# Health Related Outcomes among Heterosexual and Sexual Minority Youth and Young Adults

by

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Abstract

Study I: Using data from Waves I thru IV of the National Longitudinal Study of Adolescent Health (Add Health), the current study compared initial levels, rates of change, and quadratic curvature in three measures of substance use (cigarette, alcohol, and marijuana use) over a 13 year period (starting in high school) in four cohorts of self-identified sexual minority (gay, lesbian, and bisexual) and heterosexual youth and young adults. Using individual growth curve modeling, findings indicated that in general, with a few exceptions, sexual minority youth did not have higher initial levels of substance use, nor did they vary in their rate of change (both instantaneous and quadratic) when compared to heterosexual youth. In addition, we tested the protective influence of religiosity on the developmental trajectory of substance use with a specific focus on whether it operates differently between the two groups. Again, findings provide little evidence that religiosity operates differently as a protective factor on substance use by one's sexual orientation. This suggests that sexual minority and heterosexual youth and young adults report few differences in the developmental course of these select substance use outcomes. Implications of these findings are discussed and recommendations for future work are provided.

Study II: While much of the literature on sexual minority youth health and well-being has focused on psychological factors, physical health has not been as readily studied. Using Wave IV of the National Longitudinal Study of Adolescent Health (Add

Health), N = 15,701, the current cross-sectional study assessed to what extent self-identified sexual minority young adults (age 24-32) differ from heterosexual young adults on five measures of health (general health, blood pressure, self-medication, sleep problems, and susceptibility to illness). In addition, we tested three risk (perceived stress level, inability to handle stress, and social isolation) and three protective (close friendships, romantic relationship quality, and optimism) factors. Results indicated that sexual minority young adults had higher levels of physical health problems, and differing patterns of risk and protective factors when compared to heterosexual young adults. Thus, understanding sexual orientation and how it relates to health outcomes is an important area for further study. *

* See Appendix

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## Overview

Adolescence and young adulthood are key developmental periods to examine life trajectories and important developmental changes related to health and well-being. During this time that is marked by significant growth and development, individuals make important decisions and develop lifestyles that will affect both their short and long term health. While there is much research about health and well-being during adolescence and young adulthood (Call et al., 2002; Mulye et al., 2009), there is relatively little work that is specific to sexual minorities (gays, lesbians, and bisexuals) or that compares sexual minorities to heterosexual individuals. This is a consequential oversight as national figures indicate that between 1% and 13% of the population are sexual minorities in the United States (Savin-Williams, 2006).

Attention has been called to the fact that sexual minority populations have been disproportionately unrecognized in the public health research (Boehmer, 2002). While the research in this area has been growing, in many cases, it has been hindered by methodological limitations including nonrandom samples, small convenience samples, and a lack of comparison groups (i.e., heterosexuals; Marshal et al., 2008), a tendency for researchers to 'pathologize' sexual minorities (Rothblum, 1994), and a lack of attention to risk and protective factors (Ziyadeh et al., 2007). Based on the 13 year, nationally representative National Longitudinal Study of Adolescent Health (Add Health), the following two studies aim to address these shortcomings and to add to the knowledge

base and improve our understanding of health and well-being among sexual minorities in the United States, particularly in direct comparison to heterosexuals, and to consider substantive risk and protective factors. Together, these findings will help us understand sexual minority health within a 'normalized' developmental framework, and in addition, the findings will also be informative for future prevention and intervention efforts focused on health and well-being as well as for policy decisions.

Study I is a comparative longitudinal investigation of self-identified sexual minority and heterosexual youth and their developmental course of substance use, a health-compromising behavior that is typical of adolescents and young adults, including cigarette, alcohol, and marijuana use, spanning over thirteen years from high school into young adulthood. Studies in this area have been plagued by the aforementioned methodological limitations. This study sought to fill some of the gaps in our current understanding in this area. In particular, we examined the protective nature of religiosity, which has been shown to be a protective factor in heterosexual substance use, but has not been as readily studied in sexual minority samples.

Study II focused on physical health indicators among self-identified sexual minority and heterosexual young adults. Aside from studies of HIV and other sexually transmitted diseases, there has been surprisingly little work on physical health indictors of sexual minorities. Of the few studies that exist, there is evidence which suggests that physical health issues are greater among sexual minorities in comparison to heterosexual individuals (e.g., Diamant & Wold, 2003). However, very little empirical work has attempted to further contextualize and understand these differences by testing substantive

predictors. Study II seeks to accomplish just that by using a risk and protective factor approach.

Jointly, these studies contribute to our understanding of important areas of health and well-being in adolescent and young adult sexual minorities' lives. As researchers continue to bring attention to pertinent aspects of health and well-being in the lives of sexual minorities, much can be learned, and ultimately, these insights will provide a basis for better decision making and policies that serve the needs of this population.

## Study I

Developmental Changes in Cigarette, Alcohol, and Marijuana Use among Heterosexual and Sexual Minority Young Adults: The Salience of Religiosity

### Overview/Rationale

Data on rates of substance use among sexual minority youth and young adults provide an important foundation for understanding health and health compromising behaviors in their lives. While some level of substance use is normative during adolescence and young adulthood, substance use can lead to risky sexual activity, involvement in criminal acts, and health problems (Kandel, Warner, & Kessler, 1998) just to name a few, and hence is generally viewed as a problem behavior. Some propose that sexual minorities might be at higher risk for substance use because of their minority position in society and having to deal with the stigma that goes along with it (Meyer, 2003). Hence, substance use might be a way of coping with life's adversities. Others have proposed that sexual minorities tend to gather in gay bars as a primary area for socializing and hence are bound to have increased rates of substance use (Marshal, Friedman, Stall, & Thompson, 2009; Wong, Kipke, & Weiss, 2008). Finally, it has been proposed that family of procreation responsibilities are much more prevalent for heterosexuals and coincide with their levels of substance use tapering off during young adulthood. Yet, sexual minorities often do not have the same familial and parental duties

and therefore can more easily maintain higher levels of substance use into young adulthood (Hughes & Eliason, 2002).

Previous work has shown that sexual minorities report high levels of health compromising behaviors, including substance abuse and other problem behaviors (Rotheram-Borus, Rosario, Van Rossem, Reid, & Gillis, 1995). However, some studies have found no differences in levels of substance use between sexual minorities and heterosexuals (Lock & Steiner, 1999). The current investigation takes advantage of The National Longitudinal Study of Adolescent Health (Add Health), a large, nationally representative sample, which uniquely permits a thorough study of the developmental course among both sexual minority and heterosexual youth, related to their health and well-being over time. It examines the developmental course of substance use in the two groups, focused on three measures, namely cigarette use, alcohol use, and marijuana use. We used all four waves of Add Health data, including the recently available fourth and final wave of data, which followed participants an additional 5 to 6 years when they were between the ages of 24 and 32. The advantage of adding a fourth data point, in addition to permitting a more thorough and longer term study, is that it will permit tests of potential curvilinear effects over time. This seems particularly salient as we know based on previous research that substance use behaviors, and most other problem behaviors, commence during middle adolescence, peak during late adolescence, and subsequently decline during young adulthood (Kandel et al., 1998; Moffitt, 1993).

## Sexual Minority Youth and Substance Use

Although evidence exists that sexual minorities report higher rates of substance use during adolescence than heterosexual youth, a number of methodological limitations

characterize previous work in this area. For instance, based on a recent meta-analysis of 18 studies that examined sexual orientation and adolescent substance use, Marshal and colleagues (2008) found that sexual minorities had an increased odds of 190% for engaging in substance use when compared to heterosexual youth (Marshal et al., 2008). It was noted that the odds were especially pronounced for bisexual youth and female sexual minorities. In addition, it was found that results seem to be strongest when predicting hard drug use. The authors also concluded that most work in the area was missing a heterosexual comparison group, that little work had tested potential causal mechanisms (risk or protective factors) to address some of the observed differences between the groups, and that few studies in the area were longitudinal. Similarly, although Marshal, Friedman, Stall, and Thompson (2009) recently tested developmental trajectories of substance use among both sexual minority and heterosexual youth based on three assessment points in the Add Health data set and found that, on average, those who self-identified as lesbian, gay, or bisexual had higher initial rates of substance use, as well as steeper increases (rates of change) in substance use over time when compared to heterosexuals, no previous work has tested for potential curvilinear developmental changes in measures of substance use over time. In addition, Marshal and colleagues (2009) largely focused on the "simple" developmental course of substance use, without a consideration of etiological predictors.

The authors of the current effort are unaware of a similar meta-analysis or review article of studies examining sexual minority substance use in young adulthood. In fact, while there seems to be an abundance of studies focused on sexual minority substance use during adolescence, there is comparatively little work that exists on the same topic in

young adulthood. Of the work that does exist, samples are primarily drawn from college students. For instance, in a study of 2,220 participants, it was found that male sexual minority students had steeper increases in alcohol use compared to heterosexual male students across their first year of college, while sexual minority female students did not have steeper increases when compared to heterosexual female students (Hatzenbuehler, Corbin, & Fromme, 2008). In another nationally representative sample of college students, when compared to heterosexual students, there were no differences found in marijuana use or other illicit drug use in the previous 30 days for homosexual students, but bisexual students had higher rates of both marijuana use and other illicit drug use (Ford & Jasinski, 2006). While there is some work on this topic, our understanding of sexual minority substance use across young adulthood is limited.

Therefore, the current study sought to address these aforementioned shortcomings in the literature by studying a national sample of both self-identified sexual minority and heterosexual youth over four assessment points (starting in 1994/95 and reassessed in years 1996, 2001/02, and 2007/08), with a particular consideration of religiosity, which is an established predictor of problem behaviors (Kendler et al., 2003; Wallace et al., 2007) but has had mixed findings with regard to its usefulness as a protective factor for sexual minority youth substance use (c.f., Ziyadeh et al., 2007 and Rostosky, Danner, & Riggle, 2007; 2008).

## Religiosity

Religiosity, defined as the outward expression of one's religious beliefs which is often measured by items assessing importance of religion, belief in God, frequency of religious service attendance, and frequency of prayer and/or meditation (Cotton,

Zebracki, Rosenthal, Tsevat, & Drotar, 2006), is one form of social control that promotes socially acceptable behaviors, and that inhibits socially undesirable behaviors (i.e. problem behaviors) (Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995; McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000), including substance use (Wills, Yaeger, & Sandy, 2003). It has been noted that religion emphasizes goal setting and delayed gratification, which in turn leads to less engagement in norm-violating behavior, and in turn, it is expected that this serves to enhance health outcomes and decrease the likelihood of problem behaviors, including substance use (McCullough & Willoughby, 2009).

Furthermore, although religiosity is a known protective factor against problem behaviors among heterosexuals, it has rarely been studied as it relates to substance use behaviors in sexual minority populations; although, some recent research provides evidence that it might not have the same protective effects for sexual minority youth and young adults (Rostosky et al., 2007; 2008). Based on two time points of data (Waves I and III) in the Add Health dataset, Rostosky and colleagues (2007; 2008) found that religiosity was not associated with alcohol use, binge drinking, marijuana use, or cigarette smoking among sexual minority youth and young adults, although it was found to be associated among heterosexual youth and young adults.

In part, this is related to the fundamental challenge of reconciling one's personal sexual orientation with religious doctrine, one that does not condone homosexuality or bisexuality. In a study of 163 Christian or previously Christian lesbian women, nearly two-thirds reported that they felt tension between Christian beliefs and their sexual orientation (Mahaffy, 1996). This pattern of results was echoed in another study of 66

sexual minorities; Schuck and Liddle (2001) found that approximately two-thirds reported having a perceived conflict between their religion and their sexual orientation – from sources such as scriptural passages as well as congregational prejudice – that in turn led to personal shame, depression, and suicidal ideation. Indeed, Rostosky et al. (2008) found that in general religiosity scores declined from adolescence to young adulthood, but this decline was especially marked for sexual minorities. Gay and lesbian young adults had the biggest drop, followed by bisexual young adults.

