The Dose-Response Relationship of Adolescent Religious Activity and Substance Use: Variation Across Demographic Groups

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This article addresses two inconsistent findings in the literature on adolescent religious activity (RA) and substance use: whether a dose-response relationship characterizes the association of these variables, and whether the association varies by grade, gender, ethnicity, family structure, school type, and type of substance. Multinomial logistic regression analyses of a large, diverse data set of high school students in metropolitan Columbus, Ohio ($n = 33,007$), found marked differences in alcohol, marijuana, and cigarette use among youths who never, occasionally, or regularly participated in RA. Weekly RA was consistently associated with less substance use, yet occasional RA sometimes was associated with greater use. Four groups accounted for variations in the RA-substance use relationship: African American youths, younger White youths, 12th-grade White males, and 12th-grade White females. Researchers should avoid assuming the RA-substance use relationship is dose-response and consider the implications of this complexity for theory and practice.

Keywords: adolescents; substance use; religion

Considerable evidence suggests that religious activity (RA) is associated with decreased use of alcohol, tobacco, and marijuana use among adolescents (Amey, Albrecht, & Miller, 1996; Donahue & Benson, 1995; Wallace & Forman, 1998). Yet, studies in this area have yielded inconsistent findings on whether the effects of RA depend on individuals' demographic characteristics as well as the specific substance being studied. Even when no such differences have been reported, sample sizes are typically too small or not diverse enough to permit adequate testing (Wallace & Williams, 1997). Given the recent interest in faith-based approaches to addressing social ills like adolescent substance use (Farris, Nathan, & Wright, 2004; Office of National Drug Control Policy, n.d.), researchers and practitioners need to consider for what and for whom RA may be negatively associated with substance use.

As investigators have studied some of the mechanisms by which adolescents' RA may be associated with substance use, multivariate analyses have helped identify their relative importance (cf. Bahr, Maughan, Marcos, & Li, 1998; Mason & Windle, 2001). Much of

this research, however, rests on uncertain assumptions about the bivariate relationship between RA and substance use. The purpose of this article is to test two such assumptions: (a) whether a "dose-response" relationship characterizes the association of RA and substance use; and (b) whether this association varies by demographic group and type of substance. With their wide variety of samples, measures, and statistical techniques, previous studies in this area rarely focus directly on these questions, yet they may help explain the inconsistent findings that hamper researchers' ability to agree on the nature of the RA-substance use relationship. This study contributes to the existing literature in this area by examining a large, diverse data set with consistent measures and a systematic statistical approach. Doing so may help reconcile inconsistencies in previous research and guide future efforts to understand how RA fits into multivariate models of substance use.

Adolescent Religion and Substance Use

In the tradition of psychology (and theologian Paul Tillich), Pargament (1992) defines religion as "a search for significance in ways related to the sacred" (p. 204). This definition implies dimensions of both belief (i.e., "significance") and practice (i.e., "a search"). Writing from a different perspective, sociologists highlight religion's communal nature—that practices and beliefs only represent a religion when they are shared within a community of affiliated members (Durkheim, 1912/1965). Thus, religion is made up of three broad dimensions: beliefs, affiliation, and practice. Beliefs refer to one's understanding of the world and one's place in it. Such beliefs relate to substance use because they include perceptions of the acceptability of illegal or antisocial behavior in general, the immorality of specific behaviors (e.g., alcohol use), and the sanctity of one's physical body (Brody, Stoneman, & Flor, 1996; Lorch & Hughes, 1985). Affiliation refers to how religion shapes the structure and function of one's social network. Involvement in a congregation affords youths opportunities to develop closer relationships within the family (Mahoney, Pargament, Tarakeshwar, & Swank, 2001; Simons, Simons, & Conger, 2004) and provides opportunities for regular exposure to prosocial peers (Burkett & Warren, 1987; Simons et al., 2004) and activities (Kerestes, Youniss, & Metz, 2004). Through these mechanisms, religious affiliation can reduce the likelihood of adolescent substance use. The third dimension, religious practice, is made up of both private/nonorganizational (e.g., reading Scripture, personal prayer) and public/organizational (e.g., attending religious services; youth group activities) behaviors. This study focuses on these public or organizational behaviors and groups them under the term "religious activity" as described below.

What Is Religious Activity?

The great prevalence of RA among American youth warrants its study as a potential protective factor (Wallace & Williams, 1997). About 38% of American adolescents report attending religious worship services at least once per week and more than half attend at least once per month (Smith, Denton, Faris, & Regnerus, 2002). In addition, each week, millions of young Americans attend religious services or participate in other religious activities such as youth ministries and Bible study groups. Beside school, no other public institution engages so many young people on a regular basis (Gallup & Bezilla, 1992). Given the diversity of these activities and the different meanings assigned to them, measuring youths' religious activity can be difficult. Nonetheless, even single survey items (e.g., "How often do you go to religious services?") may capture a broad

range of participation in religious activities (Smith, 1998). In this study, we label such behavior "religious activity" (RA) and define it as youths' overall involvement in public religious activities. Although it represents only one of several dimensions of religiosity among youth (Holder et al., 2000), RA is an essential part of most conceptual definitions of religiosity. Among studies that do examine several dimensions of religion, RA often exhibits the strongest associations with adolescent risk behaviors (cf. Adlaf & Smart, 1985; Amey et al., 1996; Brown, Parks, Zimmerman, & Phillips, 2001; Lorch & Hughes, 1985).

Is There a Dose-Response Relationship Between RA and Substance Use?

In a recent review, Powell, Shahabi, and Thoresen (2003) described the negative effects of RA on adult mortality as "strong, consistent, prospective and often graded" (p. 36). Whether RA has a similar association with adolescent substance use relates to the conceptualization of RA as a protective factor and/or lack of RA as a risk factor (Miller, Davies, & Greenwald, 2000; Wallace, Brown, Bachman, & LaVeist, 2003). A dose-response relationship implies that both types of effects exist, so that, for example, the risk of no versus occasional RA exists alongside the protection associated with regular versus occasional RA (cf. Stouthamer-Loeber et al., 1993). Conceptually, such an assumption is plausible. Given the broad presence of religion in American public life, youths who do not participate in any RA may be particularly disconnected from social institutions and also lack exposure to conventional values espoused by congregations. Because adolescent substance use is negatively associated with these characteristics (Petraitis, Flay, & Miller, 1995), lack of RA may represent a risk factor (or, alternately, a risk marker) for substance use.

