THE EFFECT OF TEENAGE INCOME AND UNSTRUCTURED TIME ON ALCOHOL, MARIJUANA, AND TOBACCO USE

by

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A thesis submitted to the Graduate Council of
Texas State University in partial fulfillment
of the requirements for the degree of
Master of Science in Criminal Justice
with a Major in Criminal Justice
May 2021

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ACKNOWLEDGEMENTS

I want to start by first thanking my thesis committee, Dr. Lucia Summers, Dr. Shayne Jones, and Dr. Mark Stafford for giving their time and expertise in helping complete this thesis. I also want to thank Dr. Marcus Felson who originally chaired this thesis as well as provided the topic of interest. A special thanks to Dr. Lucia Summers who dedicated countless hours of her time to make sure the thesis presented here was my best work and it would not have been completed without her.

I also want to thank my family, friends, and girlfriend who helped me in completing this thesis. There were many hardships and delays that could have stopped this research, but their encouragement allowed me to continue. I am truly appreciative of the people I have in my life that have been patient, loving and supportive.

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ABSTRACT

The present research aimed to examine how income and time spent in structured and unstructured activities are associated with alcohol, tobacco, and marijuana use among high school seniors. The research used data from the 2018 Monitoring the Future study, and three ordinary least squares (OLS) regression models, one for each of the outcome variables. In line with expectations derived from the routine activity perspective, time spent on all three unstructured activities considered (i.e., evenings out for fun, driving around for fun, and going to parties) were positively and significantly associated with alcohol, tobacco, and marijuana use. For the structured activity of sports, both tobacco and marijuana use were negatively and significantly associated with the activity, but no significant impact on alcohol use was detected. Hours worked (the other structured activity considered) was found to be significantly and positively associated with tobacco use, against expectations. This may be explained by work income having a detrimental impact on substance use, as it would provide adolescents with the purchasing power (and thus the opportunity) required. Both alcohol and marijuana use were significantly and positively associated with this variable. Income from an allowance was significantly and positively associated with tobacco use only. This research provided a further test of the routine activity perspective and based on the findings, suggested potential measures that may reduce opportunities for substance use among adolescents.

I. INTRODUCTION

As many as 77% of senior high schoolers admit to trying alcohol, over 50% have tried cigarettes, and more than 40% have tried marijuana (Miech et al., 2018). Previous research has shown that tobacco, alcohol, and marijuana can have serious effects on a juvenile's health and life opportunities. Specifically, both tobacco and alcohol are among the leadings causes of death in preventable behaviors (Mokdad et al., 2004). While this is an extreme and long-term outcome, these illegal substances can have long-lasting effects on a juvenile's life opportunities such as falling behind academically, developing a more serious substance abuse problems, difficulties securing and maintaining employment, and even criminal behavior (Ellickson et al., 2003). For these reasons, it is important we understand what drives or enables substance use among adolescents so we can try to curtail it.

The present research aimed to examine how income and time spent in structured and unstructured activities are associated with alcohol, tobacco, and marijuana use among youth. In the pages that follow, recent research on usage rates for this population is briefly described, to set the research in context, and this is followed by a discussion of the theoretical framework for the research. The literature on the influence of the variables of interest on adolescent illicit substance use is then reviewed. This chapter concludes with a clear statement of the aims of the research and the hypotheses formulated. In the methodology chapter, a description of the data set to be employed is provided, as well as a detailed description of the explanatory and outcome variables, and the analytical strategy proposed to answer the research questions. This is then followed by the results of the analyses and a discussion of the limitations and implications of the findings.

II. LITERATURE REVIEW

Substance use among juveniles can have short- and long-term effects on their health as well as their life opportunities. A study done in the early 2000s found that the leading cause in death due to preventable behaviors was attributed to tobacco use, with alcohol consumption following closely as the third leading cause of death (Mokdad et al., 2004). Tobacco use among adolescents has also been linked to adult smoking, an increased likelihood of initiating alcohol consumption as well as binge drinking in later years, and even major depressive disorder in adulthood (Mathers et al., 2006). Although a clear causal effect has not been fully demonstrated, research has reported an association between cigarette and alcohol use with marijuana use and the latter, in turn, has been linked to a higher chance of using other drugs (Merrill et al., 1999).

Not only can substance use adversely impact the health of juveniles, but it can also limit their life opportunities if, for example, the young person gets arrested for illicit substance possession. One longitudinal study compared early drinkers, individuals who experimented with drinking, and nondrinkers, and found that early drinkers and experimenters were more likely than nondrinkers to report academic problems, substance use, and delinquent behavior in both middle school and high school (Ellickson et al., 2003). This study also reported that, by young adulthood, the individuals who engaged in early alcohol use and experimenters were more likely to abuse other substances, have employment problems, and engage in criminal and violent behavior (Ellickson et al., 2003).

Given the importance of this topic, it is crucial we develop a full understanding of the drivers of illicit substance use among juveniles, with the goal of preventing such

behaviors. Using a routine activity perspective framework (Cohen & Felson, 1979), this study examines the influence of income and time spent in structured and unstructured activities on alcohol, tobacco, and marijuana use among juveniles, using data from the Monitoring the Future study (Miech et al., 2018).

Alcohol, Tobacco, and Marijuana Use Among Adolescents

Research has shown alcohol is one of the most common substances that young people use, with 52% to 77% of senior high school students having tried alcohol (Apel et al., 2006; Johnston et al., 2004). Alcohol use among adolescents is estimated to be frequent (e.g., two thirds reporting drinking in the previous month; Bachman & Schulenberg, 1993) and, at times, heavy (e.g., 22-27% of senior high school students reported heavy alcohol usage in the past year; Anderson & Hughes, 2009; Staff & Uggen, 2003).

Tobacco has been found to be used at similarly high rates, with 54% of seniors reporting cigarette use at some time in their life (Johnston et al., 2004). Of those who had reported any tobacco use in the past year, most smoked on a daily basis, with many smoking half a pack or more a day (Bachman & Schulenberg, 1993). While not as commonly used as alcohol and tobacco, research has shown 22% of adolescents reported using marijuana in the previous year and almost 14% within the previous month (Anderson & Hughes, 2009; Staff & Uggen, 2003).