While religiosity and drug use have been studied together abundantly during adolescence, there is not as much research that has studied the effects of religiosity on drug use over time into young adulthood. Therefore, the current study aimed to more comprehensively understand whether religiosity is protective among sexual minority youth and young adults by examining the question utilizing longitudinal data from across four waves in a growth curve analytic framework based on continuous data.

## The Current Investigation

The current study examined unconditional growth models to ascertain whether or not there are differences in initial levels and rates of change among self-identified sexual minority and heterosexual participants across adolescence and young adulthood (during a 13 year time period, starting when participants were in high school) in three substance use measures (cigarette use, alcohol use, and marijuana use). We used measures of licit drugs (cigarettes and alcohol) which are used by a much larger percent of the population than illicit drugs, as well as marijuana, which is the most popular illicit drug (Kandel et al., 1998). Although we considered using measures of other illicit drug use, there simply was not enough variability in the responses. Furthermore, we controlled for four

background variables that have been known to vary with adolescent and young adult substance use and other problem behaviors, namely, sex, race, family structure, and parental education (Farrell & White, 1998; Hughes & Eliason, 2002; Wills, McNamara, & Vaccaro, 1995; Wong et al., 2008).

In addition, the study examined the effects of religiosity, and to what extent it uniquely accounts for variance in substance use among self-identified sexual minority and heterosexual youth and young adults. Findings from this work will provide important information on developmental changes in substance use during adolescence and young adulthood by utilizing a national, longitudinal data set and by overcoming a number of shortcomings in previous work.

**Research Questions**

1) To what extent do self-identified sexual minority youth and young adults differ from self-identified heterosexual youth and young adults in their initial levels, rates of change, and quadratic curvature of substance use (cigarette, alcohol, and marijuana use) over a 13 year period (starting in high school), while controlling for sex, race, family structure, and parental education? Based on previous research (Marshal et al., 2009), we hypothesized that the sexual minority groups would have higher initial levels of substance use when compared to heterosexuals. We also expected that the rates of change would be significantly different and larger for sexual minorities than for heterosexuals. Finally, we expected that the developmental trajectory for both sexual minorities and heterosexuals would increase during adolescence, peak during late adolescence, and subsequently decline during young adulthood.

2) To what extent does religiosity uniquely predict cigarette, alcohol, and marijuana use across time among self-identified sexual minority and heterosexual youth? We hypothesized that religiosity would only be a significant predictor for heterosexuals.

## Methods

### Sample

This study used data from Waves I to IV of the National Longitudinal Study of Adolescent Health (Add Health). The Add Health study began following 20,745 adolescents in grades 7 thru 12 starting in 1994/1995; they were reassessed in 1996, 2001/2002, and finally in 2007/2008. Due to the fact that younger and older adolescents should have differing trajectories of substance use because of their age difference, the current study employed four subsamples of the Add Health data - namely, we followed $9^{th}$, $10^{th}$, $11^{th}$, and $12^{th}$ graders (at Wave I) across time as separate cohorts.

### Measures

*Sex, race, family structure, and parental education* were used as control variables given that they have been associated with problem behaviors in previous studies and are correlated with the outcome variables in the current study. For *sex,* participants were asked to report their biological sex, which was coded as 0 = male and 1 = female. For *race,* participants responded to the question, "What is your race," which will be coded as 0 = European American and 1 = other racial group. *Family structure* was assessed at Wave 1. Participants were asked to indicate who else besides them lived in their household. Based on this information participants were coded as 0 = lives with both biological parents and 1 = lives in another family constellation. Finally, *parental education* was used as a proxy for SES and assessed by the highest level of education

achieved by a parent. The coding was 1 = did not complete high school, 2 = completed high school, earned GED, or completed vocational school instead of high school, 3 = attended vocational training after high school or attended some college, 4 = college graduate, 5 = professional training beyond college. For those who were missing parental education information (n = 169), mean imputation was used.

*Sexual Orientation* was measured by participant's self-identification, as assessed by the question, "Please choose the description that best fits how you think about yourself." Response choices were 1 = 100% heterosexual (straight), 2 = mostly heterosexual (straight), but somewhat attracted to people of your own sex, 3 = bisexual, that is, attracted to men and women equally, 4 = mostly homosexual (gay), but somewhat attracted to people of the opposite sex, and 5 = 100% homosexual (gay). The responses were recoded so that 1 = heterosexual, and 3, 4 and 5 = sexual minorities.

While self-identified sexual orientation has been coded various ways using the Add Health data, we chose to eliminate the "mostly heterosexual but somewhat attracted to people of your own sex" group for the purposes of our analyses, which has also been done by other scholars (e.g., Rostosky et al., 2008; Savin-Williams & Ream, 2006). Because we were interested in testing substance use in self-identified sexual minorities, we wanted to make sure we were comparing those who self-identified as sexual minorities, rather than those who self-identified as heterosexual but reported some same-sex attraction. Likewise, we wanted to make sure our comparison group of heterosexuals were people who exclusively self-identified as heterosexual.

Because we were using a sample of middle and late adolescents, we chose to use self-identification labels to assess sexual orientation rather than romantic attraction status,

which we believe is best suited to younger adolescents. The participants were not asked about sexual identification until Waves III and IV. Although we could've opted to use the sexual identity question at Wave III, we chose to use it at Wave IV because 1) there were more respondents who reported a sexual identity at Wave IV than at Wave III, and 2) we believed that since participants were older at Wave IV this would have given them more time to solidify their sexual self-identification. It has been reported that sexual minorities often have their first awareness of same-sex attractions in childhood, and often label their sexual identity and disclose to others in later adolescence or young adulthood (Floyd & Stein, 2002). However, this is known to vary, and self-identity labeling and disclosure might occur somewhat later than the average age of 17 years, especially for women (Savin-Williams & Diamond, 2000). In effect, we believe that for those who were at sometime unsure of their sexual identity, by the fourth wave of data collection, they had most likely identified with some type of sexual orientation. Using sexual identity labels at a later time to predict earlier outcomes is in line with other work using the Add Health dataset (Marshal et al., 2009).

Finally, although we would've liked to use self-identified bisexual and homosexual youth separately, we chose to group them together for two reasons, one being conceptual and one being analytical. First, conceptually we think it makes the most sense to test sexual minorities as a group given that we are using a later measure of sexual orientation to predict earlier substance use. It has been documented that sexual identity can change over time (Diamond, 1998). Specifically, it has been found that sexual minorities show around a 70% stable sexual identity over time, and that those who change identity labels often do so between the sexual minority groups (i.e. bisexual and

homosexual) (Rosario, Schrimshaw, Hunter, & Braun, 2006). So, while someone might have identified as bisexual during late adolescence and as homosexual during young adulthood, regardless, each of these self-identity labels is someone who would have been classified as a sexual minority at both time points. However, if we would have used bisexual and homosexual categories separately, we would have increased the chances of incorrectly identifying someone's sexual orientation using Wave IV self-identified sexual orientation. Secondly, in order to have enough statistical power, it was also necessary to combine the sexual minority groups. Furthermore, this is also why we did not test male and female sexual minorities separately.

*Cigarette use* was measured by the same question at all 4 waves, namely, "During the past 30 days, on how many days did you smoke cigarettes?" Response choices ranged from 0 to 30.

*Alcohol use* was measured by the same question at all 4 waves, namely, "During the past 12 months, on how many days did you drink alcohol?" Response options were 0 = none, 1 = 1 or 2 days in the past 12 months, 2 = once a month or less (3 to 12 days in the past 12 months), 3 = 2 or 3 days a month, 4 = 1 or 2 days a week, 5 = 3 to 5 days a week, and 6 = every day or almost every day.

*Marijuana use* was measured by the same question at all 4 waves, namely, "During the past 30 days, how many times/days have you used marijuana?" During Waves 1 and 2, the response possibilities were any whole number between 0 and 900, while at Wave 3 the response options were any whole number between 0 and 999. Finally, at Wave 4, the response options were 0 = none, 1 = 1 day, 2 = 2 or 3 days, 3 = 1 day a week, 4 = 2 days a week, 5 = 3 to 5 days a week, and 6 = every day or almost every

day. In order to make the first 3 waves consistent with the final wave's response options, the first three waves were recoded so that 0 = 0 (none), 1 = 1 (1 day), 2 & 3 = 2 (2 or 3 days), 4 thru 7 = 3 (1 day a week), 8 thru 11 = 4 (2 days a week), 12 thru 20 = 5 (3 to 5 days a week), and 21 and above = 6 (every day or almost every day).

*Religiosity* was measured as a time varying predictor. It was measured by the same three items at each wave, which assessed 3 of the typical indicators of religiosity -- namely, importance of religion, frequency of religious attendance, and frequency of prayer -- and has been used by other researchers using the Add Health data (e.g., Paschall, Flewelling, & Russell, 2004). The items were "How important is religion to you," "In the past 12 months, how often did you attend religious services," and "How often do you pray?" The response options were on 4 to 8 point Likert-type scales, depending on the item and wave when assessed. Therefore, items were standardized due the response options being on different scales. The responses were reverse coded so that higher scores reflect higher levels of religiosity.

Additionally, due to the fact that during Waves I and II a large number of participants (approximately 13 -14% at each wave) were not asked these religion questions because they had indicated on a previous item that they had "no religion," we recoded those participants' responses to indicate that religion had 'no importance' to them, they 'never attend' religious services, and they 'never' pray. The reliability for the religiosity scale is .87, .88, .81, and .83 for Waves I - IV, respectively.

**Plan of Analysis**

In an initial step, descriptive statistics were computed and exploratory analyses conducted. Next, unconditional means models and unconditional growth curve models

were fit to test for significant variability in the outcomes and changes over time in the three dependent measures (Singer & Willett, 2003). It was determined that the functional form of the data was quadratic, rather than linear. A series of model tests was conducted for each cohort on each dependent measure. While it is beyond the space limitations of this paper to include all 12 tables, we have included an example of the results of a series of model tests found in Table 1, which shows the full results for the $10^{th}$ grade cohort on the outcome variable cigarette use. Each model built upon previous models. Model A is an unconditional growth model, which includes a linear and quadratic measurement of time to examine whether developmental changes existed in the dependent variable. Next, Model B added control variables (sex, race, family structure, and SES) and tested their effects on the intercept, slope, and rate of change. As is typical in growth curve modeling, the significant predictors were retained for subsequent model tests, while the non-significant predictors were removed in later models (Pan, Rowe, Singer, & Snow, 2005; Singer & Willett, 2003). Therefore, although all of the same controls were entered in Model B for each outcome in every cohort, the variables that were retained for subsequent model tests differed across cohorts and by outcome. In addition, throughout model testing, if a variable was very close to being significant, it was retained in the next model.

In the next model (Model C), the effects of sexual orientation on the intercept, slope, and quadratic curve were added. In Model D, in addition to the control variables, the effects of religiosity on intercept, slope, and quadratic curve were tested. Then, in Model E, the significant effects of both sexual orientation and religiosity were entered together in the same model, along with the significant control variables. Finally, to

complete the model testing, we tested for interactions between sexual orientation and religiosity. Again, only the significant control, sexual orientation, and religiosity variables were included in the models, and sexual orientation*religiosity was added and tested on the intercept, slope, and quadratic curve.

Model fit was evaluated by standard goodness-of-fit indices, including the deviance statistic, the AIC, and the BIC. Models are typically considered better fitting models when the goodness-of-fit indices decrease across models.

## Results

### *Sample Characteristics*

Only those who were in grades 9 thru 12 at Wave I were included in the study; this comprised 71.1 % of the full Wave I Add Health sample. Additionally, participants must have met the inclusion criteria to be included in the current study, namely they (a) must have still been participating in the study at Wave IV, and (b) not have missing data on the sexual orientation variable. Therefore, the final sample consisted of N = 9,936. Broken down by cohorts, which for simplicity sake will be referred to by the grade that participants were in at Wave I, the final $9^{th}$ grade cohort had n = 2,445, the $10^{th}$ grade cohort had n = 2,661, the $11^{th}$ grade cohort had n = 2,603, and the $12^{th}$ grade cohort had n = 2,227. Self-identified sexual minorities made up 3.9% of the final full sample. Broken down by cohorts, the $9^{th}$ grade cohort included n = 119, $10^{th}$ grade cohort n = 96, $11^{th}$ grade cohort n = 108, and $12^{th}$ grade cohort n = 68.