At the other end of the spectrum, high levels of RA may also convey protection above and beyond occasional RA. Adolescents who regularly engage in RA may be well-integrated into dense mixed age social networks of peers and adults that encourage and reinforce conventional norms and provide prosocial role models (Ebstyne King & Furrow, 2004). In one national study, Wallace and colleagues (2003) reported that weekly RA (versus less frequent RA) was associated with abstaining from substance use.

The dose-response nature of the RA-substance use relationship also depends on one's conceptualization of substance use: In short, does RA have the same association with lower levels of use as it does with more intensive use? To the extent that different variables influence initiation versus escalation of substance use (Dierker, Avenevoli, Goldberg, & Glantz, 2004; Lloyd-Richardson, Papandonatos, Kazura, Stanton, & Niaura, 2002; van den Bree & Pickworth, 2005), the association between RA and substance use may not be simply dose-response. Some evidence, for instance, suggests that religiosity is associated with regular cigarette use but not occasional use (Nonnemaker, McNeely, & Blum, 2003; van den Bree, Whitmer, & Pickworth, 2004). Evidence for other substances, however, is less consistent, with effects being shown for experimental and problem alcohol use (Brown et al., 2001), as well as for problem use but not experimental use (Nonnemaker et al., 2003).

Variation by Demographic Group and Type of Substance

RA's effects may vary for different types of youths because demographic variables serve as markers for the presence of other risk factors (Rutter, 2003). For example, com-

pared with females, males tend to be more prone to sensation-seeking and perceive fewer negative consequences associated with substance use (Nolen-Hoeksma, 2004). Therefore, examining gender differences in the RA-substance use relationship represents, in part, an effort to understand whether RA affords similar protection for youths with higher or lower levels of certain risk factors. Yet, because there is no such thing as a statistically average male (or, for that matter, White teen or Catholic school sophomore; Lewin, 1931), it is necessary to study multiple dimensions of demographic differences to achieve a more nuanced understanding of the influence of a single variable like RA.

Studying demographic differences also helps make research more relevant for health promotion practice. In classrooms, congregations, and communities, adolescents are often organized by age, gender, and/or ethnicity: Schools group together teens of similar ages into grades and classrooms; congregations often develop distinct programming for girls and boys; de facto racial segregation in neighborhoods and schools often leads to youth programming that is implicitly or explicitly targeted to a specific ethnic group. In light of these divisions, research findings will be of greatest value to practitioners when they acknowledge both the universality and particularity of potential protective factors like RA.

In this article, we focus on three of the most common types of substance use in adolescence: alcohol, tobacco, and marijuana use. In addition, we concentrate on key demographic variables, including gender, ethnicity, grade, family structure, and Catholic versus public school enrollment. Fortunately, a large literature on adolescent substance use has yielded some relatively consistent findings on which to base the hypotheses for this study.

Type of Substance

Previous studies suggest that RA has less of an effect on alcohol use than on illicit drugs, particularly marijuana (Adlaf & Smart, 1985; Amoateng & Bahr, 1986; Cochran & Akers, 1989; Grunbaum, Tortolero, Weller, & Gingiss, 2000; Nelsen & Rooney, 1982; Nonnemaker et al., 2003; Wallace & Forman, 1998). Several studies have also found cigarette smoking to be negatively associated with RA, with the magnitude of the effect being similar to (Amey et al., 1996; Nonnemaker et al., 2003) or greater than (Wallace & Forman, 1998) its effect on alcohol. Based on this evidence, we hypothesize that RA will have a smaller association with alcohol than with cigarette or marijuana use.

Gender

Males and females often have profoundly different experiences within religious institutions and communities. Religious doctrine and culture shape gender roles that guide different expectations of appropriate behavior for boys and girls, expectations that may influence their likelihood of using drugs. In the same vein, researchers have noted marked gender differences in rates of many types of substance use (Johnston, O'Malley, & Bachman, 2004). It is surprising, therefore, that many prominent studies in this area do not report testing whether the RA-substance use relationship varies by gender (Amey et al., 1996; Amoateng & Bahr, 1986; Cochran & Akers, 1989; Mason & Windle, 2001; Miller et al., 2000; Nonnemaker et al., 2003; Wallace & Forman, 1998). Studies that do consider such differences have yielded inconsistent results, alternately finding similar results for males and females (Adlaf & Smart, 1985; Bahr et al., 1998; Benda & Corwyn, 2000), stronger effects among males (Piko & Fitzpatrick, 2004; Steinman &

Zimmerman, 2004; van den Bree et al., 2004), or stronger effects for females (Oman et al., 2004). In the absence of consistent findings, we hypothesize finding no gender differences.

Ethnicity

Most studies of ethnic group differences in the RA-substance use relationship are limited to comparing African American and White youth. Numerous authors have argued that religion may be particularly important for healthy development among African American youths (Christian & Barbarin, 2001; Lincoln & Mamiya, 1990; Winfield, 1995). Several studies, however, have found that the effect of religiosity on risk behavior among African Americans is smaller than its effect among other youth (Amey et al., 1996; Brown et al., 2001; Wallace et al., 2003). These findings may reflect the "semi-involuntary" nature of church in the African American community (Hunt & Hunt, 2001; Lincoln & Mamiya, 1990). In this sense, occasional RA may reflect social pressure more than serving as a distinguishing characteristic of individual youth. Based on this evidence, we hypothesize that RA will have a greater effect among White than among African American youth.

Grade

Among the many changes that occur during adolescence, increases in substance use and decreases in RA are among the most consistent across a wide range of studies and samples. Because different risk and protective factors may influence the likelihood of initiating use, progressing from experimental to problem use, and maintaining use (Petraitis et al., 1995), it is plausible that the effects of RA may also vary by grade. Nonnemaker and colleagues (2003), for example, reported that RA influenced those reporting ever using alcohol or cigarettes as well as those reporting regular/problem use of these substances but that RA was not associated with experimental use. Other studies, however, found no age differences in RA's effect on substance use (Adlaf & Smart, 1985; Benda & Corwyn, 2000; Mason & Windle, 2002). Based on the weight of the evidence, we hypothesize that in this study, RA's effects will not vary by grade.