Theoretical Framework

Routine activity theory (RAT) has been used to better understand alcohol and other substance use, and is the theoretical framework of the current study. Traditional

theories of criminality tend to focus solely on the offender while RAT focuses on the opportunities for crime in everyday life. RAT was first proposed by Lawrence E. Cohen and Marcus Felson in 1979 as an explanation for the crime rate increases observed in robbery, aggravated assault, forcible rape and homicide in the 1950s and 1960s, despite the positive social changes observed over the same time period. Cohen and Felson (1979) used the dispersion of activities away from households as the driving force for the increase in crime. This dispersion, they argued, created opportunities for crime, by increasing the likelihood of motivated offenders and suitable targets converging in space and time in the absence of a capable guardian. A motivated offender is someone who wants to commit a criminal act and has the ability to do so. A suitable target is an object or person with value to the motivated offender that is accessible and that does not present challenges of being acted upon. Finally, the absence of capable guardians refers to the lack of individuals who can prevent criminal acts. RAT proposes that, in order for a crime to occur, all three elements must be present, in what has become known as the crime triangle. If any one of these elements is eliminated, then crime can be prevented.

In the present context, a motivated offender would be any adolescent who wants to drink alcohol or use another illegal substance like tobacco and marijuana. Alcohol, tobacco, or marijuana would be the target, and such a target would become more accessible as the adolescent's spending power increases. A capable guardian would be anyone who would prevent the adolescent from using these illegal substances. During unstructured time (e.g., hanging out with friends), capable guardians would be absent so adolescents are free to do what they want, within their means. In contrast, structured

activities would limit the young person's ability to engage in deviant behavior, as capable guardians would be more likely to be present.

Impact of Structured and Unstructured Time

Adolescents' use of time is important for understanding illegal substance use among today's youth. Osgood and his colleagues, among others, applied the RAT's situational explanation of crime to explain a broader range of deviant behaviors (Osgood et al., 1996). Specifically, they reasoned that unstructured and unsupervised socializing with peers provided for ample opportunities for deviance and showed that motivation was situational in nature.

Consistent findings were reported by Barnes et al. (2007), who demonstrated the amount of time spent in unstructured activities such as relaxing alone and time spent with peers was linked to the development of adolescent problem behaviors. Barnes et al. (2007) also reported family time was a protective factor against heavy alcohol use, cigarette smoking, and illicit substance use. In a similar vein, Anderson and Hughes (2009) found parental unavailability and unstructured socializing had a moderate impact on both alcohol consumption and marijuana use, showing again that a lack of a capable guardian enables adolescent deviant behavior.

Given that unsupervised adolescents are more likely to engage in problem behaviors, it would follow that after school programs (ASP) should reduce delinquency. However, the research on this topic has produced mixed results. For example, Zill et al. (1995) used data from the Monitoring the Future survey (an earlier version of the same survey this research will use) to explore the relationship between how adolescents used their time and self-reported risky behaviors such as dropping out of school, having

children while still teenagers, being delinquent, smoking, using marijuana or cocaine, and binge drinking. They found that organized youth activities can help deter risky behavior in adolescence and young adulthood, however, relatively few U.S. adolescents were spending significant portions of their free time in constructive activities. They also reported that the beneficial impact of after-school activities depended on whether the program developed skills, created challenges, and provided fulfilling experiences for teen participants (Zill et al., 1995).

In line with these findings, Darling (2005) found adolescents who did not participate in school-based extracurricular activities were more likely to abuse substances other than alcohol, in comparison to peers who did participate. However, once controlling for demographic background characteristics, the effect sizes were quite small (Darling, 2005). Another study looked at the size of the after-school program (ASP) and its implementation. The researchers found that smaller-size ASPs were associated with less delinquency and victimization, compared to counterparts who attended larger programs (Gottfredson et al., 2007). This would be consistent with RAT as with bigger ASPs there would be less supervision, allowing more opportunity for deviant behavior. Despite the researchers finding significant reductions in substance use, program structure was not significantly related to various forms of delinquency (theft, vandalism, assault, gang involvement, weapon carrying, breaking and entering, and robbery) or victimization (theft, robbery, destruction of property, assault, or threatened assault; Gottfredson et al., 2007).

Another form of structured activity that this research will consider is sports involvement and its effect on adolescent delinquency. Lisha and Sussman (2010), in their

meta-analysis of 34 peer-reviewed studies, concluded that participation in sports was related to higher levels of alcohol consumption but did act as a protective factor against both cigarette smoking and illegal substance use. The authors suggested the "competitive nature" of sports in general may cause them to drink larger amounts of alcohol, as they compete with each other to see who can drink the most. Alternatively, or in addition to this, it was speculated that drinking may occur as a coping mechanism to the stress and anxiety associated with competitive sport (Lisha & Sussman, 2010). Another suggestion is that the association between athletics and drinking is encouraged by the culture (Lisha & Sussman, 2010).

Hoffman (2006) identified gender and setting as moderators of this relationship between extracurricular activities (incl. sports) and alcohol use. He found that there was a strong positive association between athletic involvement and alcohol use among males in higher socioeconomic status schools and among females in lower socioeconomic status schools (Hoffman, 2006). The author suggested that there is a difference in subcultures where it may be more common place for females to fall into the party subculture in lower socioeconomic status schools while the same behaviors would be less acceptable for females in high socioeconomic status schools.

From a RAT perspective, sports involvement would minimize substance use for both tobacco and marijuana due to the juveniles spending time in a structured activity. More time spent at practice or games is more time being supervised in a structured activity. RAT would suggest that alcohol usage would also decrease if involved in a sport, however, the research findings summarized here suggest otherwise. While individuals would still have that structured time of practices and games, previous

research suggests the fact that alcohol is more accepted or encouraged by the sports culture may act as a stronger, opposing mechanism.

