding those who are not in grade 9 through 12, a sexual minority variable was created for the use of analysis using a subpopulation of sexual minority youth. The first wave of data collection asked questions about romantic attraction and the gender of sexual contacts. For the purposes of this study, the romantic attraction variables asked in the first in-home survey as one of the indicators for the sexual minority indicator were used.

The sexual minority variable was constructed by comparing the participant's biological sex with the answers to 5 questions:

1. Have you ever had a romantic attraction to a female?
2. Have you ever had a romantic attraction to a male?
3. What was the sex of romantic partners? (assessed up to 3)
4. What was the sex of non-relationship romantic partners? (assessed up to 3)
5. What was the sex of non-relationship non-romantic partners? (assess up to 3)

The sexual minority variable was coded as heterosexual (0) if the biological sex of the participant was opposite sex attraction only and all reported relationship partners were the opposite sex. The sexual minority variable was coded as sexual minority (1) if the biological sex of the participant was the same sex on the attraction questions, if the participant indicated sexual attraction to both sexes, or if any of the reported relationships was with a same-sex partner. For those that reported "don't know" for sexual attraction, the sexual minority variable was coded as sexual minority (1) if the participant indicated any sexual behavior. Observations were coded as missing if the participant reported no sexual activity.

Youth Risk Behavior Survey

The Centers for Disease Control and Prevention (CDC) began collecting risk behavior data in 1991 in response to a national effort to reduce the transmission of HIV among adolescents. The Youth Risk Behavior Surveillance System was created to monitor youth behaviors in six core areas: 1) injuries and violence, 2) sexual behaviors, 3) tobacco use, 4) alcohol and other drug use, 5) nutrition and dietary behaviors, and 6) physical activity.⁷⁹ The Youth Risk Behavior Survey (YRBS) is the largest school-based survey and is encouraged in all states, territories and tribal lands in the United States. The YRBS has been conducted in the spring of odd years from 1991 through 2015. The survey is aimed at public schools including charter schools.

The YRBS sampling is made up three types of jurisdictions: 1) state samples, 2) tribal samples and 3) large urban school district samples. Each jurisdiction conducts a two-stage, cluster sample design to reproduce a representative sample of youth in grades 9 – 12 in that jurisdiction. The first stage was to select schools based on a probability proportion to school enrollment size. The second stage was a random selection of required classes at each grade level. All students in those identified classes were eligible for participation in the survey. Weighting of data was conducted for jurisdictions that had a participation rate of at least 60%.⁷⁹ The CDC also conducts a National YRBS that uses a three-stage sampling method to produce a national representation of youth across the United States; however, for this study the National YRBS dataset is not used because the National YRBS did not ask the questions used to create the sexual minority variable. The CDC recommends not combining the state, tribal and school district data to avoid

duplication of surveys. This study used only the combined state dataset for analysis (See Table 1).

Prior to each survey cycle the CDC prepares a guide for conducting the latest survey with changes that result from feedback from the jurisdictions that implement the survey.⁸⁰ Following each survey, a report is prepared and published in the even years following the survey year and only include the findings from the National YRBS; the latest report is the 2013 YRBS findings.⁸¹ While the YRBS has high reliability,^{76,82} several limitations exist including: the sampling of only public school students when youth not attending school have been shown to participate in risk behaviors at greater levels than those in school; the data is all self-reported and the extent of over- or under-reporting cannot be determined; not all states participate; and not all states include the required questions.^{79,81}

Preparing the YRBS dataset for Analysis

The preparation of the dataset for the study included three inclusion criteria:

1. States that have weights assigned to each participant;
2. States that included the question about sexual identity; and
3. States that included the question about the gender of sexual contacts.

After applying these inclusion criteria in the downloaded Microsoft Access database, the remaining state data was exported to Excel and then imported into Stata 14. Figure 3 provides a breakdown of the preparation of the dataset for analysis. The full downloaded YRBS dataset contained surveys from 36 states (n=156,673). First, the states that did not

ask the optional sexual identity and sexual partners questions were eliminated, leaving 15 states (n=94,602). Next any states that asked only one of the two optional questions were eliminated, leaving 10 states. The analyzed dataset includes 37,822 surveys from 10 states (Table 1).

Figure 3 - YRBS Dataset Preparation

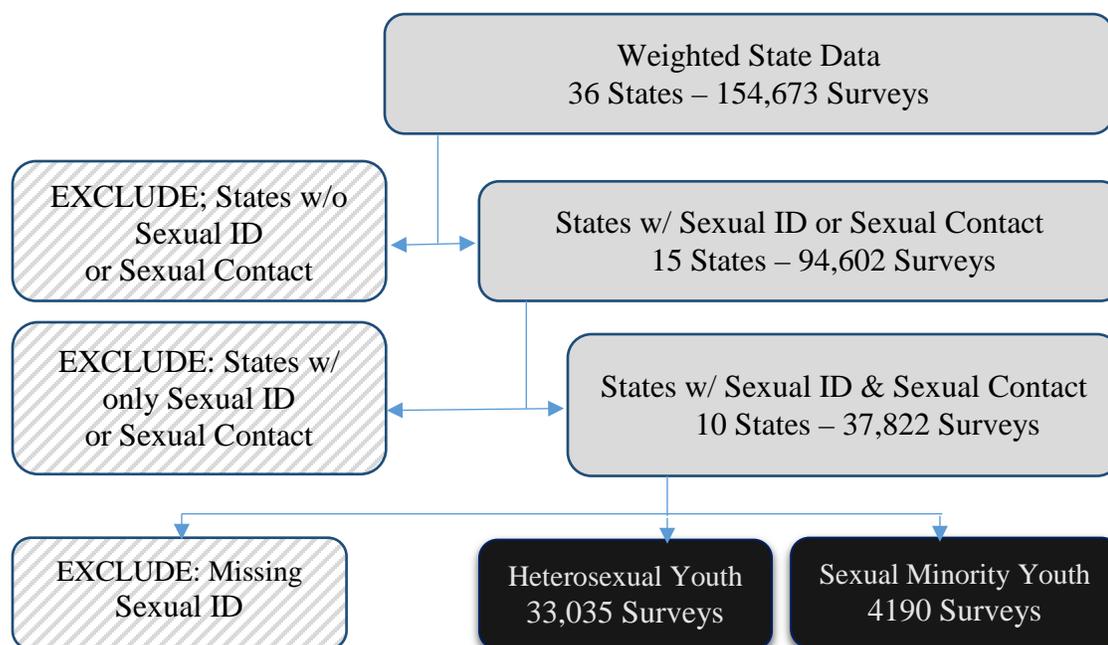


Table 1: Breakdown of State YRBS Surveys

State	# Surveys	Sexual Minority		Heterosexual		Unsure	
Connecticut (CT)	2,405	258	10.7%	2,104	87.5%	43	1.8%
Hawaii (HI)	4,631	445	9.6%	4,095	88.4%	91	2.0%
Illinois (IL)	3,276	412	12.6%	2,809	85.7%	55	1.7%
Maine (ME)	9,017	914	10.1%	7,978	88.5%	125	1.4%
Michigan (MI)	4,266	374	8.8%	3,834	89.9%	58	1.4%
New Hampshire (NH)	1,634	136	8.3%	1,464	89.6%	34	2.1%
New Mexico (NM)	5,451	631	11.6%	4,733	86.8%	87	1.6%
North Carolina (NC)	1,846	138	7.5%	1,691	91.6%	17	0.9%
Rhode Island (RI)	2,453	285	11.6%	2,126	86.7%	42	1.7%
Wisconsin (WI)	2,843	239	8.4%	2,559	90.0%	45	1.6%
Total	37,822	3,832	10.1%	33,393	88.3%	597	1.6%

YRBS Sexual Minority Subpopulation

In 2001, the YRBS began including optional questions that focused on the participant's sexual identity and the gender identity of a youth's sexual partners. These variables were used to create a variable that recognizes sexual minority youth. The two questions asked are:

1. Which of the following best describes you?
 - A. Heterosexual (straight)
 - B. Gay or lesbian
 - C. Bisexual
 - D. Not sure

2. During your life, with whom have you had sexual contact?
 - A. I have never had sexual contact
 - B. Females

C. Males

D. Females and males

Within the YRBS dataset are constructed variables. The sexual identity question (question 1) was used by the CDC to construct the variable for sexual minority in their dataset. The sexual minority constructed variable in the dataset was coded as sexual minority if a participant identified as gay/lesbian or bisexual (n=2,640). For the purpose of this study, a new sexual minority variable was created for analysis that included the sexual minority variable from the YRBS dataset as well as the sexual contacts variable in the YRBS dataset for the analysis. The new sexual minority variable was coded heterosexual (0) if the participant identified as heterosexual on the sexual identity questions and reported only opposite sex sexual contacts. The new sexual minority variable was coded sexual minority (1) if the participants identified as gay/lesbian or bisexual, or the participant indicated sexual contacts of the same-sex or both sexes. If a participant marked the sexual identity as “Unsure” and indicated no sexual contacts, the new sexual minority variable was coded missing. This classification was used to avoid any assumption that a participant who marked the sexual identity as “unsure” and did not have sexual contacts was “questioning” their sexual identity. The new variable for sexual minority (n=4,190) was used as a subpopulation variable in the analysis.

Smoking Assessment

The Add Health in-home survey asked nine (9) questions to assess smoking behaviors. The 2013 YRBS also asked nine (9) questions to assess smoking behaviors.

Within each set of nine (9) questions, six (6) common questions were used to assess whether an adolescent has ever smoked, when the adolescent started smoking, the frequency of smoking, how much an adolescent smokes, whether an adolescent is a daily smoker, and if an adolescent has made an attempt to quit smoking. The comparison of the six (6) questions used to assess smoking behaviors for this study in each of the surveys is listed in Table 2.

Table 2: Smoking Questions by Dataset used for Analysis

Add Health Smoking Question	Behavior assessed	YRBS Smoking Question
Have you ever tried cigarette smoking, even just 1 or 2 puffs?	Ever Smoked	Have you ever tried cigarette smoking, even one or two puffs?
How old were you when you smoked a whole cigarette for the first time?	Age First Smoke	How old were you when you smoked a whole cigarette for the first time?
During the past 30 days, on how many days did you smoke cigarettes?	Frequency	During the past 30 days, on how many days did you smoke cigarettes?
During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?	Amount Smoked	During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?
Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?	Daily Smoking	Have you ever smoked cigarettes daily, that is, at least one cigarette every day for 30 days?
During the past 6 months, have you tried to quit smoking cigarettes?	Quit Smoking Attempt	During the past 12 months, did you ever try to quit smoking cigarettes?

CHAPTER 3: RESULTS

Demographics

Both the Add Health and YRBS datasets were weighted. The demographic variables used for analysis included age, grade, sex, and race/ethnicity. Age was constructed as a categorical variable in the YRBS dataset with seven categories: 12 and under, 13, 14, 15, 16, 17, 18 and over. Age was recoded in the Add Health dataset to match the seven categories in the YRBS dataset. The race/ethnicity variables in Add Health were used to construct a matching variable to the four category race/ethnicity variable in the YRBS dataset (White, African-American, Hispanic and Other). The four category variable was used because the CDC recommends a minimum cell value of 100 surveys for analysis and this was used as a requirement in both datasets for the analysis. The categories for “Asian”, “American Natives” and “Pacific Islanders” in the Add Health dataset did not meet the requirement of 100 surveys. These were combined into the race/ethnicity category “Other” for analysis. For the YRBS dataset, the values for the sexual identity questions were used to create a distribution for each value (heterosexual, gay/lesbian, bisexual, unsure). For the Add Health dataset, the questions related to romantic attraction were used to create a sexual attraction variable that allows for a similar grouping (opposite-sex only, same-sex only, both sexes, unsure) to the sexual identity variable in the YRBS dataset.