Family Structure

Growing up in a home with two parents influences substance use indirectly through the greater likelihood of authoritative parenting style, quality parent-child communication, and adequate financial resources (Brody & Forehand, 1993; McLoyd, 1990). According to a protective factor model of resiliency (Garmezy, Masten, & Tellegen, 1985), RA may be most influential in homes that lack these qualities. Unfortunately, few studies have tested whether RA's protective effects vary by family structure. Guided by theory, therefore, we hypothesize that RA will have a greater effect on substance use among youths who are not living in two-parent homes.

Catholic Versus Public Schools

Students enrolled in Catholic schools generally use less cigarettes and marijuana compared to students enrolled in public schools (Donaldson, Graham, Piccinin, & Hansen, 1994; Sorensen, 2000). This may result from greater religious proscription and prescrip-

tion concerning substance use, better student-teacher interaction, higher family-school-adolescent social integration, and better coping skills through more readily available religious coping mechanisms (Amoateng & Bahr, 1986; Sorensen, 2000).

As most Catholic schools require students to attend Mass, students who do not attend services outside of school may, nonetheless, report weekly RA on a survey. By combining "apparent" with "true" weekly attendees, analyses may underestimate the effects of weekly RA among Catholic school youth. Conversely, Catholic school youth who report never participating in RA may be more distinctive than their public school counterparts. By attending a religiously affiliated school, youth not only may be compelled to attend services but they may be more likely to have numerous opportunities for at least occasional RA. As such, Catholic school youth who report never engaging in RA may be more socially marginalized and/or less connected to school than their nonattending public school peers. Because these characteristics are associated with substance use (Maddox & Prinz, 2003; Parker & Asher, 1987), the effects of never participating in RA may be greater among Catholic school youth. Because of these conflicting models and the lack of empirical evidence, we hypothesize that the effects of RA on substance use will be similar for Catholic and public school youth.

In summary, we expect RA to have a negative association with alcohol, cigarette, and marijuana use, yet we also anticipate that the magnitude of this relationship will vary across some demographic characteristics but not others. Specifically, we hypothesize that RA will have the strongest association

- with marijuana use (versus alcohol and cigarette use);
- among White youths (versus African American youths); and
- among youths not living with intact families.

In addition, we do not anticipate differences by gender, grade, or Catholic versus public school attendance. Although we test for higher order interactions (e.g., whether ethnic group differences occur for both males and females), the lack of theory and empirical findings in this area precludes our advancing specific hypotheses.

METHOD

This study was approved by the Institutional Review Board of The Ohio State University. Sponsored by the Safe and Drug-Free Schools Consortium (n.d.), the Primary Prevention Awareness, Attitude and Use Survey (PPAAUS) is a triennial census of students between the 6th and 12th grades in Franklin County, Ohio. The county includes the city of Columbus, plus 15 other school districts as well as diocesan schools. The 2000 PPAAUS included data from 75,818 students, excluding 1,600 surveys with exaggerated or careless responses and 1,626 students who refused to participate. The final data set included 64% of the total age-eligible population in the county, 78% of the total school-enrolled population, and 98% of those completing the questionnaire. The most common reasons for failing to participate in the study included being chronically absent, home-schooled, or otherwise not enrolled in school. As such, the data are only representative of students who regularly attended schools in Franklin County in 2000.

Because substance use was uncommon among younger students, data for this study are limited to students in grades 9 through 12. The large number of covariates in the study limited our ability to test for ethnic group differences beyond African American versus

Table 1.   Percentage of High School Youth Reporting No, Occasional, and Regular Use of
            Alcohol, Marijuana, and Cigarettes ($n = 33,007$)

	Alcohol	Marijuana	Cigarettes
No use	37.2	64.2	54.7
Occasional use	51.5	24.0	32.4
Regular use[a]	11.3	11.8	13.0

a. For alcohol and marijuana use, regular use refers to weekly use; for cigarette use, regular use
refers to daily use.

White youth. (For example, there were only two Hispanic males in Catholic schools who
reported "some attendance.") Therefore, our final data set ($n = 33,007$) included high
school students who were either White (79%) or African American (21%). Of the final
sample, slightly more than half were female (51%) and included students from both pub-
lic ($n = 29,927$; 91%) and Catholic ($n = 3,080$; 9%) high schools. Most students (57%)
reported living with their mother and father, whereas 20% lived with their mother and
15% reported living with a parent and a step-parent. Ninth graders represented 29% of the
sample, 10th graders 27%, 11th graders 23%, and 12th graders 20%.

Measures

RA was measured by a single item, "How often do you take part in religious activities?
(going to church/synagogue services, activities, meetings)," with six response options
including, *never* (0), *before, but not in the past year* (1), *a few times a year* (2), *about once
or twice a month* (3), *about once or twice a week* (4), and *almost every day* (5). To sim-
plify the interpretation of analyses and examine the dose-response nature of the RA-sub-
stance use relationship, we collapsed this variable into three conceptually meaningful
categories (cf. Hunt & Hunt, 2001) that reflected frequency of RA during the past year:
never (0, 1); occasional (2, 3); and weekly (4, 5). Overall, 28% of the sample reported
never participating in religious activities (in the past year), 30% reported occasional par-
ticipation, and 42% reported at least weekly participation. These proportions resemble
those reported in nationally representative samples (Smith et al., 2002).

Alcohol, marijuana, and cigarette use were each measured by single items assessing
frequency of use during the past year. Response options ranged from *never* (0) to *almost
every day* (5). We collapsed responses to each item into three conceptually meaningful
categories (no vs. occasional use vs. regular use) because the data were highly skewed
and to help model the dose-response relationship between RA and substance use. For
alcohol and marijuana use, the categories were "no use," "occasional use" (i.e., less than
weekly), and "regular use" (weekly or more often). For cigarette use, we defined regular
use as *daily use* (5) and *occasional use* as being less than daily (2, 3, 4). Table 1 presents
the proportion of youth reporting each level by type of substance use.

