



2021

RELIGIOUS BELIEFS AND BEHAVIORS AS PREDICTORS OF SUBSTANCE USE IN FIRST-YEAR COLLEGE STUDENTS: A LONGITUDINAL STUDY

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Digital Object Identifier: <https://doi.org/10.13023/etd.2021.152>

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RELIGIOUS BELIEFS AND BEHAVIORS AS PREDICTORS OF SUBSTANCE USE
IN FIRST-YEAR COLLEGE STUDENTS: A LONGITUDINAL STUDY

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Arts and Sciences
at the University of Kentucky

By
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Lexington, Kentucky
Director: Dr. Charles R. Carlson, Professor of Clinical Psychology
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2021

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ABSTRACT OF DISSERTATION

RELIGIOUS BELIEFS AND BEHAVIORS AS PREDICTORS OF SUBSTANCE USE IN FIRST-YEAR COLLEGE STUDENTS: A LONGITUDINAL STUDY

Substance use is prevalent on college campuses (e.g., Douglas et al., 1997) and can create significant negative consequences (Kodjo & Klein, 2002; NIAAA, 2006). Research suggests that religious beliefs and religious behaviors interact to predict risky substance use in first-year undergraduate students, such that students with religious beliefs but no corresponding behaviors are at risk for significant alcohol use and related problems (Brechtling et al., 2010; Cole et al., 2020). However, these studies have only been cross-sectional in nature.

The current study assessed longitudinally if the interaction of religious beliefs/behaviors influenced first-year undergraduate student substance use across the early adjustment period to college. Additionally, the study explored if perceptions of parental religiosity and/or general parental support variables influenced student substance use and religiosity, given the influence of parental variables on student behaviors (e.g., Ewing et al., 2015). Undergraduate participants ($N=157$) at the University of Kentucky completed surveys at two time points during their first fall semester.

Results indicated that students with higher religious beliefs but lower religious behaviors were the student religious grouping most at risk for substance use (p 's < .01-.05). A direction of effect analysis indicated that substance use behaviors predicted a decline in religious behaviors over time (p 's < .01-.05). Moreover, direction of effect analyses indicated that religious behaviors of mothers negatively predicted student alcohol-related problems over time ($p < .01$), while fathers' religious beliefs positively predicted student religious behaviors over time ($p < .01$). Future interventions should consider these outcomes for helping first-semester college students reduce their risky substance use.

KEYWORDS: Religiosity, substance use, college students

Hannah B. McGee

04/28/2021

Date

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ACKNOWLEDGMENTS

I would like to thank my dissertation chair, Dr. Charles R. Carlson, Ph.D., for his assistance with not only this project but my other research endeavors over the past six years. I have grown significantly as a researcher and academic as a result of his support, guidance, and mentorship, and I am incredibly grateful to have been able to learn from him. I would also like to thank my other committee members, Drs. Jessica Burris, Diane Follingstad, Janet Forren, and Gregory Smith, for their time, feedback, and insights that greatly strengthened the quality of this project and challenged me as a researcher. Finally, I would like to thank Dr. Peggy Keller for her guidance with the statistical analyses of this project. Her time and feedback enabled me to accurately explore the data presented in this work.

I would like to express my appreciation for my husband, Timothy McGee, for his constant encouragement and support throughout my academic journey. I would also like to thank my mother, Beth Prassel, and my late father, Dr. Richard Prassel, Jr., for instilling in me a love for learning and giving me the encouragement to pursue my dreams.

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CHAPTER ONE: INTRODUCTION

1.1 Background

Underage alcohol use and recreational drug use (i.e., “substance use”) have become prevalent on college campuses. Specifically, 80% of US college students report they drink alcohol at least occasionally (Douglas et al., 1997; Johnston et al., 2010) while 51% of college students admit to illegal drug use (Johnston et al., 2014). This problem is particularly apparent early in the college experience, as students often consume substances most during their first year of college (Beets et al., 2009). Unfortunately, such behaviors can create a host of negative consequences, such as injury, sexual assault, legal issues, academic concerns, and even death (Kodjo & Klein, 2002; NIAAA, 2006). However, previous research has found a connection between higher religiosity (i.e., a belief in divine existence with an emphasis on group affiliation and prescribed actions; Cole et al., 2020) and less risky substance use in underage college students (Brechtling & Carlson, 2015; Brown et al., 2007; Burriss et al., 2011; Chen et al., 2004; Ham & Hope, 2003). For the purposes of this study, risky substance use is defined as using substances in frequent or large amounts that could lead to negative consequences.

Despite research attesting to religiosity’s protective effects, recent research has found that it is different *aspects* of religiosity (i.e., beliefs and behaviors) that are protective rather than religiosity itself. More specifically, researchers have found that college students must engage in higher levels of religious behaviors (i.e., frequent engagement in concrete religious actions such as prayer, attending religious services, or reading religious literature) *and* have strong religious beliefs (i.e., passionate

endorsement of a belief in God and a religious value system) to be protected from risky substance use (Brechtling et al., 2010; Cole et al., 2020).

Additionally, these studies have found that students with higher religious beliefs unaccompanied by religious behaviors seem to be the most at risk for detrimental substance use, even more so than their non-religious peers (Brechtling et al., 2010; Cole et al., 2020). In sum, these studies indicate that religious beliefs and religious behaviors interact to predict risky substance use in underage college students, though causal conclusions cannot yet be drawn given the cross-sectional nature of data collection to this point.

There is currently a lack of research as to *why* students with higher religious beliefs but lower religious behaviors would be at risk for heavy substance use. One theory is that this group of students is making choices to use substances that they were not able to prior to living on their own in the college setting (Brechtling et al., 2010). Since many religions discourage substance use, particularly illicit and underage use (Benda et al., 2006; Ellison & Levin, 1998), students from religious families may have been taught to abstain from substances, rather than being taught to use substances responsibly if they choose to do so. Once this group of students arrives at college and are away from their parents' direct influence, they may still maintain a religious values system without wanting to maintain concrete religious behaviors, such as abstaining from substance use. The abovementioned lack of safe substance use training may lead to riskier patterns of use once these students do start to try substances.

This theory makes sense in light of current theories of college student development, specifically that changes in the brain's dopaminergic system during

adolescence/emerging adulthood can lead to increased risky, reward-seeking behavior (e.g., binge drinking), especially in those adolescents who are slower to develop their self-regulation abilities (Steinberg, 2008). Additionally, the adjustment to the college environment includes numerous changes not only in level of supervision (as mentioned previously) but also in living situation and peers (Romm et al., 2020) that may accelerate risky substance use, particularly given the lack of fully developed self-regulatory capacities in many college students. It is possible that students who do not have the discipline to support their religious beliefs with religious behaviors may be struggling with self-regulatory abilities, thus putting them at risk for engaging in risky substance use behaviors once they enter the college environment. Additionally, it could be that students struggling with self-regulatory capacities are not able to use religious behaviors to cope with the stress of the new college environment, and instead are turning to the immediate gratification of substance use. Further research is needed to determine the extent to which these theories are empirically supported.

Though research has been able to identify a higher-risk group of college students for risky substance use, this work thus far has been only cross-sectional in nature, making it difficult to draw conclusions about the direction of the relationship between religiosity and substance use. For instance, do lower levels of religious behaviors (accompanied by higher beliefs) predict risky behaviors, or does engagement in risky behaviors predict a decline in religious behaviors in students with higher religious beliefs? The present study brings more clarity to this question by means of a longitudinal data collection initiative. More specifically, the project followed college students from the beginning of their first semester of college to mid-semester of their first college semester to assess the influence

of religious beliefs/behaviors on substance use behaviors in students first adjusting to the college environment. This allowed for understanding of the direction of the relationship between religiosity and substance use among underage college students who may be at high risk for acceleration of risky substance use, given their adjustment to the stressors of a new environment (Chon & Kim, 2000), changes in level of parental supervision, and frequent consumption of substances more than older college students (Beets et al., 2009). This study's findings could have implications for interventions targeting first semester undergraduate students who are at risk for untoward substance use in the early weeks of their college experience.

Most young adults live with at least one parent before embarking on the transition to college. Thus, it is reasonable to assume that parental influences, including the role of religiosity, exert powerful influences on the behavior of young adults. As religion is often introduced to individuals by their families, this raises the question of whether *parental* religiosity predicts student religiosity and/or student substance use or if student religiosity/substance use behaviors are independent of parental perspectives. Past research has indicated that parental faith and religious traditions were positively associated with young adult religiosity (Myers, 1996; Perkins, 1987). Additionally, past studies have found that parental influence impacts adolescent substance use. One study found that acceptance/respect of general parental values and "filial piety" (i.e., obedience and respect toward parents) may be protective against binge drinking (Piko & Kovacs, 2010). A meta-analysis reported that stronger communication between parents and adolescents is a protective factor against adolescent drinking (Kuntsche & Kuntsche, 2016). One study found a positive association between poor family management after a

teen alcohol and drug related offense and subsequent teen alcohol use (Ewing et al., 2015). Finally, past findings have indicated negative associations between alcohol use and teens valuing family needs over their own needs (Ewing et al., 2015) and living in a nuclear family (Ewing et al., 2015).

Given that many students in the present study are transitioning from living with their families to living on their own, it seems particularly relevant to consider how parental factors may influence students in this adjustment period. The present study elected to include student perceptions of general parental support variables (e.g., parental involvement) in addition to the parental religiosity variables, given above findings that family relationships and parental/adolescent communication can impact adolescent substance use. The understanding of how parental factors impact adolescent substance use/religiosity over time will reveal further information for potential use in substance use interventions targeting first-year college students.