It should be noted that the majority of the $12^{th}$ grade cohort was not reassessed at Wave II; however there were approximately 640 participants of the $12^{th}$ grade cohort that were included at Wave II (this is because those who were a part of a pair sample were

retained in Wave II). While caution in the results is warranted, growth curve modeling is robust enough to handle missing cases in the outcome measures at different waves, and thus is a major advantage to this methodological approach for analyzing longitudinal data.

The age range of the entire sample was 12 to 20 years at Wave I, 13 to 21 years at Wave II, 19 to 27 years at Wave III, and 26 to 34 years at Wave IV. Age in years was used as the metric for measuring time in this study. Age was centered at the youngest aged participants at each cohort. Therefore, the $9^{th}$ grade cohort was centered at age 12, the $10^{th}$ and $11^{th}$ grade cohorts were centered at age 14, and the $12^{th}$ grade sample was centered at age 15.

*Individual Growth Curve Modeling*

*Drug Use Trajectories.* Results showed that for each indicator of drug use (cigarette, alcohol, and marijuana use) there were very little differences in the trajectories across cohorts for each individual outcome. Additionally, for all three indicators of drug use in all cohorts, the typical trajectory was such that it increased initially followed by a downward quadratic curvature (see Figure 1). Across all cohorts and outcomes, evidence suggests that on average the decline in substance use starts between 23 and 25 years of age, depending on the outcome and cohort. This is calculated by using the age and age² coefficients from the final models in the following formula: -age / 2 * age².

*Sexual Orientation.* Our first research question assessed to what extent sexual orientation uniquely predicted substance use trajectories in four cohorts. Findings from testing Model C across cohorts (which included only time, controls, and sexual orientation in the model) indicated that overwhelmingly, sexual orientation was not a

significant predictor. This is shown in Table 2. Sexual orientation had no significant effect on intercept, slope, or quadratic curvature for 9th or 12th grade cigarette use, nor any effect on intercept, slope, or quadratic curvature for any cohort's alcohol use, nor on intercept, slope, or quadratic curvature for 9th, 10th, or 11th grade marijuana use. Yet, there were some significant findings related to sexual orientation. For both 10th and 11th grade cigarette use, sexual orientation was a significant predictor of both the slope and quadratic curvature (see Table 3). Furthermore, there was a significant effect of sexual orientation on the intercept of marijuana use in the 12th grade sample.

However, once religiosity was introduced into the model (Model D), some of the significant effects by sexual orientation changed (see Table 5). Namely, there was no longer a significant sexual orientation effect on the slope or quadratic curve for 10th grade cigarette use, nor was the effect of sexual orientation on the intercept on marijuana use in the 12th grade cohort significant. Yet, the effect of sexual orientation on the slope of alcohol use in the 11th grade cohort reached significance, whereas it had only been a trend in Model C.

It was determined using the goodness-of-fit indices that the models which included religiosity were better fitting models than ones where only sexual orientation was included. Hence, the only significant effect of sexual orientation that remained after including religiosity was on the slope and quadratic curvature predicting cigarette use in the 11th grade cohort. When interpreted, results for this cohort indicate that on average heterosexuals had an instantaneous rate of change in cigarette use of .67 points per year, while sexual minorities had a significantly different instantaneous rate of change -- on average an increase of 1.55 points per year. This means that sexual minorities had a

steeper instantaneous growth rate when compared to heterosexuals. However, as the quadratic coefficient is negative, this indicates that the instantaneous rate of change eventually changed direction, and cigarette use consequently began to decline over time. For the heterosexuals, the change in direction happened about a year later (25.7 years) than for sexual minorities (24.6 years). The quadratic age term indicates that for heterosexuals, the quadratic curvature declined at .03 points per year, while for sexual minorities it decreased at .07 points per year. Thus, sexual minorities in the 11th grade cohort had a steeper instantaneous rate of change, but a faster subsequent decline in cigarette use when compared to heterosexuals.

*Religiosity.* The effects of religiosity on the outcome measures (cigarette, alcohol, and marijuana use) when only the control variables and religiosity were entered into the model (Model D) can be seen in Table 4. Overall, religiosity had the largest effect on the intercept, compared to the slope and quadratic curve, of the three outcomes. It was significant on the intercept for all cohorts for cigarette use, for the 9th and 12th grade cohorts for alcohol use, and for the 10th and 11th grade cohorts for marijuana use. Religiosity was a significant predictor of the slope for alcohol use in the 10th and 11th grade cohorts, and marijuana use in the 9th grade cohort. Religiosity was only a significant predictor on the quadratic curvature for marijuana use in the 9th grade cohort. Across all cohorts and outcomes that religiosity was significant, results indicated that the higher one's religiosity, the lower one's drug use.

When the significant effects of sexual orientation and religiosity were entered together in the same model (see Table 5), the significant effects of religiosity did not change, with one exception. That is, while the intercept of alcohol use in the 10th grade

cohort only approached significance without sexual orientation in the model, it reached significance once both sexual orientation and religiosity were included in the model.

Finally, we were interested in testing whether or not religiosity was a protective factor for both sexual minorities and heterosexuals. This was tested by including the effects of sexual orientation*religiosity on the intercepts, slope, and quadratic curvature of each outcome (Model F). As can be seen in Table 2, in general religiosity operated in the same fashion for both sexual minorities and heterosexuals. However, there were two notable exceptions. For the 10$^{th}$ grade cohort, there was a significant effect by the sexual orientation*religiosity term on the slope and quadratic curve of cigarette use. This means that while religiosity was not a significant predictor on the slope and intercept of heterosexual cigarette use in the 10$^{th}$ grade cohort, it was a significant predictor for sexual minorities. Additionally, there was a similar significant interaction effect on the intercept of marijuana use in the 11$^{th}$ grade cohort. Interpreted, this means that religiosity had a stronger impact on the intercept of marijuana use for sexual minorities than for heterosexuals.

## Discussion

Based on a national sample (Add Health) of self-identified sexual minority and heterosexual high schoolers, followed over thirteen years from adolescence into young adulthood, the current study examined the developmental course of substance use, including cigarette, alcohol, and marijuana use, and gave special consideration of the protective capacity of religiosity. In general, and consistent with predictions, the developmental trajectory for all participants, regardless of sexual orientation, was such that for all three measures of substance use the initial levels were low, followed by an

increase in substance use throughout adolescence, and finally followed by a gradual decrease in use during early adulthood. This decrease in use started between the ages of 23 and 25 years of age (see Figure 1 for an example).

We were interested in examining the extent of influence, if any, one's sexual orientation had on the developmental trajectory of substance use over time. Overall, we found very little evidence of effects by sexual orientation on the development of substance use over time, which was contrary to our predictions. Using growth curve analyses, we were able to test the effect of sexual orientation on three aspects of the developmental trajectory -- the intercept, slope, and quadratic curvature. We had three outcomes and four cohorts, thus there was a possibility of 36 instances that sexual orientation could have been a significant predictor (3 x 3 x 4 = 36). Yet, there were only 5 out of 36 instances that sexual orientation reached significance. Therefore, we can conclude that sexual orientation is not a strong predictor of substance use during adolescence and young adulthood. To further back up this claim, we also note that once religiosity was included in the models, there were even fewer significant effects by sexual orientation.

Hence, although previous work has suggested that sexual orientation is a significant predictor of substance use, our results did not support this. One study in particular that is similar to ours yet had different results is the one conducted by Marshal et al. (2009). Also based on the Add Health data set, they found that when using sexual identity labels (similar to ours) in latent growth models, the intercepts differed significantly by sexual orientation group on three indicators of substance use (frequency of alcohol use, binge drinking, and cigarette use), while the slopes differed significantly

on four substance use indicators (frequency of alcohol use, drunkenness, cigarette use, and marijuana use). The fact that we found very different results based on the same data set is particularly intriguing given that we used a similar analytic approach. However, some key differences do exist between the two efforts, namely that Marshal and colleagues used the entire dataset and simply controlled for age, whereas we considered each high school grade level individually. They also used wave as the metric of time where we used age as the metric of time, a more concise measurement. Finally, they used three time points and thus could only model linear trajectories, whereas we used four waves of data and thus were also able to test for quadratic trajectories.

Perhaps the largest difference between the two studies is the manner in which response choices were coded based on the sexual identity variable. We chose to eliminate the "mostly heterosexual but somewhat attracted to people of your own sex" group in order to make what we consider a "cleaner" comparison between heterosexuals and sexual minorities. However, Marshal and colleagues elected to retain the "mostly heterosexual" group and to include it as part of their sexual minority group. Although sexual orientation is sometimes believed to be on a continuum (Kinsey, Pomeroy, & Martin, 1948), it seems as though this "mostly heterosexual" group is still rather challenging for researchers to conceptualize and categorize as there appears to be little consensus among researchers (c.f., Hahm, Wong, Huang, Ozonoff, & Lee, 2008; Rostosky et al., 2008; Silenzio, Pena, Duberstein, Cerel, & Knox, 2007).

Another study that merits mentioning here is a study by Russell, Driscoll, and Truong (2002). This study also used the Add Health dataset, and while the methodological approach isn't as comprehensive as the current study or as Marshal et

al.'s study (2009) because the authors only used the first two waves of data, their study is similar to ours in some ways. They used romantic attraction and romantic relationships to assess sexual orientation on substance use and abuse. They concluded that while there were some significant differences in substance use by sexual orientation status, the differences were less pronounced than would have been expected based on the existing work in the field. Hence, they concluded that previous assumptions that sexual minority youth are simply always at greater risk for problem behaviors needs to be questioned. Indeed, it could be that previous studies of sexual minority substance use were plagued by small sample sizes and non-representative samples which have led researchers to prematurely draw conclusions and make inferences. In fact, it has been noted that many of the earliest participants for studies of sexual minorities and substance use were hailed from bar samples (Hughes & Eliason, 2002). Furthermore, there is evidence to suggest that sexual minority substance use has declined over the past two decades (Hughes & Eliason, 2002), which is perhaps why our current results are not in line with some previous work that did not use the Add Health data set.

Next, we were interested in testing the effects of religiosity on the developmental course of substance use. We found that religiosity had an effect on substance use (on average, the higher one's religiosity, the lower one's substance use) and that effect was most pronounced on the intercept, rather than the slope or quadratic curvature. This shows that as youth develop, the protective factor of religiosity loses its impact on substance use during adolescence and young adulthood, and that most likely, the greatest impact precedes the developmental periods modeled in the current effort. This could also be related to the fact that as youth develop into young adulthood, a decline of religiosity

is observed, independent of sexual orientation (Uecker, Regnerus, & Vaaler, 2007). It has also been noted that protective factors lose their effects over time as youth move into adulthood (Blinn-Pike, Berger, Hewett, & Oleson, 2004).

We were particularly interested in determining whether religiosity had a differential effect on substance use for self-identified sexual minorities and heterosexuals. In general, we found that this was not the case. When religiosity was a significant predictor, it operated in an identical fashion for both the heterosexual and sexual minority groups, with few exceptions. In the few instances where there was a significant effect ($10^{th}$ grade cigarette use slope and intercept; $11^{th}$ grade marijuana use intercept), it was such that religiosity was a significant predictor for the sexual minorities while not for the heterosexuals.