Data Analysis

Because each outcome variable was a three-level categorical variable, we used
multinomial logistic regression to determine which factors were significantly associated
with each outcome. The models were developed with a training data set, which included a
random sample of 75% of the entire data set. The models that resulted were examined for
goodness-of-fit and discrimination using the Hosmer-Lemeshow test and examining the

Table 2.   Summary of Direction of Associations Between Occasional/Weekly Religious Activity (RA) and Occasional/Regular Substance Use

	Alcohol Use		Marijuana Use		Cigarette Use	
	Occasional	Regular	Occasional	Regular	Occasional	Daily
Blacks						
Occasional	+	0	0	0	+	0
Weekly	–	–	–	–	0	–
Whites, 9th grade						
Occasional	0	–	–	–	0	–
Weekly	–	–	–	–	–	–
White males, 12th grade						
Occasional	+	+	0	–	0	–
Weekly	–	–	–	–	–	–
White females, 12th grade						
Occasional	+	+	0	–	+	0
Weekly	–	–	–	–	0	–

NOTE: + = positive association (e.g., youth reporting occasional versus no RA are more likely to use alcohol occasionally [versus never]); 0 = no association; – = negative association (e.g., youth reporting occasional versus no RA are less likely to use marijuana occasionally [versus never]).

area under the ROC curve, respectively (Hosmer & Lemeshow, 2000). The models were then validated with the remaining 25% of the data using the Hosmer-Lemeshow test and then fit to the entire data set to estimate the parameters and standard errors. Given the very large size of the data set, we considered p values of less than .001 to be statistically significant.

RESULTS

In this section, we present estimates of the association between RA and occasional and regular alcohol, cigarette, and marijuana use (reference = no use) and describe how these relationships varied by specific demographic characteristics. To clarify presentation of these voluminous results, we report only selected findings in the text. Table 2 summarizes the direction of associations between RA and substance use for different demographic groups, whereas Figures 1 through 3 illustrate the magnitude of the association. For all three substances, we detected no interaction effects with family structure or Catholic school attendance. Therefore, the results presented below focus on differences by ethnicity, gender, and grade. When discussing differences by grade, we simplify our presentation by reporting only results for 9th and 12th grade. For a detailed presentation of findings, please refer to Tables A1 through A3 in the Appendix.

Except as noted in the text, Hosmer-Lemeshow tests indicated that each model fit the data well (Hosmer & Lemeshow, 2000). The discriminatory power of the models was often weak for distinguishing no use from occasional use, with values of the area under the ROC curve (AUROCC) ranging from .58 to .65. The models performed better when distinguishing no use from regular use, with AUROCC values ranging from .70 to .76.
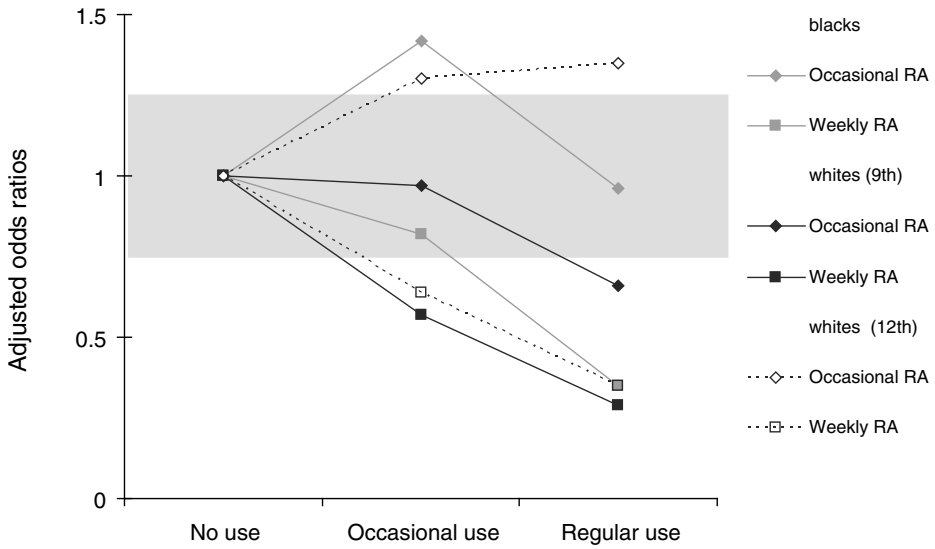
Figure 1. Adjusted odds ratios of occasional and weekly religious activity (RA) predicting occasional and regular alcohol use (reference = no use): Results for Blacks, Whites at 9th grade, and Whites at 12th grade.

NOTE: Adjusted for grade (for Blacks only), family structure, Catholic school attendance, and gender. The gray area covers odds ratios (> .82 or < 1.24) with 95% confidence intervals that include 1.00. Please see Appendix for coefficient estimates and model information.

Figure 2. Adjusted odds ratios of occasional and weekly religious activity (RA) predicting occasional and regular marijuana use (reference = no use): Results for Blacks, Whites at 9th grade, and Whites at 12th grade.

