

ABSTRACT

Religiosity Moderates Links Between Delinquency and Depression in Adolescence and Adult Alcohol Use: A Person-Centered Approach

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Research has demonstrated that delinquency and depression are longitudinally related to alcohol use, and that religiosity may influence this relationship. However, these associations have not been demonstrated using person-centered approaches that provide nuanced explorations of these constructs. Using data from the National Longitudinal Study of Adolescent to Adult Health, we examined whether adolescent delinquency and depression differentiated typologies of adult alcohol users, and how religiosity profiles influenced this relationship. Three types of religious adolescents and four types of adult alcohol users were identified via latent profile analysis. Delinquency was related to increased likelihood of membership in heavy-drinking or problematic alcohol use profiles, but the effects of depression were mixed. These relationships were strongest among those likely to be involved in both coalitional and devotional religious processes. Results demonstrate the importance of person-centered approaches in understanding how delinquency and depression are predictive of particular patterns of alcohol use.

Religiosity Moderates Links Between Delinquency and Depression in Adolescence and
Adult Alcohol Use: A Person-Centered Approach

by

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A Thesis

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Submitted to the Graduate Faculty of
Baylor University in Partial Fulfillment of the
Requirements for the Degree
of
Master of Arts

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Accepted by the Graduate School
December 2016

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ACKNOWLEDGMENTS

I must thank my mentors, Dr. Shawn Latendresse and Dr. Wade Rowatt, for their consistent guidance, expertise, and patience when I knock on their doors with, yet again, another question. Thank you for challenging me to be a better scientist, and for being phenomenal mentors to work with. Many thanks to Dr. Matt Bradshaw for his enthusiasm, intellect, and involvement as a committee member.

Thank you to the faculty, staff, and students of the Baylor University Department of Psychology and Neuroscience. Thank you for being such a supportive, innovative, and entertaining department. Special thanks to the members of the Biopsychosocial Mechanisms of Development Lab for their hours of listening to my seemingly endless chatter about this project, and for their constant reassurance that, yes, this paper will eventually be finished.

This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

DEDICATION

To Emma Marie Mills, for always reminding me that you have to say “one”
before you can say “two”

CHAPTER ONE

Introduction

There is no shortage of data to suggest that alcohol is a commonly used and misused substance among those of and below the legal age. A recent national survey estimated that 139.7 million individuals over age 12 currently drink alcohol, accounting for a substantial portion (43.6%) of the total United States population (Center for Behavioral Health Statistics and Quality [CBHSQ], 2015b). While it is possible for most individuals to consume alcohol in moderate amounts and with no adverse effects, some use alcohol to an excessive amount. The rate of problem drinking is of concern, as over 16 million American adults received a diagnosis of alcohol use disorder (AUD) in 2014 (Center for Behavioral Health Statistics and Quality [CBHSQ], 2015a). The prevalence of alcohol use and disordered drinking alone justify research pertaining to the influence of alcohol on behavior and development. However, alcohol use is related broadly to both individual and societal health. Not only is alcohol related to AUD, but excessive or problematic alcohol use is also correlated with 200 other health problems (World Health Organization, 2014). In addition, the economic costs of alcohol use and related health problems are of concern, as these disorders cost the United States approximately \$249 billion in 2010 (Sacks, Gonzales, Bouchery, Tomedi, & Brewer, 2015). Finally, in the most serious cases, alcohol use can be lethal; deaths involving alcohol use are the fourth leading preventable cause of death in the United States (Stahre, Roeber, Kanny, Brewer, & Zhang, 2014). Such evidence amplifies the need for investigation into modifiable behavioral antecedents of problematic alcohol use.

The societal and human costs of problematic alcohol use are notable, and it is clear that measures should be taken to address and reduce problematic alcohol consumption. While numerous in- and out-patient programs exist to treat those with alcohol dependence, the emphasis for decreasing rates of AUD should be placed on prevention rather

than retroactive treatment, considering that only 20% of individuals fitting the criteria for an AUD diagnosis seek treatment (Grant et al., 2015). Distinguishing those most at risk for developing alcohol problems, that is, establishing identifiable behavioral antecedents to alcohol use, highlights characteristics of precise types of individuals whose alcohol use behaviors should be carefully monitored. Additionally, because early initiation into alcohol use is related to increased likelihood of heavy drinking and alcohol-related problems (Zucker, 2008), and nearly 680,000 US adolescents were diagnosed with an AUD in 2014 (CBHSQ, 2015a), identifying behavioral antecedents in adolescence specifically, a developmental period in which much alcohol use initiation occurs, may have a strong effect on decreasing the prevalence of future alcohol use.

The present study addressed this major public health concern by identifying prototypical patterns of alcohol use behaviors, relating behavioral antecedents to each type, and investigating the role of religiosity, a contextual factor identified as a mechanism through which the relationships between delinquency, depression, and alcohol use may be modified. Utilizing a person-centered approach, we identified typologies of adult alcohol users in a nationally representative sample to distinguish nuances in how a variety of individuals use alcohol. There exists a wide range of alcohol use behaviors (e.g., frequency and quantity of consumption, binge drinking, intoxication, etc.), and particular combinations of these behaviors that exist within individuals may not lead to the same alcohol outcomes (e.g., not all individuals that drink will be diagnosed with AUD). Examining the ways in which individuals were different across their entire repertoire of alcohol use behaviors (including frequencies of consumption, binge drinking, and intoxication, among others) uncovered prototypical patterns of alcohol use, representing qualitatively different types of individuals for whom the effects of risk or protective factors were more evident.

In addition to identifying typologies of alcohol users in adulthood, we explored the extent to which specific behavioral antecedents, namely delinquency and depression, in adolescence predicted the likelihood of exhibiting the derived alcohol use profiles. Iden-

tifying the ways in which these antecedents differentially predicted the development of various types of alcohol use behaviors provided a more intricate exploration of the relative risk of delinquency and depression in leading to later alcohol use. Finally, we examined the extent to which religiosity functioned as a protective factor against delinquency, depression, and alcohol use, a relationship that has been well-documented in previous literature (Koenig, 2012; Smith, 2003). The same person-centered approach was also used to examine religiosity, identifying discrete prototypical patterns of religious beliefs and practices. Since particular types of alcohol users may experience developmental precursors to a different extent, specific combinations of religious beliefs and practices may also differentially influence these relationships in qualitatively different patterns.

CHAPTER TWO

Literature Review

Preventing problematic alcohol use begins with understanding the pathways through which individuals begin to consume alcohol. Examining the precursors to a wide range of problematic and non-problematic alcohol use allows us to discern the environmental and behavioral mechanisms through which particular types of alcohol use develop. In this section, we first explore two pathways to alcohol use that have been previously described in the literature. The *externalizing* and *internalizing pathways* refer to the extent to which delinquent behavior results from prior or concurrent behavioral dysregulation and self-medication of negative affect, respectively; these pathways are uniquely and interactively predictive of risky or problematic alcohol use. Next, we introduce person-centered approaches to data analysis, and justify their usefulness for identifying homogeneous subgroups of alcohol use behaviors. Finally, we identify religion as one factor posited to protect against internalizing and externalizing problems in addition to alcohol use, and highlight theoretical evidence for a multidimensional conceptualization of religiosity.

Internalizing and Externalizing Pathways to Alcohol Use

Robust evidence for two distinct but related behavioral pathways to alcohol use has emerged within the literature. The first, an *externalizing pathway*, is characterized by impulsive, antisocial, or delinquent behavior, and is posited to result from behavioral under-control or dysregulation (King, Iacono, & McGue, 2004; Zucker, 2008). Such conduct is presumed to be some of the first behaviorally maladaptive correlates of later substance use. Indeed, previous research demonstrates that childhood and early adolescent externalizing problems are predictive of an earlier initiation into substance use (Chassin, Pitts, DeLucia, & Todd, 1999), late adolescent alcohol use (Adalbjarnardottir & Rafnsson, 2002), and al-

cohol dependence in young adulthood (Guo, Hawkins, Hill, & Abbott, 2001). Delinquent behavior specifically is frequently antecedent to substance use, suggesting that adolescents may typically begin to use alcohol only after previous engagement in delinquent activity (Monahan, Rhew, Hawkins, & Brown, 2014). Longitudinal studies further substantiate this temporal ordering, wherein delinquency marks the commencement of a trajectory leading to subsequent alcohol use and abuse (Mason, Hitchings, McMahon, & Spoth, 2007; Wiesner & Windle, 2006). Previous research has specified that not only are delinquency and alcohol use correlated, but also that delinquency is a temporal precedent to alcohol use.

An alternate, *internalizing pathway* to alcohol use, wherein individuals use alcohol as a purported means of coping with symptoms of negative emotionality and behavioral inhibition, has also been reflected in the literature (Hussong, Jones, Stein, Baucom, & Boeding, 2011). Loeber, Stouthamer-Loeber, and Raskin White (1999) found a two-fold increase in the concurrent use of substances (including alcohol) among boys with persistent internalizing problems (e.g., depressed mood, anxiety, shy/withdrawn behavior) across both middle childhood (ages 7-11) and early adolescence (ages 10-13), but this association was not replicated in late adolescence (ages 13-18). Prospective analyses also point to positive associations between major depressive disorder at age 11 and the initiation and regular use of alcohol by age 14; these effects were invariant across sex (King et al., 2004). A cross-lagged panel analysis designed to explore direction of causation further suggested that depression at age 12 was positively associated with alcohol use at age 15, but that the reverse did not hold true (Scholes-Balog, Hemphill, Patton, & Toumbourou, 2015). Moreover, the influence of adolescent internalizing problems on alcohol use persists into adulthood, but with different effects. Evidence from two separate large-scale, longitudinal studies report that early adolescent internalizing problems (Maggs, Patrick, & Feinstein, 2008) and late adolescent depressed affect (Merline, Jager, & Schulenberg, 2008) were negatively related to alcohol use throughout early and mid-adulthood. It would seem that while early internalizing symptoms are generally associated with increased risk for alcohol

use in adolescence, they are conversely somewhat protective of the same alcohol-related behaviors in adulthood. These findings highlight the complex role of internalizing symptoms in the development of alcohol use.