Impact of Employment and Disposable Income

Another type of structured activity an adolescent may be involved with is after-school employment. After a day of classes, presentations, and completing any pending assignments, some adolescents continue their day into a formal work environment. Some believe that adolescents who engage in after-school jobs learn real-life skills and responsibility whereas others may argue that after-school work environments can put additional pressures that could tempt adolescents to seek relief through some form of illicit substance use, which they can access with the income they earn.

Prior to the introduction of the Youth Worker Protection Act by the National Research Council in 1998, there was little regulation in the hours that students of 14 to 17 years of age were allowed to work during the school year (see Apel et al., 2006). In the 1970s, the belief stood that employment would naturally bring about a sense of independence, structure, promote self-esteem and responsibility in working youth, but factors such as the nature of the type of work were not really considered (Bachman & Schulenberg, 1993).

The routine activity perspective offers two opposing mechanisms for how employment may be related to illicit substance use. On the one hand, employment is a structured activity that should act as a protective barrier, given the presence of capable guardians. On the other hand, employment offers an income that allows for more opportunity, in that the adolescent would now have the ability to purchase illicit substances. Despite this potential double-edged sword, the evidence base appears to

indicate hours worked to be positively associated with substance use, rather than the other way round.

An example of this is the study of Apel et al. (2006), who looked at the impact of formal/informal employment on substance use by looking at adolescents' worked hours. They classified juveniles into (1) working over 20 hours of formal work during the school year, (2) working a formal job only during the summer months, and (3) working an informal (freelance) job, such as babysitting. Their results showed adolescents who did work 20 hours or more were more likely to use illegal substances than students who did not work or worked fewer hours. Using data from the Monitoring the Future study, Safron et al. (2001) also reported work intensity to be positively related to substance use. Their study showed working adolescents also spent more time in unstructured social activities. Anderson and Hughes (2009) examined income specifically and detected significant positive associations between income and both alcohol and marijuana use (tobacco use was not considered in their study).

Block et al. (2019) examined substance use behaviors of middle- and high school students, focusing on how various opportunity measures impacted substance use. Using the question "On average, how much money do you have to spend on yourself each week" as a variable for income (from work or other sources, such as an allowance), the researchers found that, the more money an adolescent had to spend, the greater the likelihood they would use both alcohol and marijuana, but not tobacco (Block et al., 2019). The researchers also found that hours worked were positively related to tobacco, alcohol, and marijuana use (Block et al., 2019). The fact income was not significantly associated with tobacco use, while hours worked was, could mean adolescents are

bumming cigarettes from a co-worker or friend rather than spending their own money on them. This pattern of results also indicates there might be an additional mechanism via which employment can enable or somehow drive substance use (e.g., if the adolescent develops friendships with older colleagues).

The Proposed Study

Although substantial research exists on the impact of structured time, unstructured time, and income on adolescent substance use, it is rare for a single study to examine all three jointly. Drawing on the routine activity perspective, this study aims to do exactly this, with a focus on alcohol, tobacco, and marijuana use. The research uses data from the 2018 wave of the Monitoring the Future study to measure these effects. The hypotheses this study will seek to test, all directly derived from RAT (despite some empirical evidence to the contrary in some cases), are as follows:

1. The hours spent in unstructured activities will be positively associated with substance use.
2. The hours spent in structured sports activities will be negatively associated with substance use.
3. The hours spent in employment will be negatively associated with substance use.
4. The dollar amount earned from employment will be positively associated with substance use.
5. The dollar amount from allowances will be positively associated with substance use.

III. METHODS

Data Sources

This study used data from the Monitoring the Future (MTF): A Continuing Study of American Youth study, which was conducted by Lloyd D. Johnston, Jerald G. Bachman, Patrick M. O'Malley, John Schulenberg, and Richard A. Miech from the University of Michigan's Institute for Social Research. This survey study has been conducted yearly since 1975; the data for the current study comes from the 2018 version, which was the most recent available set at the start of the research. The MTF study is a comprehensive survey consisting of over 1,400 variables that is completed by high school seniors. In 2018, the MTF study used a multi-stage stratified sample and yielded response rates between 75% and 80% within each school (more details about the sampling strategy are provided in the Quality Issues section below).

The MTF study samples high school seniors from roughly 130 public and private high schools during spring. The high school seniors that participated in the study filled out one of six questionnaires that included many of the same questions (i.e., the core question set) as well as specific questions limited to only that version (or a limited number of versions). Each of the six questionnaires was completed by roughly 2,400 12th graders, with the total sample size for the 2018 MTF study being 14,502 high school seniors. This research used variables from both the core question set, and three variables that were only available in two of the six questionnaires. In addition, some respondents had missing data for some of the variables. A subsample of 2,874 high school seniors with no missing data for any of the variables of interest was created. As described below, univariate and bivariate analyses were performed on both this final data set (so the

sample would be consistent with the one used in the multivariate analyses) as well as on as many cases as data were available for, for any given summary or test.

Outcome, Explanatory, and Control Measures

This research examines whether income, structured time, and unstructured time are associated with alcohol, tobacco, and marijuana use among adolescents, after controlling for age, sex, and race/ethnicity.

Outcome Measures

The MTF data set offers substance use measures with various time frames (e.g., in the last year) but a decision was made to use the measures that asked about the last 30 days as this time frame was deemed to be most relevant (due to being most current); this choice is also best for establishing temporal order. Table 1 shows the dependent variables in detail, with the verbatim questions asked, and all possible responses.

Table 1. Dependent variables.

Variable	Question	Answer options
Tobacco (V2102)	How frequently have you smoked cigarettes during the past 30 days?	1 = Not at all 2 = Less than one cigarette per day 3 = One to five cigarettes per day 4 = About one-half pack per day 5 = About one pack per day 6 = About one and one-half packs per day 7 = Two packs or more per day
Alcohol (V2106)	On how many occasions (if any) have you had alcoholic beverages to drink--more than just a few sips during the last 30 days?	1 = 0 occasions 2 = 1-2 occasions 3 = 3-5 occasions 4 = 6-9 occasions 5 = 10-19 occasions 6 = 20-39 occasions 7 = 40 occasions or more
Marijuana (V2117)	On how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil) during the last 30 days?	1 = 0 occasions 2 = 1-2 occasions 3 = 3-5 occasions 4 = 6-9 occasions 5 = 10-19 occasions 6 = 20-39 occasions 7 = 40 or occasions more

N.B.: Variable code names (V202, V2106, V2117) are provided for replication purposes.