NOTE: Adjusted for grade (for Blacks only), family structure, Catholic school attendance, and gender. The gray area covers odds ratios (> .82 or < 1.24) with 95% confidence intervals that include 1.00. Please see Appendix for coefficient estimates and model information.
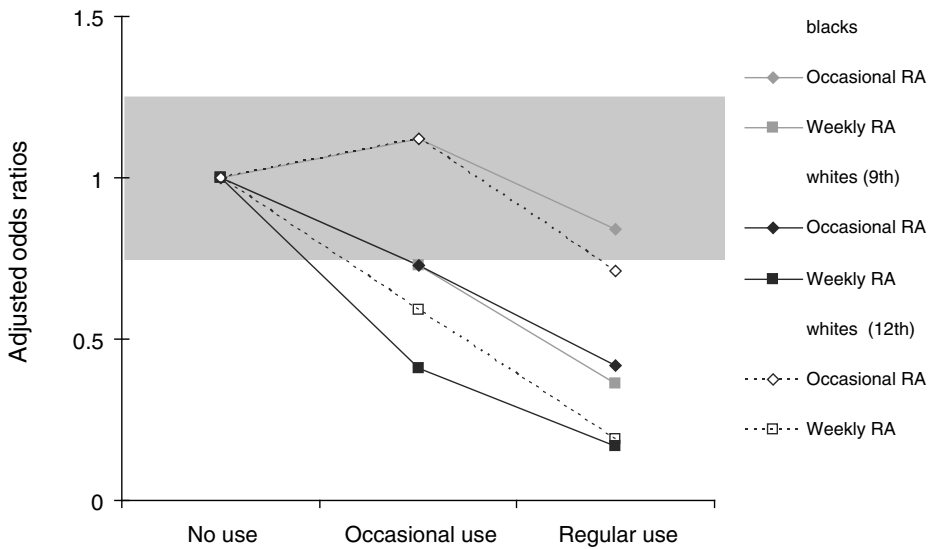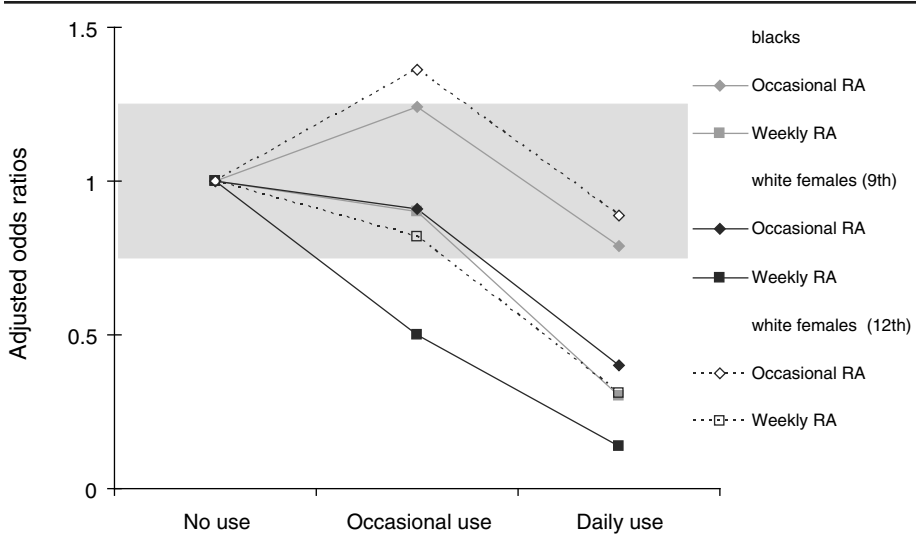
Figure 3.   Adjusted odds ratios of occasional and weekly religious activity (RA) predicting occasional and daily cigarette use (reference = no use): Results for Blacks, White females at 9th grade, and White females at 12th grade.

NOTE: Adjusted for grade and gender (for Blacks only), family structure, and Catholic school attendance. The gray area covers odds ratios (> .79 or < 1.24) with 95% confidence intervals that include 1.00. Please see Appendix for coefficient estimates and model information.

Alcohol Use

Significant interaction terms led us to estimate separate models for Whites and Blacks. Controlling for gender, grade, family structure, and Catholic school attendance, weekly RA among Blacks was associated with a decreased likelihood of both occasional (OR = .59, 95% CI = .53-.65) and regular (OR = .35, 95% CI = .27-.47) use (see Figure 1). Occasional RA, however, increased the odds of occasional alcohol use (OR = 1.42, 95% CI = 1.23-1.65) and had no association with regular use (OR = .96, 95% CI = .74-1.24).

Among Whites, the effects of occasional RA varied by grade. Controlling for the demographic characteristics, occasional RA in ninth grade had no association with occasional alcohol use (OR = .95, 95% CI = .84-1.09) and was negatively associated with regular use (OR = .68, 95% CI = .54-.84). By 12th grade, occasional RA was positively associated with both occasional (OR = 1.29, 95% CI = 1.06-1.54) and regular (OR = 1.36, 95% CI = 1.10-1.70) use.

In summary, for Blacks and Whites at all grades, weekly RA had a persistent, negative relationship with occasional and regular alcohol use. The effects of occasional RA, however, varied widely and were often associated with greater odds of alcohol use.

Marijuana Use

As with alcohol use, for marijuana use we estimated five separate models: one for Blacks and then one for Whites at each grade. Among Blacks, occasional RA had no association with occasional (OR = 1.12, 95% CI = .95-1.33) or regular (OR = .84, 95% CI = .68-1.03) marijuana use (see Figure 2). Weekly RA, however, was associated with lower odds of both occasional (OR = .73, 95% CI = .62-.85) and regular (OR = .36, 95% CI = .29-.44) use.

For Whites, the association between occasional RA and marijuana use diminished from 9th to 12th grade. In 9th grade, occasional RA was negatively associated with occasional (OR = .73, 95% CI = .62-.85) and regular (OR = .42, 95% CI = .34-.51) use. Among 12th graders, occasional RA had no association with occasional marijuana use (OR = 1.12, 95% CI = .95-1.31) and had a smaller (although still negative) association with regular use (OR = .71, 95% CI = .58-.85). Weekly RA maintained a strong negative association with occasional and regular use across all grades.

In summary, across all groups, weekly RA had a strong negative association with both levels of marijuana use. Occasional RA also was associated with decreased odds of use in several models, especially among younger Whites.

Cigarette Use

Estimating the association between RA and cigarette use required specifying six different models: one for Blacks, one for White males, and then one for White females at each grade. For Blacks, occasional RA was associated with greater odds of occasional cigarette use (OR = 1.24, 95% CI = 1.06-1.43) but had no association with daily cigarette use (OR = .79, 95% CI = .61-1.02). As presented in Figure 3, the only clear negative association involved weekly RA and daily cigarette use (OR = .30, 95% CI = .23-.40).

Both levels of RA evidenced a negative association with cigarette use among White males, with the exception of occasional RA having no association with occasional cigarette use (OR = 1.08, 95% CI = .98-1.20). For White females, the magnitude of the association for all levels of RA diminished from 9th to 12th grade. Occasional RA was negatively associated with daily cigarette use, for example, in 9th grade (OR = .40, 95% CI = .30-.52) but had no association in 12th grade (OR = .89, 95% CI = .69-1.14). The very strong negative association between weekly RA and daily cigarette use in 9th grade (OR = .14, 95% CI = .10-.18) diminished by 12th grade (OR = .31, 95% CI = .24-.41).

In summary, occasional and weekly RA often were negatively associated with daily cigarette use. The association of RA with occasional use was typically weak and, for Blacks and 12th-grade White females, was often positive.