Finally, it is important to acknowledge the potentially differing levels of substance use and religiosity based on ethnicity and gender when analyzing these variables. Specifically, previous research has suggested that black individuals are more religious than other ethnic groups (Barber, 2015), black/Hispanic individuals report more religiosity than white individuals (Chatters et al., 2008; Miltiades & Pruchno, 2002; Rote & Starks, 2010), and different aspects of religiosity (i.e., religious service attendance vs. importance of religion in one's life) vary in their protection against substance use based on race (Meyers et al., 2017). Additionally, research has shown that white individuals use more illicit drugs than other ethnic groups (Rote & Starks, 2010) and that black individuals have less accepting attitudes toward high amounts of alcohol use than other

ethnic groups (Caetano & Clark, 1999). Finally, past research indicates that males have more substance use opportunities than females (Caris et al., 2009; Delva et al., 1999; Van Etten & Anthony, 1999) and college-aged males reported higher levels of alcohol addiction than college-aged females (Greenberg et al., 1999). Based on this body of research, the present study chose to investigate ethnic and gender differences on the substance use and religiosity variables so as to appropriately include gender and ethnicity in the regression analyses when indicated.

1.2 Hypotheses

1. It was hypothesized that the present study's data would replicate that of previous research such that student substance use would differ based on their reported levels of religious beliefs/behaviors. Specifically, it was predicted that students with higher religious beliefs but lower religious behaviors would use substances in more risky ways than any other religious grouping, while students with both higher religious beliefs and higher religious behaviors would use substances less frequently and in fewer amounts than students in any other religious grouping.

2. It was hypothesized that the interaction of religious beliefs/behaviors at Time 1 would predict alcohol use variables at Time 2. More specifically, it was predicted that religious grouping would predict frequency and quantity of alcohol use and alcohol-related problems across time with religious behaviors at Time 1 moderating the relationship between beliefs at Time 1 and alcohol use at Time 2 (i.e., being in the higher beliefs/higher behaviors group at Time 1 would negatively predict alcohol use at Time 2, while being in the higher beliefs/lower behaviors group at Time 1 would positively predict alcohol use at Time 2).

3. It was hypothesized that the interaction of religious beliefs/behaviors at Time 1 would predict drug use variables at Time 2. More specifically, it was predicted that religious grouping would predict lifetime drug use and frequency of drug use across time with religious behaviors at Time 1 moderating the relationship between beliefs at Time 1 and drug use at Time 2 (i.e., being in the higher beliefs/higher behaviors group at Time 1 would negatively predict drug use at Time 2, while being in the higher beliefs/lower behaviors group at Time 1 would positively predict drug use at Time 2).

4. It was hypothesized that perceptions of parental support and/or parental religiosity at Time 1 would predict student substance use and student religiosity at Time 2. This hypothesis was exploratory in nature.

CHAPTER TWO: METHOD

2.1 Participants

Participants were University of Kentucky (UK) first-time freshman students between the ages of 18-20 years. The sample was limited to this age range because of the study's focus on underage drinking patterns during the first semester of college life. Participants were recruited during the early weeks of their first fall semester through the UK Psychology research participant pool. The project concluded with follow-up assessments during the latter part of the semester. All research procedures were approved by the University of Kentucky Institutional Review Board (IRB) for the Protection of Human Participants.

The longitudinal design of the project began with the recruitment of 217 students who participated at Time 1 of the study. Attrition occurred from Time 1 to Time 2, with only 157 students participating at both study time points and meeting the age requirements. Of these 157 students, the majority identified as female (81.5%). Further, the majority of students were 18-years-old (84.7%) with 14.6% being 19-years-old and 0.6% being 20-years-old; the average age overall was 18.16 years. The ethnic breakdown of the current sample was 77.7% Caucasian, 12.1% African American, 5.1% Asian, 4.5% Hispanic/Latino, and 0.6% American Indian/Alaskan Native. The entire sample reported being single. These data are summarized in Table 1.

Students who participated at Time 1 only ($N = 60$) had comparable demographics to students who participated at both time points. Specifically, the majority of these students identified as female (83.3%). Further, the majority were 18-years-old (66.7%)

with 26.7% being 19-years-old and 6.7% being 20-years-old; the average age overall was 18.40 years. The ethnic breakdown was 73.3% Caucasian, 8.3% African American, 3.3% Asian, 11.7% Hispanic/Latino, and 3.3% Other/Unknown. Most of the sample (98.3%) reported being single, while 1.7% reported cohabitating.

2.2 Measures

2.2.1 Demographic form—Screening Survey and Both Time Points:

Participants were asked to disclose their age, gender, ethnicity, and marital status.

2.2.2 Drinking Behaviors Measure—Screening Survey and Time Point #1:

Participants were given two single-item measures assessing drinking behaviors in the last year (Cole et al., 2020). The first assessed drinking frequency on a scale of 0 (“I didn’t drink any alcohol”) to 17 (“Four or more times a day”). The second assessed drinking quantity in a typical drinking occasion on a scale of 0 (“I didn’t drink any alcohol”) to 13 (“More than 25 drinks”). Before being asked about drinking quantity, students were provided with information about what a standard drink is. Such single-item measures yielded strong test-retest reliability (r 's = 0.84-0.85 across 11 weeks) and correlated moderately with two-week diary logs of alcohol consumption (r 's = 0.72 and 0.56, respectively) (Dollinger & Malmquist, 2009). In the present sample, adequate test-retest reliability was achieved ($r = .76$ for frequency and $r = .68$ for quantity) when comparing answers at Time 1 and Time 2.

2.2.3 Drinking Behaviors Measure—Time Point #2:

Participants were presented with two single-item measures assessing drinking behaviors in the last month (Cole et al., 2020). The first assessed drinking frequency on a scale of 0 (“I didn’t drink any alcohol”) to 13 (“Four or more times a day”). The second assessed drinking quantity in a typical drinking occasion on a scale of 0 (“I didn’t drink any alcohol”) to 13 (“More than 25 drinks”). Before being asked about drinking quantity, students were provided with information about what a standard drink is. As noted previously, such single-item measures yielded strong test-retest reliability (r 's = 0.84-0.85 across 11 weeks) and correlated moderately with two-week diary logs of alcohol consumption (r 's = 0.72 and 0.56, respectively) (Dollinger & Malmquist, 2009). In the present sample, adequate test-retest reliability was achieved ($r = .76$ for frequency and $r = .68$ for quantity) when comparing answers at Time 1 and Time 2.

2.2.4 College Alcohol Problems Scale – Revised—Screening Survey and Time Point #1:

Participants were presented with eight problems that they may have encountered as a direct result of drinking (e.g., “Feeling sad, blue, or depressed”) and asked to rate how often each problem occurred in an average month over the past year (Maddock et al., 2001). Frequency was rated on a scale of 0 (“Never”) to 5 (“10 or more times”). This scale demonstrated good internal consistency and external validity in a sample of college students (Maddock et al., 2001). The Cronbach’s alpha for the current sample was $\alpha = 0.78$.

2.2.5 College Alcohol Problems Scale – Revised—Time Point #2:

Participants were presented with eight problems that they may have encountered as a direct result of drinking (e.g., “Feeling sad, blue, or depressed”) and asked to rate how often each problem occurred in the past month (Maddock et al., 2001). Frequency was rated on a scale of 0 (“Never”) to 5 (“10 or more times”). As mentioned previously, this scale demonstrated good internal consistency and external validity in a sample of college students (Maddock et al., 2001). The Cronbach’s alpha for the current sample was $\alpha = 0.85$.

2.2.6 Drug Use Behaviors Measure—Screening Survey and Time Point #1:

Participants were given a list of 10 different drug categories (e.g., cannabis, tobacco products) and asked to indicate if, in their lifetime, they have *not* used it (“0”) or they *have* used it (“1”) (ASSIST V. 3.0, World Health Organization Assist Working Group, 2002; Humeniuk, Ali, World Health Organization, & ASSIST Phase II Study Group, 2006). A composite lifetime drug use participant score was created by adding up how many drug categories they reported using. The Cronbach’s alpha for this scale in the current sample was $\alpha = .63$.

Participants were then given the same list of drugs and asked to rate frequency of use in the past year on a scale of 0 (“Never”) to 4 (“Daily or Almost Daily”) (ASSIST V. 3.0, World Health Organization Assist Working Group, 2002; Humeniuk, Ali, World Health Organization, & ASSIST Phase II Study Group, 2006). The original time period measured by the scale was changed (i.e., from past three months to past year) to be

consistent with the present study's alcohol use measures). This measure yielded good coefficient alphas (ranging from $\alpha = 0.68-0.88$) in a sample of adolescent primary care patients (Gryczynski, et al., 2015). In the current sample, the Cronbach's alpha was $\alpha = .64$.

2.2.7 Drug Use Behaviors Measure—Time Point #2:

Participants were given a list of 10 different drug categories (e.g., cannabis, tobacco products) and asked to indicate if, in their lifetime, they have *not* used it ("0") or they *have* used it ("1") (ASSIST V. 3.0, World Health Organization Assist Working Group, 2002; Humeniuk et al., 2006). A composite lifetime drug use participant score was created by adding up how many drug categories they reported using. The Cronbach's alpha for the current sample was $\alpha = .70$.

Participants were then given the same list of drugs and asked to rate frequency of use in the past month on a scale of 0 ("Never") to 4 ("Daily or Almost Daily") (ASSIST V. 3.0, World Health Organization Assist Working Group, 2002; Humeniuk et al., 2006). The original time period measured by the scale was changed (i.e., from past three months to past month) to be consistent with the present study's alcohol use measures. This measure yielded good coefficient alphas (ranging from $\alpha = 0.68-0.88$) in a sample of adolescent primary care patients (Gryczynski, et al., 2015). In the current sample, the Cronbach's alpha was $\alpha = .51$.

2.2.8 Religious Behaviors Measure—Time Point #1:

Participants were presented with four examples of religious behaviors to assess frequency of engagement in them in the last year, on a scale of 0 (“Never”) to 7 (“Several times a day”) (Fetzer Institute/NIA, 1999). An example of a religious behavior item is, “How often do you pray privately in places other than at church or synagogue?” This scale demonstrated good internal consistency and test-retest reliability in an adolescent sample (Harris et al., 2008). The Cronbach’s alpha for the current sample was $\alpha = 0.80$.