Explanatory Measures

There are seven independent variables considered in the proposed research. Two of these variables are proxies for structured time, three for unstructured time, and two for income. Table 2 displays information about these independent variables, with the verbatim question from the survey, and all answer options.

Table 2. Independent variables.

UNSTRUCTURED ACTIVITY		
Variable	**Question**	**Answer options**
Evenings out for fun (V2194)	During a typical week, on how many evenings do you go out for fun and recreation?	1 = Less than one 2 = One 3 = Two 4 = Three 5 = Four or Five 6 = Six or Seven
Drive around for fun* (V2212)	How often do you ride around in a car (or motorcycle) just for fun?	1 = Never 2 = A few times a year 3 = Once or twice a month 4 = At least once a week 5 = Almost every day 6 = Every day
Go to parties* (V2224)	How often do you go to parties or other social affairs?	1 = Never 2 = A few times a year 3 = Once or twice a month 4 = At least once a week 5 = Almost everyday 6 = Every day
STRUCTURED ACTIVITY		
Variable	**Question**	**Answer options**
Participate in sports* (V2216)	How often do you actively participate in sports, athletics or exercising?	1 = Never 2 = A few times a year 3 = Once or twice a month 4 = At least once a week 5 = Almost everyday 6 = Every day
Hours a week you work (V2191)	On the average over the school year, how many hours per week do you work in a paid or unpaid job?	1 = None 2 = 5 or less hours 3 = 6 to 10 hours 4 = 11 to 15 hours 5 = 16 to 20 hours 6 = 21 to 25 hours 7 = 26 to 30 hours 8 = More than 30 hours

N.B.: Variable code names (V2194, V2212, V2224, V2216, V2191) are provided for replication purposes. (*) This variable is not in the core data set.

Table 2 (cont.). Independent variables.

INCOME		
Variable	**Question**	**Answer options**
Work (V2192)	During an average week, how much money did you get from a job or other work	1 = None 2 = $1-5 3 = $6-10 4 = $11-20 5 = $21-35 6 = $36-50 7 = $51-75 8 = $76-125 9 = $126-175 10 = $176+
Allowance (V2193)	During an average week, how much money did you get from other sources (allowances, etc.)?	1 = None 2 = $1-5 3 = $6-10 4 = $11-20 5 = $21-35 6 = $36-50 7 = $51-75 8 = $76-125 9 = $126-175 10 = $176+

N.B.: Variable code names (V2192, V2193, V2194, V2212, V2224) are provided for replication purposes. (*) These variables are not in the core data set.

Control Variables and Description of the Sample

The multivariate analyses performed (see Analytical Strategy section) controlled for age (measured as younger than 18 vs. 18 or older), sex (male vs. female), and race/ethnicity (Black vs. White vs. Hispanic; other races/ethnicities were classified as "Missing" by the researchers, after merging these with responses where the respondent omitted this information). Summaries for these variables, based on both the full sample of 14,502 high school seniors, and the final subsample that had no missing data for any of the variables (N=2,874), are provided in Table 3.

Table 3. Control variables.

			Full sample (N=14,502)			Subsample with no missing data (N=2,874)
	N	%	Valid %	N	%	Valid %
<18 years old	5,862	40.4	43.6	1,246	43.4	43.4
18+ years old	7,595	52.4	56.4	1,628	56.6	56.6
Missing	*1,045*	*7.2*				
Male	6,080	41.9	47.8	1,365	47.5	47.5
Female	6,652	45.9	52.2	1,509	52.5	52.5
Missing	*1,770*	*12.2*				
Black	1,292	8.9	11.6	264	9.2	9.2
White	6,835	47.1	61.4	1,860	64.7	64.7
Hispanic	2,999	20.7	27.0	750	26.1	26.1
Missing	*3,376*	*23.3*				

Analytical Strategy

This study reported descriptive statistics for all three outcome variables, as well as bivariate descriptive and inferential statistics for each explanatory-outcome variable pair. Non-parametric tests were used for analysis between the outcome and control variables, due to the distributions of the outcome variables being positively skewed. Mann Whitney tests were conducted for two of the control variables (age, sex) and Kruskal Wallis tests were used for the third control variable (race/ethnicity). Because there were seven independent variables (i.e., evenings out for fun, drive around for fun, go to parties, participation in sports, hours a week worked, work income, and allowance) and three dependent variables (i.e., tobacco, alcohol, and marijuana use), there were a total of 21 pairs, and a Spearman's correlation test was conducted for each of these.

Finally, this research ran three ordinary least squares (OLS) regression models, one for each of the outcome variables. All test assumptions were considered, including the normality of residuals assumption, and this is discussed in the Results chapter. Although the outcome variables were measured on what were technically ordinal scales, a decision was made to treat the data as continuous based on the number of points in the scales (i.e., seven). For each of these OLS regression models, the predictors included the seven independent variables and the three control variables (i.e., age, sex, and race/ethnicity). The regression models yielded coefficients for each of the predictors that allowed us to determine whether each independent variable had a significant effect on each of the dependent variables, with everything else being kept constant. The age, sex, and race/ethnicity variables were dummy-coded, with <18 years, Female, and White being the reference categories, respectively.

Quality Issues

The MTF study uses a three-stage process for their sampling, with the first step being selecting the geographic areas, the second step selecting schools, and the final step selecting students. The researchers made sure that, when selecting high schools, the probability of drawing a school was proportionate to the size of its senior class. If any of the sample schools did not want to participate, the researchers attempted to find a similar school in the same area. Of the schools that were asked to participate, a little over a third declined but replacement schools were found in every case (Miech et al., 2018). Within each school, between 75 and 80 percent of all senior students completed the questionnaires. The researchers stated that the most common reason for students not

partaking in the questionnaire was being absent on the day the survey was administered. Due to time limits and cost, it was not feasible to follow-up these missed students.