DISCUSSION

Consistent with our hypotheses and previous research, RA often had a negative association with substance use, albeit with several important caveats. This article contributes to the research literature by identifying those caveats. In this section, we highlight key findings and discuss their implications for theory, research, and practice.

Our analyses support the utility of distinguishing four demographic groupings when examining the RA-substance use relationship among high school students: (a) African American youths; (b) younger White youths; (c) 12th-grade White males; and (d) 12th-grade White females. Moreover, for most of these groups, RA is differentially associated with use of alcohol, marijuana, and cigarettes. By examining these differences summarized in Table 2, several broad patterns become apparent.

The Dose-Response Relationship and Its Implications

If the RA-substance use relationship were dose-response, one would expect occasional RA to have a modest negative association with substance use, and weekly RA a

stronger one. Inspecting Table 2, one striking finding is the contrast between occasional and weekly RA. Whereas weekly RA typically exhibited a negative association with virtually all types and levels of substance use, occasional RA more commonly had no association or even a positive association with substance use. These differences relate to conceptualizations of RA as a protective factor and/or risk factor (cf. Stouthamer-Loeber et al., 1993). Our findings for weekly RA support the conceptualization of regular RA as a protective factor. It is difficult to conclude, however, that youths who never (versus occasionally) participate in RA are more likely to engage in substance use. As such, lack of RA generally did not represent a risk factor for substance use.

The potential role of RA in discouraging substance use may be represented through different models of resiliency (Garmezy et al., 1985). The compensatory model assumes that a youth's likelihood of engaging in risky behavior is an additive function of the risk and protective factors in their lives. As such, engaging in weekly RA should therefore reduce the likelihood of substance use for all youths. In contrast, the protective factor model suggests that RA will only influence substance use among youths who are already at heightened risk of engaging in the behavior. Thus, weekly RA may only influence youths who are already at risk. Our findings are more consistent with the compensatory model in that the effects of RA were similar for youths regardless of their family living arrangements. Because youths from two-parent homes tend to experience better developmental outcomes (Brody & Forehand, 1993), the protective factor model would have predicted stronger effects for youth from non-two-parent homes. This conclusion, however, is largely speculative, as our analyses did not account for numerous other possible risk factors. Moreover, family structure may not represent a good proxy for risk processes among some youth (Zimmerman, Salem, & Maton, 1995).

The general absence of a dose-response relationship also offers implications for research. Others have observed that the RA-substance use association is not dose-response (Hadaway, Elifson, & Petersen, 1984; Piko & Fitzpatrick, 2004; Wallace & Forman, 1998), yet many studies employ methods that presuppose just such a relationship (e.g., Adlaf & Smart, 1985; Amoateng & Bahr, 1986; Grunbaum et al., 2000; Nonnemaker et al., 2003). Longitudinal studies in this area, for instance, are rare and important but tend to model both RA and substance use as continuous variables that have a linear relationship (e.g., Brown et al., 2001; Mason & Windle, 2001; Steinman & Zimmerman, 2004). Studies that employ dichotomous measures may also be problematic, as they neglect to distinguish occasional from regular substance use (Amey et al., 1996; Wallace et al., 2003) or occasional versus weekly RA (Grunbaum et al., 2000; Sutherland & Shepherd, 2001). By being among the first to explicitly examine the dose-response relationship, this study should encourage researchers to assume nonlinearity in the RA-substance use relationship and employ appropriate methods accordingly.

Inappropriately assuming a dose-response relationship risks underestimating and misspecifying the association between RA and substance use. Our findings for the differential association of RA with alcohol, marijuana, and cigarette use illustrate such concerns. Whereas RA and marijuana use largely resembled a dose-response relationship in several models, the findings for alcohol and cigarette use were frequently more complex. Whereas several studies have reported that RA has a stronger association with marijuana use than with other substances (Adlaf & Smart, 1985; Amoateng & Bahr, 1986; Grunbaum et al., 2000; Nonnemaker et al., 2003), they employed continuous measures of RA and/or substance use and statistical techniques that presupposed a dose-response relationship between the variables. If this assumption were more accurate for marijuana

use than for other substances, then apparent differences in the strength of the relationship may be due to the choice of methods.

In this regard, comparing RA's association with marijuana use versus other substance use is characterized by both similarities and dissimilarities. Our analyses found that the association of weekly RA with occasional marijuana use and alcohol use was quite similar among African Americans (AOR = .73 vs. AOR = .82), as well as for Whites in 9th grade (AOR = .41 vs. AOR = .56) and 12th grade (AOR = .59 vs. AOR = .53). In contrast, there were large differences in weekly RA's association with regular marijuana use versus alcohol use in each of these groups (African Americans: AOR = .36 vs. AOR = .96; 9th-grade Whites: AOR = .17 vs. AOR = .68; 12th-grade Whites: AOR = .19 vs. AOR = 1.36). In light of these results, it may be an oversimplification to report that marijuana is more strongly associated with RA.

Researchers attribute the stronger effects of RA on marijuana use to inconsistencies in denominational prohibitions against alcohol, as opposed to nearly universal religious proscriptions against illegal drug use (Adlaf & Smart, 1985; Amoateng & Bahr, 1986; Bock, Cochran, & Beeghley, 1987). Our findings suggest that the effects of such different proscriptions are reflected in regular substance use, whereas other mechanisms might similarly discourage low levels of both alcohol and marijuana use. This idea extends Bahr and Hawks's (1995) description of paradoxical drinking, whereby those members of abstemious religions who do drink are more likely to drink heavily and frequently. Further research will be necessary to test this hypothesis directly.

Occasional RA and Occasional Substance Use

Looking at Table 2, occasional RA consistently had no association or a positive association with occasional substance use. That is, compared to nonparticipants, youths who participate in religious activities occasionally are more likely to smoke or drink occasionally. These puzzling findings are difficult to interpret. One explanation is that the finding reflects youths who simultaneously experiment with ordering and disruptive influences as a means of comparing different identity domains (Catalano & Hawkins, 1996). Another possibility is that youths may be more likely to attend services as a result of experimenting with different substances: When parents learn of their older teens' experimental use, some may respond by encouraging their children to attend religious services. This is consistent with risk-activated models of support (Masten, 2001), in which an individual who experiences stressors (e.g., discovery of a child's substance use) seeks out support (e.g., from a religious community) as a means of coping. In a cross-sectional study like ours, this mechanism could be represented by a positive association between stressors and support. Longitudinal studies, however, suggest that substance use has a negative prospective effect on RA (Mason & Windle, 2002; Steinman & Zimmerman, 2004).