While both pathways have been linked to alcohol use separately, it must be recognized that neither pathway operates in isolation. Rather, internalizing and externalizing problems are dynamic and tend to co-occur (Gjone & Stevenson, 1997; Lilienfeld, 2003; Loeber & Burke, 2011; Oland & Shaw, 2005; Overbeek et al., 2006), evidenced by frequent co-morbidity of conduct disorder and depression in adolescents (Loeber & Burke, 2011; Wolff & Ollendick, 2006). Additionally, the emergence of both internalizing and externalizing problems largely predate adolescent alcohol use. A Finnish study found that 12-year-olds with high levels of both deviance and depressive symptoms were more likely to be engaged in heavy drinking at age 15 (Kumpulainen, 2000), and co-existing symptoms of both major depressive disorder and conduct disorder in ninth grade were predictive of alcohol use impairment in twelfth grade (McCarty et al., 2013). Even when internalizing and externalizing problems co-occur, the specific interplay between the behaviors may differentially impact the likelihood of alcohol use. For example, one study found that while the presence of both internalizing and externalizing problems were predictive of later adolescent alcohol use, this relationship was not as strong as the relationship between displaying only externalizing problems and later alcohol use (Colder et al., 2012). It appears that in this case, internalizing problems may interact with externalizing problems in such a way that this conditional association selectively functions as a protective factor against alcohol use. Such findings demonstrate the potential for these constructs to operate in synchrony, and that an individual's pathway to alcohol use may vary as a function of both internalizing and externalizing problems (Colder et al., 2012; Loeber & Burke, 2011).

Heterogeneity of Alcohol Use Behaviors

Just as the various pathways leading to alcohol use are not homogenous, neither is one's pattern of alcohol use accurately described by a singular placement on a continuum; that is, patterns of alcohol use are more complex and nuanced than a dichotomy of problematic or non-problematic use. To illustrate, some individuals frequently consume moderate levels of alcohol with no instances of binge drinking or subsequent consequences. Other individuals do consume alcohol, but only on limited occasions and in small quantities. Still, other alcohol users report frequent binge drinking episodes in addition to generally high quantities of consumption. To capture these nuances, researchers have utilized person-centered approaches to identify typologies of alcohol users. Person-centered approaches identify groups of individuals who share similar characteristics, probing qualitative differences among various types of individuals (Bergman & Trost, 2006; Laursen & Hoff, 2006). Of note, person-centered approaches do not assume that variables relate to each other in the same way across all types of individuals; this is in contrast to variable-centered approaches, such as the well-known regression or analysis of variance framework, which provides information on the ways in which variables function on average across individuals (Bergman & Trost, 2006; Laursen & Hoff, 2006). With person-centered approaches, including cluster analysis and latent class analysis among others, we are able to examine the ways in which the relationships among variables are different across particular types of people (Laursen & Hoff, 2006).

Person-centered approaches have been used in previous literature to identify groups of individuals who have similar patterns of alcohol use behaviors, including frequency and quantity of consumption, frequency of binge drinking, or experiences of alcohol-related consequences (Barnes & Welte, 1986; Donovan & Chung, 2015; Kuvaas, Dvorak, Pearson, Lamis, & Sargent, 2014; Windle, 1996). In their recent study of alcohol use utilizing latent class analysis, Donovan and Chung (2015) identified four classes of alcohol users. Individuals most likely to demonstrate the first set of item responses never or rarely consumed

alcohol (and were conventionally named the *abstainers*). A second item response pattern represented individuals who consumed alcohol on a regular basis but in small amounts (*low-intake drinkers*). Individuals most likely to demonstrate the third response pattern consumed alcohol at similar frequencies to the *low-intake drinkers*, but additionally engaged in binge drinking and became intoxicated more frequently (*non-problem drinkers*). Finally, individuals most likely to demonstrate the response pattern of the final class had the highest frequencies of binge drinking and intoxication, and also experienced more alcohol-related consequences than individuals most likely to be members of any other class (*problem drinkers*). The clear differences across various patterns of alcohol use demonstrate that previous research utilizing variable-centered approaches consisting only of indices of frequency or quantity of alcohol use has only captured one part of the relationship between alcohol use and its behavioral antecedents. Given this considerable diversity in alcohol use patterns, as well as the complex ways in which prior behaviors interact to form pathways to particular types of use, it is of interest to identify possible mechanisms through which patterns of alcohol use are prevented or promoted, remembering that these mechanisms may also be heterogeneous.

A Multidimensional Conceptualization of Religiosity

It is primarily of interest to identify factors that are related to decreased prevalence of both internalizing and externalizing problems, given their significance in the development of alcohol use (Kim, Conger, Elder Jr., & Lorenz, 2003; Loeber et al., 1999; Marmorstein, 2010; Marmorstein, Iacono, & Malone, 2010). Religiosity is one such factor that is generally considered to serve a protective function with respect to alcohol use and its developmental correlates (Borders, Curran, Mattox, & Booth, 2010; Koenig, 2012; Smith, 2003; J. M. Wallace & Forman, 1998; Wills, Yaeger, & Sandy, 2003). Cross-sectional and prospective analyses have identified small but significant negative associations between religiosity and a number of factors including delinquency (Benda & Corwyn, 1997; Laird,

Marks, & Marrero, 2011; Regnerus, 2003a, 2003b; L. H. Wallace, Moak, & Moore, 2005), depressive symptoms (Kim-Spoon, Longo, & McCullough, 2012; M. J. Pearce, Little, & Perez, 2003; Schapman & Inderbitzen-Nolan, 2002; Wright, Frost, & Wisecarver, 1993), and alcohol use (Chawla, Larimer, Lee, Lewis, & Neighbors, 2007; Mason & Windle, 2002; Nonnemaker, McNeely, & Blum, 2003). Typically, these studies have used single item or composite measures as indicators of one's religiousness. Such conceptualizations of religion are, however, limited in the extent to which they can elucidate the complexities of religion's influence on the development of alcohol use patterns. Given the multidimensional nature of this construct (Rew & Wong, 2006; Sedikides & Gebauer, 2014), surely various aspects or facets of religiosity might differentially impact alcohol use, an equally nuanced construct.

Multiple theories have posited the structure and nature of religious dimensions; one such conceptualization refers to religion in terms of two coexisting and complementary dimensions. The first dimension, coalitional processes, refers to culturally-transmitted objective religious ideologies, through which individuals become attached to their religious group; as a result, individuals exalt membership in this group above that in all others (Hansen & Norenzayan, 2006, p.191-192). The strong influence of coalitional processes has been demonstrated by positive associations between frequency of religious service attendance (one common operationalization of coalitional processes) and support for suicide attacks among samples of Palestinian Muslims and Israeli Jews (Ginges, Hansen, & Norenzayan, 2009). The second dimension, devotional processes, concerns an individual's awareness of God, a subjective perception of the supernatural, and the extent to which one engages with the divine (Hansen & Norenzayan, 2006, p.191-192). These dimensions are frequently operationalized by items referring to the frequency of religious service attendance, or belief in the inerrancy of scripture (for coalitional processes), and the frequency of personal prayer or the importance of religion in one's life (for devotional processes). In most cases, these items are combined into composite indices of devotional or coalitional

religiousness, or are completely amalgamated to create a single composite of general religiousness. However, such blending may obscure differential or additive effects of religiosity dimensions on behavior. For instance, Borders et al. (2010) found that the combination of both attendance at religious services and the use of prayer as a coping mechanism were additively related to decreased odds of problematic drinking. Thus, it is wise to examine religiosity in a multifaceted way as to capture the varied nuances through which it influences alcohol use.

Some studies have begun to examine the multidimensionality of religiosity by uncovering typologies of religious individuals with mixed levels of devotional and coalitional processes (Hodge, Andereck, & Montoya, 2007; Park et al., 2013; L. D. Pearce, Foster, & Hardie, 2013; Salas-Wright, Vaughn, Hodge, & Perron, 2012). These studies have reported differing numbers of latent religiosity groups in adolescence using a variety of person-centered approaches, allowing us to identify latent groups of individuals who share similar characteristics (Bergman & Trost, 2006; Laursen & Hoff, 2006). Utilizing cluster analysis yielded three religiosity clusters in a sample of Hispanic adolescents (Hodge et al., 2007), while latent profile analysis inferred the existence of four (Park et al., 2013) and five (Salas-Wright et al., 2012) profiles of religiosity. Additionally, a latent class analysis identified five classes of religious adolescents in a nationally representative sample (L. D. Pearce et al., 2013). Although utilizing different analytic techniques does contribute to the inconsistencies in numbers of religiosity profiles, diversity in the items used also accounts for these varied results. For example, while all studies were consistent in using measures of religious service attendance and frequency of prayer, Park et al. (2013) included indices of positive religious coping, while L. D. Pearce et al. (2013) included measures of cognitive components of religiosity, and Salas-Wright et al. (2012) incorporated the importance that friends share one's religious beliefs. Person-centered approaches are sensitive to the indicators used in the analysis, and because these studies all had slightly different items to represent religiosity (or spirituality), each analysis identified diverse latent categories that were in-

tricately tied to the specific indicators used. Given the heterogeneity in method of analysis and identification of nominal religious groups, further investigation into person-centered approaches using the most widely used indicators of religiosity is needed to elucidate the number and specific characteristics of adolescent religiosity typologies.

After identifying and classifying typologies of religious adolescents, other behavioral characteristics can be compared across members of the groups. Indeed, some research has explored the ways in which members of different religiosity profiles differ in terms of delinquency, depression, and alcohol use. In one of the first studies to use cluster analysis with respect to religiosity, Hodge et al. (2007) found that Hispanic adolescents who were classified as both religious and spiritual had the lowest levels of alcohol and tobacco use. Additionally, Salas-Wright et al. (2012) found that adolescents who were likely to be members of latent profiles with high levels of both public and private religiosity had the lowest levels of alcohol use and the lowest engagement in delinquency. Finally, Park et al. (2013) identified four groups of religious/spiritual individuals, and, interestingly, both those most likely to be members of the highly religious and those most likely to be members of the minimally religious profiles had the lowest levels of depressive symptoms. However, a limitation common across these studies is that they examined religiosity, depression, delinquency, and alcohol use cross-sectionally, which did not permit an examination of longitudinal developmental mechanisms through which these variables are related; we expanded upon this limitation in the current study.