2.2.9 Religious Behaviors Measure—Time Point #2:

Participants were presented with four examples of religious behaviors to assess frequency of engagement in them in the last month, on a scale of 0 (“Never”) to 7 (“Several times a day”) (Fetzer Institute/NIA, 1999). An example of a religious behavior item is, “How often do you watch or listen to religious programs on TV or radio?” As noted above, this scale demonstrated good internal consistency and test-retest reliability in an adolescent sample (Harris et al., 2008). The Cronbach’s alpha for the current sample was $\alpha = 0.78$.

2.2.10 Religious Beliefs Measure:

Participants were given seven items to assess degree of belief in some type of general religious values system, typically on a scale of 0 (“Disagree strongly”) to 4

(“Agree strongly”) (Fetzer Institute/NIA, 1999). A sample item is, “God’s goodness and love are greater than we can possibly imagine.” A single-item from an older version of this scale showed substantial test-retest reliability in an adolescent sample (Harris et al., 2008). The Cronbach’s alpha for the current sample was $\alpha = 0.89$ at both Times 1 and 2.

2.2.11 The Paulhus Balanced Inventory of Desirable Responding:

This measure was included to screen out participants engaging in excessive impression management or self-deception on the surveys, thus potentially skewing responses. Participants were given a 40-item measure assessing their tendency to answer survey questions in socially desirable ways (Paulhus, 1991). A sample item is, “I sometimes drive faster than the speed limit”, and each item is answered on a scale of 1 (“Not true”) to 7 (“Very true”). Typical coefficient alphas for the self-deceptive (SDE) scale range from $\alpha = .67-.77$, while typical alphas for the impression management (IM) scale range from $\alpha = .77-.85$ (Paulhus, 1991). The Cronbach’s alphas in the present study for the SDE scales were $\alpha = .78$ at Time 1 and $\alpha = .74$ at Time 2. The Cronbach’s alphas in the present study for the IM scales were $\alpha = .75$ at Time 1 and $\alpha = .73$ at Time 2.

2.2.12 Religious Behaviors Measure (Parent):

Participants were given four items assessing the frequency of their mother’s engagement in religious behaviors followed by four items assessing their father’s frequency of engagement in such behaviors (Fetzer Institute/NIA, 1999). If a student did not have contact with or feel close enough to either their mother or father (or both) to answer these, they had the option to leave items about that given parent blank. This is the

same religious behaviors measure mentioned previously that was given to the students. Items were scored on a scale of 0 (“Never”) to 7 (“Several times a day”) with the option of 8 (“I don’t know”). Participants who answered “I don’t know” to 2 or more of these items were excluded from analyses involving this variable. A sample item was, “How often does your mother read the *Bible* or other religious literature?” The Cronbach’s alphas for the current sample were $\alpha = 0.91$ for mother religious behaviors at both time points, and α ’s = 0.90 and 0.88 for father religious behaviors at Times 1 and 2, respectively.

2.2.13 Religious Beliefs Measure (Parent):

Participants were presented with seven items to assess degree of their mother’s belief in various religious principles followed by seven items assessing the degree of their father’s beliefs (Fetzer Institute/NIA, 1999). If a student did not have contact with or feel close enough to either their mother or father (or both) to answer these, they had the option to leave items about that given parent blank. This is the same religious beliefs measure mentioned previously that was given to the students. Items were scored on a scale of 0 (“Disagree strongly”) to 4 (“Agree strongly”) with the option of 5 (“I don’t know”). Participants who answered “I don’t know” to 3 or more of these items were excluded from analyses involving this variable. A sample item is, “How much would your father agree with the statement, ‘Despite all the things that go wrong, the world is still moved by love?’” The Cronbach’s alphas for the current sample were $\alpha = 0.92$ for mother religious beliefs at both time points, and α ’s = 0.94 and 0.95 for father religious beliefs at Times 1 and 2, respectively.

2.2.14 Perceptions of Parents Scale—The College-Student Scale:

Participants were given 21 items assessing their perceived maternal support followed by 21 items assessing perceived paternal support, measured on a scale of 1 (“Not at all true”) to 7 (“Very true”) (Robbins, 1994). For each parent, the scale assessed three categories: parental involvement, parental autonomy support, and parental warmth. A sample item is, “My mother clearly conveys her love for me.” If a student did not have contact with or feel close enough to either their mother or father (or both) to answer these, they had the option to leave items about that given parent blank. The Cronbach’s alphas for the current sample were as follows: mother involvement (Time 1: $\alpha=0.90$, Time 2: $\alpha=0.90$), mother autonomy support (Time 1: $\alpha=0.91$, Time 2: $\alpha=0.92$), mother warmth (Time 1: $\alpha=0.92$, Time 2: $\alpha=0.92$), father involvement (Time 1: $\alpha=0.88$, Time 2: $\alpha=0.91$), father autonomy support (Time 1: $\alpha=0.90$, Time 2: $\alpha=0.90$), father warmth (Time 1: $\alpha=0.87$, Time 2: $\alpha=0.89$).

2.3 Procedure

Participants were recruited in introductory psychology courses through the Student Research Participation (SONA) system. Screening questions for the study were provided to the administrator of the psychology subject pool screening survey—a survey sent to students in introductory psychology courses for course credit. These screening questions were the same demographic and substance use questions asked at Time 1 of the current study. Attempts were made to recruit fairly equal numbers of substance users so as to reduce zero inflation in the substance use variables. To do this, two groups of substance users were identified. A higher-using group of participants was determined to

be students drinking alcohol at least twice a month and at least two drinks per use episode. A low baseline was set for the higher-using group so as to include as many participants drinking alcohol at least semi-frequently as possible. Analyses indicated that 142 students who participated in the pre-screening survey fell into this category. A lower-using group of participants was determined to be students using alcohol ranging from not at all to up to once a month and using 0-1 drinks per use episode. Analyses indicated that 253 individuals who participated in the pre-screening survey fell into this category. Email invitations were sent through SONA to all of these students (395 in total). Pre-screening survey answers were not associated with student identity so that the investigator was only able to see how many students qualified for particular groups rather than SONA revealing which student gave which set of answers. The option through SONA to send a mass email to all qualifying students within each group was then used. To protect confidentiality, this option does not allow students to see which other students are receiving the email.

Qualifying students who chose to participate in the first round of surveys signed up for the study on SONA. They then received access to the survey link. This link took students to a consent form and the survey for Time 1, both of which were on the Redcap server platform. Participants who completed the survey were routed to a separate Redcap survey to provide their name and email address so they could receive ½ SONA research credits. These names and email address were not associated with survey answers to protect confidentiality of participants. Students were able to complete the survey from 09/08/2020 to 09/16/2020 which corresponded to the first several weeks of their initial college semester.

Two months later, students who completed the first round of surveys were emailed a link to the second round of surveys via the RedCap server. Participants were sent reminder emails every week-day until study completion. The window of time to take the second survey ranged from 11/09/2020 to 12/04/2020. Following completion of the survey round #2, participants were routed to a separate RedCap survey asking for their name, email, and mailing address so the research team could mail participants a \$20 compensation check. These participant identifiers were not associated with survey data to maintain confidentiality. Following completion of survey #2, participants were emailed a debriefing form.

Participant answers from Time 1 to Time 2 were linked by IP addresses only rather than subject identifiers. These IP addresses could only be viewed by RedCap administrators. Specifically, the research team unchecked the Participant Identifier field on Redcap so the research team was *not* able to associate email addresses with responses. All study procedures were reviewed and approved by the University of Kentucky IRB. Treatment of participants aligned with the ethical standards of the American Psychological Association.

2.4 Analyses

To test hypothesis #1, independent samples single-tailed t-tests were used. The a priori hypotheses allowed for these focused contrasts between the higher religious beliefs, lower religious behaviors (i.e., the hypothesized higher risk) group and the other religious groups, and between the higher religious beliefs, higher religious behaviors (i.e., the hypothesized lower risk) group and the other religious groups.

To test hypotheses #2 and #3, a direction of effect analysis from Time 1 to Time 2 was conducted to explore if religiosity influences substance use or if substance use influences religiosity since previous cross-sectional analyses have not allowed investigation of which variable is predicting which outcome. Previous cross-sectional analyses of these models have only shown associations between variables rather than directional effects across time. For this study, Poisson loglinear regression or Negative Binomial regression strategies were used to analyze data, given that the variables of interest were count data (i.e., non-negative integers with a range from 0 to a given upper bound depending on the measure at hand). In other words, these models are used to better fit variables that cannot take on an infinite number of values (Grace-Martin, n.d.).

All models were fit with both Poisson and Negative Binomial models to determine the better fit. To compare systematically between these two models, several statistical comparisons were made. First, Pearson chi-square values (i.e., a measure of over-dispersion and goodness of model fit) were considered. Using empirically validated criteria (Payne et al., 2018), it was determined that chi-square values less than and/or equal to 1.2 performed well with Poisson regression, while those with values higher than that (up to 5.0) performed better with a Negative Binomial model. Additionally, the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), and the Log Likelihood value (all statistics that measure model fit) were compared between the two models, and the model with the smaller AIC, smaller BIC, and larger log likelihood was considered the most accurate (Yusuf & Ugalahi, 2015). For most of the models with zero-inflated outcome variables, neither Poisson nor Binomial Regression models fit the data as well as Poisson/Binomial models specifically designed to deal with zero-inflated

data did (i.e., zero-inflated count models). To choose between a Poisson or Negative Binomial count model, similar criteria to the above were employed (i.e., comparing Log Likelihood and AIC values between the two models). To deal with excess zeros, these zero-inflated analyses produced two models per regression analysis: the original regression model being assessed (e.g., does the interaction of beliefs/behaviors at Time 1 predict alcohol frequency at Time 2?) and a model predicting the existence of excess zeros across time (e.g., does the beliefs/behaviors interaction at Time 1 predict excess zeros on the alcohol frequency measure at Time 2?).