The curious findings for occasional RA may also help describe ethnic group differences. Several excellent studies already evidence the stronger association of RA and substance use among White versus African American youth (Amey et al., 1996; Brown et al., 2001; Wallace et al., 2003). Our findings parallel those of Wallace and colleagues (2003), who found that youth who attended religious services rarely or monthly (versus never) were less likely to abstain from alcohol and cigarette use. They found such effects, however, only among African Americans and not Whites. This study builds on this earlier work by suggesting that Black/White differences in the RA-substance use relationship may be limited to younger high school students. Figures 1 through 3 suggest that patterns

of the RA-substance relationship are largely similar for African Americans and 12th-grade Whites. These earlier studies that found ethnic group differences were either limited to younger high school students (Brown et al., 2001) or did not test whether ethnic group differences varied by age (Amey et al., 1996; Wallace et al., 2003).

Implications for Health Promotion

Faith-based approaches to adolescent health promotion often rest on the premise that making teens in some way "more religious" will result in their becoming "less risky." Overall, our findings do not contradict this assumption, yet they do suggest that caution is warranted. Congregational programming for teens often includes both outreach to unaffiliated youth as well as efforts to strengthen social networks among those already affiliated. Similarly, parents may encourage their children to participate in religious activities in the hopes that doing so will limit their involvement in risky behavior. Our findings question whether encouraging teens to participate in RA occasionally—either through congregational outreach or parental insistence—is a promising strategy for adolescent substance use prevention. A more effective strategy may be to encourage greater participation among teenagers who are already affiliated with a congregation.

Another implication involves the age at which faith-based efforts are likely to be most effective. Although not a longitudinal study, our findings may suggest that the protective effects of RA may decline markedly during high school, at least for White youths. Practitioners working with faith-based organizations on substance use prevention might expect greater success in delaying heavy use among younger teens. In contrast, our findings provide much less support for the role of RA in discouraging use among older adolescents.

Limitations

Our single-item measures of RA and substance use captured only a small part of the complex, multidimensional relationship among these variables. This measurement concern is particularly worrisome when studying adolescents who have limited autonomy in determining the frequency of their religious service attendance (Wallace & Williams, 1997). Still, it is noteworthy that this study and others have detected moderate to large effects based on such limited measures. Among White ninth graders, for example, weekly attenders were only 17% as likely as never attenders to smoke marijuana. Nonetheless, there remains a great need for studies that employ different methods and more extensive measures of religion.

Another weakness of the study is its limited external validity beyond youths who regularly attend school in Franklin County, Ohio. Not only do both adolescent RA and substance use appear to vary by region (Johnston et al., 2004; Smith et al., 2002) but the relationship between the two may vary depending on community-level dimensions of religious behavior and norms (Regnerus, 2003). It is even less clear how these findings might extend to out-of-school youth. Out-of-school or truant adolescents were not included in the study and yet are more likely to engage in substance use and, perhaps, are less likely to participate in RA (Loury, 2004). Still, there is some evidence that the overall negative association of RA and substance use is also true for out-of-school youth. Grunbaum and colleagues (2000) found that RA was negatively associated with marijuana use in a high-risk sample of youths from "dropout prevention and recovery high schools." (A combined measure of cigarette and alcohol use had a similar odds ratio [.59], but the 95% confidence interval included 1.00.) In addition, employing extraordinary

efforts to entice truant youth to participate in school-based surveys of risk behavior may not markedly alter the findings (Guttmacher, Weitzman, Kapadia, & Weinberg, 2002). Nonetheless, further research will need to assess whether our findings can be extended to other regions as well as to out-of-school youth.

Even among youths within Franklin county schools, we were unable to include those reporting ethnicities other than White and African American. A growing number of American youths identify themselves as Asian, Hispanic, and Native American, yet we know little about how RA may influence their development. To the extent that religion has different meanings and effects among these teenagers, our findings may be irrelevant to their experiences.

The cross-sectional design of this study precluded our ability to test for the causal effects of RA on substance use. As a result, we cannot discount the possibility that the observed associations might be due to the spurious effects of a third variable. Personality traits, for example, can be detected in childhood and later influence both RA and substance use (Kendler, Gardner, & Prescott, 1997). Still, RA's broad association with so many proximate influences on adolescent substance use—parental monitoring, peer network characteristics, beliefs (Mahoney et al., 2001; Simons et al., 2004)—makes it unlikely that the relationship is entirely spurious. Rather, religiosity in general or RA in particular may represent a mediating mechanism by which personality influences the development of substance use during adolescence.

Conclusion

The relationship between adolescents' RA and substance use is complex and, at times, strong. Because effects may vary for different youth and different substances, both theory and findings like those in this study can guide researchers' decisions about when to anticipate variation in the RA-substance use relationship. For practitioners, our findings suggest that the greatest potential for faith-based prevention efforts may involve discouraging heavy substance use among younger teens. Rigorous program evaluation will be necessary to replicate this finding and expand the very limited published literature on faith-based approaches to adolescent substance use prevention (Bahr & Hawks, 1995; Johnson, Tompkins, & Webb, 2002).