While this approach attempts to provide an accurate representation of the United States, it does have its limitations. The biggest limitation is that the MTF study does not include individuals who have dropped out of high school in the last few months of their senior year. The researchers acknowledge that this segment of the population is important for specific behaviors, such as illicit substance use and delinquency. However, they argue that the cost of including these individuals would be too great as they would be hard to track down and less likely to be interviewed. This missing data could affect the current study, though. Missing students that either dropped out of high school or were not present when the study was conducted could be because they are either missing lessons or have dropped out altogether due to (1) working at a job or (2) using illegal substances and/or engaging in non-normative behavior. Because of this potential sampling bias, the correlation between these variables may be weaker than if they were able to be a part of the study.

For measurement validity of the outcome variables, this research will use variables that asked about use of the illegal substance in the previous 30 days. These variables were chosen for the reasons stated earlier, namely them providing a more recent and thus more relevant measure that may better allow for temporal order to be established. In any case, this research uses data from a cross-sectional survey, so temporal order cannot be proven. Non-spuriousness may also be an issue. In other words, if significant relationships are detected between the independent and the dependent variables, there could always be an unmeasured variable that explains these relationships.

An example of an unmeasured variable in this case could be associations with older and/or delinquent peers. For instance, teenagers who have a job for income may be working with older colleagues who drink and/or smoke and this could explain an increase in substance use, if they are spending time with these individuals. This hypothetical can also be applied to the unstructured time variables. If these teens are spending time at parties or driving around with delinquent peers, this could also explain any significant relationships detected. In such cases, these unmeasured variables could be acting as either mediators or moderators of the relationships between the independent variables of interest and substance use.

Ethical Issues

This research carries minimal risk because the data used is publicly available, which makes the research exempt under Category 4. According to the provisions in 28 CFR § 46.102 "human subject" is defined as "a living individual about whom an investigator conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information." This research exclusively involves the examination of secondary data that is anonymous and publicly available. This research is therefore not subject to the regulations of the provisions in 28 CFR § 46.102 (see Appendix A).

IV. RESULTS

Descriptive and bivariate analyses were conducted on the final subsample with no missing data (N=2,874) and then repeated on as many cases for which data were available from the full sample. In the next section, descriptive statistics are provided for both the final subsample of 2,874 and the bigger available sample (whose size varied depending on the variables considered), to set the final subsample in context and assess any bias that may have resulted from this attrition. After this, the analysis presented in this chapter will be limited to the final subsample, although the bivariate analysis results based on the bigger samples is presented in Appendix B.

Descriptive Analyses

When considering alcohol usage in the previous 30 days, it was found 4,340 (32.2%) high school seniors consumed at least some alcohol, with similar findings observed in the final subsample (964, or 33.7%). Tobacco usage in the previous 30 days was lower at 7.5% (1,033) in the bigger sample and 7.1% (202) in the final subsample. Finally, 3,096 (23.1%) high school seniors had smoked marijuana in the previous 30 days, and this rate was similar for the subsample (615, or 21.5%). These frequencies and the full distributions in Figure 1 show that, at least for the outcome measures, the final subsample (with no missing data) appeared similar to the bigger data sets, although some minor inconsistencies could be observed. When Mann-Whitney tests were used to compare the final subsample (N=2,874) to the rest of the students for each case, no significant differences were detected for alcohol (U=15,055,371, Z=1.738, ns) or tobacco (U=15,404,341, Z=-1.305, ns), but those outside of the final subsample appeared to use marijuana at higher rates (U=14,686,156.5, Z=-2.772, $p<.01$)