These findings namely that religiosity operated in the same fashion for both sexual minorities and heterosexuals are inconsistent with previous work and contradictory with our hypotheses. Rostosky and colleges (2007; 2008) found that religiosity was associated with indicators of substance use in heterosexual young adults, but not in sexual minority young adults. Given that Rostosky et al. also utilized the Add Health data set, it is particularly informative to more closely consider the similarities and differences between the two efforts. In their earlier article (2007), the authors utilized sexual attraction status to measure sexual orientation, while in their later paper (2008) they utilized sexual identity labels. Their findings related to religiosity's effect on substance use did not appear to differ because of the different ways in which sexual orientation was assessed. Thus, we do not believe the findings from the current study differ from theirs due to our measurement of sexual orientation (which we

operationalized using self-identity labels consistent with their 2008 paper).

The main things that differed were the operational definition of religiosity and the statistical methods employed. In both of their studies, they used religiosity measured at Wave I by three items which assessed how often participants had attended religious services in the past 12 months, attended special youth activities in the past 12 months, and the importance of religion to the participant. We also used the items assessing religious service attendance and importance of religion, yet we used frequency of prayer as the third item in our scale rather than an additional measure of religious service attendance (i.e. youth activities). We believe that with the items available in the Add Health dataset, our measure is a more comprehensive index of religiosity. In addition, in Rostosky et al.'s 2008 paper, the authors also utilized a secondary measure of religion (i.e. proximal religiosity, which taps into meaning making of religion; example item: "Angels are present to help or watch over me") composed of items not available until Wave III. However, we did not include those items because our use of religiosity as a time variant predictor, a more nuanced test of its effects, required that the same items were assessed at each of the four assessments.

Perhaps the biggest difference was that Rostosky et al. used simple logistic (2007) and multiple regression (2008) analyses based on Waves I and III of the Add Health dataset, whereas we used longitudinal growth curve analysis with Waves I thru IV. Hence, our study utilized a more comprehensive test of the data and took a distinctly developmental focus. We were able to test the effect of religiosity on the intercept, slope, and quadratic curvature of drug use trajectories. In addition, our use of assessing religiosity as a time varying predictor is a major advantage of using growth curve

analyses. We were able to consider religiosity as varying across time rather than relying on a measure of it at one single point in time. Given that religiosity has been shown to decline across time in adolescence and young adulthood (Rostosky et al., 2008; Uecker et al., 2007), using religiosity in this manner simply represents a more sensitive developmental test of its effects over time.

**Limitations**

Although there are numerous strengths, the current study is not without limitations. For example, the study has some methodological limitations as measurement was based exclusively on self-report measures, which increases the likelihood of social desirability in responses. However, this was reduced by the use of computer assisted self-administered interviewing (CASI) which has been shown to improve the reliability of responses (Aquilino, Wright, & Supple, 2000).

Additionally, we made a decision to combine the sexual minority groups in order to increase statistical power, even though studies have shown the importance of analyzing bisexuals separately from gays and lesbians (Ford & Jasinski, 2006). Further, it might be seen as a limitation that we assessed sexual orientation at a later time point to predict earlier substance use. However, we believe that it is well justified to do so, as we have thoroughly explained in the measures section, and this same approach has been used in previous research (e.g., Hahm, et al., 2008; Hatzenbuehler et al., 2008).

Furthermore, we only assessed three indicators of substance use, rather than a more comprehensive test of other illicit drugs, such as cocaine, heroin, inhalants, or nonmedical use of psychotropic drugs. This was so because there either simply wasn't enough variability in the illicit drug measures that were available, or the illicit substance

use variables were not assessed consistently across four points in time. Also results must be interpreted with caution as the substance use outcomes were only assessed with one question and in some instances, particularly with alcohol use, participants were asked to recall how many times they had used substances over long periods of time (i.e., a year).

Finally, our religiosity variable was only made up of three items. However, despite this, it remained reliable. Future studies would benefit from having a more extensive measure of religiosity. For instance, researchers might examine proximal (rather than distal) religiosity - or in other words, measures of meaning-making of religious beliefs such as relationship with God and belief in Divine support, as well as more negative associations with religiosity, such as anger at God or fear of God's punishment (Cotton et al., 2006).

While there were limitations, we also believe the strengths of the study outweigh the limitations. We used a nationally representative sample - which is especially important for increasing our understanding of young adult substance use, which has often been plagued by samples relying on college students that are not representative of young adults in general. This study sheds light on the average developmental trajectory of substance use for all youth and young adults, regardless of sexual orientation. Also, as far as we know, this is the first study of sexual minority youth and young adult substance use to test longitudinal trajectories with a consideration of non-linear changes over time (quadratic term). In addition, we focused on religiosity, a well-known, substantive protective factor, where not many others have focused on substantive protective factors to further understand sexual minority substance use (see Ford & Jasinski, 2006; Hatzenbuehler et al., 2008; and Ziyadeh et al., 2007 for some exceptions). Finally, we

measured religiosity as a time varying predictor. This is a major advantage of using growth curve modeling (Pan et al., 2005). Because one's religiosity is not stable at each wave, we can increase the precision of measurement by assessing it at each wave of data collection.

**Conclusions and Future Directions**

Our results emphasize the need for researchers to further test their assumptions about sexual minority youth and young adults automatically being at increased odds for problem behaviors. Educators, researchers, and health care providers should assess their views to ascertain that they do not have a tendency to view sexual minorities through a pathological lens. As a whole our results do not show that sexual minority youth and young adults are generally at an increased risk for substance use. Future studies should focus on protective factors and what makes sexual minority youth and young adults stronger in the face of adversity, including identifying protective factors that retain protective effects into young adulthood. Finally, researchers should continue to conduct rigorous and methodologically sound studies to iron out differences in perceived or real findings related to sexual minority youth and young adults compared to heterosexual youth and young adults.

Table 1. Multilevel Models for Change in Cigarette use Over Time (10th grade cohort)

| | | Model A | Model B | Model C | Model D | Model E | Model F |
|---|---|---|---|---|---|---|---|
| Fixed Effects | | | | | | | |
| Initial Status | Intercept | 2.860*** | 4.933*** | 5.725*** | 5.370*** | 5.366*** | 5.383*** |
| | | (.248) | (.753) | (.509) | (.505) | (.505) | (.504) |
| | Female | | 1.280** | .741* | .891* | .865* | .882* |
| | | | (.490) | (.375) | (.374) | (.373) | (.373) |
| | Race | | -3.773*** | -4.320*** | -3.984*** | -3.990*** | -3.988*** |
| | | | (.499) | (.347) | (.349) | (.348) | (.348) |
| | SES | | -.541** | -.491*** | -.453*** | -.447*** | -.452*** |
| | | | (.196) | (.129) | (.127) | (.127) | (.127) |
| | Family Structure (FS) | | .788 | | | | |
| | | | (.496) | | | | |
| | Sexual Minorities (SM) | | | -1.580 | | | |
| | | | | (1.309) | | | |
| | Religiosity (Relig) | | | | -.824** | -.875*** | -.872*** |
| | | | | | (.271) | (.131) | (.134) |
| | SM*Relig | | | | | | 2.010 |
| | | | | | | | (1.398) |
| Rate of Change | Age | .842*** | .925*** | .908*** | .934*** | .913*** | .930*** |
| | | (.076) | (.230) | (.079) | (.078) | (.078) | (.078) |
| | Female*Age | | -.447** | -.185*** | -.177*** | -.174*** | -.175*** |
| | | | (.151) | (.035) | (.035) | (.035) | (.035) |
| | Race*Age | | -.272 | | | | |
| | | | (.154) | | | | |
| | SES*Age | | .063 | | | | |
| | | | (.060) | | | | |
| | FS*Age | | .175 | | | | |
| | | | (.153) | | | | |
| | SM*Age | | | .853* | | .506 | |
| | | | | (.398) | | (.278) | |
| | Relig*Age | | | | -.030 | | |
| | | | | | (.086) | | |
| | SM*Relig*Age | | | | | | -.995* |
| | | | | | | | (.477) |
| Quadratic Curve | Age² | -.036*** | -.040*** | -.038*** | -.040*** | -.039*** | -.040*** |
| | | (.004) | (.012) | (.004) | (.004) | (.004) | (.004) |
| | Female* Age² | | .014 | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | (.008) | | | | |
| | Race* Age² | | .023** | .009*** | .009*** | .009*** | .009*** |
| | | | (.008) | (.002) | (.002) | (.002) | (.002) |
| | SES* Age² | | -.004 | | | | |
| | | | (.003) | | | | |
| | FS* Age² | | -.005 | | | | |
| | | | (.008) | | | | |
| | SM* Age² | | | -.045* | | -.029 | |
| | | | | (.021) | | (.016) | |
| | Relig* Age² | | | | .002 | | |
| | | | | | (.005) | | |
| | SM*Relig* Age² | | | | | | .060* |
| | | | | | | | (.027) |
| Variance Components | Within-person (Residual) | 34.896*** | 34.833*** | 34.844*** | 34.847*** | 34.845*** | 34.876*** |
| | | (1.050) | (1.044) | (1.045) | (1.045) | (1.044) | (1.045) |
| | In initial status UN (1,1) | 82.405*** | 78.468*** | 78.775*** | 77.470*** | 77.439*** | 77.28*** |
| | | (5.114) | (4.985) | (4.991) | (4.962) | (4.955) | (4.952) |
| | In rate of change UN (2,2) | 5.725*** | 5.648*** | 5.664*** | 5.659*** | 5.643*** | 5.636*** |
| | | (.461) | (.457) | (.457) | (.457) | (.456) | (.456) |
| | In quadratic curve UN (3, 3) | .014*** | .013*** | .013*** | .014*** | .014*** | .013*** |
| | | (.001) | (.001) | (.001) | (.001) | (.001) | (.001) |
| | Covariance UN (2,1) | -10.711*** | -10.841*** | -10.848*** | -10.830*** | -10.795*** | -10.765*** |
| | | (1.338) | (1.323) | (1.324) | (1.321) | (1.319) | (1.319) |
| Goodness-of-fit | | | | | | | |
| | Deviance Statistic | 71402.690 | 71176.685 | 71207.799 | 71088.862 | 71085.821 | 71083.791 |
| | AIC | 71422.690 | 71220.685 | 71243.799 | 71124.862 | 71121.821 | 71121.791 |
| | BIC | 71494.573 | 71378.828 | 71373.188 | 71254.235 | 71251.193 | 71083.791 |

Note: An unconditional means model was fit, as well as an unconditional growth model with linear time only; however, these were not included in the table due to space limitations. Model A is the unconditional growth model with quadratic time. Model B tested just the control variables. Only significant controls were retained in subsequent models. Model C added sexual orientation. Model D tested the effects of religiosity. Model E builds on Model B by testing both the effects of the significant sexual orientation and religiosity variables. Finally, in Model F, interactions of sexual orientation*religiosity were added. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 2. Description of Main Sexual Orientation (SO) Findings

| | Cigarettes | | Alcohol | | Marijuana | |
|---|---|---|---|---|---|---|
| | Main effects by sexual orientation | Religiosity*sexual orientation interaction effects | Main effects by sexual orientation | Religiosity*sexual orientation interaction effects | Main effects by sexual orientation | Religiosity*sexual orientation interaction effects |
| 9th grade | ns | ns | ns | ns | ns | ns |
| 10th grade | sig. on slope<br>sig. on curve | relig*SO sig. on slope<br>relig*SO sig. on curve | ns | ns | ns | ns |
| 11th grade | sig. on slope<br>sig. on curve | ns | ns | ns | ns | relig*SO sig. on intercept |
| 12th grade | ns | ns | ns | ns | sig. on intercept | ns |

Note. After religiosity was entered into the models, the significant effects of sexual orientation for 10th grade cigarette use and for 12 grade marijuana use was no longer significant. Likewise, the effect of sexual orientation on the slope of 11th graders' alcohol use, which nearly reached significance without religiosity in the model, did reach significance once religiosity was included in the model. Ns = non significant