Overview of Present Study

In the current study, we provided a number of contributions to the literature on these processes. First, given the complex, multidimensional natures of religiosity and alcohol use (Donovan & Chung, 2015; Rew & Wong, 2006) we examined typologies of both religiosity and alcohol use using a person-centered approach to uncover nuances of each construct, as well as variation in the relationships between these constructs across diverse

types of individuals. All work that has been done on both profiles of religiosity (Park et al., 2013; Salas-Wright et al., 2012) and alcohol use (Barnes & Welte, 1986; Donovan & Chung, 2015; Windle, 1996) has examined cross-sectional correlates of co-occurring behavior. Longitudinal extensions are needed to examine the extent to which various developmental precursors impact the likelihood of exhibiting such behavior patterns later in life. Thus, we examined longitudinal relationships from adolescent delinquency and depressive symptoms to adult alcohol use typology. In addition, this relationship was examined within the context of latent profiles of religiosity to determine the extent to which religiosity differentially moderates these associations. Given that there is variation in the characteristics of typologies of both religiosity and alcohol use in the literature (Barnes & Welte, 1986; Donovan & Chung, 2015; Park et al., 2013; L. D. Pearce et al., 2013; Salas-Wright et al., 2012; Windle, 1996), and that it would be difficult to make predictions about the relationships among all nuances within typologies of these constructs, all analyses were considered exploratory.

CHAPTER THREE

Methods

Sample

The National Longitudinal Study of Adolescent to Adult Health (Add Health) is a nationally representative survey of American adolescents, providing data on a wide range of health behaviors, attitudes, and environmental factors, including demographics, family relationships, sexual behavior, deviance, and substance use (Harris et al., 2009). The first wave of data collection took place during the 1994-1995 school year, initially consisting of in-school surveys of over 90,000 US students in 7th-12th grades. Approximately 12,000 of these students were randomly selected to participate in detailed home interviews. Adolescents who completed the in-home interview were contacted for a second wave of data collection in 1996. Further waves of data collection were conducted in 2001-2002 (when respondents were approximately ages 18-26) and 2008-2009 (approximately ages 24-32) and are currently scheduled for 2015-2017. For detailed sampling information, see Harris et al. (2009).

Of the 12,000 students who completed in-home interviews during Wave 1 data collection, the data from 6,503 respondents were de-identified and made available for public use. We reduced this sample to consist only of White, African American, or Hispanic individuals who self-reported Catholic or Protestant religious affiliation and had no missing responses to any of the five religiosity items at Waves 1 and 2. These restrictions were put into place in order to facilitate use of the maximal amount of complete data in the set. We also restricted the sample to individuals that had complete responses to alcohol use items at Wave 4. The final sample consisted of 2,610 individuals (55.5% female). These adolescents had a mean age of 15.57 years at Wave 1, and were comprised of 63.2% White, 24.4% African American, and 12.5% Hispanic individuals. Nearly three-fourths (73.1%) of

the sample identified as Protestant at Wave 1. At Wave 4, the sample drank alcohol approximately 60 days per year (just over once per week), consuming an average of 2.75 drinks per occasion.

Measures

Demographics

All demographic data reflects adolescent responses at Wave 1. Biological sex was dummy coded (female = 1). Age was calculated by subtracting participants' date of birth from the date of their in-home interview. Effect coding was used to derive two indicators of race, with Caucasians serving as the reference group in comparison to both African Americans and Hispanics.

Delinquency

Nonviolent delinquent behavior was assessed via five items in the Wave 1 in-home interview, reflecting the frequency of engagement in the following behaviors within the previous 12 months: "deliberately damage property that didn't belong to you," "steal something worth more than \$50," "steal something worth less than \$50," "go into a house or building to steal something," and "sell marijuana or other drugs." Individuals responded on a scale where 0 = "never," 1 = "1 or 2 times," 2 = "3 or 4 times," and 3 = "5 or more times" ($\alpha = .63$). Items were originally selected from Harden and Mendle (2012) but were then reduced to include only those items that appeared in all waves of data collection.

Depression

Depressive symptoms were assessed via the Center for Epidemiologic Studies Depression Scale (Jacobson & Newman, 2014). Nine items from this scale appear in every wave of the in-home interview, and thus were selected for analysis at Wave 1. Participants were asked how often each of the following statements were true of them during the past week (on a scale from 0 = "never or rarely" to 3 = "most or all of the time"): "you were

bothered by things that didn't usually bother you," "you felt that you could not shake off the blues," "you felt that you were just as good as other people" (reverse scored), "you had trouble keeping your mind on what you were doing," "you felt depressed," "you felt that you were too tired to do things," "you enjoyed life" (reverse scored), "you felt sad," and "you felt that people disliked you" ($\alpha = .78$). Specified items were recoded such that higher values represented more frequent presence of depressive symptoms.

Religiosity

Religiosity was assessed from items in the Wave 2 questionnaire. Items consisted of frequency of religious service attendance and frequency of attendance at other religiously affiliated activities, such as youth group or choir (both on a scale from 1 = "once a week or more" to 4 = "never"); frequency of personal prayer (1 = "at least once a day" to 5 = "never"); belief in the inerrancy of scripture (1 = "agree" or 2 = "disagree"); and importance of religion in one's life (1 = "very important" to 4 = "not important at all"). All items were recoded so higher response values indicated more frequent practice or stronger belief. Coefficient alpha for these items indicated good internal consistency ($\alpha = .70$). Additionally, a single item asked about respondent's religious affiliation, and was dichotomously coded into Catholic = 0 and Protestant = 1.

Alcohol Use

Items to assess adult alcohol use were taken from the Wave 4 questionnaire, and were identical to those used in Donovan and Chung (2015). The first items asked whether the participant had ever had a drink of alcohol more than 2 or 3 times, to which respondents could answer "yes" or "no." Three separate items measured the number of days in the past year in which the respondent engaged in a certain drinking behavior: "During the past 12 months, on (1) how many days did you drink alcohol; (2) how many days did you drink 5 or more drinks in a row; (3) how many days have you been drunk or very high on alcohol?" Response categories consisted of 0 = "none," 1 = "1 or 2 days," 2 = "once a month or less,"

3 = “2 or 3 days a month,” 4 = “1 or 2 days a week,” 5 = “3 to 5 days a week,” and 6 = “every day or almost every day.” One item asked about the quantity of alcohol consumed per occasion: “Think of all the times you have had a drink during the past 12 months. How many drinks did you usually have each time?” Participants responded to this question with a number from 1 to 18.

Alcohol-related consequences were also assessed at Wave 4. Four items asked about the frequency of experiencing such consequences, and each item was responded to on a three-point scale, where 0 = “never,” 1 = “1 time,” and 2 = “more than 1 time.” These four items covered the frequency with which consuming alcohol (1) disrupted responsibilities in school or the workplace, (2) led to situations that may have put oneself or others at risk, (3) led to legal problems or arrest, and (4) led to relationship problems with family, friends, or colleagues. Coefficient alpha across all items was .62.

A composite measure of adolescent alcohol use was created by multiplying the quantity of alcohol consumed by frequency of alcohol use using items from the Wave 1 questionnaire that had the same wording as those for quantity and frequency in Wave 4. This was used as a control variable in all analyses predicting Wave 4 alcohol use.

Analytic Plan

All analyses were conducted in Mplus version 7.2 (L. K. Muthén & Muthén, 1998-2007). A number of steps were taken to reduce the data before the final model was constructed. First, factor scores of delinquency and depression were extracted via confirmatory factor analysis (CFA). We also carried out exploratory factor analyses to substantiate the unidimensionality of both constructs. While unconventional, this was done to ensure that the exact items used to extract factor scores in CFA were definitively representative of a single latent construct within the sample of interest, since no previous study had used a set of items that was identical to ours.

Next, latent profile analyses (LPAs) were conducted with respect to Wave 2 religiosity and Wave 4 alcohol use indicators. LPA identifies homogeneous subgroups of individuals from a heterogeneous population by examining prototypical patterns of responding to a set of items, and classifying cases into a pre-specified number of groups (profiles) based on the likelihood of sharing discrete homogeneous patterns of item responses (Arminger, Clogg, & Sobel, 1995; Collins & Lanza, 2010). LPA tests a series of models comparing $k + 1$ profiles with k profiles (e.g., a two-profile model compared to a one-profile model) to determine whether extraction of an additional profile results in a significant decrement in fit. Subsequent comparisons are run in which additional profiles are extracted from the data (i.e., $k + 2$ profiles vs. $k + 1$ profiles, $k + 3$ profiles vs. $k + 2$ profiles, etc.), continuing until the addition of another profile yields a significant decrement in model fit. The result of each model provides every case with a posterior probability of membership in each of the extracted profiles. When examining latent profiles it is imperative to remember that extracted profiles represent *prototypical patterns* of item responses, that is, individuals with high likelihood of membership in a particular profile have a strong likelihood of exhibiting a specific pattern of item responses.

While there is no optimal standard for determining the appropriate number of profiles in LPA, model selection was based upon a number of criteria. Bayesian information criteria (BIC) and Akaike information criteria (AIC) are indicators of model fit where decreasing values across successive models suggest improved fit (Nylund, Asparouhov, & Muthén, 2007). Because BIC may continue to decrease across successive models in large samples (Latendresse et al., 2009), additional fit measures were also considered. Entropy measures the amount of organization or accuracy in determining profile membership on a scale from 0 to 1, with increasing values indicating better classification of profile membership (Pastor, Barron, Miller, & Davis, 2007). The theoretical fit of the model, number of individuals in resulting profiles, and significance levels (p -values) from the Vuong-Lo-Mendell-Rubin Likelihood Ratio test were also considered (Lo, Mendell, & Rubin, 2001; Vuong, 1989).

For a complete list of considerations in identifying appropriate profile structure in LPA, see Nylund et al. (2007).