Analysis

Stata 14™ was used for the demographic analysis. Since both datasets provided weighting variables, the “survey” data commands were used and proportions were

reported on population estimates rather than the unweighted number of participants in the surveys. The tabulate command was used to create a table of proportions with 95% confidence intervals. Logistic regressions were completed including each of the demographic variables and proportions with odds ratios are reported for each demographic variable.

Results

Add Health Demographics

Table 3 details the demographic breakdown of the sexual minority youth and their heterosexual peers in the Add Health sample. The estimated proportion of sexual minority youth in this sample was 8%. The heterosexual group was not statistically different from the full sample across the demographic variables of age, grade, sex and race/ethnicity. The sexual minority youth tended to skew to the older ages over 15 years with the largest proportion being 18 or older. The distribution in grades for sexual minority youth was also skewed towards the later grades. The distribution of sexes was nearly the same in both groups and looks similar to the full sample. The distribution of race/ethnicity in the sexual minority youth was dissimilar to their heterosexual peers. The sexual minority youth had fewer estimated white members than the heterosexual youth, but the overlapping confidence intervals indicate that this difference is not statistically significant. The sexual minority youth compared to heterosexual peers showed greater distributions for African Americans (16.9% vs. 15.6%), Hispanics (13.0% vs. 11.1%).

Table 3: Add Health Demographics

	Total Proportion 95% CI	Sexual Minority Proportion 95% CI	Heterosexual Proportion 95% CI
Age			
12 or under	0.0% [0,0]	0.0%	0.0% [0,0]
13	0.1% [.00063,.0026]	0.0%	0.1% [.00069,.0028]
14	5.3% [.0461,.0611]	3.9% [.0229,.0659]	5.4% [.0468,.0631]
15	21.5% [.2011,.2286]	18.4% [.1546,.2167]	21.7% [.2037,.2313]
16	25.1% [.2409,.2614]	24.8% [.21,.2894]	25.1% [.2408,.2622]
17	24.8% [.2374,.2583]	25.1% [.2108,.2966]	24.7% [.237,.2581]
18 or over	23.2% [.2176,.2476]	27.9% [.2342,.3275]	22.8% [.2139,.2433]
Grade			
9	26.4% [.2443,.2845]	23.1% [.1921,.276]	26.7% [.2469,.2874]
10	24.8% [.2389,.2572]	23.9% [.206,.2759]	24.9% [.2392,.2584]
11	23.6% [.2255,.2457]	24.7% [.2174,.2782]	23.5% [.2247,.2446]
12	25.3% [.2406,.2653]	28.3% [.2486,.3197]	25.0% [.2373,.2634]
Sex			
Male	50.6% [.4906,.5222]	50.7% [.4656,.5491]	50.6% [.4903,.5222]
Female	49.4% [.4778,.5094]	49.3% [.4509,.5344]	49.4% [.4778,.5097]
Race/Ethnicity			
White	66.6% [.5873,.736]	63.5% [.5446,.7172]	66.8% [.5899,.7385]
African American	15.7% [.112,.2168]	16.9% [.1178,.2365]	15.6% [.1109,.2162]
Hispanic	11.3% [.0766,.1634]	13.0% [.0885,.1874]	11.1% [.075,.1624]
Other	6.4% [.0448,.0903]	6.6% [.0371,.1135]	6.4% [.0452,.0891]
Sexual Minority			
	7.9% [.0721,.0875]		

YRBS Demographics

Table 4 details the estimated proportion of adolescents in each of the demographic categories of age, grade, sex, and race/ethnicity for sexual minority youth and their heterosexual peers. The estimated proportion of this sample that was coded sexual minority youth is 11%. Both groups were evenly distributed amongst 15, 16 and 17 year olds that account for 75% of the population. Both groups had fewer youth in aged 18 or older and 14 and younger. Since the sample was weighted on grade rather than age, it was not a surprise to see an even distribution of adolescents in all the grades for both groups.

The distribution of sexes in the sexual minority group was not similar to the heterosexual group. The sexual minority youth adolescent group was 63% female compared to the heterosexual group at 47% female. The race/ethnicity of the heterosexual group was not statistically different from the full sample. The race/ethnicity distribution of sexual minority youth, however, was not similar to their heterosexual peers. The sexual minority youth were less white than their heterosexual peers (52% vs 63%). The distribution of non-white races was greater in each race category: African American (20% vs 15%), Hispanic (18% vs. 14%).

Table 4: YRBS Demographics

	Total	Sexual Minority	Heterosexual
	<u>Proportion</u>	<u>Proportion</u>	<u>Proportion</u>
	95% CI	95% CI	95% CI
Age			
12 or under	0.4%	1.5%	0.3%
	[.0029,.0052]	[.0101,.0224]	[.0017,.0039]
13	0.3%	0.6%	0.2%
	[.0018,.0034]	[.0028,.0125]	[.0014,.003]
14	10.6%	7.9%	10.9%
	[.0934,.1204]	[.064,.0979]	[.0962,.1241]
15	25.2%	23.5%	25.4%
	[.2306,.2737]	[.2075,.2648]	[.2325,.2758]
16	25.5%	24.8%	25.6%
	[.2348,.2765]	[.2196,.2793]	[.2355,.2774]
17	23.6%	24.8%	23.4%
	[.2185,.2533]	[.2174,.2823]	[.2169,.2519]
18 or over	14.5%	16.8%	14.3%
	[.1297,.1626]	[.1428,.197]	[.1268,.1601]
Grade			
9	26.9%	23.9%	27.2%
	[.2353,.3047]	[.2005,.2812]	[.2382,.3089]
10	25.6%	24.9%	25.7%
	[.226,.2885]	[.2135,.2872]	[.2264,.2898]
11	24.2%	26.9%	23.9%
	[.2181,.2673]	[.234,.3068]	[.2149,.2642]
12	23.4%	24.4%	23.2%
	[.2067,.2629]	[.2032,.2903]	[.2055,.2616]
Sex			
Male	50.9%	36.5%	52.6%
	[.4919,.5265]	[.3376,.3934]	[.5084,.5441]
Female	49.1%	63.5%	47.4%
	[.4735,.5081]	[.6066,.6624]	[.4559,.4916]
Race/Ethnicity			
White	62.3%	52.4%	63.5%
	[.5832,.6616]	[.4755,.5721]	[.5947,.6733]
African American	15.2%	19.9%	14.6%
	[.1228,.1862]	[.1592,.2462]	[.1175,.1805]
Hispanic	14.3%	18.4%	13.9%
	[.1257,.1628]	[.1598,.2105]	[.1203,.1589]
Other	8.2%	9.3%	8.0%
	[.0741,.0901]	[.0781,.1104]	[.0724,.0892]
Sexual Minority	10.7%		
	[.0992,.1143]		

Sexual Minority Groups

The estimated proportion of youth who were coded as sexual minority was 7.9% for the Add Health sample and 10.7% for the YRBS sample. Table 5 details the odds ratios for the demographics of the sexual minority groups in each of the study samples. The sexual minority youth in the Add Health sample showed very little difference compared to their heterosexual peers in any category. The sexual minority youth in the YRBS sample showed differences compared to their heterosexual peers in several categories including age, sex and race/ethnicity. The most notable difference between the two samples was the difference in sex and race/ethnicity distribution. The YRBS sexual minority youth were twice as likely to be female as their heterosexual peers, while the Add Health sexual minority youth showed no difference in distribution by sex. The YRBS sexual minority youth also were more likely to be non-white than their heterosexual peers while the Add Health sexual minority youth showed no difference in distribution by race/ethnicity.

Sexual Minority Youth Subgroups

For the Add Health sample a subgroup option was created for the romantic attraction variable and named “opposite sex – non norm.” Those youth that reported having opposite-sex attractions only, but also reported sexual partners that were inconsistent with that report were coded as “opposite sex – non norm.” For the YRBS sample a new subgroup option was created for the sexual identity variable and named “heterosexual – non norm.” Those youth who reported a heterosexual identity but also

reported having sexual partners of the same-sex or both sexes were recoded as “heterosexual – non norm.”

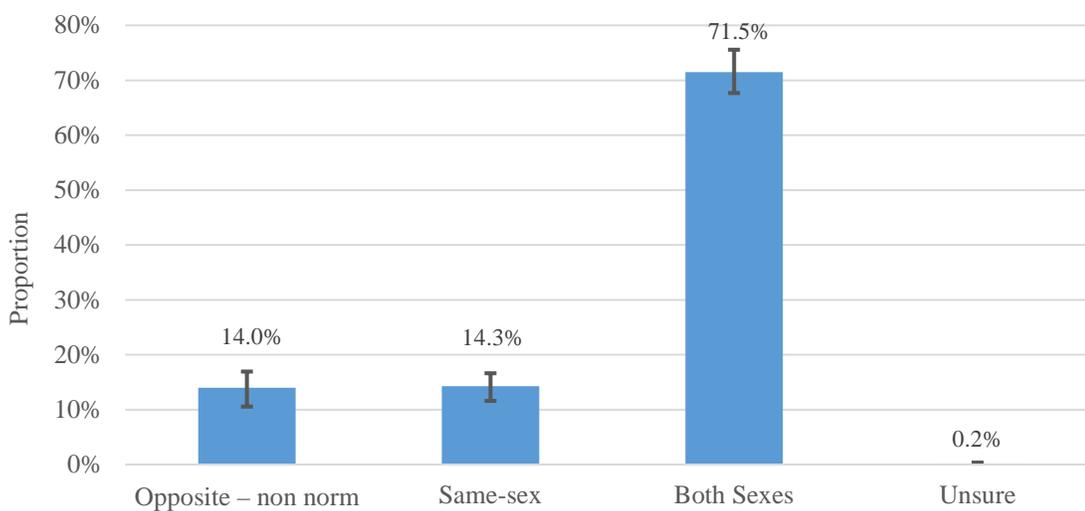
Table 5: Odds Ratios for demographic characteristics of adolescents coded as sexual minority youth

	2013 YRBS				1994 Add Health				
	Odds Ratio	P>t	[95% CI]		Odds Ratio	P>t	[95% CI]		
Age									
12 or Under	1.00				1.000				
13	0.26	0.18	0.04	1.87	1.000				
14	0.15	0.00	0.06	0.36	0.517	0.043	0.273	0.978	
15	0.21	0.00	0.09	0.47	0.619	0.046	0.387	0.991	
16	0.23	0.00	0.10	0.53	0.747	0.111	0.521	1.070	
17	0.30	0.01	0.12	0.73	0.793	0.191	0.559	1.124	
18 or Over	0.41	0.04	0.18	0.96	1.000				
Grade									
9	1.00				1.000				
10	0.90	0.42	0.70	1.16	0.949	0.724	0.711	1.269	
11	0.88	0.27	0.69	1.11	0.934	0.701	0.657	1.328	
12	0.62	0.01	0.43	0.89	0.863	0.538	0.539	1.383	
Sex									
Male	1.00								
Female	2.06	0.00	1.83	2.31	1.026	0.769	0.865	1.215	
Race/Ethnicity									
White	1.00				1.000				
African American	1.61	0.00	1.33	1.95	1.114	0.388	0.870	1.426	
Hispanic	1.58	0.00	1.31	1.90	1.211	0.190	0.908	1.615	
Other	1.41	0.00	1.14	1.75	1.093	0.627	0.761	1.571	

The Add Health adolescents who were coded as sexual minority (Figure 4) reported mostly both-sex attractions (71.5%) with fewer reporting same-sex only