The first major regression analysis was to test whether the religious behaviors/beliefs interaction at Time 1 predicted alcohol and drug use at Time 2 such that religious behaviors at Time 1 would moderate the relationship between religious beliefs at Time 1 and substance use at Time 2. In this regression model, the substance use variable at Time 1 was entered as a predictor variable (to test for an auto-regressive effect) and the religious beliefs/religious behaviors variables at Time 1 were entered as the predictor variables of interest (both mean-centered to resolve issues of multicollinearity, given the high correlation between religious beliefs and behaviors). Any covariates (e.g., gender, ethnicity) being controlled for as predictor variables were also included in the model.

A second major regression analysis was used to test if the substance use variables at Time 1 predicted religious behaviors or beliefs, respectively, at Time 2. In this model, the religious behaviors or beliefs variable at Time 1 was entered as a predictor variable (to test for an auto-regressive effect), followed by the given substance use variable at

Time 1 as the predictor variable of interest. Any covariates (e.g., gender, ethnicity) being controlled for were also entered as predictor variables.

Finally, to test hypothesis #4, exploratory analyses were performed to determine if perceptions of parental support and/or parental religiosity predicted student substance use and student religiosity. Tests were performed to assess if parental variables at Time 1 predicted student substance use and student religiosity at Time 2, with the parental variable for the given model (e.g., mother's religious behaviors at Time 1) and any covariates being controlled for (e.g., gender, ethnicity) entered as predictor variables. To assess direction of effect appropriately, the auto-regressive effect was also determined for each model (e.g., in a model predicting alcohol use frequency at Time 2, alcohol use frequency at Time 1 was entered as a predictor variable).

CHAPTER THREE: RESULTS

3.1 Validity Checks and Covariates

First, mean differences on the study's primary variables (i.e., religiosity variables and substance use variables) between participants completing only the first survey ($N = 60$) and participants completing both surveys ($N = 157$) were examined. Independent samples t-tests revealed that Time 1 only participants reported significantly higher levels of alcohol use quantity ($M = 2.57, SD = 2.46$) than both time participants ($M = 1.92, SD = 2.00$), $t(215) = -2.00, p = .048, d = 0.29$, and significantly more alcohol-related problems ($M = 3.58, SD = 5.15$) than both time participants ($M = 1.76, SD = 3.37$), $t(79.09) = -2.55, p = .013, d = 0.42$.

Given the self-report and online nature of the data collection, a validity check was performed on the 157 participants who completed both surveys to ensure the most accurate dataset possible. This validity check involved scoring and evaluating participant's answers on the Paulhus Balanced Inventory of Desirable Responding (Paulhus, 1991). Thirty-two participants were excluded from final data analyses for demonstrating blatant response patterns of excessive self-deceptive enhancement or impression management on the basis of their Paulhus scores exceeding one standard deviation from the mean of a college student population that this scale was normed with (Paulhus, 1991). This resulted in the data of 125 participants being retained for final data analyses.

Independent samples t-tests revealed that, at time one, excluded participants reported significantly lower levels of alcohol use frequency ($M = 1.44, SD = 2.17$) than included participants ($M = 3.40, SD = 3.18$), $t(69.18) = 4.10, p = .000, d = 0.72$, significantly less alcohol-related problems ($M = 0.63, SD = 1.29$) than included participants ($M = 2.05, SD = 3.67$), $t(141.06) = 3.56, p = .000, d = 0.52$, significantly less lifetime drug use ($M = 0.75, SD = 0.88$) than included participants ($M = 1.51, SD = 1.35$), $t(72.85) = 3.87, p = .000, d = 0.67$, significantly less drug use frequency ($M = 0.88, SD = 1.16$) than included participants ($M = 2.73, SD = 3.03$), $t(133.06) = 5.45, p = .000, d = 0.81$, significantly more religious behaviors ($M = 9.72, SD = 6.29$) than included participants ($M = 6.31, SD = 5.50$), $t(155) = -3.04, p = .003, d = 0.58$, and significantly more religious beliefs ($M = 19.81, SD = 5.59$) than included participants ($M = 17.10, SD = 6.08$), $t(155) = -2.29, p = .023, d = 0.46$.

Similarly, at time two, excluded participants reported significantly less alcohol use frequency ($M = 2.59, SD = 3.28$) than included participants ($M = 4.38, SD = 3.76$), $t(155) = 2.46, p = .015, d = 0.51$, significantly less alcohol use quantity ($M = 0.94, SD = 1.46$) than included participants ($M = 2.02, SD = 2.11$), $t(68.40) = 3.37, p = .001, d = 0.60$, significantly less alcohol-related problems ($M = 0.84, SD = 2.80$) than included participants ($M = 2.14, SD = 3.93$), $t(66.05) = 2.15, p = .036, d = 0.38$, significantly less lifetime drug use ($M = 0.91, SD = 1.09$) than included participants ($M = 1.74, SD = 1.51$), $t(65.26) = 3.56, p = .001, d = 0.63$, significantly less drug use frequency ($M = 1.16, SD = 1.95$) than included participants ($M = 2.27, SD = 2.48$), $t(155) = 2.37, p = .019, d = 0.50$, significantly more religious behaviors ($M = 10.00, SD = 5.91$) than included participants ($M = 6.05, SD = 5.63$), $t(155) = -3.51, p = .001, d = 0.68$, and significantly more religious

beliefs ($M = 19.75$, $SD = 5.67$) than included participants ($M = 17.07$, $SD = 5.77$), $t(155) = -2.35$, $p = .020$, $d = 0.47$. These findings are expected given that students with high social desirability scores would report less substance use (given that underage substance use is often not socially acceptable) and more religiosity (given that religiosity is often socially acceptable) than students not as wary of answering in socially desirable ways.

It should be noted that as a further check on the integrity of the dataset with the elimination of these 32 individuals, regression models for hypotheses two and three with all 157 participants were conducted while controlling for self-deceptive enhancement and impression management. These analyses assessed if the social desirability measures were significant covariates when predicting substance use, given that underage substance use is often not considered socially acceptable. None of these analyses suggested that social desirability significantly predicted substance use variables/religiosity variables across time (all p 's > .05).

Given that social desirability was not a significant covariate when running models with all 157 participants, one could argue that all 157 individuals should have been retained for analyses. Additionally, one could argue that these 32 individuals who reported high religiosity but low substance use may actually be answering truthfully, given the expected negative relationship between religiosity and substance use. To address these concerns, the present study ran the regression analyses for hypotheses two and three with all 157 individuals. Results revealed that no analyses were significantly affected except the regression results that only trended toward significance with 125 individuals became fully statistically significant. The present study elected to use the more conservative approach by proceeding with the elimination of the 32 individuals

deemed to have excessive socially desirable response patterns, as this had been the plan when the study began to best report accurate data and aligned with previous study methodologies employed by this study's research group (e.g., Cole et al., 2020). This decision is discussed further in the "Limitations" section.

The means and standard deviations of the primary variables of interest can be seen in Tables 2 and 3. Overall, at both Times 1 and 2, the sample had a moderately high score on the religious beliefs measure but a moderately low score on the religious behaviors measure. In the same vein, at both Times 1 and 2, participants had relatively low scores on the substance use measures.

Tests were performed to see if demographic characteristics influenced the primary variables of interest (i.e., religiosity variables and substance use variables) as discussed in the "Introduction" section. Independent samples t-tests indicated that males reported more alcohol-related problems ($M = 3.57, SD = 4.22$) than females ($M = 1.71, SD = 3.46$) at Time 1, $t(123) = -2.23, p = .027, d = 0.48$. These tests also indicated that, males ($M = 3.09, SD = 2.81$) reported a higher alcohol use quantity than females ($M = 1.78, SD = 1.86$) at Time 2, $t(26.48) = -2.14, p = .042, d = 0.55$, and reported a higher drug use frequency ($M = 3.30, SD = 2.80$) than females ($M = 2.04, SD = 2.35$) at Time 2, $t(123) = -2.25, p = .026, d = 0.49$. Given these findings, gender was entered as a model covariate when fitting longitudinal models involving alcohol use quantity, alcohol-related problems, and drug use frequency.

When differences based on ethnicity were examined, tests revealed that white students ($M = 3.76, SD = 3.08$) reported a higher alcohol use frequency than black students ($M = 1.47, SD = 2.03$) at Time 1, $t(25.42) = 3.75, p = .001, d = 0.88$, and that

white students ($M = 2.33$, $SD = 3.82$) reported more alcohol-related problems than black students ($M = 0.33$, $SD = 1.29$) at Time 1, $t(61.44) = 3.90$, $p = .001$, $d = 0.70$, whereas black students ($M = 9.73$, $SD = 5.57$) reported a higher frequency of religious behaviors than white students ($M = 6.05$, $SD = 5.34$) at Time 1, $t(109) = -2.47$, $p = .015$, $d = 0.68$.

Additionally, tests revealed that white students ($M = 2.43$, $SD = 4.01$) reported more alcohol-related problems than black students ($M = 0.40$, $SD = 1.55$) at Time 2, $t(50.50) = 3.54$, $p = .001$, $d = 0.67$. Finally, black students ($M = 9.73$, $SD = 5.57$) reported higher levels of religious behaviors than Hispanic students ($M = 2.00$, $SD = 2.35$) at Time 1, $t(18) = 2.97$, $p = .008$, $d = 1.81$, while black students ($M = 8.87$, $SD = 5.26$) reported higher levels of religious behaviors than Hispanic students ($M = 2.80$, $SD = 3.83$) at Time 2 as well, $t(18) = 2.36$, $p = .030$, $d = 1.32$. Given these findings, ethnicity was entered as a covariate when fitting longitudinal models involving alcohol use frequency, alcohol-related problems, and religious behaviors. Given the over-representation of white students in the present sample, ethnicity was entered as a dummy coded variable (i.e., “White” vs. “Other”) in analyses.

3.2 Examination of Hypothesis #1

The first hypothesis of the current study was that students would differ in their substance use based on their reported levels of religious beliefs/behaviors. Specifically, it was hypothesized that students with higher religious beliefs but lower religious behaviors would use substances more frequently and in higher amounts than other participants with both higher beliefs and higher behaviors, both lower beliefs and lower behaviors, and lower beliefs but higher behaviors. It was also hypothesized that students with both

higher religious beliefs and higher religious behaviors would use substances less frequently and in fewer amounts than students in any other religious beliefs/behaviors category.