Table 3. Fixed Main Effects of Sexual Orientation on the Intercept, Slope (instantaneous rate of change), and Quadratic Change in Cigarette, Alcohol, and Marijuana use by Cohort

| | Cigarettes | | | Alcohol | | | Marijuana | | |
|---|---|---|---|---|---|---|---|---|---|
| | Intercept | Slope | Curve | Intercept | Slope | Curve | Intercept | Slope | Curve |
| 9th grade | -1.097 | .159 | .004 | -.063 | .029 | .000 | -.394 | .100 | -.003 |
| 10th grade | -1.580 | .853* | -.045* | -.267 | .084 | -.003 | -.158 | .081 | -.002 |
| 11th grade | .493 | .843* | -.042* | -.323 | .122 | -.004 | .333 | -.014 | .001 |
| 12th graders | -1.110 | .694 | -.034 | -.538 | .049 | .002 | -.645* | .127 | -.004 |

Note: Background variables were controlled for. Due to the fact that the slope of 11th grade alcohol use nearly reached significance, it was retained in further analyses, at which point it reached statistical significance once additional variables were entered into the model. * $p < .05$; ** $p < .01$; *** $p < .001$

Table 4. Fixed Main Effects of Religiosity on the Intercept, Slope (instantaneous rate of change), and Quadratic Change in Cigarette, Alcohol, and Marijuana Use by Cohort

| | Cigarettes | | | Alcohol | | | Marijuana | | |
|---|---|---|---|---|---|---|---|---|---|
| | Intercept | Slope | Curve | Intercept | Slope | Curve | Intercept | Slope | Curve |
| 9th grade | -1.289*** | .012 | -.000 | -.196** | .008 | -.001 | -.071 | -.043** | .002** |
| 10th grade | -.824** | -.030 | .002 | -.086 | -.033* | .001 | -.121** | -.018 | .001 |
| 11th grade | -1.350*** | -.043 | .005 | -.093 | -.034* | .001 | -.253*** | .008 | .000 |
| 12th graders | -1.245** | -.017 | .004 | -.267*** | .009 | -.001 | -.149* | -.014 | .001 |

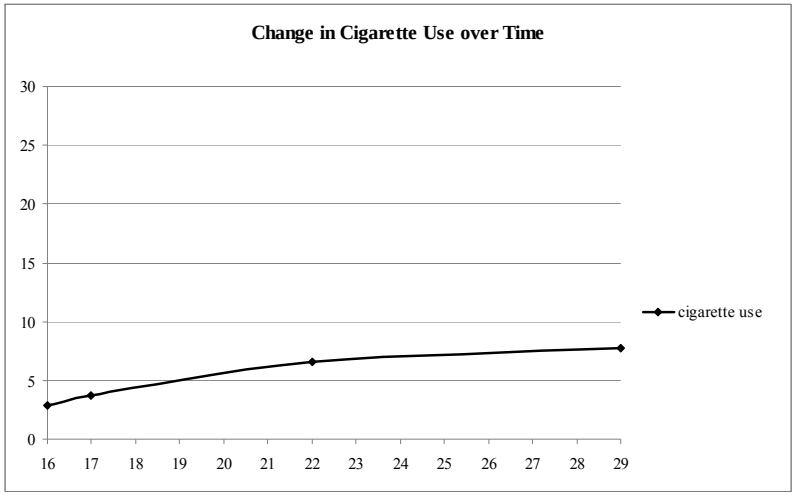
Note: Background variables were controlled for. Due to the fact that the intercept of 10th grade alcohol nearly reached significance, it was retained in further analyses, at which point it reached statistical significance once additional variables were entered into the model. ** $p < .01$; *** $p < .001$

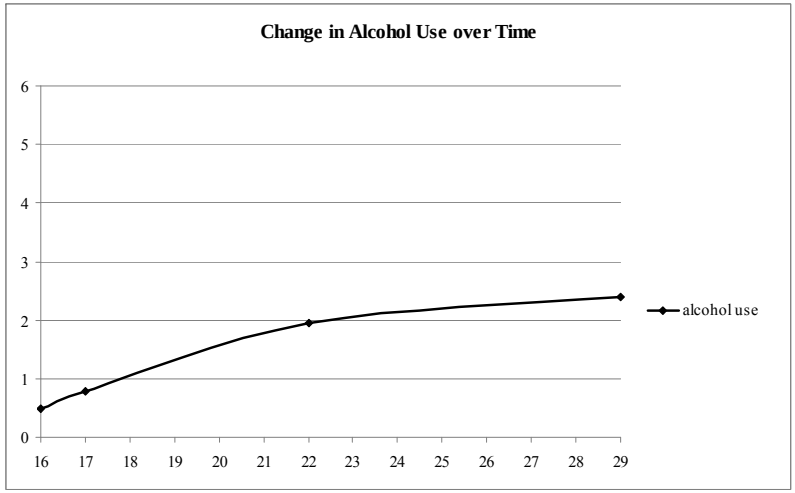
Table 5. Fixed Effects of Sexual Orientation and Religiosity Entered Simultaneously in Growth Curve Models to Predict Cigarette, Alcohol, and Marijuana Use by Cohort

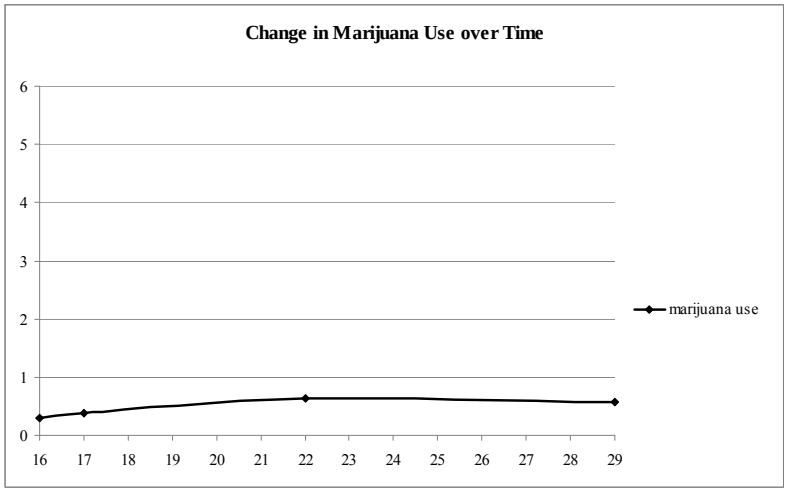
| | Cigarettes | | | Alcohol | | | Marijuana | | |
|---|---|---|---|---|---|---|---|---|---|
| | Intercept | Slope | Curve | Intercept | Slope | Curve | Intercept | Slope | Curve |
| 9th grade | | | | | | | | | |
| Sexual orientation | | | | | | | | | |
| Religiosity | -1.237*** | | | -.240*** | | | | -.062*** | .003*** |
| 10th grade | | | | | | | | | |
| Sexual orientation | | .506 | -.029 | | | | | | |
| Religiosity | -.875*** | | | -.124*** | -.018*** | | -.152*** | | |
| 11th grade | | | | | | | | | |
| Sexual orientation | | .871*** | -.044*** | | .031** | | | | |
| Religiosity | -1.274*** | | | | -.027*** | | -.178*** | | |
| 12th graders | | | | | | | | | |
| Sexual orientation | | | | | | | -.054 | | |
| Religiosity | -1.026*** | | | -.266*** | | | -.166*** | | |

Note: Only the significant (or nearly significant) main effects of sexual orientation and religiosity from previous models were entered into the final model. Background variables were controlled for. ** $p < .01$; *** $p < .001$

Figure 1. Prototypical Plots of the Unconditional Growth Curve Models for Cigarette, Alcohol, and Marijuana Use for 10th Grade Cohort



## Study II

Risk and Protective Factors in Health:

A Comparison of Self-identified Sexual Minority and Heterosexual Young Adults

### Overview/Rationale

Chronic real or perceived stress can have dire consequences on a person's health and well-being. It can affect one's mental health, such as depression (Hammen, Kim, Eberhart, & Brennan, 2009), and can also lead to engagement in health compromising behaviors, such as substance use (Cohen, 2000). Additionally, stress can result in a greater likelihood of infections, autoimmune diseases, and even cancer (Kemeny & Schedlowski, 2007). Minority stress models (Meyer, 1995) suggest that sexual minorities are at increased risk of stress due to their minority position in society. Indeed, it has been documented that sexual minorities often experience and report high levels of chronic stressors, including prejudice, discrimination, and victimization (Herek, 2009; Ueno, 2005; Williams, Connolly, Pepler, & Craig, 2005), which in turn have been reported to increase the risk for mental health problems or health compromising behaviors (e.g. Grella, Greenwell, Mays, & Cochran, 2009). While much work exists that tests this notion of stress and mental health outcomes in sexual minorities, indicators of physical health among sexual minorities, with the exceptions of work on HIV and other sexually transmitted infections, have not been frequently considered or studied as a general

measure of overall adjustment. In fact, in a review of Medline articles from the 1980s and 1990s, Boehmer (2002) concluded that only 0.1% of all Medline articles addressed sexual minority issues, and of these, 61% were disease-specific; in particular, nearly 56% were specific to HIV/AIDS and other sexually transmitted diseases. Hence, Boehmer concluded that sexual minority issues have been neglected in the public health arena, and that more research is needed, especially outside the realm of sexually transmitted infections.

Of the handful of studies that have examined nondisease-specific physical health and well-being outcomes among sexual minorities, only one study by Huebner and Davis (2007) exclusively examined physical health outcomes. Most other work included one or two physical health outcome measures as part of a larger set of adjustment indicators, including ones assessing mental health or health compromising behaviors (e.g., Diamant & Wold, 2003; Ortiz-Hernandez, Tello, & Valdes, 2009; Saewyc, Bearinger, Heinz, Blum, & Resnick, 1998; Sandfort, Bakker, Schellevis, & Vanwesenbeeck, 2006). Additionally, of these studies, one only examined women (Diamant & Wold, 2003), while two did not include comparison groups (i.e., heterosexuals; Huebner & Davis, 2007; Saewyc et al., 1998). Thus, our current knowledge base about indicators of physical health among sexual minorities is limited at best, largely due to a dearth of work on this topic and due to methodological limitations of previous work. However, based on previous work, it seems that sexual minorities report disproportionately more health problems than heterosexuals (Diamant & Wold, 2003; Ortiz-Hernandez et al., 2009; Sandfort et al., 2006).

The current cross-sectional study sought to examine indicators of physical health (general health, blood pressure, self-medication use, sleep problems, and susceptibility to illness) in a national sample of self-identified heterosexual, bisexual, and homosexual young adults (age 24 - 32) using a risk and protective factor conceptual framework. Young adulthood is an optimal developmental period to examine health indicators as this is a time when health problems can start arising. This means that new information from this effort can be informative in developing preventative interventions. The study assessed to what degree both risk and protective factors are predictive of health indicators. It built on previous work that has aimed to examine similarities or differences in the developmental course of mental health adjustment indicators among sexual minority and heterosexual youth (Jenkins & Vazsonyi, 2010), informed by a minority stress model (Meyer, 1995); however, unlike much previous work which has focused on internalizing symptoms or mental health indicators, the current study examined physical health symptoms.

Additionally, it moves the little work on this topic that exists forward by examining substantive risk and protective factors, the first known study to do so. Russell (2003) has urged researchers who study sexual minorities to examine normative risk and protective factors, but also ones unique to sexual minorities. Therefore, the risk and protective factors part of the current study are normative, in the sense that they apply to all individuals, independent of sexual orientation, yet they are ones that have been identified in previous research as particularly salient to sexual minorities. Hence, we tested a total of six substantive variables. More specifically, the three risk factors are general level of perceived stress, inability to cope with stress, and social isolation, while

the three protective factors include romantic relationship quality, number of close friends, and optimism.