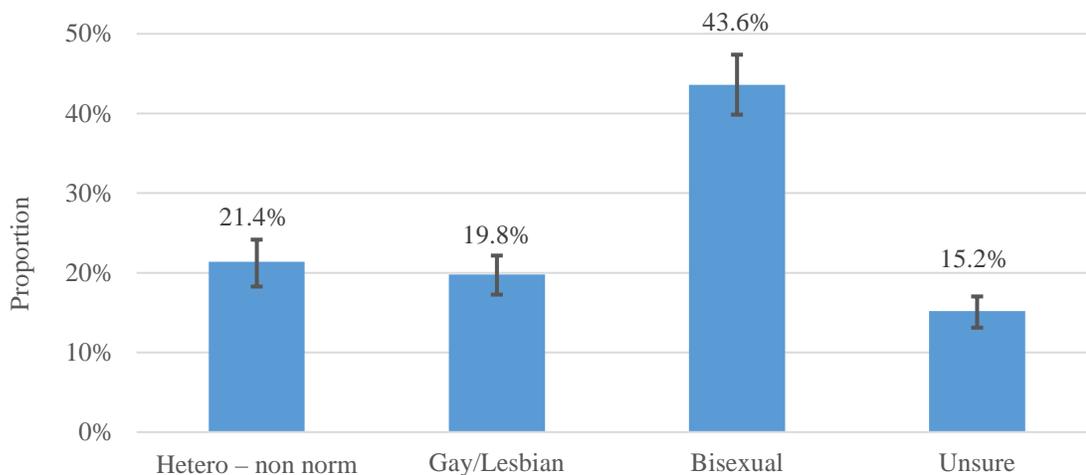
attractions (14.3%) or not knowing their attractions (0.2%). Those who were coded as opposite – non norm accounted for 14.0% of the sexual minority youth. The YRBS adolescents who were coded as sexual minority (Figure 5) identify mostly as bisexual (43.6%) with fewer identifying as gay or lesbian (19.8%) or unsure of sexual identity (15.2%). Those who identified as heterosexual but have sexual contact with the same sex or both sexes account for 21.4% of the sexual minority youth. While the distribution was different in the two samples, the pattern was the same in both groups with the greatest number of youth falling in the category of bisexual or attraction for both sexes and a smaller proportion of youth with same sex attraction or gay/lesbian identity than those who identified as heterosexual or only attracted to the opposite sex.

Figure 4 - Estimated proportion of sexual minority youth in each subgroup of **romantic attraction** in the 1994 Add Health dataset with 95% confidence intervals



For data table, see Appendix B

Figure 5 - Estimated proportion of sexual minority youth in each subgroup of **sexual identification** in the 2013 YRBS dataset with 95% confidence intervals



For data table, see Appendix B

Research Question One

Are the smoking behaviors of sexual minority youth different from their heterosexual peers within the two data sets?

Hypothesis 1a: Sexual minority youth in both samples will show significant disparity in the six smoking behaviors measured compared to heterosexual peers within their own sample. Sexual minority youth will begin smoking at a younger age, smoke more frequently, and have a greater incidence of daily smoking than their heterosexual peers.

Hypothesis 1b: The disparity in smoking behaviors between the sexual minority and heterosexual youth in the 2013 YRBS will be greater than the disparity in smoking behaviors between the sexual minority and heterosexual youth in the 1994 Add Health survey.

Hypothesis 1c: For youth who are regular (current) smokers the smoking behaviors of sexual minority youth will not be significantly different from their heterosexual peers within the same cohort.

Analysis

A secondary data analysis of the Add Health and YRBS datasets was completed using Stata14™. Both datasets are national large-scale surveys with weighting applied, and therefore, the “survey” commands are used to complete the analyses. The “tabulate” command was used to create estimated population proportions with 95% confidence intervals. Logistic regressions were run to create odds ratios for the 6 smoking questions being analyzed for each sample. Because significant differences were found in the subpopulation in the YRBS sexual minority youth by age, sex and race/ethnicity, logistic regressions were also conducted adjusting for the three demographic variables. While the Add Health subpopulation did not show the same differences, adjusted odds ratios for age, sex and race/ethnicity were computed for consistency in reporting.

For this analysis 7 dichotomized smoking variables were created for each survey: 1) ever smoked; 2) first cigarette before the age of 13; 3) heavy smoker (smoking more than 10 cigarettes per day; 4) current smoker (smoking any number of cigarettes during the last 30 days); 5) frequent smoker (smoking at least 20 cigarettes in the last 30 days); 6a) daily smoker (smoking all the last 30 days); 6b) ever smoked daily; and 7) tried to quit (making a quit attempt in the last 6 months or 12 months). Daily smoking was assessed with a second variable that provides historical as well as current daily use. Since this question was asked on both surveys, both daily smoking variables are included.

The assessment of the 7 smoking questions was completed for the full sample. A second analysis was completed for current smokers and included 6 of the 7 smoking variables. Proportions and odds ratios were run for each of the 6 smoking variables. Tables with proportions of all smoking variables is included in Appendix A.

Results

Smoking Behaviors

Smoking disparities were present in all seven of the smoking variables in both the 1994 Add Health sample and the 2013 YRBS sample. A greater proportion of sexual minority youth reported having ever smoked, had their first cigarette before 13, been a current smoker, been a frequent smoker, been a daily smoker, ever been a daily smoker, and having made a quit attempt. In the Add Health sample, the adjusted odds ratios for each smoking assessment variable ranged from 1.5 to 2. In the YRBS sample, the adjusted odds ratios ranged from 3 to 4 times more for sexually minority youth for each smoking variable. The variable for trying to quit smoking in both samples, fortunately, also showed more sexual minority youth tried to quit smoking than their heterosexual peers.

Ever smoked (Table 6). A significantly greater estimated proportion of sexual minority youth reported having ever smoked than their heterosexual peers in both samples (Add Health: 71.9% vs. 63.3%; YRBS: 63.8% vs. 36.3%) The adjusted odds ratio for Add Health youth indicated that sexual minority youth were nearly 1.5 times more likely to have ever smoked than their heterosexual peers. The adjusted odds ratio

for YRBS youth indicated that sexual minority youth were 3.2 times more likely to have ever smoked than their heterosexual peers.

Table 6: Youth reported ever smoking with estimated proportion by sexual minority category with unadjusted and adjusted odds ratios

	Add Health Smoking Results				YRBS Smoking Results			
	Proportion [95% CI]		Odds Ratio* [95% CI]		Proportion [95% CI]		Odds Ratio* [95% CI]	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
Ever Smoked	63.3% [.6105, .6547]	71.9% [.674, .7592]	1.5 [1.21, 1.82]	1.5 [1.23, 1.85]	36.3% [.3397, .3865]	63.8% [.5982, .6753]	3.1 [2.68, 3.56]	3.2 [2.71, 3.67]

*p<.05 for all odds ratios; +odds ratios adjusted for age, sex and race/ethnicity

Smoked before the age of 13 (Table 7). A significantly greater estimated proportion of sexual minority youth reported smoking their first cigarette before the age of 13 than their heterosexual peers (Add Health: 23.8% vs. 16.1%; YRBS: 22.3% vs. 7.2%) The adjusted odds ratio in the Add Health youth indicated that sexual minority youth were 1.7 times more likely to have smoked before the age of 13 than their heterosexual peers. The adjusted odds ratio for YRBS youth indicated that sexual minority youth were nearly 4 times more likely to have smoked before the age of 13 than their heterosexual peers.

Table 7: Youth reported smoking first cigarette before age 13 with estimated proportion by sexual minority category with unadjusted and adjusted odds ratios

	Add Health Smoking Results				YRBS Smoking Results			
	Proportion [95% CI]		Odds Ratio* [95% CI]		Proportion [95% CI]		Odds Ratio* [95% CI]	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
First Cigarette before 13	16.1%	23.8%	1.6	1.7	7.2%	22.3%	3.7	3.8
	[.1461, .1775]	[.2025, .2782]	[1.28, 2.07]	[1.36, 2.20]	[.0647, .0799]	[.1956, .2528]	[3.11, 4.41]	[3.13, 4.55]

*p<.05 for all odds ratios; +odds ratios adjusted for age, sex and race/ethnicity

Current smoker (Table 8). A significantly greater estimated proportion of sexual minority youth reported smoking at least once in the last 30 days than their heterosexual peers (Add Health: 45.3% vs. 31.4%; YRBS: 31.8% vs. 11.4%) The adjusted odds ratio for Add Health youth indicated that sexual minority youth were nearly 2 times more likely to be a current smoker than their heterosexual peers. The adjusted odds ratio for YRBS youth indicated that sexual minority youth were 3.8 times more likely to be a current smoker than their heterosexual peers.

Table 8: Youth coded as current smokers (smoked at least once in the last 30 days) with estimated proportion by sexual minority category with unadjusted and adjusted odds ratios

	Add Health Smoking Results				YRBS Smoking Results			
	Proportion [95% CI]		Odds Ratio* [95% CI]		Proportion [95% CI]		Odds Ratio* [95% CI]	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
Current Smoker	31.4%	45.3%	1.8	1.9	11.4%	31.8%	3.6	4.1
	[.2885, .3398]	[.3994, .5066]	[1.50, 2.18]	[1.55, 2.29]	[.1036, .1242]	[.2882, .3483]	[3.17, 4.17]	[3.54, 4.70]

*p<.05 for all odds ratios; +odds ratios adjusted for age, sex and race/ethnicity

Frequent smoker (Table 9). A significantly greater estimated proportion of sexual minority youth reported smoking at least 20 days in the last 30 days than their heterosexual peers (Add Health: 26.0% vs. 17.1%; YRBS: 11.0% vs. 3.9%) The adjusted odds ratio for Add Health youth indicated that sexual minority youth were 1.7 times more likely to be a frequent smoker than their heterosexual peers. The adjusted odds ratio for YRBS youth indicated that sexual minority youth were 3 ½ times more likely to be a frequent smoker than their heterosexual peers.

Table 9: Youth coded as frequent smokers (smoked at least 20 of 30 days) with estimated proportion by sexual minority category with unadjusted and adjusted odds ratios

	Add Health Smoking Results				YRBS Smoking Results			
	Proportion [95% CI]		Odds Ratio* [95% CI]		Proportion [95% CI]		Odds Ratio* [95% CI]	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
Frequent Smoker	17.1% [.1531,.1914]	26.0% [.2213, .3027]	1.7 [1.40, 2.06]	1.8 [1.44, 2.17]	3.9% [.0341, .0448]	11.0% [.0918, .1319]	3 [2.50, 3.71]	3.5 [2.91, 4.26]

*p<.05 for all odds ratios; +odds ratios adjusted for age, sex and race/ethnicity

Heavy Smoker (Table 10). A significantly greater estimated proportion of sexual minority youth reported heavy smoking than their heterosexual peers (Add Health: 11.4% vs. 8.4%; YRBS: 4.4% vs. 1.0%) The adjusted odds ratio for Add Health youth indicated sexual minority youth were 1.4 times more likely to be a heavy smoker than their heterosexual peers. The adjusted odds ratio for YRBS youth indicated sexual minority youth were nearly 5 times more likely to be a heavy smoker than their heterosexual peers.