After the best fitting models were selected, we assessed main effects via multinomial logistic regression wherein the latent categorical variable representing alcohol use response patterns was regressed on delinquency and depression. Demographic covariates of age, race, and sex, in addition to covariates of Wave 1 alcohol use and Catholic/Protestant identification were included in these and all subsequent models. After main effects were assessed, we examined the moderating effects of religiosity profiles on the associations between delinquency/depression and alcohol use profile membership. The theoretical model is depicted in Figure 3.1. The moderating effects of religiosity were accounted for by separate model specifications for each latent religiosity profile; that is, the multinomial logistic regression of the latent categorical variable representing alcohol use on depression and delinquency was conditioned on the profile-specific parameters of each religiosity latent profile (B. O. Muthén & Asparouhov, 2011; L. K. Muthén & Muthén, 1998-2007). This allowed us to compare the extent to which delinquency, depression, as well as the interaction between them predicted likelihood of membership in alcohol use profiles, given likelihood of membership in a particular religiosity profile.

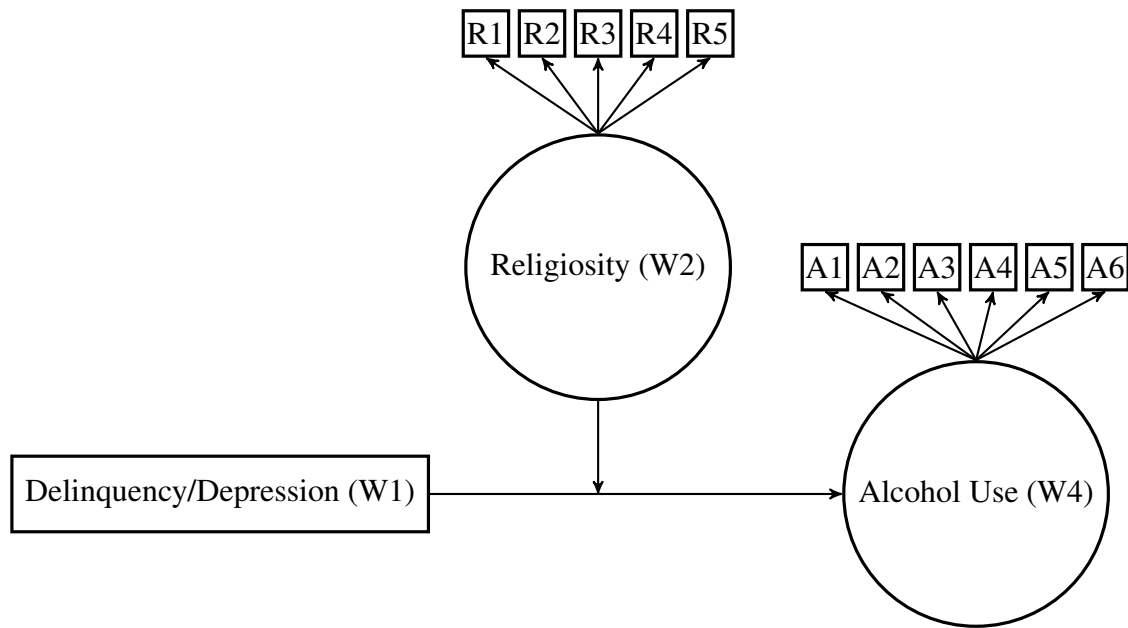


Figure 3.1: Model in which latent profiles of religiosity at Wave 2 moderates the influence of delinquency and depression at Wave 1 influence latent profiles of alcohol use at Wave 4.

CHAPTER FOUR

Results

Data Reduction

Delinquency and Depression Factors

Exploratory factor analyses confirmed unidimensional delinquency and depression constructs. Factor loadings for the five delinquency items ranged from 0.65 to 0.87, and factor loadings for the nine depression items ranged from 0.39 to 0.89. Eigenvalues for the delinquency items supported a one-factor model with an eigenvalue of 3.38 accounting for 67.6% of the variance, and the depression items similarly loaded onto a single factor; the eigenvalue for the one-factor model was 4.28, and accounted for 47.5% of the variance.

Religiosity Latent Profile Model Selection and Identification

We explored two- through four-profile LPA models to identify the best-fitting number of religiosity profiles. As seen in Table 4.1, BIC values continually decreased across the two- through four-profile models, but the four-profile model exhibited a significant decrement in model fit ($p = .66$). Thus, the three-profile model was selected. To facilitate comparison among the profiles, mean item responses among individuals most likely to be members of each religiosity profile (based on their highest posterior probability of membership) are graphically depicted in Figure 4.1.

The most representative profile accounted for 49.0% of the sample ($n = 1279$) and was characterized by the highest mean responses to the religiosity items on average. This profile was conventionally referred to as the *loyal* profile. On average, members of this profile prayed and attended religious services and activities more frequently than members of any other profile, demonstrating mean item frequencies consistently one half standard deviation above the sample mean.

Table 4.1: Model Selection Criteria for Latent Profile Analyses on Wave 2 Religiosity Items

Criterion	Number of Profiles		
	2	3	4
BIC	33448.94	<i>33124.07</i>	33012.90
AIC	33283.01	<i>32872.11</i>	32674.90
Entropy	0.74	<i>0.69</i>	0.66
p -value ($k + 1$ vs. k)	0.00	<i>0.00</i>	0.66

Note. AIC = Akaike information criteria. BIC = Bayesian information criteria. p -values are derived from Vuong-Lo-Mendell-Rubin Likelihood Ratio Test. Italic type denotes criterion values for selected model.

The next most representative profile accounted for 37.9% of the sample ($n = 989$) and demonstrated at or slightly below mean levels of religiosity. Specifically, individuals most likely to demonstrate this response pattern (referred to as the *reserved*) had a mean importance of religiosity and attendance at religious activities that was one full standard deviation below those most likely to be members of the *loyal*. Individuals most likely to be members of the *reserved* were on average nearly one standard deviation below those most likely to be members of the *loyal* on all other items, excluding belief in the inerrancy of scripture (on which those most likely to be members of the *reserved* were on average less than a half standard deviation below those most likely to be members of the *loyal*).

The final profile was representative of the smallest proportion of the sample ($n = 342$, 13.1%) and was referred to as the *apathetic*. The most defining characteristics of this response pattern was a mean frequency of attendance at religious services and mean frequency of prayer that were two full standard deviations below that of those most likely to be members of the *loyal* on average. Interestingly, those most likely to be members of the *apathetic* profile were similar to members of the *reserved* regarding importance of religion, but were on average at least one-half standard deviation lower than members of the *reserved* on all other items.

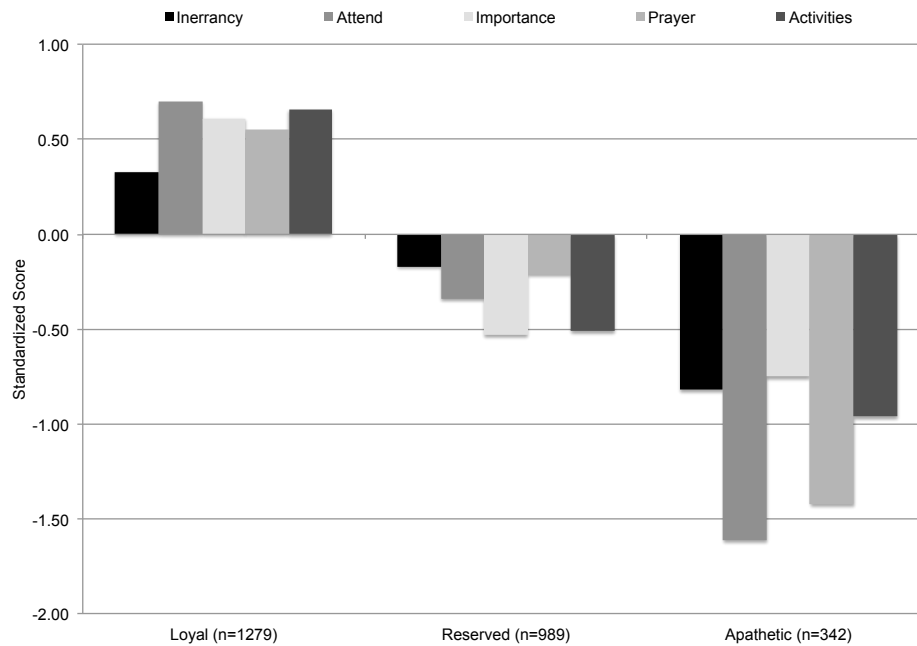


Figure 4.1: Average standardized responses to Wave 2 religion items by hard-coded membership in religiosity latent profiles.

Alcohol Use Latent Profile Model Selection and Identification

Prior to inclusion in LPA, the Wave 4 alcohol use items were recoded in accordance with thresholds that were determined to be empirically significant by Donovan and Chung (2015) in the public use Add Health sample at Wave 1. Whether an individual had ever had a drink was recoded dichotomously (0 = “No” and 1 = “Yes”). The items capturing drinking frequency, frequency of getting drunk, and frequency of binge drinking were recoded into three response categories (0 = “None,” 1 = “Once/year to 2-3 days/month,” and 2 = “Once/week plus”). The item measuring the average consumption during a single drinking episode was recoded into four response categories (0 = “None,” 1 = “1 drink,” 2 = “2-6 drinks,” and 3 = “7+ drinks”). Finally, the sum of negative consequences was recoded dichotomously (0 = “0-2 consequences” and 1 = “3+ consequences”).

Model selection criteria for two- through five-profile LPA models can be found in Table 4.2. All fit indices (except for entropy, which did not substantially change) consistently improved across the two- through five-profile models. However, the four-profile model was

selected over the five-profile model, as the five-profile model produced one profile containing 34 individuals (0.01% of the sample), which was insufficient to draw any meaningful comparisons with other profiles. Average alcohol use characteristics of the resulting four response patterns are graphically depicted in Figure 4.2, and Table 4.3 provides the same characteristics in their original units. We adopted the profile names provided by Donovan and Chung (2015) to facilitate comparison between our analyses.

The profile that was representative of the largest portion of the sample ($n = 894$, 34.3%) demonstrated mean item responses that were consistently one half standard deviations above the sample mean, and was referred to as the *non-problem drinkers* (Donovan & Chung, 2015). Individuals most likely to demonstrate this pattern consumed nearly four drinks per drinking occasion and drank just over 85 days per year (approximately 25% of days per year). Additionally, they reported being intoxicated 10 days per year, and engaged in binge drinking nearly 14 days per year on average, but reported experiencing one or two alcohol-related consequences in their lifetime.