**Health in Sexual Minority Populations**

Sexual minorities might be susceptible to more negative health outcomes for several reasons. For instance, it is known that one's mental health can affect one's physical health (Cohen, 2000), and as mentioned earlier, the stress of dealing with prejudice and discrimination can lead to adverse mental health outcomes, which has been shown to be true in studies of sexual minorities (e.g., D'Augelli, 2003; Williams et al., 2005). One study found that higher levels of discrimination was associated with number of sick days from work and non-prescription medication use in a sample of gay and bisexual men (Huebner & Davis, 2007). In particular, prolonged exposure to stress can have an effect on one's immunological functioning [see Kemeny & Schedlowski (2007) for a thorough review], as well as lead to engagement in health compromising behaviors and maladaptive coping strategies (Groër, Meagher, & Kendall-Tackett, 2010).

Some researchers suggest that sexual minorities have more behavioral risk factors that can lead to worse health and/or disease. For instance when lesbian women were compared to heterosexual women, risk factors such as higher cigarette and alcohol use, being overweight, and less routine examinations were noted (Aaron et al., 2001; Cochran et al., 2001). Still, others say that sexual minorities might be at a disadvantage for accessing health care, such as having no health insurance (Cochran et al., 2001), which might also affect health outcomes.

Of the little research that exists, studies have found that sexual minorities tend to report poorer overall health than heterosexuals (Mercer et al., 2007). When specific

conditions of health are examined, there have been some mixed results. For instance, Sandfort et al. (2006) found that gays and lesbians reported a higher number of acute symptoms in the previous 14 days as well as more chronic health conditions when compared to heterosexuals. However, the same results were not found for bisexuals. In another study, there was no difference found in self-reported breast cancer between lesbian/bisexual and heterosexual women (Cochran et al., 2001). Finally, while Diamant & Wold (2003) found a significant difference in ever having a diagnosis of heart disease such that bisexual and lesbian women had higher rates than heterosexual women, this was not the case with several other health outcomes. The researchers found no difference in arthritis, diabetes, chronic respiratory conditions, asthma, hypertension, or osteoporosis. Thus, more research needs to be conducted to help further our understanding of how one's sexual orientation influences one's health outcomes.

**Predictors of Health Outcomes**

We have chosen to examine known risk and protective factors of health outcomes. Perceived stress, inability to cope with stress, and social isolation are the risk factors of interest in the current study. In general, higher levels of perceived stress, higher levels of inability to cope with stress, and higher levels of social isolation have all been consistently associated with greater health problems and disease (House, 2001; Nowack, 1991; Olff, 1999). Stress variables and social isolation have been shown to be particularly salient to sexual minorities (Huebner & Davis, 2007; Ueno, 2005).

The protective factors we examined in the current study are romantic relationship quality, number of close friends, and optimism. The first two factors are measures of social support, which in general has been found to be a protective factor for health

outcomes (Cohen, 2004; Uchino, 2006), and has oft been cited as a protective factor for sexual minorities for a host of well-being outcomes (Sheets & Mohr, 2009; Williams et al., 2005). In particular, in a national sample of adolescents it was found that the interpersonal supportiveness of a romantic relationship was a stronger protective factor for sexual minority youth than heterosexual youth (Russell & Consolacion, 2003). Also, it has been noted that social support in the form of close friendships might be especially salient for sexual minorities, especially in the face of parental rejection to one's sexual orientation (Nesmith, Burton, & Cosgrove, 1999). In addition to social support, optimism has also been shown to be a consistent protective factor for health outcomes (Rasmussen, Scheier, & Greenhouse, 2009). While it has not been as readily studied in sexual minority populations, there has been some research conducted on gay men with AIDS which concluded that optimism was a protective coping resource (Taylor et al., 1992).

## The Current Investigation

The current study assessed to what degree self-identified bisexual and homosexual young adults are similar to or differ from their heterosexual counterparts on several measures of health (general health, blood pressure, self-medication usage, sleep problems, and susceptibility to illness). The health variables were chosen from among those available in the Wave IV Add Health dataset. Although the participants were assessed on a number of chronic conditions (such as epilepsy, heart disease, and hepatitis C), there was very little variability in those variables. Instead we focused on more common indicators of health and well-being, and not on specific diseases. Furthermore, the study assessed to what extent known risk (general stress level, inability to cope with stress, and social isolation) and protective factors (romantic relationship quality, close

friendships, and optimism) predict differences in health indicators among self-identified bisexual and homosexual versus heterosexual young adults. We included sociodemographic variables that have been identified as correlates of health outcomes and are often controlled for in studies of health (Adler & Rehkopf, 2008; Saewyc et al., 1998); these include race, sex, and SES.

**Research Questions**

1) To what extent do self-identified sexual minority and heterosexual young adults differ on measures of health (general health, high blood pressure, self-medication usage, sleep problems, and susceptibility to illness)? It was hypothesized based on the minority stress model that sexual minority young adults would exhibit higher levels of health problems when compared to heterosexual young adults.
2) To what extent do known risk (general stress level, inability to cope with stress, and social isolation) and protective factors (romantic relationship quality, close friendships, and optimism) predict differences in health among sexual minority and heterosexual young adults, while controlling for background variables (race, sex, and SES)? It was hypothesized that higher levels of perceived stress, inability to cope with stress, and social isolation would predict higher levels of self-reported health problems, whereas higher levels of romantic relationship quality, close friendships, and optimism would predict lower levels of self-reported health. While minority stress models indicate that these risk and protective factors might influence health outcomes among sexual minorities, there is essentially no previous comparative empirical work that could inform study predictions. However, it was hypothesized

that these risk and protective factors would operate largely in a similar manner across groups.

## Methods

### Sample

This study used data from the recently released Wave IV National Longitudinal Study of Adolescent Health (Add Health). This was the fourth and final wave of a nationally representative sample of adolescents first interviewed 13 years earlier and commencing in 2007/2008. The participants were between the ages of 24 and 32 at Wave IV, and the final wave of data collection included N = 15,701 young adults.

### Measures

*Race, sex, and SES* were used as control variables given that they have been associated with health outcomes in previous studies and were correlated with the outcome variables in the current study. For *sex,* participants were asked to report their biological sex, which was coded as 0 = male and 1 = female. For *race, p*articipants responded to the question, "What is your race?" which was coded as 0 = other racial groups and 1 = European American. Finally, *SES* was assessed with a question that asked participants to compare where they currently stand relative to other Americans in terms of education and income. Responses ranged from 1 (lowest) to 10 (highest).

*Sexual Orientation* was assessed by the question, "Please choose the description that best fits how you think about yourself." Response choices were 1 = 100% heterosexual (straight), 2 = mostly heterosexual (straight), but somewhat attracted to people of your own sex, 3 = bisexual, that is, attracted to men and women equally, 4 = mostly homosexual (gay), but somewhat attracted to people of the opposite sex, and 5 =

100% homosexual (gay). The responses were recoded so that 1 = heterosexual, 3 = bisexual, and 4 and 5 = homosexual. Following the work of Rostosky, Danner, and Riggle (2008), we opted not to include the "mostly heterosexual but somewhat attracted to people of your own sex" group in our analyses. This is because we were interested in understanding self-identified sexual minorities - i.e. those who self-identify as a sexual minority, rather than those who self-identify as heterosexual but acknowledge some same-sex attractions. Further, we believe that by eliminating this group rather than combining them with the "completely heterosexual" group, we have a valid comparison group of heterosexuals. This allows us to make comparisons of groups that are distinctly unique on this dimension.

Those who reported that they were heterosexual but somewhat attracted to the same sex (n = 1,526), asexual (n = 71), or didn't know or refused (n = 69) were excluded from analyses. Therefore, the final sample size was N = 14,035.

Health Outcomes

*General Health* was assessed by one item: "In general, how is your health?" Response options were 1 = excellent, 2 = very good, 3 = good, 4 = fair, and 5 = poor. For the purposes of logistic regression, the responses were recoded as follows: 1, 2, & 3 = 0 (good); 4 & 5 = 1 (poor).

*Blood Pressure* was classified according to the participants' systolic and diastolic blood pressure readings, which were taken and classified by trained and certified interviewers. The categories were 1 = normal, 2 = prehypertension, 3 = hypertension I, and 4 = hypertension II. For the purposes of logistic regressions, the categories were recoded as 1 = 0 (normal); 2 thru 4 = 1 (high).

*Self-medication Usage* was assessed by the two items, "In the past 24 hours, have you taken aspirin or aspirin-containing medications including cold and allergy medications or headache powders," and "In the past 24 hours, have you taken other anti-inflammatory medications? Some examples include: Advil, Aleve, Ibuprofen, Motrin, Naproxen, Nuprin." Item response choices were either 0 = no or 1 = yes; therefore, negative endorsement of both questions was coded as 0 (no), while positive endorsement on either question was coded as 1 (yes).

*Sleep problems* was assessed by the following two questions: "Over the past four weeks, how often did you have trouble falling asleep" and "Over the past four weeks, how often did you have trouble staying asleep throughout the night?" Response choices were 0 = never in the past four weeks, 1 = less than once a week, 2 = 1 or 2 times a week, 3 = 3 or 4 times a week, and 4 = 5 or more times a week. For the purposes of logistic regressions, the items were recoded so that endorsing 0 on both items was scored as 0 (no), while positive endorsement on either items was recoded as 1 (yes).

*Susceptibility to Illness* was measured by the participants' positive endorsements on three items: "Have you had nausea or vomiting or diarrhea in the last two weeks," "Have you had cold or flu-like symptoms such as sore throat, runny nose, or cough in the last two weeks," and "Have you had fever in the last two weeks?" Item response choices were either 0 = no or 1 = yes; therefore, negative endorsement on all three questions was coded as 0 (no), while positive endorsement on any question was coded as 1 (yes).

Risk and Protective Factors

*General Stress Level* was measured by the 4-item Perceived Stress Scale (Cohen & Williamson, 1988), which included the sum of 4 items: "In the last 30 days, how often

have you felt that you were unable to control the important things in your life," "In the last 30 days, how often have you felt confident in your ability to handle your personal problems," "In the last 30 days, how often have you felt that things were going your way," and "In the last 30 days, how often have you felt that difficulties were piling up so high that you could not overcome them?" Response choices were 0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = very often. The alpha for this scale is .72.

*Inability to Cope with Stress* was assessed by a scale containing 5 items: "I keep my cool," "I get stressed out easily," "I am not easily bothered by things," "I am relaxed most of the time," and "I rarely get irritated." Response choices were 1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = strongly disagree. The item, "I get stressed out easily," was reversed scored. The alpha for this scale is .76.

*Social isolation* was assessed by the item, "How often do you feel isolated from others?" Response choices ranged from 0 = never, 1 = rarely, 2 = sometimes, to 3 = often.

*Romantic relationship quality* was assessed by a scale developed by 7 items which assessed participants' current or most recent romantic relationship on aspects of enjoyment of doing day-to-day activities together, satisfaction with the way of handling disagreements, satisfaction with the way finances are handled, amount of time partner spends listening, expression of love and affection, satisfaction with sex life, and trust in partner. An example item is, "My partner (expresses/expressed) love and affection to me." Response options were 1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = strongly disagree. Items were reverse scored so that higher scores are indicative of higher romantic relationship quality. The reliability for this scale is .89.

*Close Friendships* was assessed by the question, "How many close friends do you have? (Close friends include people whom you feel at ease with, can talk to about private matters, and can call for help.)" Response choices were 1 = none, 2 = 1 or 2 friends, 3 = 3 to 5 friends, 4 = 6 to 9 friends, and 5 = 10 or more friends.

*Optimism* was assessed by a scale containing four items: "I'm always optimistic about my future," "I hardly ever expect things to go my way," "Overall I expect more good things to happen to me than bad," and "I rarely count on good things happening to me." Responses were 1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = strongly disagree. Two of the items were reverse coded so that higher scores were indicative of higher levels of optimism. The reliability for this scale is $\alpha$ = .65.

## Plan of Analysis

In an initial step, descriptive statistics were computed. Then, in order to test research question 1, whether health indicators differ by self-identified sexual orientation groups (heterosexual, bisexual, homosexual), crosstabs with chi-square significance tests were conducted. As an additional confirmation, one way ANOVAs were also computed with post hoc tests to determine how heterosexuals, bisexuals, and homosexuals differed from each other. To answer research question 2, that is whether there are differences in the 6 predictors of health outcomes by heterosexuals, bisexuals, and homosexuals, we used logistic regression analysis.