To test these hypotheses and in accordance with past studies (Brechtling et al., 2010; Cole et al., 2020), four religious groupings were constructed by using a median split to divide both the religious behaviors/beliefs variables into higher and lower groups. The four groups were constructed as follows: 1. Higher beliefs/Higher behaviors (n Time 1 = 53; n Time 2 = 54); 2. Higher beliefs/Lower behaviors (n Time 1 = 10; n Time 2 = 13); 3. Lower beliefs/Higher behaviors (n Time 1 = 13; n Time 2 = 18); 4. Lower beliefs/Lower behaviors (n Time 1 = 49; n Time 2 = 40). The numbers in each group changed from Time 1 to Time 2 due to some students changing their level of behaviors and/or beliefs as the semester went on. Independent samples one-tailed t-tests were run to test for significant differences in substance use variable means based on religious grouping. The present study did not control for multiple comparisons in these analyses (e.g., use the Bonferroni procedure or other similar method) given concerns that such controls may inflate the risk of false negatives and hide a true effect present in the data (Perneger, 1998). Moreover, focused contrasts were used given the a priori nature of hypothesis one, whereby minimizing the numbers of statistical tests used. For the first step in testing hypothesis one, the substance use means of the higher religious beliefs/lower religious behaviors group were compared to the substance use means of the other three religious groupings which were combined into a single group.

When assessing mean differences at Time 1, the higher/lower group reported significantly higher alcohol use frequency ($M = 6.20$, $SD = 3.55$) than the combined other

three groups ($M = 3.15$, $SD = 3.04$), $t(123) = 3.01$; $p = .002$; $d = 0.92$, significantly higher alcohol use quantity ($M = 3.50$, $SD = 2.42$) than the other groups ($M = 1.95$, $SD = 1.91$), $t(123) = 2.41$, $p = .009$, $d = 0.71$, and significantly higher alcohol-related problems ($M = 4.50$, $SD = 4.45$) than the other groups ($M = 1.84$, $SD = 3.53$), $t(123) = 2.24$, $p = .014$, $d = 0.66$. Though the following mean differences were not statistically significant, the higher/lower group reported more lifetime drug use at Time 1 ($M = 1.60$, $SD = 1.17$) than the other groups ($M = 1.50$, $SD = 1.37$), $t(123) = 0.21$, $p = .416$, $d = 0.08$, and more drug use frequency ($M = 3.70$, $SD = 3.20$) than the other groups ($M = 2.64$, $SD = 3.02$), $t(123) = 1.06$, $p = .147$, $d = 0.34$.

When assessing mean differences at Time 2, the higher/lower group reported significantly higher levels of alcohol use frequency ($M = 6.00$, $SD = 3.74$) than the combined other three groups ($M = 4.20$, $SD = 3.73$), $t(123) = 1.65$, $p = .05$, $d = 0.48$, and significantly higher levels of alcohol use quantity ($M = 3.39$, $SD = 2.60$) than the other groups ($M = 1.86$, $SD = 2.00$), $t(123) = 2.52$, $p = .007$, $d = 0.66$. Though none of the following mean differences reached statistical significance, the higher/lower group had a higher alcohol-related-problems mean ($M = 3.31$, $SD = 4.72$) than the other groups ($M = 2.01$, $SD = 3.83$), $t(123) = 1.13$, $p = .131$, $d = 0.30$, a higher lifetime drug use mean ($M = 2.00$, $SD = 1.08$) than the other groups ($M = 1.71$, $SD = 1.56$), $t(123) = 0.64$, $p = .261$, $d = 0.22$, and a higher drug use frequency mean ($M = 2.69$, $SD = 2.10$) than the other groups ($M = 2.22$, $SD = 2.52$), $t(123) = 0.65$, $p = .260$, $d = 0.20$.

The second major step in testing hypothesis #1 was to compare the substance use means of the higher religious beliefs, higher religious behaviors group to the substance

use means of the other three religious groupings which were combined into a single group.

When assessing mean differences at Time 1, the higher/higher group reported significantly less alcohol use frequency ($M = 2.70, SD = 2.74$) than the combined other three groups ($M = 3.90, SD = 3.39$), $t(121.86) = -2.12, p = .015, d = 0.39$, significantly less alcohol-related problems ($M = 1.40, SD = 3.08$) than the other groups ($M = 2.53, SD = 4.00$), $t(122.72) = -1.79, p = .038, d = 0.32$, significantly less lifetime drug use ($M = 1.25, SD = 1.22$) than the other groups ($M = 1.71, SD = 1.41$), $t(123) = -1.92, p = .029, d = 0.35$, and significantly less drug use frequency ($M = 1.98, SD = 2.20$) than the other groups ($M = 3.28, SD = 3.44$), $t(120.86) = -2.57, p = .006, d = 0.45$. Though the following mean difference did not reach statistical significance, the higher/higher group reported less alcohol use quantity ($M = 1.85, SD = 1.88$) than the other groups ($M = 2.24, SD = 2.07$), $t(123) = -1.08, p = .142, d = 0.20$.

When assessing mean differences at Time 2, the higher/higher group reported significantly less lifetime drug use ($M = 1.43, SD = 1.27$) than the combined other three groups ($M = 2.00, SD = 1.64$), $t(123) = -2.08, p = .020, d = 0.39$, and significantly less drug use frequency ($M = 1.80, SD = 2.09$) than the other groups ($M = 2.63, SD = 2.70$), $t(123) = -1.89, p = .031, d = 0.34$. Though the following mean differences were not significant, the higher/higher group reported less alcohol use frequency ($M = 3.82, SD = 3.60$) than the other groups ($M = 4.82, SD = 3.85$), $t(123) = -1.48, p = .071, d = 0.27$, less alcohol use quantity ($M = 1.89, SD = 2.11$) than the other groups ($M = 2.11, SD = 2.13$), $t(123) = -0.59, p = .280, d = 0.10$, and less alcohol-related problems ($M = 2.10, SD = 3.94$) than the other groups ($M = 2.18, SD = 3.95$), $t(123) = -0.13, p = .450, d = 0.02$.

3.3 Examination of Hypothesis #2

The second hypothesis proposed that the interaction of religious beliefs/behaviors at Time 1 would predict alcohol use variables at Time 2. More specifically, it was expected that religious grouping would predict frequency and quantity of alcohol use and alcohol-related problems across time (i.e., being in the higher/higher group at Time 1 would negatively predict alcohol use at Time 2, while being in the higher/lower group at Time 1 would positively predict alcohol use at Time 2). In other words, religious beliefs and behaviors would interact to predict alcohol use with religious behaviors at Time 1 moderating the relationship between beliefs at Time 1 and alcohol use at Time 2.

All of the alcohol use variables in the study were zero-inflated. At Time 1, approximately 32% of the sample denied alcohol use in the past year while 68% of the sample denied experiencing any alcohol-related problems in a typical month in the past year. At Time 2, 39% of the sample denied alcohol use in the past month while 67% of the sample denied experiencing any alcohol-related problems in the past month.

To assess the potential effect of interacting religious beliefs/behaviors at Time 1 on alcohol use variables at Time 2, zero-inflated regression models were run. Results from the count model in a zero-inflated Poisson regression model indicated that neither religious behaviors ($B = -.010, p = .546$), religious beliefs ($B = .004, p = .764$), nor the interaction ($B = .001, p = .614$) at Time 1 predicted alcohol use frequency at Time 2. In the same vein, neither religious behaviors ($B = .011, p = .635$), religious beliefs ($B = .005, p = .805$), nor the interaction ($B = -.004, p = .254$) at Time 1 predicted alcohol use

quantity at Time 2. Finally, a zero-inflated Negative Binomial regression count model indicated that neither religious behaviors ($B = -.063, p = .137$), religious beliefs ($B = .028, p = .417$), nor the interaction ($B = .004, p = .544$) at Time 1 predicted alcohol related problems at Time 2.

Following these analyses, a zero-inflated Negative Binomial regression model was run to assess if any of the alcohol use variables at Time 1 predicted religious behaviors at Time 2. The zero-inflated model was selected given that the outcome variable (i.e., religious behaviors) was zero-inflated (i.e., 16.8% of the sample denied engaging in any religious behaviors at Time 2). Results from the count model indicated that alcohol use frequency at Time 1 negatively predicted religious behaviors at Time 2 ($B = -.046, p = .011$). Though alcohol use quantity at Time 1 did not significantly predict religious behaviors at Time 2 ($B = -.051, p = .062$), there was a trend in this direction. Finally, though alcohol-related problems at Time 1 did not significantly predict religious behaviors at Time 2 ($B = -.030, p = .075$), there was a trend in this direction.

Finally, regression models were run to assess if any of the alcohol use variables at Time 1 predicted religious beliefs at Time 2. A Poisson regression model indicated that alcohol use frequency at Time 1 did not predict religious beliefs at Time 2 ($B = .003, p = .722$). In the same vein, it was found that alcohol use quantity at Time 1 did not predict religious beliefs at Time 2 ($B = .013, p = .255$), nor did alcohol-related problems at Time 1 predict religious beliefs at Time 2 ($B = -.002, p = .769$).

3.4 Examination of Hypothesis #3

The third hypothesis of the study proposed that the interaction of religious beliefs/behaviors at Time 1 would predict drug use variables at Time 2. More specifically, it was proposed that religious grouping would predict lifetime drug use and frequency of drug use across time (i.e., being in the higher/higher group at Time 1 would negatively predict drug use at Time 2, while being in the higher/lower group at Time 1 would positively predict drug use at Time 2). In other words, religious beliefs and behaviors would interact to predict drug use with religious behaviors at Time 1 moderating the relationship between beliefs at Time 1 and drug use at Time 2.

All of the drug use variables in the study were zero-inflated. At Time 1, 25% of the sample denied ever having tried any drugs in their lifetime while 27% of the sample denied using any drugs in the past year. At Time 2, 20% of the sample denied having ever tried any drugs in their lifetime while 36% of the sample denied using any drugs in the past month.