Table 10: Youth coded as heavy smokers (smoked more than 10 cigarettes per day) with estimated proportion by sexual minority category with unadjusted and adjusted odds ratios

	Add Health Smoking Results				YRBS Smoking Results			
	Proportion [95% CI]		Odds Ratio* [95% CI]		Proportion [95% CI]		Odds Ratio* [95% CI]	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
Heavy Smoker	8.4% [.0718, .0968]	11.4% [.0897, .143]	1.4 [1.07 1.86]	1.4 [1.07, 1.88]	1.0% [.008, .0134]	4.4% [.0297, .0649]	4.4 [3.01, 6.42]	4.9 [3.27, 7.30]

*p<.05 for all odds ratios; +odds ratios adjusted for age, sex and race/ethnicity

Daily Smoker (Table 11). A significantly greater estimated proportion of sexual minority youth reported current daily smoking than their heterosexual peers (Add Health: 18.7% vs. 12.9%; YRBS: 8.1% vs. 2.9%) The adjusted odds ratio for Add Health youth indicated that sexual minority youth were 1.6 times more likely to be current daily smokers than their heterosexual peers. The adjusted odds ratio for YRBS youth indicated that sexual minority youth were 3.3 times more likely to be current daily smokers than their heterosexual peers. Sexual minority youth also reported a significantly greater history of any daily smoking compared to their heterosexual peers (Add Health: 36.4% vs. 25.9%; YRBS: 21.4% vs. 6.9%). The adjusted odds ratio for Add Health youth indicated that sexual minority youth were 1.7 times more likely to have ever been a daily smoker than their heterosexual peers. The adjusted odds ratio for YRBS youth indicated that sexual minority youth were more than 4 times more likely to have ever been a daily smoker than their heterosexual peers.

Table 11: Youth reported being a daily smoker and ever being a daily smoker with estimated proportion by sexual minority category with unadjusted and adjusted odds ratios

	Add Health Smoking Results				YRBS Smoking Results			
	Proportion [95% CI]		Odds Ratio* [95% CI]		Proportion [95% CI]		Odds Ratio* [95% CI]	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
Current Daily Smoker	12.9% [.1129, .1469]	18.7% [.1561, .223]	1.6 [1.28, 1.90]	1.6 [1.28, 1.98]	2.9% [.0248, .0334]	8.1% [.0637, .1016]	3 [2.31, 3.80]	3.3 [2.55, 4.24]
Anytime Daily Smoker	25.9% [.2383, .2807]	36.4% [.32, .4111]	1.6 [1.36, 1.98]	1.7 [1.39, 2.10]	6.9% [.0571, .0822]	21.4% [.1755, .2578]	3.7 [3.00, 4.54]	4 [3.26, 4.96]

*p<.05 for all odds ratios; +odds ratios adjusted for age, sex and race/ethnicity

Tried to quit (Table 12). A significantly greater estimated proportion of sexual minority youth reported having tried to quit smoking than their heterosexual peers (Add Health: 21.7% vs. 16.7%; YRBS: 21.6% vs. 8.0%). The time period for making a quit attempt varied between the two surveys. The Add Health survey asked for quit attempts in the 12 months prior to the survey being completed while the YRBS asked for quit attempts in the 6 months prior to the survey being completed. The adjusted odds ratio for Add Health youth indicated that sexual minority youth were 1.7 times more likely to have tried to quit smoking than their heterosexual peers. The adjusted odds ratio for YRBS youth indicated that sexual minority youth were 3.4 times more likely to have tried to quit smoking than their heterosexual peers.

Table 12: Youth reported making a quit attempt with estimated proportion by sexual minority category with unadjusted and adjusted odds ratios

	Add Health Smoking Results				YRBS Smoking Results			
	Proportion [95% CI]		Odds Ratio* [95% CI]		Proportion [95% CI]		Odds Ratio* [95% CI]	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
Tried to Quit	16.7% [.1541,.1811]	21.7% [.1822, .2561]	1.4 [1.10, 1.72]	1.4 [1.11, 1.75]	8.0% [.0715, .0885]	21.6% [.187, .2477]	3.2 [2.67, 3.80]	3.4 [2.82, 4.06]

*p<.05 for all odds ratios; +odds ratios adjusted for age, sex and race/ethnicity

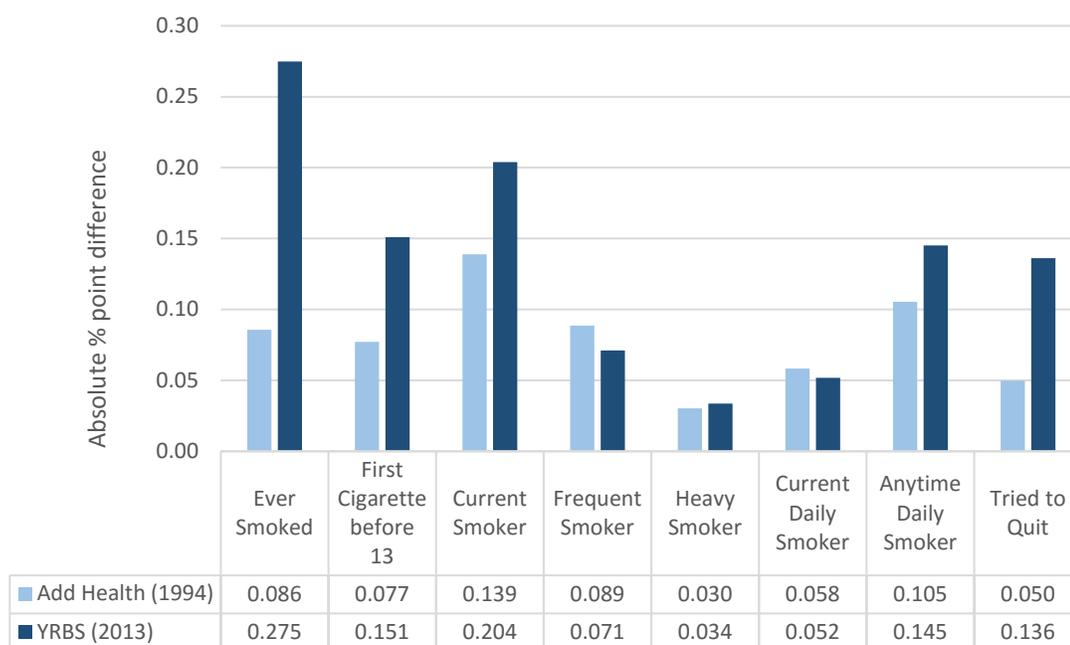
As hypothesized, a disparity exists in each of the samples on all of the smoking variables. In both the Add Health and the YRBS samples, sexual minority youth had greater proportions than their heterosexual peers in youth reporting having ever smoked, tried their first cigarette before the age of 13, been current smokers, been frequent smokers and been daily smokers. Greater proportions of sexual minority youth in both samples report having tried to quit than their heterosexual peers.

Comparison of Smoking Disparity

For all smoking variables, proportion tables were imported into Microsoft Excel™ and a value was calculated for the difference between the proportions in the sexual minority youth and the heterosexual youth in each sample. As hypothesized, the smoking disparities between the sexual minority youth and their heterosexual peers in the Add Health sample and the YRBS sample were different. While examining estimated population means does not allow for significance testing of the difference of the means, the trend in differences demonstrated the disparity between heterosexual youth and sexual minority youth existed in both samples for each of the smoking variables

(Figure 6). The disparities in the smoking variables were greater for the sexual minority youth in the 2013 YRBS sample for those who reported having ever smoked, smoked the first cigarette before age 13, been a current smoker, having ever been a daily smoker and tried to quit smoking. The disparity in the those who were frequent smokers and those who were daily smokers was similar in the two samples.

Figure 6 - Absolute difference (disparity) in proportions on smoking variables between heterosexual and sexual minority youth by sample



Current Smokers Only

An analysis was completed to examine the differences between heterosexual and sexual minority current smokers. Current smokers for this study were those who reported smoking any cigarettes during the last 30 days prior to completing the survey.

Table 13: Smoking assessment variables for current smokers with estimated proportion of youth by sexual minority category in each sample with unadjusted and adjusted odds ratios

	Add Health				YRBS			
	Proportion [95% CI]		Odds Ratio		Proportion [95% CI]		Odds Ratio	
	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺	Hetero- sexual	Sexual Minority	Unadj	Adj ⁺
First Cigarette before 13	34.1% [.3145, .3676]	41.7% [.3545, .4823]	1.4* [1.04, 1.84]	1.5* [1.08, 1.97]	30.9% [.2691, .3513]	41.5% [.3454, .4876]	1.6** [1.14, 2.21]	1.7** [1.18, 2.41]
Frequent Smoker	54.7% [.5196, .5732]	57.4% [.5173, .6296]	1.1 [0.88, 1.42]	1.1 [0.87, 1.47]	34.5% [.3147, .3765]	34.7% [.3002, .3976]	1 [0.80, 1.27]	1.2 [0.96, 1.54]
Heavy Smoker	25.9% [.2334, .2854]	23.9% [.1907, .2957]	0.9 [0.66, 1.24]	0.9 [0.67, 1.26]	9.2% [.073, .116]	14.0% [.0982, .1947]	1.6 [1.06, 2.40]	1.8 [1.15, 2.90]
Current Daily Smoker	41.1% [.38, .4431]	41.4% [.3575, .4726]	1 [0.79, 1.29]	1 [0.77, 1.30]	25.4% [.2281, .2809]	25.4% [.2045, .3107]	1 [0.76, 1.33]	1.1 [0.83, 1.52]
Anytime Daily Smoker	69.8% [.6732, .7213]	71.3% [.6527, .767]	1.1 [0.81, 1.42]	1.1 [0.85, 1.22]	44.5% [.4011, .4899]	58.2% [.5024, .6576]	1.7*** [1.27, 2.39]	2.2*** [1.53, 3.03]
Tried to Quit	52.9% [.504, .5544]	46.9% [.4189, .5205]	0.8* [0.63, 0.99]	0.8* [0.62, 0.99]	50.0% [.4625, .5366]	50.9% [.4371, .58]	1 [0.74, 1.45]	1 [0.69, 1.43]

*p<.05, **p<.01, ***p<.001; +adjusted for age, sex, and race/ethnicity

In both samples, sexual minority youth were more similar in most of the smoking variables (Table 13). In the Add Health sample sexual minority youth were more likely to have smoked their first cigarette before the age of 13 (adjusted OR, 1.5) and less likely to have made a quit attempt (adjusted OR, 0.8). In the YRBS sample, sexual minority smokers were more likely to have smoked their first cigarette before the age of 13 (adjusted OR, 1.7) and more likely to have ever been a daily smoker (adjusted OR, 2.2).

Research Question Two

Are smoking behaviors between the two samples different for sexual minority youth and heterosexual youth?

Hypothesis 2a: Smoking behaviors among heterosexual youth will be different from the Add Health sample in 1994 to the YRBS sample in 2013. Fewer heterosexual smokers will have reported initiating smoking before age 13 in 2013 and the YRBS sample of heterosexual smokers will have fewer reported frequent smokers, heavy smokers and daily smokers.

Hypothesis 2b: Smoking behaviors among sexual minority youth will not be significantly different from the Add Health sample in 1994 to the YRBS sample in 2013. Sexual minority youth will have reported initiating smoking before age 13 in 2013 at the same rates as those in 1994, and the YRBS sample of sexual minority youth will not be statistically different in reported frequent smokers, heavy smokers and daily smokers.

Hypothesis 2c: Smoking behaviors in sexual minority youth who are current smokers will not be significantly different between the Add Health and YRBS samples. Those initiating smoking before the age of 13 will not be different between 1994 and 2013, and the proportion of current sexual minority smokers who are frequent smokers, heavy smokers and daily smokers will not be statistically different between the two samples.