## Results

### *Sample Characteristics*

Descriptive sample information can be found in Table 1. The average age of

participants was 29.1 years, with a standard deviation of 1.75, and the average self-reported SES level was 5.04 out of a 10 point scale, with a standard deviation of 1.72. Consistent with other studies (e.g., Savin-Williams, 2006), only a small percentage of the sample self-identified as a sexual minority (1.8% bisexual and 2.4% homosexual vs. 95.8% heterosexual). Those self-identifying as sexual minorities did not significantly differ from those identifying as heterosexual with respect to race, but did differ by sex and SES.

*Crosstabs with Chi-square Analyses and ANOVAs*

Table 2 presents the results from the crosstabs with chi-square analyses. Results indicate that when only sexual orientation is included in the analyses, there are statistically significant differences in all five of the health outcomes (general health, blood pressure, self-medication, sleep problems, and susceptibility to illness) by sexual orientation groups. As a follow-up, and to determine exactly where differences lie, one-way ANOVAs were conducted with posthoc contrasts. The ANOVAs confirmed that there were indeed significant differences in health outcomes by sexual orientation groups (general health: $F(2, 14032) = 14.74$, $p < .001$; blood pressure: $F(2, 13746) = 4.17$, $p < .05$; self-medication: $F(2, 14031) = 3.06$, $p < .05$; sleep problems: $F(2, 13855) = 11.39$, $p < .001$; susceptibility to illness: $F(2, 14032) = 4.22$, $p < .05$ ). However, the differences were rather modest in size based on inspection of the eta squared statistic ($\eta^2$ = range from .000 to .002).

Because the homogeneity of variance assumption was violated as determined by examining the Levene statistic ($p < .001$), we used Dunnett C post hoc comparisons. For general health, bisexuals had statistically significant higher scores than both

heterosexuals and homosexuals. For blood pressure, homosexuals had significantly higher scores than bisexuals. For self-medication, bisexuals had significantly higher scores than heterosexuals. For sleep problems, bisexuals and homosexuals both had significantly higher scores than heterosexuals. Finally, although the ANOVA indicated that there was a significant difference in susceptibility to illness between groups, post hoc tests did not substantiate this finding, although a trend was found, where bisexuals reported higher susceptibility to illness than heterosexuals ($p = .07$).

*Logistic Regressions*

Table 3 presents the results from the logistic regressions by heterosexual, bisexual, and homosexual groups. For heterosexuals, general health was significantly predicted by race, SES, perceived stress, inability to cope with stress, romantic relationship quality, and optimism (Nagelkerke $R^2 = .11$), while for bisexuals, it was predicted by sex, inability to cope with stress and romantic relationship quality (Nagelkerke $R^2 = .26$). General health was not significantly predicted by any of the substantive predictors, nor by the control variables for the homosexuals. For blood pressure, none of the substantive predictors in the study were significant for any of the three groups; significant control variables were sex and SES for both the heterosexual and homosexual groups, and sex only for the bisexual group. Self-medication use was significantly predicted by race, sex, perceived stress, inability to cope with stress, and close friendships for heterosexuals (Nagelkerke $R^2 = .02$), and only by race and optimism for homosexuals (Nagelkerke $R^2 = .05$). It was not significantly predicted by any of the substantive predictors, nor by the control variables for the homosexual group. Sleep problems were significantly predicted by race, sex, SES, perceived stress, inability to

cope with stress, social isolation, romantic relationship quality, and close friendships for heterosexuals (Nagelkerke $R^2 = .10$), by SES and perceived stress for bisexuals (Nagelkerke $R^2 = .21$), and by sex, inability to cope with stress, social isolation, and romantic relationship quality for homosexuals (Nagelkerke $R^2 = .17$). Finally, susceptibility to illness was significantly predicted by sex, perceived stress, inability to cope with stress, social isolation, and close friendships for heterosexuals (Nagelkerke $R^2 = .02$), while none of the substantive predictors were significant for either the bisexuals or homosexuals (SES was a significant control variable for the bisexual group).

Close friendships was a significant predictor for heterosexuals for all four of the outcomes, yet the coefficient was not in the expected direction for two of the outcomes (sleep problems and susceptibility to illness). Coding was double checked as well as correlations and multicollinearity problems using the VIF and tolerance statistics. We did not find any causes for alarm and believe the findings are simply a unique result of the data.

It should be noted that the magnitude of significant effects was sometimes quite different. For heterosexuals, higher levels of inability to cope with stress was associated with a 22% increase in likelihood of reporting poor health; however, for bisexuals, higher levels of inability to handle stress was associated with a 243% increase in reporting poor health. Likewise, having higher levels of romantic relationship quality was associated with an 18% chance of reduction in reporting poor health for heterosexuals; however, for bisexuals this was associated with a 42% chance of reduction. These size differences were also evident in the prediction of sleep problems. For heterosexuals, higher perceived stress was associated with a 9% increase in sleep problems, whereas for bisexuals, it was

associated with a 17% increase. Higher levels of inability to cope with stress was associated with a 22% increase in sleep problems for heterosexuals, yet with a 109% increase for homosexuals. Finally, higher levels of social isolation was associated with an increased odds of having sleep problems by 46% for heterosexuals, whereas for homosexuals it increased the odds of having sleep problems by 66%.

Finally, in order to be sensitive to sample size, we combined the bisexual and homosexual individuals into a single group (sexual minorities) and re-tested the logistic regression models (see Table 4). Once combined, general health was significantly predicted by inability to cope with stress (Nagelkerke $R^2 = .15$), self-medication usage was predicted by perceived stress and optimism (Nagelkerke $R^2 = .07$), and sleep problems were significantly predicted by sex, SES, inability to cope with stress and social isolation (Nagelkerke $R^2 = .16$). Neither blood pressure nor susceptibility to illness was significantly predicted by any of the six substantive variables of interest.

## Discussion

Based on a national sample (Add Health), the current study examined physical health indicators in self-identified heterosexual, bisexual, and homosexual young adults using a risk and protective factor approach. Overall, health problems for this sample were relatively low, which is consistent with other similar-aged studies (e.g., Ortiz-Hernandez et al., 2009). Results indicate that when only sexual orientation was included in the models, it was a significant predictor of the five indicators of health problems (general health, blood pressure, self-medication, sleep problems, and susceptibility to illness). Although we did not make predictions about whether bisexuals or homosexuals would have higher levels of health problems per se, we did expect that sexual minorities would

have the higher levels of health problems vis-à-vis heterosexual individuals. This is indeed accurate as it was never the case for any of the five health indicators that heterosexuals had the highest levels. Results indicated that homosexuals had significantly higher levels of sleep problems than heterosexuals and significantly higher blood pressure than bisexuals. However, bisexuals seemed to fair the worst on these health indicators. Bisexuals had significantly poorer general health than both heterosexuals and homosexuals, significantly more self-medication usage than heterosexuals, significantly more sleep problems than heterosexuals, and a trend towards more susceptibility to illness than heterosexuals.

While our study found that bisexuals faired worse on health outcomes, this was not the case in Sandfort et al.'s (2006) Dutch population based study which found that homosexuals were more at risk than bisexuals. Yet, in a British probability survey, bisexual women reported more ill health outcomes than heterosexuals or homosexuals (Mercer et al., 2007), similar to findings in the current study. These differences in findings might be related to different measurement of sexual orientation and small sample sizes of bisexuals. These differences need to be further examined in future studies.

Also, results indicated that overall the risk and protective factors operated in the expected directions. That is, higher levels of perceived stress, inability to cope with stress, and social isolation were associated with higher levels of health problems. On the other hand, higher levels of romantic relationship quality and optimism were associated with lower levels of health problems. While we expected that higher numbers of close friendships would have a negative relationship with health problems, this was not supported by the data across each of the health outcomes. Interestingly, and

unexpectedly, among heterosexuals, higher numbers of close friendships was associated with more sleep problems and higher susceptibility to illness.

Furthermore, we tested three risk and three protective factors in each group for each outcome. It is interesting to note that for the most part, there were more significant risk factors than significant protective factors regardless of the sexual orientation group that one belonged to. We also found that across outcomes the heterosexual group had more significant risk and protective factors than either the bisexual or homosexual group. For example, when predicting susceptibility to illness, the heterosexual group had four significant predictors, yet the bisexual and homosexual group both had no significant risk and protective factors. This pattern of heterosexuals having more significant protective factors than either bisexuals or heterosexuals was true for all of the outcomes except for blood pressure, in which case none of the tested risk and protective factors were significant for any of the groups.

Even after combining the bisexual and homosexual groups to address potential sample size limitations, findings did not change appreciably in that heterosexuals had a greater number of significant risk and protective factors than sexual minorities. This is surprising given that we chose variables that have been identified in the literature as particularly salient for sexual minorities. However, this might be because we chose our variables based on known risk and protective factors for sexual minorities' mental health, which might not be as salient for physical health indicators. Due to the dearth of studies that examine risk and protective factors in physical health of sexual minorities, this is an area ripe for future exploration

While the direction of significant effects was the same for heterosexuals,

bisexuals, and homosexuals, the magnitude was sometimes quite different. For instance, higher levels of inability to cope with stress was associated with a 22% increase in likelihood of reporting poor health outcomes for heterosexuals, but with a 243% increase for bisexuals. For all models that had the same significant predictors by sexual orientation group, the predictor in the sexual minority group (bisexual or homosexual) increased the chances of reporting negative health outcomes more so than for the heterosexual group. This shows that while there were more significant predictors for the heterosexual group, when the bisexual or homosexual groups had significant predictors they had stronger odds ratios.

Overall, these findings contribute to the knowledge base on health issues among sexual minority and heterosexual young adults. First, findings provide evidence that bisexual and homosexual young adults report different levels of health indicators, and hence, it can not be assumed that minority stress operates in a similar manner across sexual minority groups. Future studies should try to further examine bisexual and homosexual individuals separately when possible. In addition, the results of this study show that risk and protective factors might not operate in the same fashion for bisexuals and homosexuals versus heterosexuals when predicting health outcomes. Future studies should seek to examine additional potential risk and protective factors that might explain some of the observed differences in health outcomes by sexual orientation groups. More research is also needed to understand why some risk and protective factors seem to have more of an effect on sexual minority groups. Again, new investigations need to take special consideration to understand and identify risk and protective factors unique to bisexuals.

**Limitations**

With the exception of blood pressure, all outcomes were measured by self-reports, which increases the chance of social desirability in responses. Also, we were not able to specifically assess stress due to prejudice and discrimination. Rather, we were only able to assess general perceived stress, and not the source of the stress. It could be that different types of stress or different sources of stress are particularly meaningful for different sexual orientation groups. In addition, some of the measures were assessed with only one item largely due to the choice of items in the Wave IV dataset. For instance, we assessed social support from friends with one item that asked participants how many friends they have. While it has been noted that quality of social relationships, more so than quantity of social relationships, is more meaningful in college age students (VanderVoort, 1999), we simply did not have a measure from Wave IV that comprehensively measured quality of friendships.

While there are limitations to the current study, we believe there are also numerous strengths. For instance, we were able to examine bisexuals and homosexuals separately rather than combining them into one group. This is not always possible due to small sample sizes, but has been shown to be important in understanding differences within the sexual minority population (Saewyc et al., 2009). Further, we used a nationally representative sample of young adults which makes our results more generalizable to the general population of young adults. Finally, we studied physical health in sexual minorities as opposed to mental health, which has more typically been studied. Results of this study can inform future work that can continue to fill some of the gaps in our understanding of this important, yet understudied, area.