To assess the potential effect of interacting religious beliefs/behaviors at Time 1 on drug use variables at Time 2, two different models were run. First, a Poisson regression model indicated that neither religious behaviors ($B = -.002, p = .942$), religious beliefs ($B = .007, p = .736$), nor the interaction ($B = -.001, p = .767$) at Time 1 predicted lifetime drug use at Time 2. In the same vein, a zero-inflated Poisson regression model indicated that neither religious behaviors ($B = -.028, p = .206$), religious beliefs ($B = .002,$

$p = .919$), nor the interaction ($B = .003, p = .300$) at Time 1 predicted drug use frequency at Time 2.

Following these analyses, a zero-inflated Negative Binomial regression model was run to assess if any of the drug use variables at Time 1 predicted religious behaviors at Time 2. This zero-inflated model was selected given that the outcome variable (i.e., religious behaviors) was zero-inflated (i.e., 16.8% of the sample denied engaging in any religious behaviors at Time 2). Results from the count model indicated that lifetime drug use at Time 1 negatively predicted religious behaviors at Time 2 ($B = -.093, p = .033$). Drug use frequency at Time 1 did not predict religious behaviors at Time 2 in the count model ($B = -.027, p = .168$). However, in the zero-inflation model, drug use frequency at Time 1 positively predicted the chance of reporting a zero for religious behaviors at Time 2 ($B = .531, p = .036$).

Finally, regression models were run to assess if any of the drug use variables at Time 1 predicted religious beliefs at Time 2. A Poisson regression model indicated that lifetime drug use at Time 1 did not predict religious beliefs at Time 2 ($B = -.001, p = .967$), nor did drug use frequency at Time 1 predict religious beliefs at Time 2 ($B = -.003, p = .678$).

3.5 Examination of Hypothesis #4—Exploratory Analyses

The fourth hypothesis proposed that perceptions of parental support and/or parental religiosity at Time 1 would predict student substance use and student religiosity at Time 2. When investigating the parental religiosity variables at Time 1, it was noted that numerous participants skipped these questions or answered “I don’t know”, resulting

in missing data (percentages of missing data ranged from 8.8% to 24%). Given the exploratory nature of these analyses, despite the missing data the planned analyses were conducted.

Results of zero-inflated Poisson regression models indicated that neither mother involvement at Time 1 ($B = .021, p = .612$), mother autonomy support at Time 1 ($B = .005, p = .892$), mother warmth at Time 1 ($B = .003, p = .937$), father involvement at Time 1 ($B = .013, p = .723$), father autonomy support at Time 1 ($B = -.010, p = .798$), nor father warmth at Time 1 ($B = .001, p = .979$) predicted student alcohol use frequency at Time 2. Additionally, neither mother religious behaviors at Time 1 ($B = -.004, p = .572$), father religious behaviors at Time 1 ($B = .003, p = .650$), mother religious beliefs at Time 1 ($B = -.002, p = .841$), nor father religious beliefs at Time 1 ($B = .000, p = .951$) predicted student alcohol use frequency at Time 2.

Results of zero-inflated Poisson regression models indicated that neither mother involvement at Time 1 ($B = .055, p = .395$), mother autonomy support at Time 1 ($B = .034, p = .556$), mother warmth at Time 1 ($B = .028, p = .693$), father involvement at Time 1 ($B = .052, p = .338$), father autonomy support at Time 1 ($B = .089, p = .145$), nor father warmth at Time 1 ($B = .108, p = .096$) predicted student alcohol use quantity at Time 2. Additionally, neither mother religious behaviors at Time 1 ($B = -.012, p = .238$), father religious behaviors at Time 1 ($B = .006, p = .549$), mother religious beliefs at Time 1 ($B = .004, p = .746$), nor father religious beliefs at Time 1 ($B = .010, p = .401$) predicted student alcohol use quantity at Time 2.

Results of zero-inflated Negative Binomial regression models indicated that neither mother involvement at Time 1 ($B = .260, p = .065$), mother autonomy support at

Time 1 ($B = .126, p = .240$), mother warmth at Time 1 ($B = .279, p = .150$), father involvement at Time 1 ($B = .046, p = .592$), father autonomy support at Time 1 ($B = .079, p = .432$), nor father warmth at Time 1 ($B = .072, p = .438$) predicted student alcohol-related problems at Time 2. Additionally, neither father religious behaviors at Time 1 ($B = -.002, p = .915$), mother religious beliefs at Time 1 ($B = -.039, p = .077$), nor father religious beliefs at Time 1 ($B = .000, p = .999$) predicted student alcohol-related problems at Time 2. However, results did indicate that mother religious behaviors at Time 1 negatively predicted student alcohol-related problems at Time 2 ($B = -.054, p = .001$).

Results of Poisson regression models indicated that neither mother involvement at Time 1 ($B = .004, p = .946$), mother autonomy support at Time 1 ($B = .023, p = .695$), mother warmth at Time 1 ($B = .048, p = .473$), father involvement at Time 1 ($B = .009, p = .866$), father autonomy support at Time 1 ($B = .036, p = .521$), nor father warmth at Time 1 ($B = .019, p = .738$) predicted student lifetime drug use at Time 2. Additionally, neither mother religious behaviors at Time 1 ($B = -.006, p = .507$), father religious behaviors at Time 1 ($B = .002, p = .818$), mother religious beliefs at Time 1 ($B = .006, p = .676$), nor father religious beliefs at Time 1 ($B = .007, p = .516$) predicted student lifetime drug use at Time 2.

Results of zero-inflated Poisson regression models indicated that neither mother involvement at Time 1 ($B = .090, p = .134$), mother autonomy support at Time 1 ($B = .066, p = .216$), mother warmth at Time 1 ($B = .073, p = .262$), father involvement at Time 1 ($B = -.015, p = .771$), father autonomy support at Time 1 ($B = -.070, p = .218$), nor father warmth at Time 1 ($B = -.080, p = .124$) predicted student drug use frequency at Time 2. Additionally, neither mother religious behaviors at Time 1 ($B = -.012, p =$

.197), father religious behaviors at Time 1 ($B = -.001, p = .938$), mother religious beliefs at Time 1 ($B = -.016, p = .149$), nor father religious beliefs at Time 1 ($B = -.016, p = .122$) predicted student drug use frequency at Time 2.

Results of zero-inflated Negative Binomial regression models indicated that neither mother involvement at Time 1 ($B = -.002, p = .9353$), mother autonomy support at Time 1 ($B = -.023, p = .557$), mother warmth at Time 1 ($B = -.014, p = .738$), father involvement at Time 1 ($B = .027, p = .535$), father autonomy support at Time 1 ($B = .061, p = .191$), nor father warmth at Time 1 ($B = .058, p = .233$) predicted student religious behaviors at Time 2. Additionally, neither mother religious behaviors at Time 1 ($B = .007, p = .395$), father religious behaviors at Time 1 ($B = .015, p = .128$), nor mother religious beliefs at Time 1 ($B = .017, p = .257$) predicted student religious behaviors at Time 2. However, results did indicate that father religious beliefs at Time 1 positively predicted student religious behaviors at Time 2 ($B = .051, p = .000$).

Finally, results of Negative Binomial regression models indicated that neither mother involvement at Time 1 ($B = .017, p = .814$) nor father warmth at Time 1 ($B = .052, p = .533$) were related to student religious beliefs at Time 2. In the same vein, Poisson regression models indicated that neither mother autonomy support at Time 1 ($B = .014, p = .391$), mother warmth at Time 1 ($B = .018, p = .334$), father involvement at Time 1 ($B = .005, p = .783$), nor father autonomy support at Time 1 ($B = .022, p = .228$) predicted student religious beliefs at Time 2. Additionally, neither mother religious behaviors at Time 1 ($B = -.001, p = .800$), father religious behaviors at Time 1 ($B = -.001, p = .779$), mother religious beliefs at Time 1 ($B = -.002, p = .684$), nor father religious beliefs at Time 1 ($B = -.002, p = .694$) predicted student religious beliefs at Time 2.

Table 3.1 Demographic Characteristics

	<i>N</i>	<i>%</i>
Gender		
Female	128	81.5
Male	29	18.5
Ethnicity		
Caucasian	122	77.7
African American	19	12.1
Asian	8	5.1
Hispanic/Latino	7	4.5
American Indian/ Alaskan Native	1	0.6
Age		
18	133	84.7
19	23	14.6
20	1	0.6
Marital status		
Single	157	100%

Table 3.2 Means, Standard Deviations, and Minimum/Maximum Values of Primary Variables at Time One

	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
<i>S,Max.*</i>					
Religious beliefs 24.00	125	17.10	6.08	0.00	24.00
Religious behaviors 25.00	125	6.31	5.50	0.00	22.00
Alcohol use frequency 17.00	125	3.39	3.18	0.00	12.00
Alcohol use quantity 13.00	125	2.07	1.99	0.00	7.00
Alcohol Problems 40.00	125	2.05	3.67	0.00	14.00
Number of drugs tried 10.00	125	1.51	1.35	0.00	6.00
Drug use frequency 40.00	125	2.73	3.03	0.00	15.00

*Maximum score available for the given scale.

Table 3.3 Means, Standard Deviations, and Minimum/Maximum Values of Primary Variables at Time Two

	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
<i>S,Max.*</i>					
Religious beliefs 24.00	125	17.07	5.77	0.00	24.00
Religious behaviors 25.00	125	6.05	5.63	0.00	23.00
Alcohol use frequency 17.00	125	4.38	3.76	0.00	12.00
Alcohol use quantity 13.00	125	2.02	2.11	0.00	8.00
Alcohol problems 40.00	125	2.14	3.93	0.00	18.00
Number of drugs tried 10.00	125	1.74	1.51	0.00	9.00
Drug use frequency 40.00	125	2.27	2.48	0.00	12.00

*Maximum score available for the given scale.