APPENDIX
Tables A1-A3. Adjusted Odds Ratios (with 95% confidence intervals) for Occasional and Weekly Religious Activity Predicting Occasional and Weekly Alcohol Use (Table A1); Marijuana Use (Table A2); and Cigarette Use (Table A3)

Table A1. Adjusted[a] Odds Ratios (with 95% confidence intervals) for Occasional and Weekly Religious Activity Predicting Occasional and Weekly Alcohol Use: Separate Models for Blacks and for Whites in 9th, 10th, 11th, and 12th Grades

	Occasional Alcohol Use[b]					Weekly Alcohol Use[b]				
		Whites					Whites			
	Blacks	9th	10th	11th	12th	Blacks	9th	10th	11th	12th
Religious activity										
Never	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Occasional	1.42	.95	1.07	1.22	1.29	.96	.68	.73	.96	1.36
	(1.23	(.84-	(.93-	(1.04-	(1.06-	(.74-	(.54-	(.59-	(.78-	(1.10-
	-1.65)	1.09)	1.24)	1.43)	1.54)	1.24)	.84)	.89)	1.18)	1.70)
Weekly+	.82	.56	.59	.59	.63	.35	.30	.29	.31	.35
	(.71-	(.50-	(.52-	(.51-	(.54-	(.27-	(.24-	(.24-	(.25-	(.29-
	.93)	.63)	.68)	.68)	.74)	.47)	.38)	.35)	.39)	.44)

NOTE: *N*s for each model: Blacks, *n* = 6,355; 9th-grade Whites, *n* = 7,175; 10th-grade Whites, *n* = 6,885; 11th-grade Whites, *n* = 6,151; 12th-grade Whites, *n* = 5,279.
a. Adjusted for grade (Blacks only), gender, family structure, and Catholic school attendance.
b. Reference = no alcohol use.

Table A2. Adjusted[a] Odds Ratios (with 95% confidence intervals) for Occasional and Weekly Religious Activity Predicting Occasional and Weekly Marijuana Use: Separate Models for Blacks, for Whites in 9th Through 11th Grades, and for Whites in 12th Grade

	Occasional Marijuana Use[b]					Weekly Marijuana Use[b]				
		Whites					Whites			
	Blacks	9th	10th	11th	12th	Blacks	9th	10th	11th	12th
Religious activity										
Never	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Occasional	1.12	.73	.79	.87	1.12	.84	.42	.54	.57	.71
	(.95-	(.62-	(.68-	(.75-	(.95-	(.68-	(.34-	(.45-	(.47-	(.58-
	1.33)	.85)	.92)	1.00)	1.31)	1.03)	.51)	.65)	.68)	.85)
Weekly+	.73	.41	.47	.51	.59	.36	.17	.21	.22	.19
	(.62-	(.34-	(.40-	(.44-	(.50-	(.29-	(.14-	(.17-	(.18-	(.15-
	.85)	.48)	.54)	.60)	.69)	.44)	.22)	.26)	.28)	.24)

NOTE: *N*s for each model: Blacks, *n* = 6,355; 9th-grade Whites, *n* = 7,168; 10th-grade Whites, *n* = 6,882; 11th-grade Whites, *n* = 6,156; 12th-grade Whites, *n* = 5,283.
a. Adjusted for grade (Blacks only), gender, family structure, and Catholic school attendance.
b. Reference = no marijuana use.

Table A3. Adjusted[a] Odds Ratios (with 95% confidence intervals) for Occasional and Weekly Religious Activity Predicting Occasional and Daily Cigarette Use: Separate Models for Blacks, for White Males, and for White Females in 9th, 10th, 11th, and 12th Grades

| | Occasional Cigarette Use[b] | | | | | | Daily Cigarette Use[b] | | | | | |
| | | White | White Females | | | | | White | White Females | | | |
	Blacks	Males	9th	10th	11th	12th	Blacks	Males	9th	10th	11th	12th
Religious activity												
Never	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Occasional	1.24	1.08	.91	.72	1.15	1.36	.79	.55	.40	.43	.48	.89
	(1.06-	(.98-	(.74-	(.57-	(.93-	(1.08-	(.61-	(.48-	(.30-	(.34-	(.38-	(.69-
	1.43)	1.20)	1.11)	.90)	1.41)	1.71)	1.02)	.62)	.52)	.56)	.62)	1.14)
Weekly+	.90	.75	.50	.65	.57	.82	.30	.23	.14	.16	.18	.31
	(.77-	(.68-	(.41-	(.53-	(.47-	(.66-	(.23-	(.20-	(.10-	(.12-	(.14-	(.24-
	1.03)	.83)	.61)	.80)	.70)	1.02)	.40)	.27)	.18)	.21)	.24)	.41)

NOTE: *N*s for each model: Blacks, *n* = 6,380; White males, *n* = 12,430; 9th-grade White females, *n* = 3,606; 10th-grade White females, *n* = 3,549; 11th-grade White females, *n* = 3,235; 12th-grade White females, *n* = 2,756.

a. Adjusted for grade (Blacks and White males only), gender, family structure, and Catholic school attendance.

b. Reference = no cigarette use.

Model Fit Indices for Multinomial Logistic Regression Models Predicting Alcohol Use, Marijuana Use, and Cigarette Use

Model Fit Indices for Alcohol Use

		N	Area Under ROC Curve	Hosmer-Lemeshow $\chi^2_{(8)}$ Goodness-of-Fit Test $(p =)$
Blacks	no vs. occasional use	5,323	.63	.40
Blacks	no vs. weekly	3,088	.70	.54
Whites	no vs. occasional use	17,352	.65	.39
Whites	no vs. weekly	9,302	.72	.92

Model Fit Indices for Marijuana Use

		N	Area Under ROC Curve	Hosmer-Lemeshow $\chi^2_{(8)}$ Goodness-of-Fit Test $(p =)$
Blacks	no vs. occasional use	4,971	.64	.70
Blacks	no vs. weekly	4,139	.70	.70
Whites, 9th grade	no vs. occasional use	5,083	.65	.82
Whites, 9th grade	no vs. weekly	4,675	.75	.32
Whites, 10th grade	no vs. occasional use	4,786	.64	.46
Whites, 10th grade	no vs. weekly	4,675	.76	.80
Whites, 11th grade	no vs. occasional use	4,086	.60	.83
Whites, 11th grade	no vs. weekly	3,428	.70	.59
Whites, 12th grade	no vs. occasional use	3,456	.60	.23
Whites, 12th grade	no vs. weekly	2,786	.72	.03

Model Fit Indices for Cigarette Use

		N	Area Under ROC Curve	Hosmer-Lemeshow $\chi^2_{(8)}$ Goodness-of-Fit Test $(p =)$
Blacks	no vs. occasional use	5,358	.62	.23
Blacks	no vs. weekly	3,829	.73	.02
White females	no vs. occasional use	2,290	.63	.45
White females	no vs. weekly	1,743	.76	.20
White males	no vs. occasional use	2,198	.58	.05
White males	no vs. weekly	1,740	.73	.14

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