Table 1. Sample Demographic Characteristics

| | Total Sample n = 14,035 | Heterosexual n = 13,447 | Bisexual n = 248 | Homosexual n = 340 |
|---|---|---|---|---|
| | No. (%) | No. (%) | No. (%) | No (%) |
| Sex | | | | |
| Female | 6996 (49.8) | 6646 (49.4) | 195 (78.6) | 155 (44.1) |
| Male | 7042 (50.2) | 6799 (50.6) | 53 (21.4) | 190 (55.9) |
| Race | | | | |
| African American | 3214 (22.9) | 3066 (22.8) | 67 (27.1) | 81 (23.9) |
| Asian American | 896 (6.4) | 865 (6.4) | 8 (3.2) | 23 (6.8) |
| European American | 8557 (61.1) | 8224 (61.3) | 141 (57.1) | 192 (56.6) |
| Native American | 199 (1.4) | 180 (1.3) | 8 (3.2) | 11 (3.2) |
| Other | 1144 (8.2) | 1089 (8.1) | 23 (9.3) | 32 (9.4) |
| Age | | | | |
| 20s | 7751 (55.2) | 7394 (55.0) | 162 (65.3) | 195 (57.4) |
| 30s | 6284 (44.8) | 6053 (45.0) | 86 (34.7) | 145 (42.6) |
| SES | | | | |
| Lower | 8873 (63.4) | 8464 (63.1) | 188 (75.8) | 221 (65.0) |
| Upper | 5129 (36.6) | 4950 (36.9) | 60 (24.2) | 119 (35.0) |

Table 2. Sample Prevalence of Health Indicators

| | Total Sample No. (%) | Heterosexual No. (%) | Bisexual No. (%) | Homosexual No (%) | $\chi^2$ |
|---|---|---|---|---|---|
| General Health | | | | | 29.43*** |
| Good | 12724 (90.7) | 12224 (90.9) | 202 (81.5) | 298 (87.6) | |
| Poor | 1311 (9.3) | 1223 (9.1) | 46 (18.5) | 42 (12.4) | |
| Blood Pressure | | | | | 8.33* |
| Normal | 4551 (33.1) | 4362 (33.1) | 95 (39.4) | 94 (28.0) | |
| High | 9198 (66.9) | 8810 (66.9) | 146 (60.6) | 242 (72.0) | |
| Self-medications | | | | | 6.11* |
| No | 10211 (72.8) | 9805 (72.9) | 164 (66.1) | 242 (71.2) | |
| Yes | 3823 (27.2) | 3641 (27.1) | 84 (33.9) | 98 (28.8) | |
| Sleep Problems | | | | | 22.76*** |
| No | 4518 (32.6) | 4380 (33.0) | 52 (21.3) | 86 (25.5) | |
| Yes | 9340 (67.4) | 8897 (67.0) | 192 (78.7) | 251 (74.5) | |
| Susceptibility to Illness | | | | | 8.43* |
| Less | 10219 (72.8) | 9821 (73.0) | 165 (66.5) | 233 (68.5) | |
| More | 3816 (27.2) | 3626 (27.0) | 83 (33.5) | 107 (31.5) | |

Note: *** $p < .001$, * $p < .05$

Table 3. Logistic Regression Predicting Health Indicators by Sexual Orientation Group

| | Heterosexual n = 12,828 | | | Bisexual n = 231 | | | Homosexual n = 317 | | |
|---|---|---|---|---|---|---|---|---|---|
| **General Health** | b | SE | OR (CI) | b | SE | OR (CI) | b | SE | OR (CI) |
| Perceived Stress | .08*** | .01 | 1.08 (1.06-1.11) | .03 | .08 | 1.03 (.88-1.20) | .13 | .08 | 1.14 (.97-1.334) |
| Inability to Cope with Stress | .20*** | .06 | 1.22 (1.10-1.37) | 1.23*** | .36 | 3.43 (1.70-6.93) | .50 | .30 | 1.65 (.93-2.95) |
| Social Isolation | .07 | .04 | 1.07 (1.00-1.15) | -.11 | .21 | .90 (.60-1.36) | -.05 | .22 | .95 (.62-1.47) |
| Romantic Relationship Quality | -.20*** | .04 | .82 (.76-.88) | -.54** | .21 | .58 (.39-.87) | .30 | .23 | 1.358 (.86-2.11) |
| Close Friendships | -.07* | .03 | .93 (.87-1.00) | -.19 | .23 | .83 (.53-1.29) | -.01 | .20 | .99 (.66-1.47) |
| Optimism | -.34*** | .06 | .71 (.63-.79) | -.18 | .33 | .83 (.43-1.59) | -.23 | .32 | .80 (.43-1.48) |
| **Self-Medication Usage** | | | | | | | | | |
| Perceived Stress | .03*** | .01 | 1.03 (1.01-1.04) | .12 | .06 | 1.12 (1.00-1.28) | .09 | .06 | 1.10 (.98-1.23) |
| Inability to Cope with Stress | .17*** | .04 | 1.19 (1.11-1.28) | .32 | .26 | 1.38 (.83-2.28) | -.15 | .21 | .87 (.57-1.30) |
| Social Isolation | .01 | .03 | 1.01 (.96-1.06) | -.27 | .17 | .77 (.55-1.06) | -.08 | .16 | .92 (.67-1.26) |
| Romantic Relationship Quality | -.03 | .03 | .98 (.93-1.03) | .16 | .17 | 1.17 (.84-1.65) | .18 | .16 | 1.20 (.88-1.63) |
| Close Friendships | -.07*** | .02 | .94 (.90-.98) | .14 | .17 | 1.15 (.82-1.61) | .20 | .14 | 1.22 (.93-1.61) |
| Optimism | -.04 | .04 | .96 (.89-1.04) | -.36 | .26 | .70 (.42-1.17) | -.63** | - | .53 (.33-.86) |
| **Sleep Problems** | | | | | | | | | |
| Perceived Stress | .09*** | .01 | 1.09 (1.08-1.11) | .16* | .08 | 1.17 (1.01-1.36) | -.05 | .07 | 1.00 (.84-1.18) |
| Inability to Cope with Stress | .20*** | .04 | 1.22 (1.14-1.31) | .58 | .31 | 1.79 (.98-3.27) | .72** | .24 | 2.09 (1.12-3.90) |
| Social Isolation | .38*** | .03 | 1.46 (1.40-1.54) | .23 | .20 | 1.26 (.86-1.85) | .36* | .18 | 1.66 (1.05-2.63) |
| Romantic Relationship Quality | -.11*** | .03 | .90 (.85-.95) | -.16 | .21 | .85 (.56-1.30) | -.34* | .17 | .63 (.40-.98) |
| Close Friendships | .09*** | .02 | 1.09 (1.05-1.13) | .16 | .21 | 1.17 (.78-1.77) | .11 | .15 | 1.00 (.69-1.46) |
| Optimism | .01 | .04 | 1.01 (.94-1.09) | -.64 | .34 | .53 (.27-1.03) | -.14 | .27 | .97 (.49-1.94) |
| **Susceptibility to Illness** | | | | | | | | | |
| Perceived Stress | .03*** | .01 | 1.04 (1.02-1.05) | .04 | .06 | 1.05 (.93-1.18) | -.00 | .07 | .95 (.84-1.08) |
| Inability to Cope with Stress | .18*** | .04 | 1.20 (1.12-1.29) | .40 | .25 | 1.49 (.91-2.45) | -.02 | .27 | 2.05 (1.27-3.29) |
| Social Isolation | .08*** | .03 | 1.09 (1.04-1.14) | -.10 | .16 | .91 (.67-1.24) | .15 | .20 | 1.44 (1.02-2.03) |
| Romantic Relationship Quality | .00 | .03 | 1.00 (.95-1.06) | .00 | .16 | 1.00 (.73-1.38) | .02 | .19 | .71 (.51-1.00) |
| Close Friendships | .06** | .02 | 1.06 (1.02-1.10) | .16 | .17 | 1.17 (.84-1.63) | .09 | .17 | 1.12 (.83-1.51) |
| Optimism | .00 | .04 | 1.00 (.93-1.08) | .03 | .26 | 1.03 (.62-1.70) | -.34 | .33 | .87 (.51-1.48) |

Note. Controlled for race, sex, and SES. Heterosexual n = 12,827 or 12,828 depending on outcome.
*** $p < .001$, ** $p < .01$, * $p < .05$

Table 4. Logistic Regression Predicting Health Indicators for Heterosexuals and Sexual Minorities

| | Heterosexual n = 12,828 | | | Sexual minorities n = 548 | | |
|---|---|---|---|---|---|---|
| **General Health** | b | SE | OR | b | SE | OR |
| Perceived Stress | .08*** | .01 | 1.08 (1.06-1.11) | .08 | .05 | 1.08 (.97-1.20) |
| Inability to Cope with Stress | .20*** | .06 | 1.22 (1.10-1.37) | .71*** | .21 | 2.04 (1.35-3.08) |
| Social Isolation | .07 | .04 | 1.07 (1.00-1.15) | -.05 | .15 | .950 (.72-1.27) |
| Romantic Relationship Quality | -.20*** | .04 | .82 (.76-.88) | -.10 | .14 | .91 (.69-1.19) |
| Close Friendships | -.07* | .03 | .93 (.87-1.00) | -.15 | .14 | .86 (.65-1.15) |
| Optimism | -.34*** | .06 | .71 (.63-.79) | -.15 | .22 | .86 (.56-1.32) |
| **Self-medication Usage** | | | | | | |
| Perceived Stress | .03*** | .01 | 1.03 (1.01-1.04) | .11** | .04 | 1.11 (1.03-1.21) |
| Inability to Cope with Stress | .17*** | .04 | 1.19 (1.11-1.28) | .04 | .16 | 1.04 (.76-1.41) |
| Social Isolation | .01 | .03 | 1.01 (.96-1.06) | -.18 | .11 | .83 (.67-1.04) |
| Romantic Relationship Quality | -.03 | .03 | .98 (.93-1.03) | .17 | .11 | 1.19 (.95-1.48) |
| Close Friendships | -.07*** | .02 | .94 (.90-.98) | .16 | .11 | 1.17 (.95-1.45) |
| Optimism | -.04 | .04 | .96 (.89-1.04) | -.49** | .17 | .61 (.44-.86) |
| **Sleep Problems** | | | | | | |
| Perceived Stress | .09*** | .01 | 1.09 (1.08-1.11) | .05 | .05 | 1.05 (.96-1.16) |
| Inability to Cope with Stress | .20*** | .04 | 1.22 (1.14-1.31) | .58** | .18 | 1.783 (1.25-2.54) |
| Social Isolation | .38*** | .03 | 1.46 (1.40-1.54) | .28* | .13 | 1.32 (1.03-1.69) |
| Romantic Relationship Quality | -.11*** | .03 | .90 (.85-.95) | -.25 | .13 | .784 (.60-1.01) |
| Close Friendships | .09*** | .02 | 1.09 (1.05-1.13) | .13 | .12 | 1.14 (.90-1.45) |
| Optimism | .01 | .04 | 1.01 (.94-1.09) | -.34 | .20 | .71 (.48-1.06) |
| **Susceptibility to Illness** | | | | | | |
| Perceived Stress | .03*** | .01 | 1.04 (1.02-1.05) | .03 | .04 | 1.03 (.95-1.112) |
| Inability to Cope with Stress | .18*** | .04 | 1.20 (1.12-1.29) | .20 | .15 | 1.23 (.91-1.65) |
| Social Isolation | .08*** | .03 | 1.09 (1.04-1.14) | -.02 | .11 | .98 (.79-1.21) |
| Romantic Relationship Quality | .00 | .03 | 1.00 (.95-1.06) | -.13 | .11 | .88 (.71-1.08) |
| Close Friendships | .06** | .02 | 1.06 (1.02-1.10) | .14 | .10 | 1.14 (.93-1.40) |
| Optimism | .00 | .04 | 1.00 (.93-1.08) | -.14 | .17 | .87 (.63-1.21) |

Note. Controlled for race, sex, and SES. Heterosexual n = 12,827 or 12,828 depending on outcome. *** $p < .001$, ** $p < .01$, * $p < .05$

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# Appendix

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