Table 4.2: Model Selection Criteria for Latent Profile Analyses on Wave 4 Alcohol Use Items

Criterion	Number of Profiles			
	2	3	4	5
BIC	26325.62	23980.23	23027.89	23041.55
AIC	26183.01	23763.21	22736.46	22675.71
Entropy	1.00	0.89	<i>0.91</i>	0.89
p -value ($k + 1$ vs. k)	0.00	0.00	<i>0.00</i>	0.00

Note. AIC = Akaike information criteria. BIC = Bayesian information criteria. p -values are derived from Vuong-Lo-Mendell-Rubin Likelihood Ratio Test. Italic type denotes criterion values for selected model.

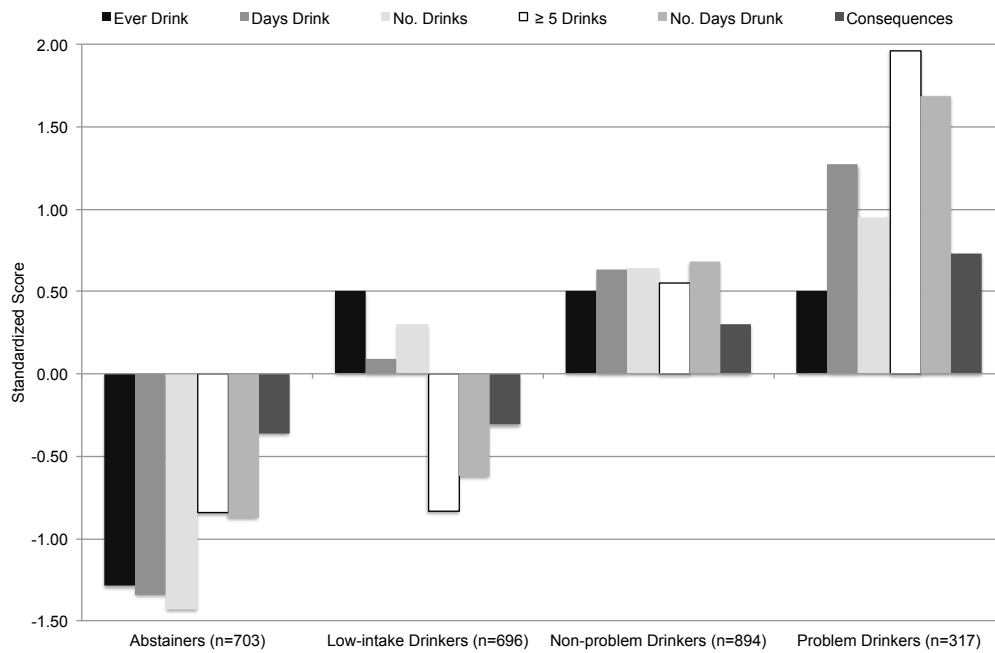


Figure 4.2: Average standardized responses to Wave 4 alcohol use items by hard-coded membership in alcohol use latent profiles.

Table 4.3: Characteristics of Alcohol Use Profiles in Original Units

Item	Abstainers	Low-Intake	Non-Problem	Problem
No. Days Drink	0.00	25.77	85.20	203.93
No. Drinks	0.00	2.47	3.87	6.33
Binge Drinking	0.00	1.03	13.75	153.63
Intoxication	0.00	0.70	10.47	103.94
Consequences	0.23	0.35	1.62	2.72

Note. No. Days Drink: Number of days per year drink alcohol. No. Drinks: Number of drinks per drinking occasion. Binge drinking: Number of days per year drank five or more drinks. Intoxication: Number of days per year get drunk. Consequences: Sum of alcohol-related consequences (range from 0-8).

A second response pattern was representative of 26.9% of the sample ($n = 705$), referred to as the *abstainers* (Donovan & Chung, 2015). This profile represented those who rarely or never drink alcohol, demonstrated by average reports of the quantity and frequency of alcohol use among individuals most likely to be members of the *abstainers* nearly two full standard deviations below those most likely to be members of the *non-*

problem drinkers. Individuals most likely to be members of the *abstainers* reported no instances of binge drinking or intoxication, nearly one standard deviation below the sample mean.

The next response pattern was representative of a similar proportion of the sample ($n = 696$, 26.6%), referred to as the *low-intake drinkers* (Donovan & Chung, 2015). This pattern was named for reports of light alcohol consumption among individuals most likely to be members of this profile. Individuals likely to exhibit this pattern reported average frequencies and quantities of alcohol consumption near the sample mean (drinking approximately two and a half drinks on 26 days per year). On average, these individuals were similar to members of the *abstainers* profile regarding binge drinking, intoxication, and alcohol-related consequences, but had frequencies and quantities of alcohol consumption that were one and a half standard deviations above those most likely to be *abstainers*.

The final profile was representative of the smallest proportion of the sample ($n = 317$, 12.1%), referred to as the *problem drinkers* (Donovan & Chung, 2015). This pattern was characterized by holding the highest mean frequencies across all alcohol use items. Compared to those most likely to be members of the *non-problem drinkers*, individuals most likely to display the response pattern of the *problem drinkers* were one and a half standard deviations higher on binge drinking frequency (indicating binge drinking on 154 days per year), a full standard deviation higher on frequency of intoxication (reporting being drunk 104 days per year), and nearly half a standard deviation higher on number of alcohol-related consequences (experiencing slightly fewer than three consequences on average).

Main Effects

First, the main effects of delinquency and depression on alcohol use profiles were examined. Table 4.4 provides the odds ratios related to likelihood of membership in the alcohol use profiles as predicted by delinquency and depression separately, as well as the

interaction between them. Unconditionally (not accounting for likelihood of membership in religiosity profile), delinquency differentiated between likelihood of membership in nearly all alcohol use profiles. With increasing delinquency, individuals were just over two times more likely to be members of the *problem drinkers* than they were to be members of either the *abstainers* ($OR = 2.14, p < .001$) or *low-intake drinkers* ($OR = 2.35, p < .001$).¹ Similarly, odds of being a member of the *abstainers* or *low-intake drinkers* profiles were lower when compared to those of being a member of the *non-problem drinkers* as delinquency increased; that is, individuals were nearly twice as likely to be members of the *non-problem drinkers* when compared to the *abstainers* ($OR = 1.76, p < .001$) and *low-intake drinkers* ($OR = 1.94, p < .001$) for every unit increase in delinquency. However, adolescent delinquency did not significantly differentiate between the likelihood of being a member of the *problem drinkers* compared to *non-problem drinkers*, and did not predict the likelihood of membership in the *abstainers* compared to *low-intake drinkers* profiles, as these odds ratios were all nonsignificant.

¹ Odds ratios of 1 indicate that individuals are equally likely to be a member of either profile. Odds ratios greater than 1 denote that individuals are more likely to be a member of the comparison group than they are to be a member of the reference group. Odds ratios less than 1 denote that individuals are less likely to be a member of the comparison group than they are to be a member of the reference group. When we take the inverse (i.e., $1/X$) of an odds ratio, we switch the reference group, so what used to be the reference group is now the comparison group, and vice versa. In Table 4.4, the *abstainers* and *low-intake drinkers* (comparison groups) are compared to the *problem drinkers* (reference group). The odds ratios are less than 1; for likelihood of membership in the *abstainers*, $OR = 0.47, p < .001$, and for likelihood of membership in the *low-intake drinkers*, $OR = 0.43, p < .001$. If we take the inverse of these odds ratios (so that likelihood of membership in the *abstainers* and *low-intake drinkers* are now reference profiles, and likelihood of membership in the *problem drinkers* is the comparison group), these odds ratios are now greater than 1; for likelihood of membership in the *abstainers*, $OR = 2.14, p < .001$, and for likelihood of membership in the *low-intake drinkers*, $OR = 2.35, p < .001$.

Table 4.4: Odds Ratios for Membership in Alcohol Use Profiles Conditioned on Religiosity Latent Profile Memberships, Predicted by Delinquency and Depression

Predictor	Condition	Problem Reference						Non-Problem Reference				Abstainers Ref.	
		Abstainers		Low-Intake		Non-Problem		Abstainers		Low-Intake		Low-Intake	
		<i>OR</i>	<i>p</i>	<i>OR</i>	<i>p</i>	<i>OR</i>	<i>p</i>	<i>OR</i>	<i>p</i>	<i>OR</i>	<i>p</i>	<i>OR</i>	<i>p</i>
Delinquency	Unconditional	0.468	.000	0.425	.000	0.825	.184	0.568	.000	0.515	.000	0.907	.530
	Loyal	0.121	.002	0.121	.002	0.324	.104	0.374	.035	0.347	.036	1.000	.999
	Reserved	0.824	.511	0.705	.224	1.189	.508	0.693	.146	0.593	.043	0.855	.527
	Apathetic	0.604	.075	0.488	.013	0.859	.515	0.704	.186	0.568	.043	0.807	.480
Depression	Unconditional	0.944	.681	0.878	.361	0.739	.023	1.278	.019	1.188	.129	0.929	.482
	Loyal	0.207	.004	0.205	.001	0.080	.000	2.593	.031	2.574	.046	0.992	.974
	Reserved	1.252	.418	1.124	.679	1.228	.428	1.020	.921	0.917	.688	0.899	.616
	Apathetic	1.545	.074	1.230	.415	0.747	.203	2.067	.000	1.646	.024	0.796	.309
Del.xDep.	Unconditional	0.997	.992	0.840	.526	0.925	.790	1.077	.779	0.908	.712	0.843	.509
	Loyal	***	***	0.000	.000	0.000	.000	0.415	.515	0.003	.014	0.007	.015
	Reserved	0.947	.926	0.560	.227	0.730	.547	1.296	.627	0.767	.567	0.591	.270
	Apathetic	0.849	.720	1.504	.264	0.916	.839	0.927	.869	1.643	.208	1.772	.168

Note. *OR* = odds ratio. Unconditional models reflect the effect of the predictor on differentiation among alcohol use profiles alone. Other models reflect the effect of the predictor on differentiation among alcohol use profiles, conditioned on the religiosity profile of interest (i.e., the effect of delinquency on alcohol use, moderated by religiosity). All models control for demographic covariates. The delinquency by depression interaction in predicting likelihood of membership in alcohol use profiles utilizing *problem drinkers* as the reference profile cannot be interpreted because the *problem drinkers-loyal* religiosity profile cell is too small ($n = 8$).