CHAPTER FOUR: DISCUSSION

4.1 Overall Findings

The high rates of alcohol and drug use among college students (e.g., Douglas et al., 1997; Johnston et al., 2014), particularly first-year college students (Beets et al., 2009), indicate further research is needed to identify risk and protective factors associated with this use. The current study expanded on previous cross-sectional research examining the relationship between religious beliefs and behaviors and substance use (Brechtling et al., 2010; Cole et al., 2020) by investigating the potential influence of religious beliefs and behaviors on substance use in first-year college students during their initial adjustment to the college environment. The present study replicated findings of previous studies (Brechtling et al., 2010; Cole et al., 2020) indicating that students with higher religious beliefs but lower religious behaviors were the student religious grouping most at risk for substance use, while the student religious grouping of both higher religious beliefs and higher religious behaviors was the least at risk for substance use. Findings also indicated that, over time, engagement in substance use behaviors predicted discordancy between religious beliefs and religious behaviors such that religious behaviors declined over time while religious beliefs did not vary across time. Finally, religious behaviors of mothers predicted student alcohol-related problems over time, while religious beliefs of fathers predicted student religious behaviors over time. However, the majority of parental variables did not predict student outcomes across time. In sum, the present study longitudinally established a relationship between substance use behaviors and religious beliefs/behaviors in college students initially adjusting to the

college environment, while replicating the work of past studies and identifying two important parental factors related to student behaviors across time.

The study's first longitudinal hypothesis was that the interaction of religious beliefs/behaviors at Time 1 would predict alcohol use variables at Time 2. More specifically, religious grouping was expected to predict frequency and quantity of alcohol use and alcohol-related problems across time with religious behaviors at Time 1 moderating the relationship between beliefs at Time 1 and alcohol use at Time 2 (i.e., being in the higher/higher group at Time 1 would negatively predict alcohol use at Time 2, while being in the higher/lower group at Time 1 would positively predict alcohol use at Time 2). Data indicated that the hypothesis was actually significant in the opposite direction. Specifically, the more alcohol use frequency students reported at Time 1, the less religious behaviors they reported at Time 2. This same pattern was also observed for alcohol use quantity and alcohol-related problems although the effects were non-significant. Given the level of zero-inflation for the alcohol use variables and the statistical significance of the relationship between quantity/problems and behaviors when analyses were run with all 157 participants, it is reasonable to assume that this effect would have reached significance with less zero-inflation and more participants. Overall, these findings suggest that engagement in alcohol use behaviors preceded a change in the pattern of religious beliefs/behaviors, with religious behaviors decreasing over time and religious beliefs remaining unaffected.

Additionally, the study hypothesized that the interaction of religious beliefs/behaviors at Time 1 would predict drug use variables at Time 2. More specifically, religious grouping was expected to predict lifetime drug use and frequency

of drug use across time with religious behaviors at Time 1 moderating the relationship between religious beliefs at Time 1 and drug use at Time 2 (i.e., being in the higher/higher group at Time 1 would negatively predict drug use at Time 2, while being in the higher/lower group at Time 1 would positively predict drug use at Time 2). Again, this hypothesis was significant in the opposite direction such that the more lifetime drug use students reported at Time 1, the less religious behaviors they reported at Time 2. These findings suggest that, similar to the findings associated with alcohol use, engagement in drug use behaviors exacerbated the discrepancy in religious beliefs/behaviors, with religious behaviors decreasing over time and religious beliefs remaining unaffected.

Findings from the present study support previous evidence (Brechtling et al., 2010; Cole et al., 2020) that students with higher religious beliefs but lower religious behaviors do use substances more than most non-religious students. However, the present study reveals that over time the directionality of the relationship between religious beliefs/behaviors and substance use is opposite from what has been previously hypothesized (Brechtling et al., 2010; Cole et al., 2020). The present findings appear to support findings of Cole (2018) who reported cross-sectional evidence for alcohol use preceding discordant religious beliefs and behaviors. Additionally, Cole (2018) suggested that the presence of certain personality traits (i.e., lack of planning, lack of perseverance, sensation seeking, positive urgency, negative urgency, and perceived invincibility) and the lack of other traits (i.e., Conscientiousness and Agreeableness) may lead to increased alcohol use, which in turn may lead to incongruent religious beliefs and behaviors. It appears that this premise that alcohol use leads to decreased religious behaviors across

time is strongly supported by the present study's findings. The data from Cole (2018) and the present study are important, as they suggest in both a cross-sectional and longitudinal design (respectively) that it is the presence of substance use behaviors that drives incongruency between religious beliefs and behaviors, rather than beliefs/behaviors driving substance use as originally surmised (Brechting et al., 2010; Cole et al., 2020).

The finding that alcohol and drug use predict a decline in religious behaviors but no change in religious beliefs may be explained by several factors. It could be that substance use behaviors dissuade participation in religious behaviors (Cole et al., 2020). For instance, drinking large quantities of alcohol one evening and waking up feeling ill may deter one from taking time to read a passage from a sacred writing that morning or to attend religious services. It may also be possible that feeling guilty about one's alcohol use may deter one from praying or engaging in other religious behaviors, given that many religious traditions disapprove of substance use (Benda et al., 2006). Actively praying to God may worsen these feelings of guilt and intensify the cognitive dissonance associated with engaging in substance use that contradicts one's belief system (Cole, 2018). Cognitive dissonance may increase further due to these students holding strong religious beliefs that they no longer support with corresponding religious behaviors. This may create an even wider gap between the students' belief systems and their choices to participate in religious behaviors. Sustained reductions in religious behaviors may also precipitate further risky substance use behaviors, as past research has identified the protective role of concordant religious beliefs and behaviors against risky substance use behaviors (e.g., Burris et al., 2011; Chen et al., 2004; Ham & Hope, 2003) and the ability of religiosity to protect against substance use across time (Mason & Windle, 2001). In the

same vein, religious students who choose to abstain from or use substances in moderation may be able to maintain both their religious behaviors and beliefs due to social reinforcers and the absence of cognitive dissonance that might otherwise accrue when using substances in a risky fashion.

An additional complementary theory explaining why substance use behaviors predict religious behaviors is that college students embrace a new peer group upon arriving at college (Romm, 2020). Many students may drink alcohol or use drugs at social events when meeting new peers and/or navigating difficult emotions related to the stressors of a new environment (Chon & Kim, 2000). It could be that students may choose to model their behaviors after new peers to be accepted (e.g., choosing to drink more alcohol than they normally would), resulting in or exacerbating a religious beliefs/behaviors discordancy as time progresses. Additionally, given past research suggesting that higher descriptive drinking norms (i.e., perceptions of how much someone else is drinking) for close friends are associated with more alcohol use (Baer et al., 1991; Brechting et al., 2015), it could be that these students who develop or exacerbate a beliefs/behaviors discordancy are assuming that their peers are using substances frequently and in high amounts, thus encouraging these students to use more substances themselves to fit in or attempt to grow closer to these new friends. Students who are able to maintain both high religious behaviors and beliefs may do so by associating with peers who do not use substances at all or use in moderation and by possessing lower descriptive drinking norms. Overall, substance use behaviors appear to predict engagement in religious behaviors across time, such that students who engage in

substance use behaviors subsequently reduce their religious behaviors even though they maintain their level of religious beliefs.

The study's final hypothesis stated that perceptions of parental support and/or parental religiosity at Time 1 would predict student substance use and student religiosity at Time 2. This hypothesis was exploratory in nature and resulted in very few significant findings. Specifically, the higher the mother's involvement in religious behaviors at Time 1, the less alcohol-related problems the student reported at Time 2. This could be explained by the possibility that religious mothers may teach their children that excessive substance use is not appropriate which leads to fewer alcohol-related problems for those students. This aligns with a study which found that acceptance/respect of parental values may protect against binge drinking (and thus potentially alcohol-related problems) (Piko & Kovacs, 2010). However, this does not explain why mother's religious behaviors only at Time 1 (rather than the father's) predicted alcohol-related problems. This could be explained by previous research asserting that mothers pass on religious values to their children more so than fathers, due to being in more of a caretaking role than the father (Boyatzis, 2006) and to women generally being more religious than men (Boyatzis, 2006; Miller & Hoffmann, 1995; Perry et al., 2015). An additional possibility is that women may engage in more religious behaviors than men due to being more risk-averse (Miller & Hoffmann, 1995). Thus, this risk averse nature from highly religious mothers might be conveyed to their children and explain why these children are less likely to have alcohol-related problems (i.e., less likely to engage in risky substance use).

The additional finding related to parental values was that the higher the father's religious beliefs at Time 1, the higher degree of religious behaviors the student reported

at Time 2. Specifically, it could be that fathers discussing their religious beliefs and emphasizing the importance of religion with their children may encourage their children to partake in religious behaviors even after beginning college. This aligns with previous work suggesting that parental faith and religious traditions were positively correlated with young adult religiosity (Myers, 1996; Perkins, 1987). However, this does not explain why the same finding was not also found with the mother's religious beliefs predicting student's religious behaviors. This is particularly puzzling given the findings that the mother's religiosity is typically more influential than the father's religiosity (Boyatzis, 2006). Another possibility for this finding is that a unique aspect of the father/daughter relationship (given the over-representation of females in the present sample) is in operation. For example, a recent paper (Gish, 2016) explored the influence of the sexual purity movement on the relationship between fathers and daughters. This movement (Gish, 2016) espouses the view of fathers as the leaders of households who protect their daughters, monitor their behaviors, and serve as primary male influencers until their daughters start family units of their own. It follows then that many of these participants may ascribe to the idea of their fathers being the leader of their households and an influential figure who they look up to and feel protected by in times of stress. Thus, these participants may be guided strongly by their father's religious beliefs in times of transition such that they increase their religious behaviors over time as a coping strategy.