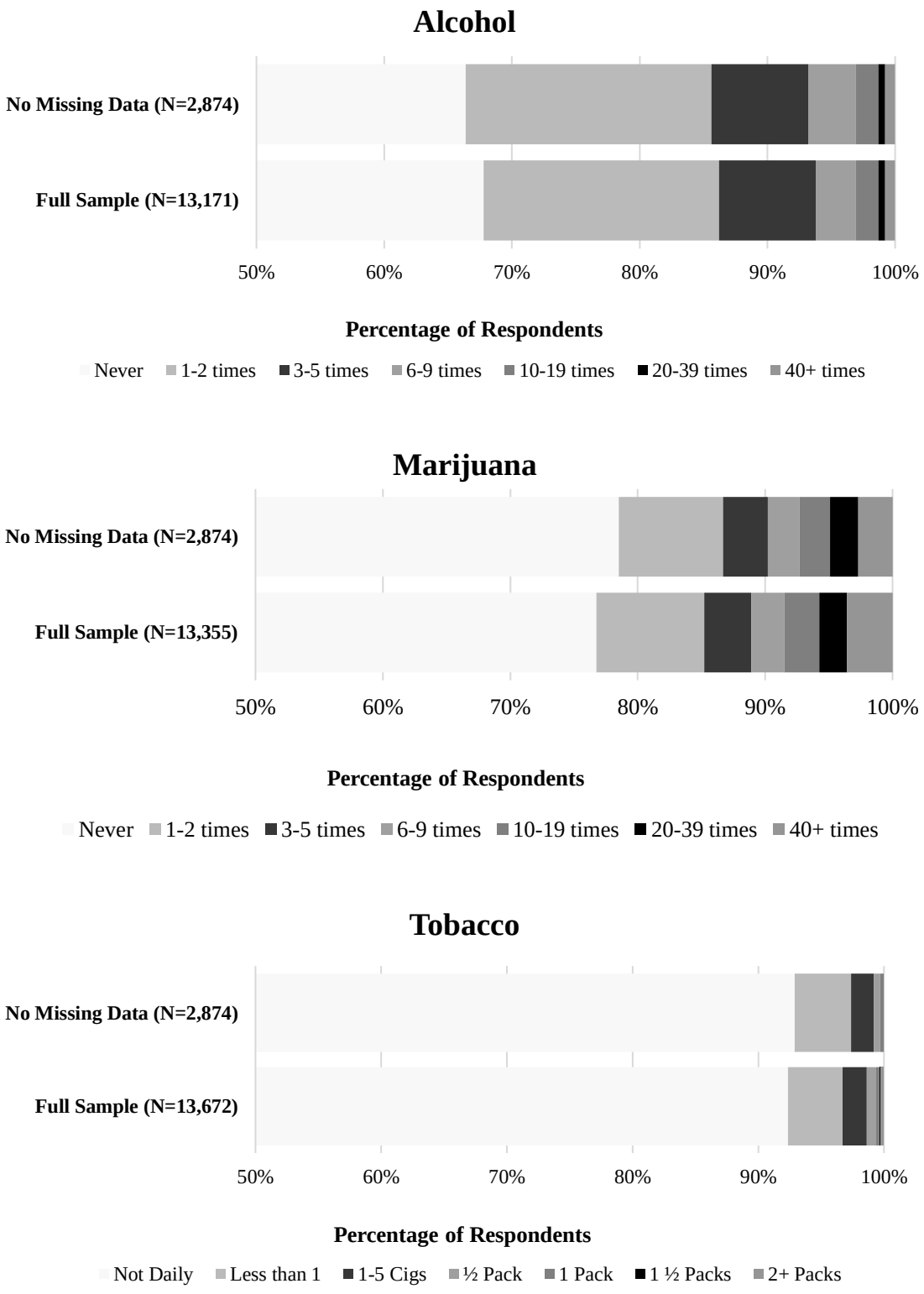


Figure 1. Substance use frequencies over the previous 30 days.

Bivariate Analyses

Due to the non-normal distributions observed in the three substance use variables, nonparametric tests were used for all bivariate analyses. When examining the relationship between the outcome and the control variables, Mann-Whitney tests were used for age and sex, and a Kruskal-Wallis test for race/ethnicity. A series of Spearman's correlation tests were then used to assess the relationships between the three outcome measures and all independent variables, which included the proxies for unstructured activities (i.e., evenings out for fun, driving around for fun, going to parties), structured activities (i.e., participating in sports, hours of work a week), and income (i.e., income from work, allowance).

Control Variables

Age. The first control variable considered was age (i.e., whether the respondent was younger than 18 or not) and how this was associated with the use of each of the three substances (see

Figure 2). It was found that there were only slight differences in substance use between the two age groups. No significant differences were detected for either tobacco (U=1,026,877, Z=1.293, ns) or marijuana use (U=1,009,739.5, Z=-.285, ns). The biggest difference that was detected was for alcohol use, with 31.9% of all high school seniors who were younger than 18 using alcohol at some point during the previous 30 days, as compared to the 34.8% of those who were 18 or older and who reported doing so. The Mann-Whitney test revealed there was a marginally statistically significant difference for this variable (U=1,050,035.5, Z=1.942, p=.052). As indicated earlier, the same analyses

were repeated using all cases for which data were available, and the same pattern of results was obtained, except for tobacco, for which a statistically significant was then detected (see Appendix B), probably due to the increased sample size.

Sex. The second control variable considered was sex and how this was associated with the use of each of the three substances (see

Figure 3). It was found that males in the final subsample used more tobacco and marijuana than females overall, while females used more alcohol than males. However, the only significant difference detected was for marijuana (U=988,439, Z=-2.603, p<.001). The test results showed that there was no significant difference between males and females for tobacco use (U=1,013,523, Z=-1.663, ns; although this was significant when all available data were considered, see Appendix B). Likewise, the Mann-Whitney test for alcohol use found no significant differences between the sexes (U=1,027,052.5, Z=-.153, ns).

Race/ethnicity. The last control variable considered was race/ethnicity, where some differences in substance use were found, shows the frequency of each substance for each of the three race/ethnicities. Starting with alcohol, it was found that the percentage of White seniors that consumed alcohol in the previous 30 days (38.9%) was twice the percentage of Black seniors (18.9%) relative to their sample, with Hispanic seniors falling in the middle (25.3%). A Kruskal-Wallis test revealed there were significant differences between the three groups (H=78.523, p<.001). The pairwise post-hoc tests revealed it was the White group that was significantly different from the other two groups, while these (i.e., Hispanic, Black) were not significantly different from each

other (see Table 4).