The effects of depression on alcohol use were more obscure in the unconditional model. In this model, depression failed to differentiate between those most likely to be *low-intake drinkers* and members of the other three profiles, as well as between members of the *problem drinkers* and *abstainers*. Interestingly, however, as depression increased, individuals were equally more likely to be members of both the *abstainers* ($OR = 1.28, p = .019$) and *problem drinkers* ($OR = 1.35, p = .023$)² profiles when comparing to the *non-problem drinkers*; when likelihood of membership in the *non-problem drinkers* was the reference group, individuals were approximately 33% more likely to be members of the *abstainers* and *problem drinkers* for each unit increase in depression.

Moderation by Religiosity

Next, we assessed the extent to which religiosity moderated the effects of delinquency and depression on likelihood of membership in alcohol use profiles. Table 4.4 also provides odds ratios and significance levels of the association between delinquency/depression and alcohol use profiles conditioned on membership in religiosity profiles below the results of the unconditional model. Religiosity moderated the effect of delinquency on alcohol use profiles such that the relationship between delinquency and likelihood of membership in alcohol use profiles was stronger when conditioned on likelihood of membership in the *loyal* profile, and was weaker when conditioned on likelihood of membership in either the *apathetic* or *reserved* profiles. For example, with increasing delinquency (not accounting for likelihood of membership in religiosity profile), individuals were almost twice as likely to be members of the *non-problem drinkers* than they were to be members of the *low-intake drinkers* ($OR = 1.94, p < .001$). However, given that they were most

² In Table 4.4, likelihood of membership in the *non-problem drinkers* is the reference profile for comparison to likelihood of membership in the *abstainers*, but the likelihood of membership in the *problem drinkers* is the reference profile when the likelihood of membership in the *non-problem drinkers* is compared to it. As such, the odds ratio is less than 1 when the *non-problem drinkers* are compared to the *problem drinkers*, but is greater than 1 when the *abstainers* are compared to the *non-problem drinkers*. Taking the inverse of an odds ratio will reverse the reference profile, so 1 was divided by the odds ratio of comparing the *non-problem drinkers* to the *problem drinkers* in Table 4.4 (i.e., $1/0.739 = 1.35$) to place the *non-problem drinkers* as the reference group in both odds ratios.

likely to be members of the *loyal* religiosity profile, individuals were nearly three times as likely to be members of the *non-problem drinkers* ($OR = 2.88, p = .036$). At the same time, the effect of delinquency on likelihood of membership in alcohol use profile was weaker among members of the *apathetic* or *reserved* profiles. In fact, when conditioned on likelihood of membership in the *apathetic* religiosity profile, individuals were only 1.75 times more likely to be members of the *non-problem drinkers* ($OR = 1.75, p = .043$) for every unit increase in delinquency, which was weaker than the unconditional relationship (in which individuals were two times as likely to be a member of the *non-problem drinkers* with each unit increase in delinquency). Similarly, when not accounting for likelihood of membership in religiosity profile, individuals were over two times more likely to be members of the *problem drinkers* when compared to the *abstainers* ($OR = 2.14, p < .001$) and *low-intake drinkers* ($OR = 2.35, p < .001$) with increasing delinquency. However, among those most likely to be members of the *loyal* religiosity profile, delinquency was more strongly associated with likelihood of membership in alcohol use profile, demonstrated by an eight-fold increase in likelihood of membership in the *problem drinkers* compared to the *abstainers* ($OR = 8.26, p = .002$) and *non-problem drinkers* ($OR = 8.26, p = .002$) for each unit increase in delinquency.

The depression-alcohol use relationship was also moderated by religiosity such that the association between depression and alcohol use was stronger when conditioned on likelihood of membership in the *loyal* religiosity profile. When conditioned on membership in the *loyal* profile, depression significantly differentiated between likelihood of membership in all pairs of alcohol use profiles except for the *low-intake drinkers* compared to the *abstainers*. Among those most likely to be members of the *loyal* religiosity profile, an increase in depression was related to significant increases in likelihood of membership in the *problem drinkers* in comparison to the *abstainers*, *low-intake drinkers*, and *non-problem drinkers*. When compared to the *abstainers* and *low-intake drinkers*, individuals were nearly five times more likely to be members of the *problem drinkers* ($OR = 4.83, p =$

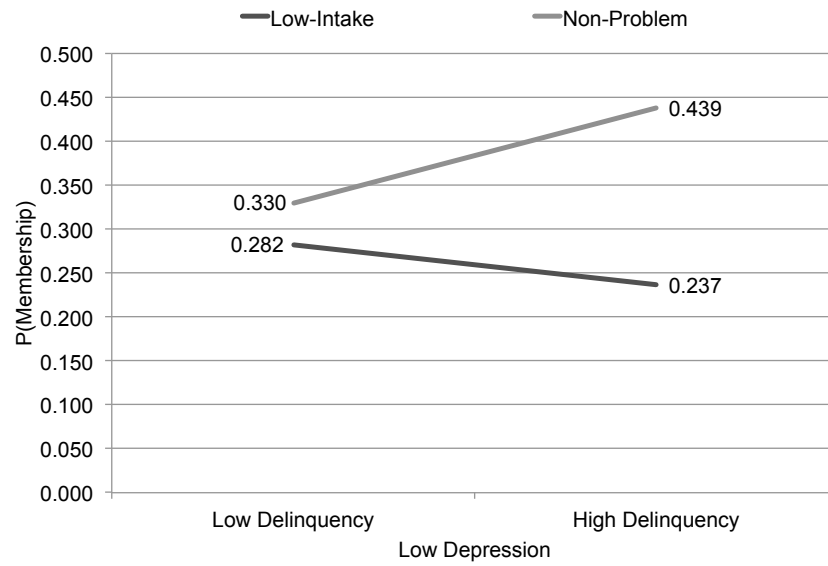
.004 and $OR = 4.88, p = .001$, respectively), and individuals were over twelve times more likely to be members of the *problem drinkers* when compared to the *non-problem drinkers* ($OR = 12.50, p < .001$) per unit increase in depression. In addition, those most likely to be members of the *loyal* profile were over two and a half times more likely to be members of the *abstainers* ($OR = 2.59, p = .031$) or *low-intake drinkers* ($OR = 2.57, p = .046$) than they were to be members of the *non-problem drinkers* for each unit increase in depression. Individuals with higher depression who exhibited the religiosity characteristics demonstrated by those most likely to be members of the *loyal* profile were more likely to abstain or drink minimally than they were to frequently drink moderate amounts (i.e., they were less likely to demonstrate the alcohol use pattern exhibited by those most likely to be members of the *non-problem drinkers*).

Among those most likely to be members of the *apathetic* profile, depression significantly differentiated between likelihood of membership in the *abstainers* and the *low-intake drinkers* compared to the *non-problem drinkers*, such that individuals were twice as likely to be members of the *abstainers* ($OR = 2.07, p < .001$) and just over one and a half times more likely to be members of the *low-intake drinkers* ($OR = 1.65, p = .024$) with increasing delinquency. These effects highlight an important interaction; while members of the *apathetic* religiosity profile were more likely to be *abstainers* than *low-intake drinkers* in comparison to *non-problem drinkers*, members of the *loyal* religiosity profile were approximately equally likely to be members of the *abstainers* ($OR = 2.59, p = .031$) or the *low-intake drinkers* ($OR = 2.57, p = .046$) in comparison to the *non-problem drinkers*. Depression did not differentiate between any of the alcohol use profiles when conditioned on the *reserved* religiosity profile.

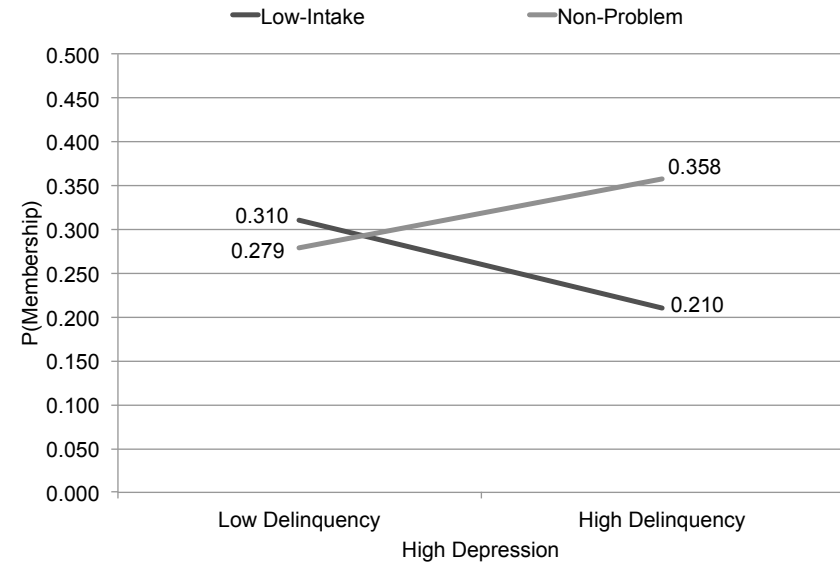
Two small, but significant, three-way (delinquency x depression x religiosity) interactions in predicting likelihood of membership in alcohol use profiles were also present; the conditional association of the delinquency by depression interaction was only evident among those most likely to be members of the *loyal* religiosity profile. Among those most

likely to be members of the *loyal* profile, the delinquency by depression interaction significantly differentiated among those most likely to be members of the *low-intake drinkers* as compared to the *non-problem drinkers* ($OR = 0.003, p = .014$). This interaction is graphically depicted in Figure 4.3. Overall, the magnitude of the difference between probabilities of membership in each profile increased as a function of increasing delinquency, that is, individuals were more likely to be members of the *non-problem drinkers* and less likely to be members of the *low-intake drinkers* as delinquency increased. However, at low levels of depression, individuals were always more likely to be members of the *non-problem drinkers*, while at high levels of depression individuals were slightly more likely to be members of the *low-intake drinkers* when they engaged in low levels of delinquency, and were more likely to be members of the *non-problem drinkers* when they had high levels of delinquency.