Analysis

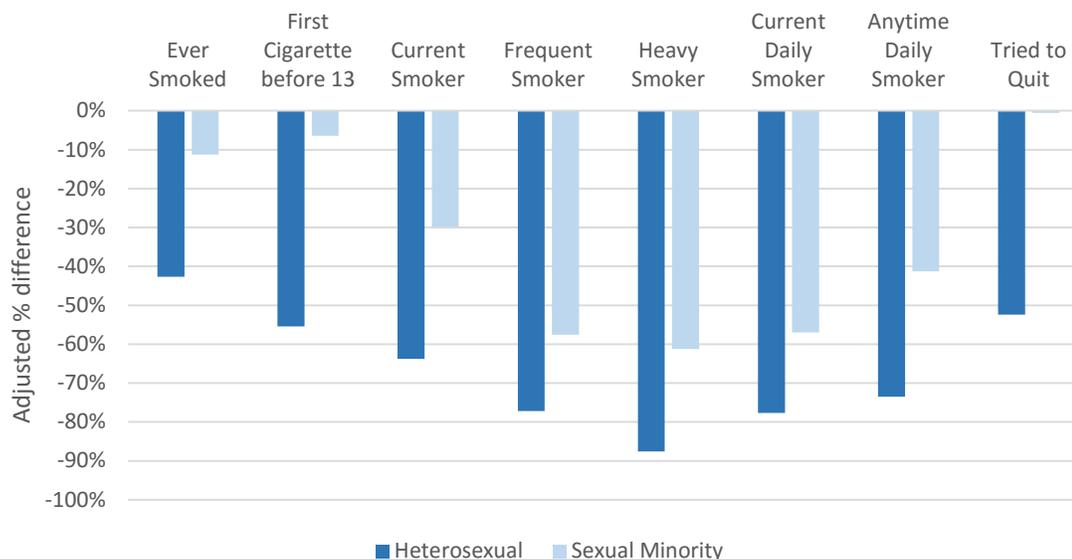
A new variable was created in each dataset to represent the year of the dataset, 1994 for the Add Health dataset and 2013 for the YRBS dataset. A combined dataset was created that pulled all the variables related to weighting, demographics and smoking. A super-stratification variable was created that included combining the value of the stratification variable in the original dataset with the year of the dataset to maintain the weighting of each of the original samples. Due to small cell size for non-white races in the Add Health subpopulation of sexual minority smokers, a new variable was created for race/ethnicity that dichotomized race/ethnicity into white and non-white. The estimated proportions and odds ratios were run for demographics of the sexual minority youth by survey to estimate the likelihood of a difference in the Add Health sexual minority youth compared to the YRBS sexual minority youth. Proportions and logistic regressions were also run for the subpopulation of sexual minority youth who were coded as current smokers on the smoking variables: 1) first cigarette before 13 years of age, 2) heavy smoker 3) daily smoker, and 4) ever been a daily smoker. Two sets of logistic regressions were run; one with no adjustment and one with adjustments for sex and race/ethnicity.

Results

Difference between the two samples

A difference was found for all the smoking variables in heterosexual youth between the YRBS and the Add Health samples (Figure 7). The differences indicated a reduction in all the smoking variables for heterosexual youth.

Figure 7 - Relative difference (decrease) in smoking variables between Add Health (1994) and YRBS (2013) samples by sexual minority category



The differences in smoking variables for sexual minority youth between the two samples did not reflect the changes seen in the heterosexual youth. While there was a difference in sexual minority youth who reported ever having smoked, the reduction was about 3 times greater for the heterosexual youth. Most noticeable in the sexual minority youth was the smaller difference in those who smoked their first cigarette before the age of 13 and no discernable difference in those who tried to quit, which is not reflected in the heterosexual youth that showed a dramatic difference in both of those variables. The difference in frequent smokers and current daily smokers were similar in the both heterosexual and sexual minority youth between the two samples.

Demographics of Sexual Minority Current Smokers

The demographics of the two groups of sexual minority smokers only differed in

distribution by sex and race/ethnicity (Table 14). Sexual minority smokers were 1.7 times more likely to be female in the YRBS subpopulation and 2.2 time more likely to be non-white.

Table 14: Demographic proportions and odds ratios for sexual minority current smokers

		1994 - Add Health	2013 - YRBS	OR
Age	12 or under	0.000	3.2%	1.0
			[.0183,.0563]	
	13	0.000	0.5%	1.0
			[.0008,.0282]	
	14	4.7%	7.4%	2.3
		[.0215,.1004]	[.05,.1076]	[.94,5.73]
	15	16.4%	18.1%	1.6
		[.1267,.2087]	[.1436,.2247]	[.98,2.73]
16	26.0%	23.0%	1.3	
		[.2006,.3293]	[.1886,.2767]	[.76,.2.24]
17	24.3%	28.5%	1.7*	
		[.1968,.2962]	[.2355,.3405]	[1.07,2.82]
	18 or over	28.6%	19.4%	1.0
		[.2241,.3578]	[.1559,.2376]	[1.0,1.0]
Grade	9	24.0%	22.8%	1.0
			[.1828,.3083]	[.1729,.2943]
	10	22.7%	18.6%	0.9
		[.1692,.2979]	[.144,.2355]	[.46,1.61]
	11	24.4%	28.6%	1.2
	[.2046,.2872]	[.2391,.3377]	[.73,2.08]	
12	28.9%	30.1%	1.1	
		[.2377,.347]	[.2492,.3578]	[.65,1.85]
Sex	male	45.5%	32.7%	1.0
		[.3964,.5156]	[.2755,.3832]	
	female	0.545	67.3%	1.7**
		[.4844,.6036]	[.6168,.7245]	[1.21,2.43]
Race/ Ethnicity	white	4.7%	60.6%	1.0
		[.0215,.1004]	[.5485,.6614]	
	non-white	16.4%	39.4%	2.2**
		[.1267,.2087]	[.3386,.4515]	[1.38,3.62]

*p<.05, ***p<.001

Smoking variables for sexual minority current smokers

Contrary to the hypothesis, smoking behaviors in the two samples of sexual minority smokers were different in all but two smoking variables (Table 15). The estimated proportion of sexual minority current smokers having their first cigarette before the age of 13 was 42% in both samples. The estimated proportion of sexual minority smokers making a quit attempt was also similar with nearly half of current smokers reporting a quit attempt in both samples. When adjusting for sex and race/ethnicity, the odds ratio for heavy smokers became non-significant, indicating those who are heavy smokers in each sample may be similar.

Table 15: Estimated proportions for sexual minority smokers on smoking variables with unadjusted and adjusted odds ratios

	1994 - Add Health	2013 - YRBS	OR unadj	OR adj
First cigarette before 13	41.7% [.3548,.4818]	41.5% [.3455,.4875]	1 [.67,1.47]	0.95 [.62,1.45]
Frequent Smoker	57.4% [.5177,.6293]	34.7% [.3003,.3975]	0.4** [.29,.54]	.44*** [.32,.60]
Heavy Smoker	23.9% [.191,.2953]	14.0% [.0983,.1947]	.52* [.32,.84]	0.6 [.36,.95]
Daily Smoker	41.4% [.3579,.4723]	25.4% [.2045,.3106]	.48** [.33,.70]	.55** [.38,.80]
Ever Daily Smoker	71.3% [.6531,.7667]	58.2% [.5025,.6575]	0.56* [.37,.86]	.61* [.39,.94]
Tried to quit	46.9% [.4192,.5202]	50.9% [.4372,.5799]	1.2 [.82,1.66]	1.2 [.80,1.78]

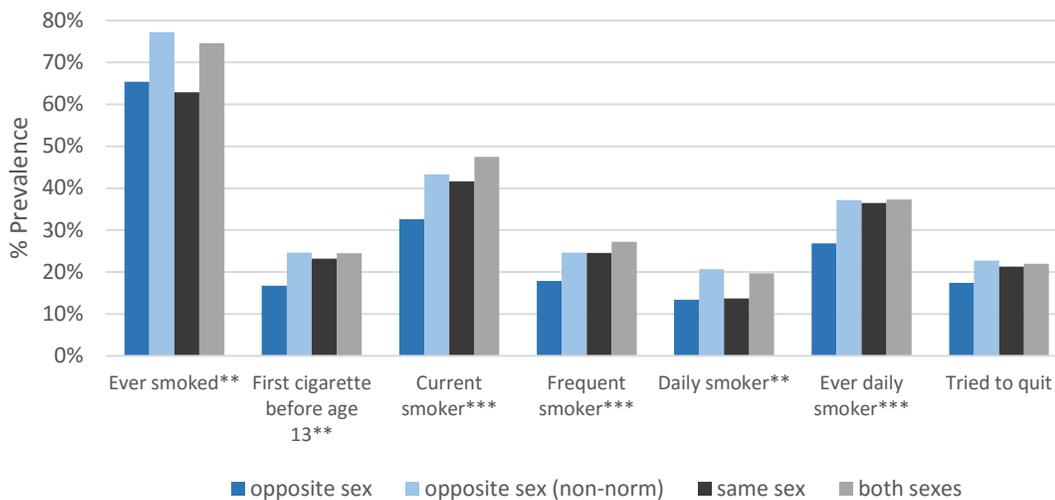
*p<.05, **p<.01, ***p<.0001; adjusted for age, sex and race/ethnicity

Smoking variables for sub-groups of sexual minority youth

While the sub-groups within the sexual minority youth variable cannot be directly compared between the Add Health and YRBS samples, exploring the distribution on the smoking variables was conducted for each of the two sub-samples to look at patterns and trends. The number of surveys in the Add Health dataset that reported “do not know” for romantic attractions was too small to be included in this analysis (Figure 8). Those youth who reported opposite only attractions but also reported sexual contacts with same-sex partners were recoded as “opposite sex – non norm,” indicating that they report like the heterosexual majority, but their sexual behavior was inconsistent with that report.

Most notable was the pattern that emerged with those who report both sex attractions and those who were coded as heterosexual (non-norm). In each of the smoking variables the two sub-groups have similar prevalence and tend to have the greatest prevalence. Those who reported opposite-sex only attractions tended to have the lowest prevalence in each of the smoking variable except two. For those reporting having ever smoked and being daily smokers, the opposite-sex only and same-sex only groups were nearly the same. The only variable not significantly different in prevalence was attempts to quit smoking.

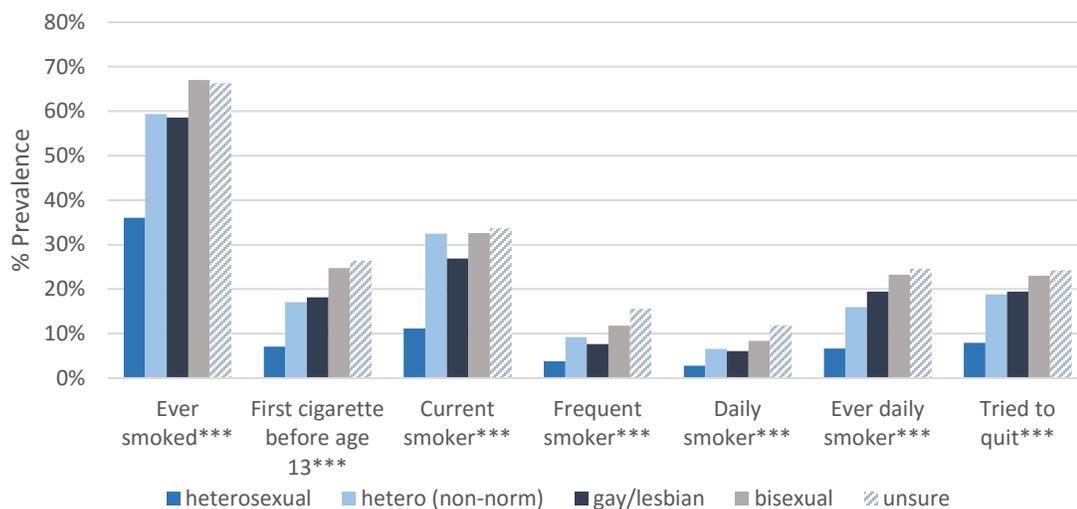
Figure 8 - Add Health (1994): Estimated proportion of youth for smoking variables by romantic attraction



** $p < .01$, *** $p < .001$, data table in Appendix C

The YRBS dataset used sexual identity as a variable to determine sexual minority classification (Figure 9). Those youth who reported a heterosexual identity but also reported sexual contacts with same-sex partners were recoded into a sub-group “heterosexual – non norm,” which indicated that their sexual contacts were not consistent with their heterosexual identity. The YRBS allowed an option on the sexual identity question coded as “unsure” for any youth who do feel comfortable identifying in one of the other subgroups. Similar to the Add Health subgroups, the highest prevalence in each smoking variable was those youth who reported a bisexual identity. Those who identified as heterosexual but also reported sexual contacts with same-sex partners had a prevalence that mirrored those who reported heterosexual identity and opposite-sex only sexual partners.