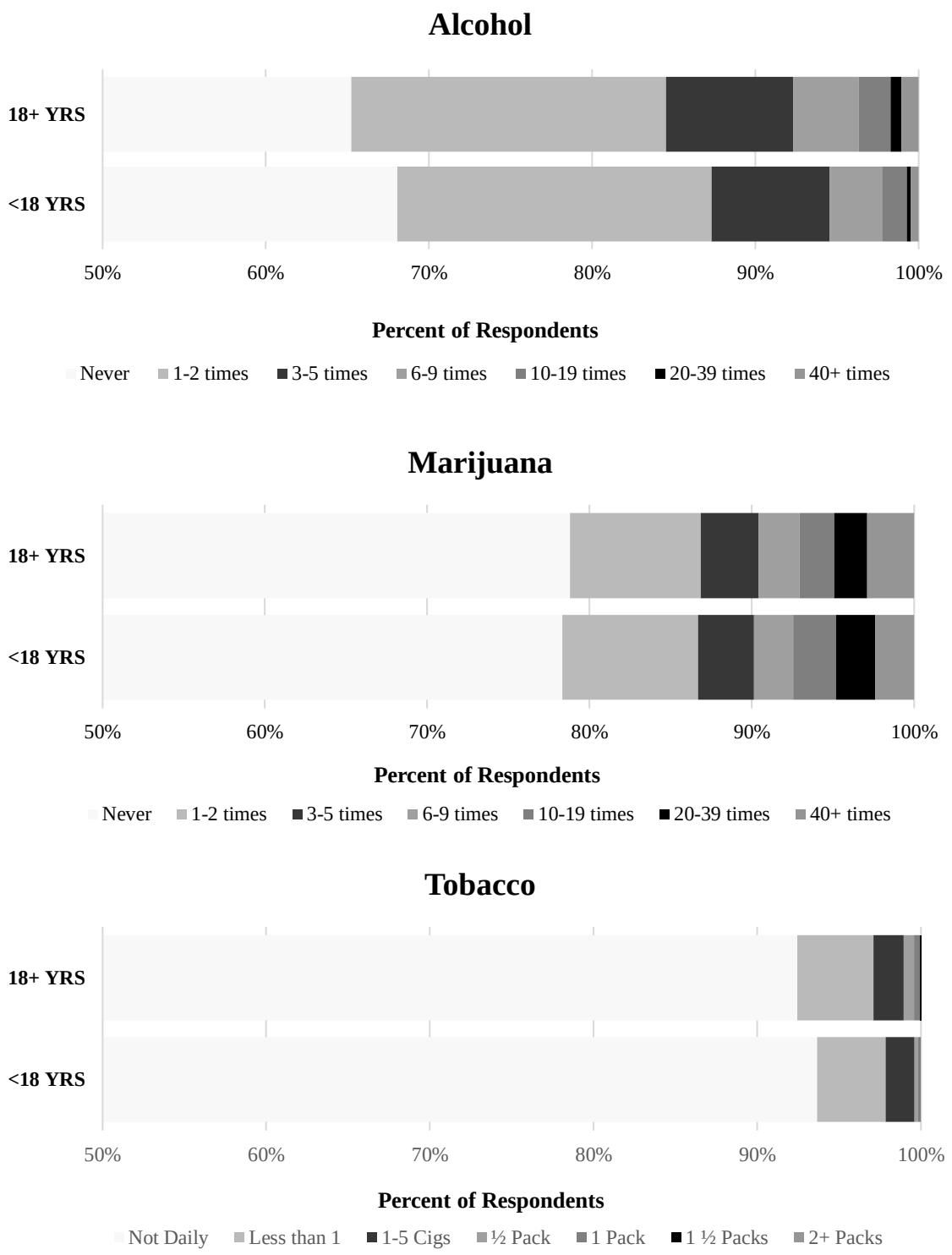


Figure 2. Age of respondent and substance use in the preceding 30 days.