Also only among those most likely to be members of the *loyal* religiosity profile, the delinquency by depression interaction differentiated among those who were more likely to be members of the *low-intake drinkers* compared to the *abstainers* ($OR = 0.007, p = .015$; see Figure 4.4). Regardless of depression level, the likelihood of membership in the *low-intake drinkers* and *abstainers* decreased as a function of increasing delinquency. However, among those with high levels of depression, individuals were always more likely to be a member of the *abstainers*, while at low levels of depression individuals were more likely to be members of the *abstainers* when they also engaged in low levels of delinquency, but were more likely to be members of the *low-intake drinkers* when they engaged in high levels of delinquency.

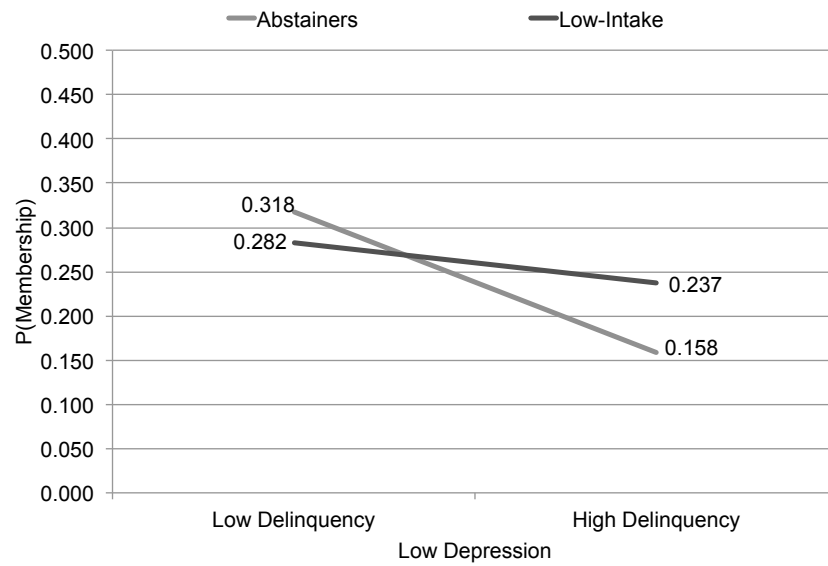


(a) Interaction among those with low depression.

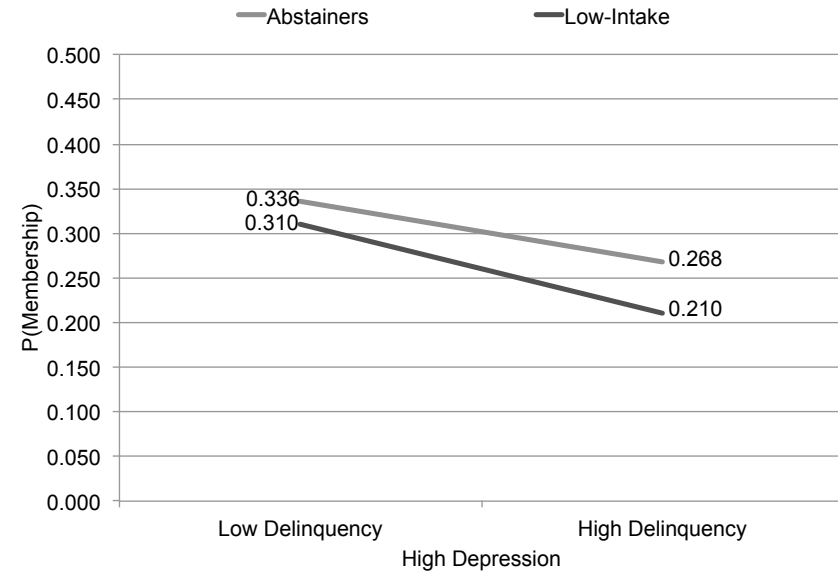


(b) Interaction among those with high depression.

Figure 4.3: Delinquency x depression x religiosity interaction in predicting likelihood of membership in the *low-intake* compared to *non-problem drinkers* among those most likely to be members of the *loyal* religiosity profile.



(a) Interaction among those with low depression.



(b) Interaction among those with high depression.

Figure 4.4: Delinquency x depression x religiosity interaction in predicting likelihood of membership in the *abstainers* compared to *low-intake drinkers* among those most likely to be members of the *loyal* religiosity profile.

CHAPTER FIVE

Discussion

This examination of behavioral antecedents to adult alcohol use suggests that adolescent delinquency and depression may serve to differentiate typologies of alcohol users in adulthood. These relationships were influenced by religiosity, such that the magnitude of the relationships between delinquency/depression and membership in alcohol use profiles was conditional on one's likelihood of exhibiting particular patterns of religious behaviors.

Delinquency

Engaging in delinquent activities during adolescence was related to an increased likelihood of heavier drinking in adulthood, irrespective of experiencing alcohol-related consequences (represented by a high likelihood of membership in the *non-problem drinkers* and *problem drinkers* with increasing delinquency). More delinquent adolescents were also less likely to drink lightly in adulthood, as evidenced by lower likelihoods of membership in the *abstainers* and *low-intake drinkers* when compared to the *non-problem* or *problem drinkers*. Religiosity moderated this relationship, such that these effects were more pronounced among individuals likely to demonstrate strong engagement with both devotional and coalitional religious processes (i.e., individuals most likely to demonstrate the pattern of religious behaviors represented by the *loyal* profile) and were more modest among individuals likely to demonstrate less engagement with either coalitional or devotional processes (i.e., those most likely to be members of the *reserved* and *apathetic* profiles).

These relationships among delinquency, religiosity, and alcohol use support previous literature linking adolescent delinquency to later alcohol use (Mason et al., 2007), but do not directly replicate the protective effect of religiosity typically discussed in the literature, wherein self-reported religiosity was related to decreased risk for engagement in

delinquency and alcohol use (Benda & Corwyn, 1997; Herrenkohl et al., 2003; Hodge et al., 2007; Regnerus, 2003b; Smith, 2003; J. M. Wallace & Forman, 1998). There are a number of possible explanations for why this well-documented protective relationship was not replicated in this analysis. First, it may be that those who are strongly religious in all domains experience psychological reactance (Brehm, 1966). Reactance refers to one's tendency to act in a manner inconsistent with prescribed behavior as retaliation against feeling that one's autonomy has been challenged. Strongly religious individuals may feel that the behavioral mandates set by their religion (such as proscribing the consumption of alcohol) challenge their individual autonomy, and drink heavily as a response to this perceived deficit of control.

It may also be that individuals who are highly religious continue to take part in heavy drinking because they anticipate forgiveness for such behavior. Previous studies have shown that national crime rates increase as a function of national religiosity (Shariff & Rhemtulla, 2012), potentially because religious individuals expect to receive grace or be forgiven for committing transgressions. It may be that specific religious beliefs of religious individuals, on average, lead them to either rebellion against God's control over their lives or to expect forgiveness, thus failing to act as a protective factor in such a way as to insulate religious individuals from alcohol use.

Finally, it may be that the ways in which religiosity influences behavior develop and change across time. Given that religiosity may not influence all aspects of behavior at all times (Chaves, 2010), it may be that religiosity does not protect against alcohol use given other contextual circumstances. Additionally, religiosity changes as individuals mature (Fowler, 1981); it may be that religiosity shifted during the transition from adolescence to adulthood, and that religious beliefs and practices during adulthood, rather than adolescent religiosity, is more strongly tied to adult alcohol use. The combination of developments in religious faith and contextual effects of religiosity on behavior suggest that adolescent religiosity may not be a potent influence on behavior in adulthood.

However, a more robust explanation of why traditional protective effects of religiosity were not supported in this analysis may be attributed to the person-centered approach used to operationalize religiosity. Although Benda and Corwyn (1997) posited that a multi-dimensional examination of religiosity may reveal complex relationships through which religiosity protects against delinquency, previous work has mainly applied variable-centered approaches, utilizing single item or composite measures of religious service attendance, strength of evangelism (including identity as a born-again Christian), personal religiosity, and religious affiliation or church membership (Benda & Corwyn, 1997; Herrenkohl et al., 2003; Hodge et al., 2007; Regnerus, 2003b). These variable-centered approaches assume that variables relate to each other in the same way across all types of individuals (Bergman & Trost, 2006; Laursen & Hoff, 2006), leaving the potential for interactions among underlying dimensions of these variables to remain latent. While it may be that religiosity, on average, is correlated with decreased delinquency and alcohol use, this relationship may be conditional on the particular components of religiosity examined. Given that particular facets or dimensions of religiosity are most protective against the negative peer influence related to delinquency (Grier & Gudiel, 2011), it may be that the specific combination of religious practices and cognitions demonstrated by members of the *loyal* profile is not the most effective pattern of religiosity in buffering against the influence of adolescent delinquency as a risk factor for alcohol use. Other studies using person-centered approaches to religiosity have inferred that qualitatively different types of religious individuals engaged in varying levels of delinquent behavior and alcohol use (Salas-Wright et al., 2012). As such, our analysis has replicated this effect, and has provided additional evidence that a synthesis of varying levels of religious beliefs and practices (as opposed to indices of low, medium, and high religiosity) could provide additional information about characteristics of diverse individuals that is complementary to that obtained by a variable-centered approach.

Depression

Depression was also predictive of particular types of adult alcohol use. Adolescents who experienced more symptoms of depression were less likely to drink heavily and were more likely to either abstain from drinking or to demonstrate a problematic pattern of alcohol use. Religiosity moderated these effects such that the relationship between depression and membership in alcohol use profiles was slightly stronger among those least likely to attend services or pray (i.e., those most likely to be members of the *apathetic* profile), but this relationship was strongest and most pronounced among those who were most likely to feel religion was important and attend services frequently (i.e., those most likely to be members of the *loyal* profile). However, the association between depression and alcohol use was not significant among those who had near average engagement with both coalitional and devotional processes (i.e., those most likely to be members of the reserved profile).