Figure 9 -YRBS (2013): Estimated proportion of youth for smoking variables by sexual identity



*** $p < .001$ data table in Appendix C

The two patterns that were consistent in each of the samples were: 1) those in the subgroups with both-sex attractions and bisexual identity had greater prevalence in each of the tobacco variables; and 2) those who were coded as opposite-sex (non-norm) and heterosexual (non-norm) had a prevalence similar to those who were coded as both-sex attracted or bisexual.

CHAPTER 4: DISCUSSION

A secondary data analysis of two large United States datasets collected 20 years apart was completed to examine smoking behaviors in the subgroups of youth who were coded as sexual minorities. Disparities in all smoking behaviors assessed were found in each sample when sexual minority youth were compared to heterosexual peers. The 1994 Add Health dataset indicated that sexual minority youth were consistently about 1.5 times more likely than their heterosexual peers to be included in each of the smoking behaviors. Even in the attempts to quit smoking variable, the odds of a sexual minority youth attempting to quit were 1.4 times greater than their heterosexual peers.

The findings for the sexual minority youth in the 2013 YRBS dataset were concerning. The data indicated that the sexual minority youth were at least 3 times more likely to be included in each of the smoking behaviors. Like the Add Health dataset, more sexual minority youth reported attempting to quit than their heterosexual peers (OR=3.4).

When examining the smoking variables for current smokers among sexual minority youth, the disparities began to disappear. In the Add Health youth, only two smoking variables were found to be significantly different than their heterosexual peers, smoking before the age of 13 and attempting to quit. Compared to heterosexual current smokers, more sexual minority current smokers smoked their first cigarette before 13 and more sexual minority youth had reported making a quit attempt. However, with the overlap of the confidence intervals in both of those variables, there is a likelihood that the estimated subpopulations of heterosexual and sexual minority youth may not actually be different. In the 2013 YRBS sample the only significant differences were found in those smoking before the age of 13 and those that had ever been a daily smoker. Again, more

sexual minority youth reported smoking their first cigarette before 13 than their heterosexual peers and more sexual minority youth reported having ever been a daily smoker than their heterosexual peers.

The findings of a disparity within each sample was consistent with findings in several studies that looked at smoking in sexual minority youth.^{15,28,31,83} While this is a concern, a greater concern for public health practitioners and tobacco control programs is the large differences between the two samples in the disparity. The reduction in smoking was seen in both sexual minority youth and their heterosexual peers; however, the reduction in smoking behaviors seems to be disproportionate, with sexual minority youth showing less reduction than their heterosexual peers in smoking behaviors. This would suggest that the prevention and cessation efforts for adolescents has been more successful with heterosexual youth than sexual minority youth. Twenty years of public policy, lawsuits, and messaging have been successful in significantly reducing smoking behaviors in adolescents overall,^{4,83,84} but a growing disparity for those who identify outside of the heterosexual norm should drive public health officials to examine more carefully how prevention efforts might not be resonating with sexual minority youth.

This study used the data from two high school samples, both of which had a high percentage of sexual minority youth reporting that they smoked their first cigarette before the age of 13. The percentage of sexual minority youth who reported their first cigarette before the age of 13 in 1994 was not significantly different from youth reporting in 2013. In contrast, the difference between the two samples in heterosexual youth indicated a significantly lower number of youth smoked before the age of 13 in the YRBS sample in

2013. Prevention efforts in earlier ages seem to be effective in heterosexual youth as opposed to sexual minority youth. Perhaps psycho-sexual development and the exploration of sexual orientation begins earlier than expected.

Family and school influences play important roles in sexual minority youth. While parental support has been found to be a protective factor in early initiation of smoking in adolescents in general,^{85,86} one study using the Add Health data from Wave 3 found less reported parental support/connectedness in sexual minority youth than their heterosexual peers and worse health outcomes.⁸⁷ Youth who experience victimization and bullying in school relating to sexual orientation or the perception of not being heterosexual, has been found to be associated with poor health outcomes and increased drug use, including tobacco, in sexual minority youth - especially those who are actively questioning their sexual orientation.⁸⁸⁻⁹⁰ If youth are not finding support within the traditional family and school systems, they may be reaching out to support systems that have more entrenched smokers that influence early smoking behaviors.

Alternatively, early childhood trauma has been found to be associated with early initiation and regular smoking in adolescents⁹¹, and youth who experience trauma related to early expression of non-heterosexual behavior may lead to early initiation. Programs that support psycho-sexual development may not be addressing the needs of youth exploring developmental aspects related to sexual orientation early enough, leading youth to look outside traditional support settings of family, friends and school.

The most surprising finding was the difference in the estimated proportion of sexual minority youth in the two samples. Based on assumptions from the literature,

adolescents tend to be less comfortable assigning themselves to a sexual identity group than they are to report on attractions of the same-sex.^{37,92} If this is indeed true, the estimated proportion of youth in the 2013 YRBS group should be smaller than the 1994 Add Health group since the YRBS dataset asked about sexual identity and Add Health survey asked about romantic attraction. This, however, was not the case with this study. Savin-Williams and Diamond found sexual minority youth progress through a process from sexual attraction to sexual identity to sexual identity disclosure.⁹³ The increase in those self-identifying as gay/lesbian and bisexual may be happening earlier than they found in the late 1990's with the presence of gay/straight alliances in schools, increased safety measures to protect sexual minority youth and more positive social attitude towards non-heterosexual behaviors.⁹⁴ Asking questions about sexual identity and sexual attraction would provide a more complete description of the psycho-sexual developmental stage of adolescents completing surveys.

In the context of an ecological model, there may have been a significant cultural shift in several of the influences (friends, school, social circles, political) that have allowed more youth to feel comfortable reporting sexual identify outside of the heterosexual norm over the 20 years represented.⁷ One explanation could be that structural stigma has been reduced. Structural stigma as defined by Link and Phelan is “the co-occurrence of labeling, stereotyping, separation, status loss, and discrimination in a context in which power is exercised.⁹⁵” Mark Hatzenbuehler’s research found a strong association between greater levels of structural stigma and negative health consequences, including increased smoking behaviors in sexual minorities.^{62,96,97} Attitudes about same-

sex relationships have shifted and recognition of same-sex marriage have become a societal norm.⁹⁸⁻¹⁰¹ Gay/straight alliances in high schools became more prevalent over the last two decades and contributed to increased feelings of comfort and safety amongst youth who do not have a sexual orientation that includes only opposite attractions, relationships or identities.^{102,103} Media has included same-sex characters in more positive or normalized representations.^{104,105} Social media has allowed for global outreach of youth to explore outside their closest friends and communities, finding support in exploring feelings that might otherwise be hidden.⁷ With these multiple shifts in the political, social, school and friendship influences in the ecological model, adolescents may now be experiencing a more open environment in which to progress through psycho-sexual development than in the past, allowing for a greater number to self-identify outside the heterosexual norm.

Minority stress theory is often used as a model to help explain the disparity in adolescent sexual minority health behaviors and outcomes.¹⁰⁶ The theory posits that being a sexual minority contributes to unique psycho-social stressors beyond those of their heterosexual peers and thereby contributes to sexual minority youth having stronger associations with negative health behaviors.¹⁰⁷ The findings of this study might challenge the core elements of minority stress theory. If the environment in which sexual minority youth are able to progress through their psycho-sexual development has become more open, the theory should posit that the association to negative health behaviors would decrease in sexual minority youth and disparity in those behaviors should also decrease.¹⁰⁸ The increased disparity may be caused by new psycho-social stressors related

to being in a more open environment that may bring existing prejudices and discrimination towards the sexual minority more to the forefront. However, this idea would need to be examined more carefully as it could be viewed as provocative and suggest backlash on the acceptability of sexual minority identification or behavior.

Alternatively, from the ecological perspective, the support systems that an adolescent reaches out to may perpetuate participation in negative health behaviors. If more youth are reaching out to support networks in communities that also still have a high prevalence of negative health behaviors or even an enculturation of negative health behaviors, such as seen in many sexual minority communities, the influence of those communities may be more powerful than the messaging and influence of the political and school systems. The reduction in smoking in sexual minority youth in this study may more closely mirror changes in the communities that sexual minority youth reach out to for support rather than the reduction in smoking seen in the majority population. For example, evaluative research at a support center for sexual minority youth found an increase in smoking at the center was related to a lack of non-smoking positive role models, a lack of supervision, and an increase in social interactions where cigarettes were offered by peers.¹⁰⁹

Strengths and Limitations

While the two datasets are not ideally matched, there are several reasons for using them for this study. Both datasets used two-step randomization models to sample from large populations to create representative samples. Both samples used students from

school settings, allowing the study to be consistent in high school populations. The sampling allowed for equal distributions across grades and sex. Any difference in racial distribution should be a reflection of changing racial demographics over the 20 years. Because the datasets were collected 20 years apart, there is no risk of duplicated subjects in the samples. Each of the datasets included the sampling variables that allowed for analysis of population estimates. Lastly, each sample had at least one recognized variable that could be used to create a sexual minority variable and included a second variable that identified the gender/sex of sexual partners.

The findings within each sample are reported with high confidence in the proportions and the differences between groups within the two independent samples. However, comparisons between the two samples must be reported with caution. The sexual minority coding was not exactly the same in each dataset and the findings might be slightly skewed by over- or under- reporting in one of the samples based on the variable used to code sexual minority variables. Also, weighting of the samples was not the same. The Add Health dataset was weighted for a national sample, while the YRBS dataset was weighted for each State. The YRBS dataset only included 10 states, so it cannot be deemed a national representation, but a representation of the estimated populations of those 10 states. The Add Health dataset used four regions for stratification (West, Midwest, South and Northeast). Only one of the states in the YRBS dataset is from the Southern United States, so the South as a region may be under-represented in the YRBS analysis.

Implications

Research

This analysis created several questions for further exploration. The 2013 YRBS included a survey conducted in 10 large urban school districts. The data for nine of the ten school districts included the variable for sexual identity and sexual minority. The demographics, especially race/ethnicity, are unique to the school district and have greater reporting of racial minorities than the State and National YRBS. Conducting a descriptive analysis of the District YRBS may provide insight into any differences in urban settings and sexual minority smokers.

The 2015 National YRBS added the sexual identity and sexual minority variables so there is a true national sample for analysis instead of combining an incomplete set of states.¹¹⁰ Conducting a similar comparative analysis between the 2013 State YRBS dataset, the 2015 YRBS dataset with the same states, and the 2015 National YRBS dataset would provide valuable insight into whether the 2013 State YRBS dataset and the sexual minority population is an anomaly or whether there is a cultural shift regarding self-reported sexual identity.

Exploring adolescent self-reporting of sexual orientation variables is key in understanding the effect of cultural changes on psycho-sexual development. To further the science in sexual orientation and sexual development, community-based participatory research should be conducted with adolescents to identify best practices in reporting sexual orientation variables, such as sexual identity, sexual attraction, and sexual

behaviors. Until questions related to sexual orientation are standardized, comparative analysis, such as this, is tenuous at best.