4.2 Limitations

As with any research undertaking, the current study has several limitations. First, the study suffered from restriction of range in terms of ethnicity and gender. The sample

was overwhelmingly (81.5%) female primarily identifying as Caucasian (77.7%). Thus, the results of this study are not necessarily generalizable either to males or varying ethnic groups. However, significant gender and ethnic differences on the primary variables were controlled for (as discussed in the “Results” section) to ensure results were not unduly influenced by either gender or ethnicity. The primarily female composition of the study could be accounted for by the presence of more females on college campuses than males (Goldin et al., 2006). An additional factor could be that women prefer written communication more than men (Caspi et al., 2008) and were more willing to participate in the project, given that the current study was administered entirely online in a written format. Whatever the reason for the difference in male/female recruitment, this could explain the zero-inflation of the substance use variables given that past research has indicated that men use substances more than women due to increased access (Caris et al., 2009; Delva et al., 1999; Van Etten & Anthony, 1999) and that college-aged men reported more alcohol addiction than college-aged women (Greenberg et al., 1999). However, more recent research suggests that the gender substance gap is narrowing (Keyes et al., 2008; Seedat et al., 2009b; Steingrimsson et al., 2012). Some of these findings associated with the narrowing of the gap between male and female substance use appear to be reflected in the current study, as males scored significantly higher than females on some but not all of the substance use measures. Thus, it could be that low numbers of males in the present study may explain some but not all of the current study’s zero-inflation concerns.

A final point concerning the potential influence of the present study’s gender distribution is that this study focused on the construct of religiosity and did not assess the

construct of spirituality (i.e., a “personal search for connection with a larger sacredness”; Piedmont, 1999, p. 988). This construct (spirituality) has been shown to predict risky behaviors differently based on gender. Specifically, one study (Burriss et al., 2009) found that spirituality served as a risk factor for risky sexual practices for females only, whereas an additional study (Burriss et al., 2011) found that spirituality served as a risk factor for underage alcohol use in both males and females. Additionally, a recent study (Nadal et al., 2018) suggested that, when dividing college students into groups based on levels of religiosity and spirituality, students who identified as both religious and spiritual had the best psychosocial outcomes whereas students who identified as religious but not spiritual had the worst outcomes. Given gender differences related to spirituality, the primarily female nature of the present sample, and the seemingly important relationship between religiosity/spirituality in predicting risk, it would have been illuminating if the present study had included measures of the spirituality construct and explored how spirituality may relate to both religious beliefs/behaviors and substance use behaviors across time for both males and females.

An additional point concerning the treatment of the gender/ethnicity variables in the present study is that controlling for these variables in the regression models may have diluted results. More specifically, given past research (e.g., Barber, 2015; Greenberg et al., 1999) reporting ethnic/gender differences in substance use/religiosity and ethnic/gender differences seen in the present study, it could be that controlling for these demographic variables prevents awareness of relationships between substance use/religiosity that could be mediated and/or moderated by demographic variables. Thus, though the present study chose to control for significant demographic differences so as to

clearly explicate the relationship between religious beliefs/behaviors and substance use, one could argue that not controlling for these differences could also be illuminating.

A second limitation was the zero-inflation of the substance use variables and religious behaviors variable. Though zero-inflated regression models were utilized when appropriate to accurately analyze the data while accounting for excess zeros, the large number of zeros and low substance use/religious behaviors means in general may have affected the results and/or hidden a true effect. This issue was likely caused by the fact that the students completing the surveys were low substance users and engagers in religious behavior overall. Thus, the students classified as “higher” for most of the variables actually scored on the relatively lower ends of the measurements. This problem was further exacerbated by many of the higher substance users dropping out of the study after Time 1. This drop-out could be explained by the nature of alcohol-related consequences. For instance, if students are having multiple alcohol-related academic problems, they may not be very concerned about prioritizing taking part 2 of an optional online survey. In sum, the present study’s longitudinal findings may be underestimations of relationships between substance use/religiosity given zero-inflation.

A third limitation relates to the measures employed in the current study. Though the present study attempted to use a measure that had been well validated, an argument could be made that some items in the religious beliefs measure tap more into spirituality (e.g., believing in the goodness of a higher being) rather than a particular religious value system. Additionally, one could argue that, as the drug use measures ask about alcohol use, the participants’ alcohol answers would be unnecessarily inflated given that they are filling out separate measures concerning alcohol frequency/quantity. However, the

present study chose to leave the drug use measures as they were so as to maintain the reliability/validity of these scales in their originally developed states.

A fourth limitation was the use of the median split procedure to create the religious beliefs/behaviors groupings. One could argue that this treats all participants above the median as equal, despite the fact that participants with different values in that range may actually differ significantly from each other. However, the present study chose to proceed with this method so as to best replicate previous cross-sectional work (e.g., Cole et al., 2020). Additionally, a common method for dealing with median split concerns (i.e., splitting the sample into three groups and eliminating the middle group) was not feasible for the present study given the restriction of range and limited numbers of participants present in the study.

A fifth limitation was the study's use of self-report and the use of a social desirability measure to screen out potentially inaccurate responders. Students may have felt uncomfortable answering questions honestly about such sensitive issues as illicit substance use and religiosity. Some students may have feared legal or academic repercussions if admitting to using illicit substances, despite being assured of the confidentiality of the study. Though the current study attempted to account for this by means of a social desirability measure, it could be that some students answered honestly on the social desirability measure while still answering dishonestly on the substance use measures. However, it should be noted that previous research has demonstrated the validity and reliability of self-report measures among adolescent populations (Winters et al., 1990), which suggests that the present study's data may be reliable and valid, despite concerns raised above. Additionally, as discussed in the results section, eliminating

individuals with excessive socially desirable response patterns appeared to decrease the power of the study's statistical findings while potentially also taking out "extreme" responders who were actually answering honestly. The present study proceeded with this conservative elimination method due to a desire to control as much as possible for inaccurate response patterns given concerns about student honesty when answering questions about substance use.

A final limitation was the time period of the current study. This study was carried out during the COVID-19 pandemic which may have prevented students from going out and drinking/using drugs as much as they may have done in normal times. This could help explain the zero-inflation in the substance use variables present in this study.

4.3 Future Directions

Future research should replicate this study in a larger and more representative sample of the underage college student population (e.g., more equal numbers of males and females, more equal ethnic representation, broader range of alcohol/substance use). It may be illuminating also to replicate this study in other types of college populations (e.g., small liberal arts colleges, public universities in diverse locations, etc.). Finally, it may prove useful to see if the current study's results are replicated in a same-age population not attending college to determine if these results apply simply to college students or to the young-adult population in general. This latter study would be particularly interesting given that a previous study found that young adults not attending college engaged in more substance use behaviors than young adults attending college (White et al., 2005). Any of these projects should include higher numbers of participants to reduce the

presence of zero-inflation due to limited range of substance abuse in the sample. It would be particularly interesting to see if, when attempting to replicate hypothesis one, studies with larger numbers of participants continue to find the effect sizes that were found in the present study. This could prove useful as small to moderate effect sizes in larger numbers of participants speak to notable effects in the real world (Steering Committee of the Physicians Health Study Research Group, 1988).

The results of the present study also suggest that potential mediators for the relationship between substance use and religious behaviors should be investigated further in future studies. Such mediators may include the influence of peer group, emotional and/or cognitive responses to engaging in substance use, physical effects of the substance use, or other as of yet unknown factors identified in exploratory studies. A better understanding of the mechanisms fueling the relationship between substance use and religiosity will be crucial moving forward to identify students at risk for problematic substance use and to help develop strategies for the reduction of risky substance use behaviors in this population. These studies could also assess the personality factors identified by Cole (2018) as influencing substance use in this population and see if these factors predict risk over time.

Future studies may do well to investigate different religious beliefs measures to determine the most accurate way of measuring this construct. For instance, future studies may find a measure that asks more specifically about religious values and beliefs in more fundamentalist teachings, as opposed to more general levels of beliefs in a “loving higher power”. Additionally, studies should consider measurement of other constructs associated with religious issues such as spirituality. It is clear from the present results that alcohol

and drug use in underage college students is significantly linked to beliefs and behaviors associated with religiousness.

Finally, studies should be designed to explore the utility of the present study's findings for substance use prevention programs for first-year college students. Such programs could provide educational strategies and information about minimizing risks when engaging in substance use behaviors, especially for the high-risk individuals entering college with higher religious beliefs but lower religious behaviors as compared to others in their peer group. Such programs could also use the knowledge of mediators of the relationship displayed in this study to assist in the development of successful intervention programs. In sum, intervention programs based in the research concerning key factors related to risky substance use need to be implemented to help reduce the negative consequences of risky substance use in underaged college students.

4.4 Summary

In conclusion, the current study extends the work of previous studies (Brechtling et al., 2010, Cole et al., 2020) investigating the relationship between religious beliefs/behaviors and risky substance use patterns in underage college students. The current study built on this past work by conducting a longitudinal study to assess the causal direction of this relationship and to investigate how this relationship may operate in first-year college students newly adjusting to the college environment. Though this study did find that substance use typically varied in predicted directions by religious beliefs/behaviors grouping, the longitudinal relationship found between religious behaviors and substance use behaviors suggests that substance use behaviors diminish

religious behaviors over time. The religious beliefs/behaviors discrepancy and its relationship to risky substance use is challenging for students in the early days of college as this discrepancy likely only widens over time and puts students at risk for intensifying the negative outcomes associated with substance use. Thus, interventions prior to beginning college that teach not only safe substance use but personal values exploration, healthy coping strategies, and identity formation may prove helpful for preventing exacerbation of risk for first semester college students. Future studies should replicate the present study's findings with larger, more representative samples and investigate the mediating mechanisms fueling the relationship between substance use and religious beliefs/behaviors in order to promote the development of effective interventions.

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HONORS AND AWARDS

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April 2015	Psychology Research Award
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PUBLISHED MANUSCRIPTS

Cole, H. A., Prassel, H. B., Keller, P. S., & Carlson, C. R. (2020). Religious beliefs and behaviors as predictors of substance use among college students. *Psychology of Religion and Spirituality, 12*(1), 101-115.
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Cole, H.A., **Prassel, H.B.**, & Carlson, C.R. (2018). A meta-analysis of computer-delivered drinking interventions for college students: A comprehensive review of studies from 2010-2016. *Journal of Studies on Alcohol and Drugs, 79*(5), 686-696.

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