Given that previous research has found a negative relationship between adolescent depression and adult alcohol use (King et al., 2004; Maggs et al., 2008; Merline et al., 2008), the finding that depression in adolescence was related to decreased likelihood of membership in low-consuming or abstaining profiles is not surprising. Depressive symptoms, part of a larger category of internalizing symptoms, may be associated with decreased alcohol use in adulthood due to a later initiation into alcohol use. Initiation into alcohol use is strongly tied to social interaction (Hussong, 2000), and because adolescents with depressive symptoms may avoid social interaction, they may be less likely to begin drinking. Given that earlier initiation into alcohol use is linked to increased likelihood of alcohol disorder (DeWit, Adlaf, Offord, & Ogborne, 2000), depressive symptoms that prevent adolescents from interacting with peers in such a way that would promote alcohol use may function as a protective factor against later disorder. However, that depression was also related to an increased likelihood of problematic drinking patterns, particularly among those who were most likely to demonstrate strong engagement with religiosity, is of interest. While depression has been linked to an increase in problematic drinking, these effects have

mainly been found during adolescence (Scholes-Balog et al., 2015). Our findings would be some of the first to demonstrate this effect across the transition from adolescence to adulthood; however, future research must further investigate this relationship to substantiate these findings.

The results of this study provide mixed support for the presence of an internalizing pathway to alcohol use (Hussong et al., 2011) in the context of alcohol use operationalized as likelihood of membership in particular profiles of alcohol use. Depression differentially predicted likelihood of membership in these profiles, and this change in operationalization of alcohol use (i.e., examining latent profiles of alcohol use rather than indices of frequency/quantity of consumption) demonstrates that depression is related to lower likelihoods of particular combinations of alcohol use behaviors, rather than single items of alcohol use or composite scores utilized in previous research (e.g., Scholes-Balog et al., 2015). Given that these results also differ according to the type of religiosity one is most likely to exhibit, it may be that the particular combination of religious beliefs and practices exhibited by those most likely to be members of the *loyal* religiosity profile amplify the effects of depression on alcohol use, resulting in a stronger effect among the most religious.

Delinquency x Depression Interaction

The presence of a three-way (depression x delinquency x religiosity) interaction predicting likelihood of membership in the *low-intake drinkers* substantiates the complex ways in which depression and delinquency interact during adolescence to predict later alcohol use. In general, regardless of how many depressive symptoms one experienced, higher levels of delinquency were related to lower likelihoods of abstaining or consuming alcohol in small amounts, and were associated with increased risk of demonstrating heavy drinking patterns. However, the likelihood of demonstrating heavy drinking patterns (i.e., likelihood of membership in the *non-problem drinkers*) was slightly lower among those who experienced more depressive symptoms. While the likelihood of heavy drinking still increased as

a function of delinquency, those who also reported depressive symptoms were less likely to demonstrate heavy drinking patterns than those who did not experience depressive symptoms. It may be that delinquency is a more robust predictor of particular kinds of alcohol use, such that delinquency is inversely related to abstaining or low levels of consumption, but that the extent to which delinquency predicts heavy alcohol use is dependent upon co-occurring depressive symptoms. These findings substantiate those of Colder et al. (2012), who found that externalizing problems were more effective predictors of later alcohol use when adolescents were only displaying externalizing problems. However, if externalizing problems were coupled with internalizing problems, the relationship between these predictors and alcohol use was weaker. It appears that while delinquency in adolescence indicates that individuals will engage in some kind of alcohol use as an adult, the extent to which this alcohol use will consist of binge drinking and/or intoxication is dependent upon comorbid depression.

Limitations

These findings must be appreciated in light of a number of limitations. First, membership in the *loyal* profile was related to more pronounced odds (that is, either higher or lower odds continuing in the same direction as the unconditional effects) of membership in each alcohol use profile when compared to the *problem drinkers*; however, only eight individuals were members of both the *loyal* religiosity profile and the *problem drinkers* (see Table 5.1). Thus, even though comparisons between the problem drinkers and any other alcohol use profile within the *loyal* profile resulted in extremely large and significant odds ratios, these results may not be trustworthy due to a small cell size. We caution against making conclusions about the relationship between the predictors and alcohol use profiles using the *problem drinkers* as a reference group when conditioned on membership in the *loyal* religiosity profile.

An additional limitation is related to our examination of delinquency and depression at baseline, religion one year post-baseline, and alcohol use outcomes 13 years post-baseline. This leaves a large period of time unaccounted for, in which numerous events may have happened that were not captured by data collection. For instance, it may be that some individuals became dependent upon alcohol and subsequently went into treatment, and are now represented in the *abstainers*; these individuals may be qualitatively different from those who have never drank or drink infrequently. Also, the reciprocal effects of delinquency and depression may differentially influence adulthood alcohol use profiles (Kim et al., 2003). Parallel process models that track these influences at each time point may provide a more nuanced understanding of how these intertwined factors predict alcohol use.

Other limitations include a reduction in sample from the original, nationally representative Add Health sample. While such reductions were made in order to make meaningful comparisons utilizing all available data, this practice reduces the generalizability of our findings. Such reduction in sample may have influenced the examination of the protective effects of religion on delinquency, similar to the ways in which the relationship between delinquency and religion varies depending on the region of the country in which the sample is taken (Stark, 1996). Additionally, we did not account for socioeconomic status (e.g., total household income, parental level of education, etc.) in these analyses because the effects of these factors were beyond the scope of this project. However, such omission limits our ability to account for additional environmental factors in the development of alcohol use and the initial levels of adolescent delinquency. Finally, we did not account for a number of other variables that have been related to the development of alcohol use, such as social support (Borders et al., 2010), peer alcohol use (Mason et al., 2007), and self-regulation (Desmond, Ulmer, & Bader, 2013; DeWall et al., 2014). Future research should include additional auxiliary variables, such as those just mentioned, to understand the complex mechanisms through which these typologies develop across time.

Table 5.1: Numbers of Individuals in Religiosity-Alcohol Use Profile Combinations

Alcohol Use Profile	Religiosity Profile						Total	
	Loyal		Reserved		Apathetic			
Problem	8	2.5%	161	50.9%	147	46.5%	316	100.0%
	1.4%		13.5%		17.5%			
Non-Problem	227	32.1%	305	54.1%	176	24.9%	708	100.0%
	39.1%		25.6%		21.0%			
Low-Intake	110	12.5%	439	49.7%	334	37.8%	883	100.0%
	19.0%		36.9%		39.8%			
Abstainers	235	33.4%	286	40.7%	182	25.9%	703	100.0%
	40.5%		24.0%		21.7%			
Total	580		1191		839		2610	
	100.0%		100.0%		100.0%			

Note. Religiosity profiles were derived from Wave 2 responses, while alcohol use profiles were derived from Wave 4 responses. Percentages to the right of the cell reflect proportion of the religiosity profile in the respective alcohol use profile; percentages below the cell reflect the proportion of the alcohol use profile in that particular religiosity profile. Percentages may be off by 0.1% due to rounding. These *ns* were taken from the full model; they will not match with the unconditional LPA models in Figures 2 and 3.

Implications and Future Directions

This is the first attempt to examine two person-centered analyses of religion and alcohol use within a single model. Such analyses capture different characteristics of individuals than do variable-centered analyses and allow for examination of nuances in the relationships between delinquency, depression, religiosity, and alcohol use across various qualitatively different typologies of religious individuals and alcohol users. As such, we propose that delinquency and depression are predictive of alcohol use depending on what *type* of religious person an individual is (accounting for varying levels of numerous religious behaviors and beliefs), rather than assuming delinquency and depression impact alcohol use in the same way across all individuals with the same numerical score of religiosity. Such a person-centered examination of religiosity in particular is pertinent, considering a societal trend of decreasing affiliation with organized religion, evidenced by increasing numbers of Americans considering themselves to be religious “nones” (L. D. Pearce et al., 2013; Pew Research Center, 2015). Even though fewer Americans are identifying with traditional religious denominations, this does not mean that they are avoiding existential thinking or an occasional attendance at a religious activity; person-centered approaches will continue to be useful to identify nuances in such patterns of nontraditional or unorganized religious beliefs and practices. Future research should continue examining the composition of adolescent religiosity profiles utilizing a wide variety of religious indicators, psychosocial correlates of those profiles, and the stability of religiosity patterns over time.

Additionally, we replicated the alcohol use profile structure at Wave 4 that was found by Donovan and Chung (2015) among the Add Health sample at Wave 1. We suggest that the observed stability across a thirteen-year span offers some validity as to the structure of discrete drinking profiles. However, we did not assess whether the same individuals who were members of each profile in Donovan and Chung’s analysis demonstrated the same pattern of alcohol use in our analysis (i.e., were those most likely to be members of the *abstainers* at Wave 1 still most likely to be members of the *abstainers* at Wave 4?) Future

research should examine whether individuals remain in the same alcohol use profile over time, or whether other factors, such as self-regulation, stressful life events, or alcohol abuse treatment influence a shift in drinking profile membership. This may also reveal whether the likelihood of demonstrating one pattern of drinking behaviors is predictive of a different pattern later in life (e.g., are those who are likely to demonstrate the pattern of alcohol use behaviors represented by the *non-problem drinkers* likely to later demonstrate that of the *problem drinkers*?).

These results highlight the nuanced pathways through which delinquency and depression are related to later alcohol use. The person-centered approach used in this analysis identified three types of religious adolescents and four types of adult alcohol users, and inferred that delinquency and depression differentially predict the extent to which individuals developed these prototypical response patterns. This suggests that those working with delinquent or depressed youth must assess not only one's religious service attendance or personal importance of religiosity to estimate the extent to which religiosity should be a protective factor, but should examine the combination of particular religious beliefs and practices to which that individual ascribes. In addition, it is important to identify what *type* of alcohol use is most important to prevent for each individual throughout the lifespan. That is, is it more important that a particular individual avoids initiating into alcohol use at any point in life? Or, is it more important that an individual avoids problematic alcohol use, while light to moderate adult alcohol use is still acceptable? Behavioral antecedents of abstinence or light use can be identified, and those antecedents can be promoted among at-risk individuals. Future research is also needed to identify whether specific facets of externalizing behaviors other than delinquency (e.g., antisocial behavior, aggression, drug use, etc.) or specific types of internalizing problems other than depression (e.g., social anxiety, excessive withdrawal, etc.) are prospectively related to particular patterns of alcohol use so that these specific behavioral antecedents can also be targeted in prevention or intervention efforts.

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