Further research needs to be conducted around the continued early initiation of smoking with sexual minority youth. Policy and practice have clearly made a difference in adolescent smoking overall, but the continuing pattern of early initiation may indicate that prevention efforts targeted at sexual minority youth may need to start sooner than adolescence. The influences on exploring sexual development needs to be conducted to identify associations with factors related to families, friends, schools, and support systems that youth access for resources and role modeling.

Policy and Practice

Best practices for standardizing questions regarding sexual orientation need to be adopted. A single question may be difficult to create as the concepts of sexual identity, sexual attraction and the relationship between the two, when combined with sexual contacts, is complex and the concepts are not really interchangeable.³³

Youth experience in psycho-sexual development needs to be included in the development of curricula targeted at risk behaviors and the relationship with sexual development. If more youth are self-reporting on questions that place them within a framework of “sexual minority,” teachers and other professionals who serve adolescents need a broader training to address high risk behaviors, like smoking, and the relationship with sexual development.^{94,111}

New prevention strategies need to be developed to target smoking and sexual development together at the elementary school level. Prevention efforts over the last 20 years have been effective for heterosexual youth, but the message in the curricula and campaigns are not going far enough to interrupt the pattern of early initiation of smoking.

Prevention strategies for youth who identify as bisexual and/or those youth who have sexual attractions to both sexes need to be developed. Targeting sexual minority youth through LGB efforts may be missing youth who do not align with LGB identities. The reduction in smoking in those who have same-sex only attractions or identify as gay/lesbian indicates that targeted efforts may be effective in communities that are focused on the gay/lesbian youth. However, those who identify as bisexual or have both sex attractions may feel out of place in a dichotomized sexual orientation where they feel pressured to identify as gay or straight.³³ For 20 years there has been a consistent pattern of bisexual youth and youth attracted to both sexes who reported greater smoking prevalence across all the smoking variables examined even after controlling for covariates. Unique targeted programming is need for this subgroup regarding smoking.

Conclusions

Disparities in smoking behaviors between sexual minority youth and their heterosexual peers continue to exist after 20 years of focused tobacco policy and prevention campaigns. While both groups have seen a decrease in smoking behaviors and an increase in quit attempts, the decrease in sexual minority youth does not reflect the same significant decrease seen in heterosexual youth. Prevention efforts appear to have

been effective overall, but with disproportionate effects. While studies over the last 20 years have recommended targeted efforts for sexual minority youth and smoking, the effect of any efforts are not as effective as those for the general adolescent population.

The social and culture aspects for sexual minority youth and sexual identity may have experienced a significant shift leading more youth to identify with non-normative (heterosexual) groups. Given the shift in the demographics of adolescents, comparisons of the Add Health dataset from 1994 with recent datasets since 2010 must be reported with caution. Future research needs to focus on developing an understanding of sexual minority youth in current environments. Using datasets from a cohort of adolescents from more than 20 years in past to predict behaviors in the current environments may be misguided.

Smoking behaviors of greatest concern continue to be the earlier initiation of smoking in sexual minority youth and the greater frequency of current smokers in this group. Practice-based research should focus on identifying factors within family, friends, social media, school and support systems that perpetuate the disparity in smoking behaviors between sexual minority and heterosexual youth. Policy and programming should then be guided by this research in current environments.

APPENDIX A: PROPORTION TABLES FOR SMOKING VARIABLE

Table 16: Proportion of youth in each smoking variable for sexual minority and heterosexual youth for each sample with 95% confidence intervals

	Add Health			YRBS		
	Hetero- sexual	Sexual Minority	Total	Hetero- sexual	Sexual Minority	Total
Ever Smoked	63.3%	71.9%	64.0%	36.3%	63.8%	39.1%
	[.6105, .6547]	[.674, .7592]	[.6178, .661]	[.3397, .3865]	[.5982, .6753]	[.3674, .4151]
Age First Cigarette						
Never Smoked	49.4%	37.3%	48.4%	74.2%	47.1%	71.4%
	[.4681, .5196]	[.3202, .4299]	[.4584, .5102]	[.7245, .7578]	[.4342, .5089]	[.6963, .7309]
8 or younger	2.5%	3.3%	2.5%	1.9%	7.4%	2.5%
	[.0206, .0291]	[.0209, .0504]	[.0214, .0296]	[.0164, .0229]	[.0594, .0914]	[.0216, .0289]
9 or 10	4.1%	7.4%	4.4%	1.6%	4.8%	1.9%
	[.0352, .0474]	[.0535, .1014]	[.0376, .0502]	[.0128, .0189]	[.038, .0615]	[.0163, .0219]
11 or 12	9.6%	13.2%	9.9%	3.7%	10.1%	4.3%
	[.0864, .1062]	[.107, .1612]	[.0901, .108]	[.0332, .041]	[.0838, .1205]	[.0396, .0477]
13 or 14	17.5%	18.8%	17.6%	8.4%	14.7%	9.1%
	[.1616, .19]	[.151, .2307]	[.1626, .1909]	[.0765, .093]	[.1266, .1706]	[.0828, .0995]
15 or 16	13.0%	14.9%	13.2%	8.1%	12.3%	8.6%
	[.1214, .139]	[.1142, .1922]	[.1235, .1398]	[.0728, .0908]	[.1024, .1476]	[.0771, .095]
17 or older	4.0%	5.2%	4.1%	2.1%	3.5%	2.2%
	[.0356, .044]	[.0369, .072]	[.0365, .0451]	[.0173, .025]	[.0259, .0475]	[.0188, .0264]
First Cigarette Before 13	16.1%	23.8%	16.7%	7.2%	22.3%	8.7%
	[.1461, .1775]	[.2025, .2782]	[.1532, .1825]	[.0647, .0799]	[.1956, .2528]	[.0795, .0958]

	Add Health			YRBS		
	Hetero- sexual	Sexual Minority	Total	Hetero- sexual	Sexual Minority	Total
Cigarettes/Day						
Did not smoke	69.3%	56.5%	68.2%	88.9%	68.3%	86.9%
	[.6664, .7174]	[.512, .617]	[.6563, .7074]	[.8759, .9014]	[.6438, .7196]	[.8539, .8824]
<1 per day				3.0%	7.2%	3.4%
				[.0263, .0333]	[.0578, .0903]	[.0304, .0377]
1 per day	5.8%	7.8%	5.9%	2.2%	6.1%	2.6%
	[.0515, .0642]	[.0568, .1059]	[.0533, .0656]	[.0184, .0261]	[.0476, .077]	[.0221, .0299]
2-5 per day	11.4%	16.9%	11.8%	3.8%	11.3%	4.5%
	[.1036, .1256]	[.1425, .1983]	[.1082, .1295]	[.0315, .0451]	[.0908, .14]	[.0383, .0533]
6-10 per day	5.2%	7.5%	5.4%	1.1%	2.7%	1.3%
	[.0454, .0605]	[.0572, .097]	[.0473, .062]	[.0089, .0138]	[.0181, .0397]	[.0103, .0155]
11-20 per day	6.8%	7.8%	6.9%	0.6%	1.7%	0.7%
	[.058, .0796]	[.0575, .106]	[.059, .0801]	[.004, .008]	[.0097, .0306]	[.0048, .0097]
>20 per day	1.6%	3.5%	1.7%	0.5%	2.7%	0.7%
	[.012, .0199]	[.0218, .0566]	[.0136, .0213]	[.0032, .0068]	[.0173, .0413]	[.0049, .0096]
Number of Days Smoked in Last 30 Days						
0 days	68.6%	54.8%	67.5%	88.7%	68.3%	86.6%
	[.6602, .7115]	[.4934, .6006]	[.6487, .7011]	[.8758, .8964]	[.6517, .7118]	[.8548, .8767]
1-2 days	5.3%	9.8%	5.7%	3.4%	7.7%	3.8%
	[.0484, .0588]	[.0706, .1343]	[.0517, .0624]	[.0306, .0378]	[.0622, .0944]	[.0352, .0417]
3-5 days	3.8%	3.8%	3.8%	1.7%	5.6%	2.1%
	[.0335, .043]	[.0234, .0597]	[.0337, .0427]	[.0141, .0207]	[.0433, .0714]	[.0178, .0246]
6-9 days	1.7%	1.2%	1.6%	1.1%	4.3%	1.4%
	[.0134, .0207]	[.0063, .0212]	[.0132, .02]	[.0089, .0132]	[.0323, .0565]	[.0119, .0166]
10-19 days	3.4%	4.6%	3.5%	1.2%	3.2%	1.4%
	[.0294, .0399]	[.0328, .0628]	[.0305, .0404]	[.0104, .0148]	[.0226, .0449]	[.0122, .0169]
20-29 days	4.3%	7.3%	4.5%	1.0%	3.0%	1.2%
	[.0368, .0489]	[.0544, .0963]	[.0394, .051]	[.0081, .0133]	[.021, .0417]	[.0099, .0152]
all days	12.9%	18.7%	13.4%	2.9%	8.1%	3.4%
	[.1129, .1469]	[.1561, .223]	[.1173, .1516]	[.0248, .0334]	[.0637, .1016]	[.0294, .0392]

	Hetero- sexual	Add Health Sexual Minority	Total	Hetero- sexual	YRBS Sexual Minority	Total
Current Smoker	31.4% [.2885, .3398]	45.3% [.3994, .5066]	32.5% [.2989, .3513]	11.4% [.1036, .1242]	31.8% [.2882, .3483]	13.4% [.1233, .1452]
Frequent Smoker	17.1% [.1531, .1914]	26.0% [.2213, .3027]	17.8% [.1599, .1986]	3.9% [.0341, .0448]	11.0% [.0918, .1319]	4.6% [.0406, .0526]
Heavy Smoker	25.9% [.2334, .2854]	23.9% [.1907, .2957]	25.6% [.2331, .2812]	1.0% [.008, .0134]	4.4% [.0297, .0649]	1.4% [.0107, .0176]
Daily Smoker	12.9% [.1129, .1469]	18.7% [.1561, .223]	13.4% [.1173, .1516]	2.9% [.0248, .0334]	8.1% [.0637, .1016]	3.4% [.0294, .0392]
Every Smoked Daily	25.9% [.2383, .2807]	36.4% [.32, .4111]	26.7% [.2467, .2889]	6.9% [.0571, .0822]	21.4% [.1755, .2578]	8.4% [.0705, .0996]
Tried to Quit	16.7% [.1541, .1811]	21.7% [.1822, .2561]	17.1% [.1583, .1848]	8.0% [.0715, .0885]	21.6% [.187, .2477]	9.3% [.0843, .1027]

APPENDIX B: PROPORTION TABLES FOR SEXUAL MINORITY SUBGROUPS

Table 17: Estimated proportion of sexual minority youth in each subgroup of romantic attraction in the 1994 Add Health dataset with 95% confidence intervals

	Opposite – non norm	95% CI	Same- sex	95% CI	Both Sexes	95% CI	Unsure	95% CI
Sexual Attraction	14.0%	[.1106, .1745]	14.3%	[.1197, .1701]	71.5%	[.6743, .7532]	<1%	[.00043, .0096]

Table 18: Estimated proportion of sexual minority youth in each subgroup of sexual identification in the 2013 YRBS dataset with 95% confidence intervals

	Hetero – non norm	95% CI	Gay/ Lesbian	95% CI	Bi	95% CI	Unsure	95% CI
Sexual Identity	21.4%	[.1864, .2453]	19.8%	[.1744, .2234]	43.6%	[.3982, .4735]	15.2%	[.1337, .1729]

APPENDIX C; SMOKING VARIABLES ACROSS THE SUB-GROUPS WITHIN
SEXUAL MINORITY GROUPS

Table 19: 1994 Add Health smoking variables by sexual orientation with 95% confidence intervals and Pearson Chi2

	opposite sex [95% CI]	opposite sex (non-norm) [95% CI]	same sex [95% CI]	both sexes [95% CI]	chi2	p
Ever smoked	65.4% [.6342,.6731]	77.2% [.6811,.8433]	62.9% [.4948,.7454]	74.5% [.6892,.7944]	52.13	0.0016
First cigarette before 13	16.7% [.152,.1838]	24.7% [.1736,.3375]	23.2% [.144,.3512]	24.5% [.1996,.2971]	55.74	0.001
Current smoker	32.6% [.3019,.3518]	43.3% [.3283,.5445]	41.7% [.3104,.5313]	47.5% [.4094,.5408]	112.18	0
Frequent smoker	17.9% [.1606,.1986]	24.6% [.1725,.3386]	24.6% [.1631,.3525]	27.2% [.2265,.3228]	67.64	0
Daily smoker	13.4% [.1183,.1521]	20.7% [.1388,.2974]	13.7% [.0755,.2356]	19.7% [.1576,.2433]	41.04	0.0018
Ever daily smoker	26.9% [.2482,.29]	37.1% [.2671,.489]	36.5% [.2543,.4919]	37.3% [.3207,.4282]	71.96	0.0001
Tried to quit	17.4% [.1611,.188]	22.7% [.1464,.3352]	21.3% [.1345,.3204]	22.0% [.1784,.2674]	19.57	0.0971

Table 20: 2013 YRBS smoking variables by sexual orientation with 95% confidence intervals and Pearson Chi2

	Heterosexual [95% CI]	hetero (non-norm) [95% CI]	gay/ lesbian [95% CI]	Bisexual [95% CI]	Unsure [95% CI]	chi2	p
Ever smoked	36.1% [.3376,.3842]	59.4% [.5183,.6654]	58.6% [.4921,.6739]	67.0% [.62,.7166]	66.3% [.5584,.754]	764.46	0
First cigarette before 13	7.1% [.0634,.0788]	17.1% [.1281,.2252]	18.2% [.1295,.2483]	24.7% [.2087,.2905]	26.4% [.2001,.3395]	930.00	0
Current smoker	11.2% [.1018,.1229]	32.5% [.2561,.4014]	26.9% [.2097,.3384]	32.6% [.2862,.369]	33.7% [.2699,.4113]	1169.13	0
Frequent smoker	3.8% [.0328,.0436]	9.2% [.0667,.1262]	7.7% [.0452,.1269]	11.8% [.0898,.1535]	15.6% [.1079,.2196]	429.90	0
Daily smoker	2.8% [.0237,.0325]	6.6% [.0441,.0965]	6.1% [.0313,.1145]	8.3% [.0574,.1199]	11.9% [.0829,.1679]	309.77	0
Ever daily smoker	6.7% [.0553,.0801]	15.9% [.0926,.2602]	19.5% [.1407,.2632]	23.2% [.1753,.3011]	24.6% [.1741,.3364]	300.84	0
Tried to quit	7.9% [.0713,.0882]	18.8% [.1314,.2628]	19.5% [.1525,.2452]	23.0% [.1878,.2792]	24.3% [.175,.3263]	407.54	0

APPENDIX D: YRBS SURVEY QUESTIONS INCLUDED IN ANALYSIS DATASET

Description	Variable
Two- or three-character survey site code that uniquely identifies a survey location	sitecode
Name of location covered by a survey	sitename
Type of survey site – “District”, “State”, or “National”	sitetype
4-digit year of survey – 1991, 1993, etc.	year
Record weight – used in statistical analyses	weight
Stratum – used in statistical analyses	stratum
Primary Sampling Unit (PSU) – used in statistical analyses	PSU
<p>How old are you?</p> <ul style="list-style-type: none"> A. 12 years old or younger B. 13 years old C. 14 years old D. 15 years old E. 16 years old F. 17 years old G. 18 years old or older 	age
<p>What is your sex?</p> <ul style="list-style-type: none"> A. Female B. Male 	sex
<p>In what grade are you?</p> <ul style="list-style-type: none"> A. 9th grade B. 10th grade C. 11th grade D. 12th grade E. Ungraded or other grade 	grade
<p>4-level variable from race and ethnicity questions:</p> <ul style="list-style-type: none"> 1 = “White” 2 = “Black or African American” 3 = “Hispanic/Latino” 4 = “All Other Races” 	race4
<p>7-level variable from race and ethnicity questions:</p> <ul style="list-style-type: none"> 1 = “American Indian/Alaska Native” 2 = “Asian” 3 = “Black or African American” 4 = “Hispanic/Latino” 5 = “Native Hawaiian/Other Pacific Islander” 6 = “White” 7 = “Multiple Races (Non-Hispanic)” 	race7

Description	Variable
Which of the following best describes you? A. Heterosexual (straight) B. Gay or lesbian C. Bisexual D. Not sure	qsexid
During your life, with whom have you had sexual contact? A. I have never had sexual contact B. Females C. Males D. Females and males	qsexpart
Sexual identity: 1 = "Heterosexual" 2 = "Gay or Lesbian" 3 = "Bisexual" 4 = "Not Sure"	sexid
Collapsed sexual identity: 1 = "Heterosexual" 2 = "Sexual Minority" (includes students who responded that they were gay or lesbian or bisexual) 3 = "Unsure"	sexid2
Sex of sexual contact(s): 1 = "Never had sex" 2 = "Opposite sex only" 3 = "Same sex only" 4 = "Both Sexes"	sexpart
Collapsed sex of sexual contact(s): 1 = "Never had sex" 2 = "Opposite sex only" 3 = "Same sex only or both sexes"	sexpart2
Smoked on 20 of past 30 days	qnfrcig
Percentage of students who smoked daily during the past 30 days	qndaycig
Used any tobacco past 30 days	qnanytob
Have you ever tried cigarette smoking, even one or two puffs? A. Yes B. No	Q31

Description	Variable
<p>How old were you when you smoked a whole cigarette for the first time?</p> <ul style="list-style-type: none"> A. I have never smoked a whole cigarette B. 8 years old or younger C. 9 or 10 years old D. 11 or 12 years old E. 13 or 14 years old F. 15 or 16 years old G. 17 years old or older 	Q32
<p>During the past 30 days, on how many days did you smoke cigarettes?</p> <ul style="list-style-type: none"> A. 0 days B. 1 or 2 days C. 3 to 5 days D. 6 to 9 days E. 10 to 19 days F. 20 to 29 days G. All 30 days 	Q33
<p>During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?</p> <ul style="list-style-type: none"> A. I did not smoke cigarettes during the past 30 days B. Less than 1 cigarette per day C. 1 cigarette per day D. 2 to 5 cigarettes per day E. 6 to 10 cigarettes per day F. 11 to 20 cigarettes per day G. More than 20 cigarettes per day 	Q34
<p>During the past 30 days, how did you usually get your own cigarettes? (Select only one response.)</p> <ul style="list-style-type: none"> A. I did not smoke cigarettes during the past 30 days B. I bought them in a store such as a convenience store, supermarket, discount store, or gas station C. I bought them from a vending machine D. I gave someone else money to buy them for me E. I borrowed (or bummed) them from someone else F. A person 18 years old or older gave them to me G. I took them from a store or family member H. I got them some other way 	Q35

Description	Variable
<p>During the past 30 days, on how many days did you smoke cigarettes on school property?</p> <p>A. 0 days B. 1 or 2 days C. 3 to 5 days D. 6 to 9 days E. 10 to 19 days F. 20 to 29 days G. All 30 days</p>	Q36
<p>Have you ever smoked cigarettes daily, that is, at least one cigarette every day for 30 days?</p> <p>A. Yes B. No</p>	Q37
<p>During the past 12 months, did you ever try to quit smoking cigarettes?</p> <p>A. I did not smoke during the past 12 months B. Yes C. No</p>	Q38
<p>During the past 30 days, on how many days did you use chewing tobacco, snuff, or dip, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, or Copenhagen?</p> <p>A. 0 days B. 1 or 2 days C. 3 to 5 days D. 6 to 9 days E. 10 to 19 days F. 20 to 29 days G. All 30 days</p>	Q39
<p>During the past 30 days, on how many days did you smoke cigars, cigarillos, or little cigars?</p> <p>A. 0 days B. 1 or 2 days C. 3 to 5 days D. 6 to 9 days E. 10 to 19 days F. 20 to 29 days G. All 30 days</p>	Q40
<p>Have you ever had sexual intercourse?</p> <p>A. Yes B. No</p>	Q59

Description	Variable
<p>How old were you when you had sexual intercourse for the first time?</p> <ul style="list-style-type: none"> A. I have never had sexual intercourse B. 11 years old or younger C. 12 years old D. 13 years old E. 14 years old F. 15 years old G. 16 years old H. 17 years old or older 	Q60
<p>During your life, with how many people have you had sexual intercourse?</p> <ul style="list-style-type: none"> A. I have never had sexual intercourse B. 1 person C. 2 people D. 3 people E. 4 people F. 5 people G. 6 or more people 	Q61
<p>During the past 3 months, with how many people did you have sexual intercourse?</p> <ul style="list-style-type: none"> A. I have never had sexual intercourse B. I have had sexual intercourse, but not during the past 3 months C. 1 person D. 2 people E. 3 people F. 4 people G. 5 people H. 6 or more people 	Q62

APPENDIX E: ADD HEALTH SURVEY QUESTIONS USED IN ANALYSIS
DATASET

Description	Variable
Respondent identifier number	AID
Interviewer, please confirm that R's sex is (male) female(Ask if necessary.)	BIO_SEX
What is your birth date? month [and year]?	H1GI1M
What is your birth date? [month and] year?	H1GI1Y
Are you of Hispanic or Latino origin?	H1GI4
What is your race? White Black or African American American Indian or Native American Asian or Pacific Islander Other	H1GI6A H1GI6B H1GI6C H1GI6D H1GI6E
Which one category best describes your racial background?	H1GI8
What grade {ARE/WERE} you in?	H1GI20
Have you ever tried cigarette smoking, even just 1 or 2 puffs?	H1TO1
How old were you when you smoked a whole cigarette for the first time?	H1TO2
Have you ever smoked cigarettes regularly, that is, at least 1 cigarette every day for 30 days?	H1TO3
How old were you when you first started smoking cigarettes regularly?	H1TO4
During the past 30 days, on how many days did you smoke cigarettes?	H1TO5
In what month [and year] did you quit smoking cigarettes?	H1TO6M
In what [month and] year did you quit smoking cigarettes?	H1TO6Y
During the past 30 days, on the days you smoked, how many cigarettes did you smoke each day?	H1TO7
During the past 6 months, have you tried to quit smoking cigarettes?	H1TO8
Of your 3 best friends, how many smoke at least 1 cigarette a day?	H1TO9
Have you ever had a romantic attraction to a female?	H1NR1
Have you ever had a romantic attraction to a male?	H1NR2
What is {INITIALS}'s sex?	H1RI20_1

Description	Variable
Romantic Interest	H1RI20_2 H1RI20_3
We had sexual intercourse Romantic Interest	H1RI21O1 H1RI21O2 H1RI21O3
What is {INITIALS}'s sex? Romantic non-relationship	H1RX20_1 H1RX20_2 H1RX20_3
We had sexual intercourse Romantic non-relationship	H1RX21O1 H1RX21O2 H1RX21O3
What is {INITIALS}'s sex? Non-romantic non-relationship	H1NR15_1 H1NR15_2 H1NR15_3
Have you had sexual intercourse with {INITIALS}? Non-romantic non-relationship	H1NR22_1 H1NR22_2 H1NR22_3
Primary Sampling Unit – School ID	PSUSCID
Stratum variable	REGION
Wave one weighting variable	GSWGT1

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