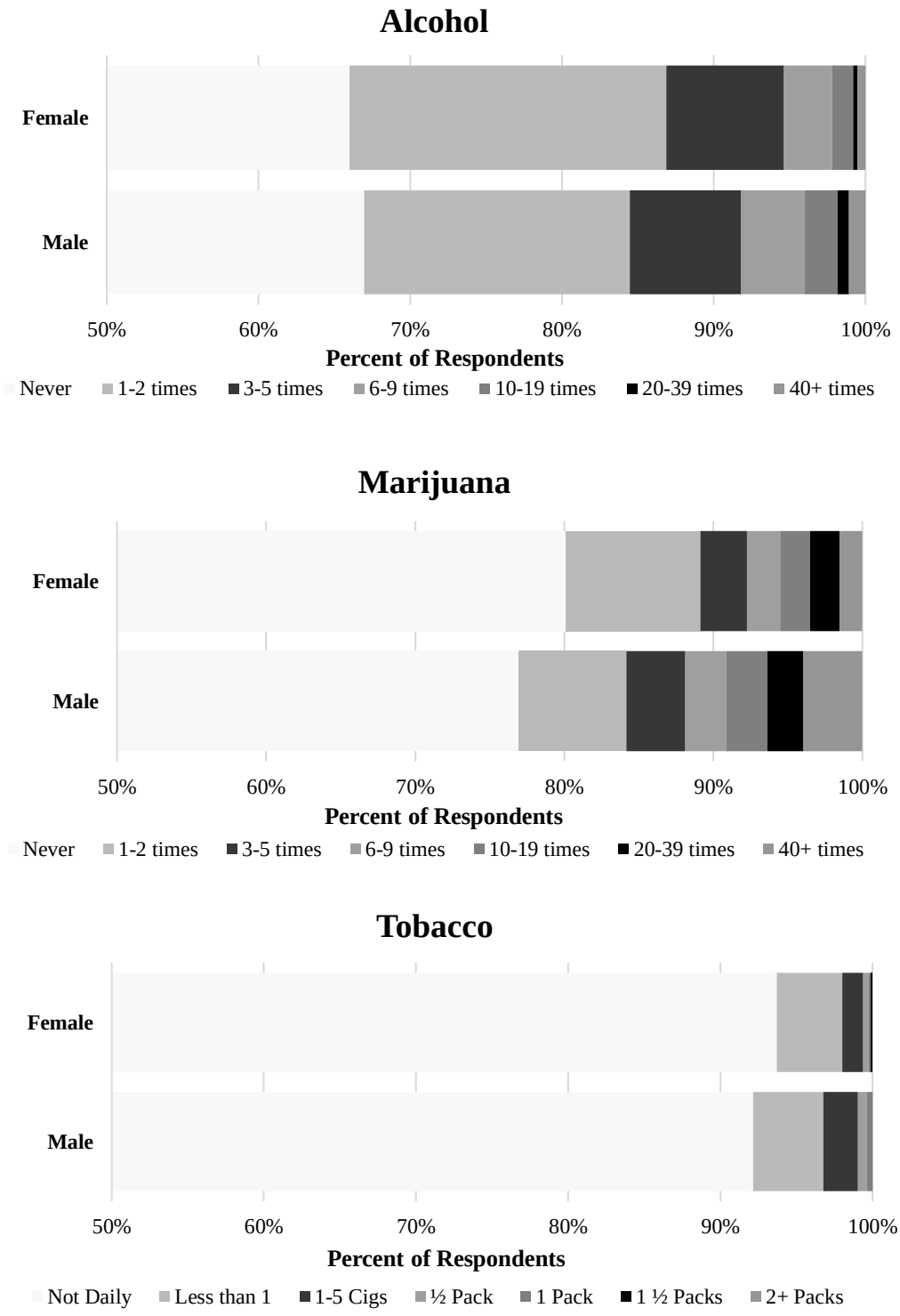
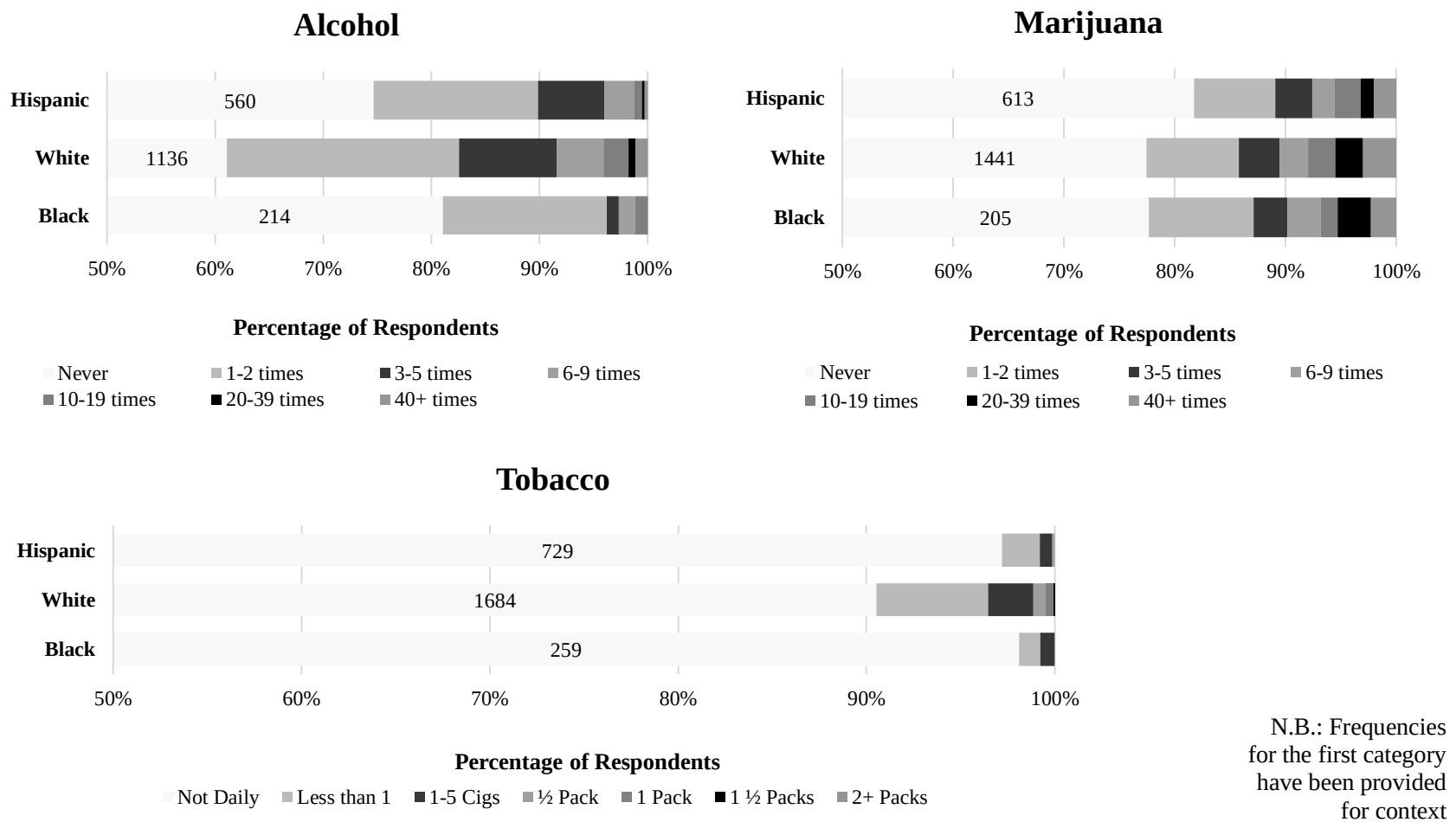


Figure 3. Sex of respondent and substance use in the preceding 30 days.



N.B.: Frequencies for the first category have been provided for context

Figure 4. Race/ethnicity and substance use in the preceding 30 days ($N_{Hispanic}$=750; N_{White}=1,860; N_{Black} =264).

Table 4. Pairwise comparisons for differences in alcohol use between different races/ethnicities.

	A	B
A. White		
B. Black	6.819***	
C. Hispanic	6.846***	-2.129

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Tobacco usage was no different, with more White seniors smoking more than the other two ethnicities; 9.5% of all White seniors reported having smoked in the last 30 days, as compared to 2.8% of Hispanic seniors and 1.9% of Black seniors. This second Kruskal-Wallis test revealed there were significant differences in tobacco use between the three groups (H=48.254, p<.001). A series of pairwise post-hoc tests revealed that, as with alcohol, tobacco use among White seniors was significantly higher than in the other two groups of students, while there was not a significant difference between Hispanic and Black high school seniors (see Table 5).

Table 5. Pairwise comparisons for differences in tobacco use between different races/ethnicities.

	A	B
A. White		
B. Black	4.503***	
C. Hispanic	6.045***	-0.485

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Marijuana usage showed interesting results in that all race/ethnicities were close in usage. White seniors were still barely ahead at 22.5% smoking marijuana in the previous 30 days, closely followed by Black seniors at 22.3%, and lastly Hispanic seniors at 18.3%. An interesting find was that a higher percentage of Black seniors consumed more marijuana than alcohol. The last Kruskal-Wallis test revealed there were significant differences in marijuana use among the races/ethnicities ($H=6.479$, $p<.05$). Pairwise post-hoc tests revealed that White seniors used marijuana at significantly higher rates than Hispanic students, while the other group comparisons (i.e., White vs. Black, and Hispanic vs. Black) were not statistically significant (see Table 6).

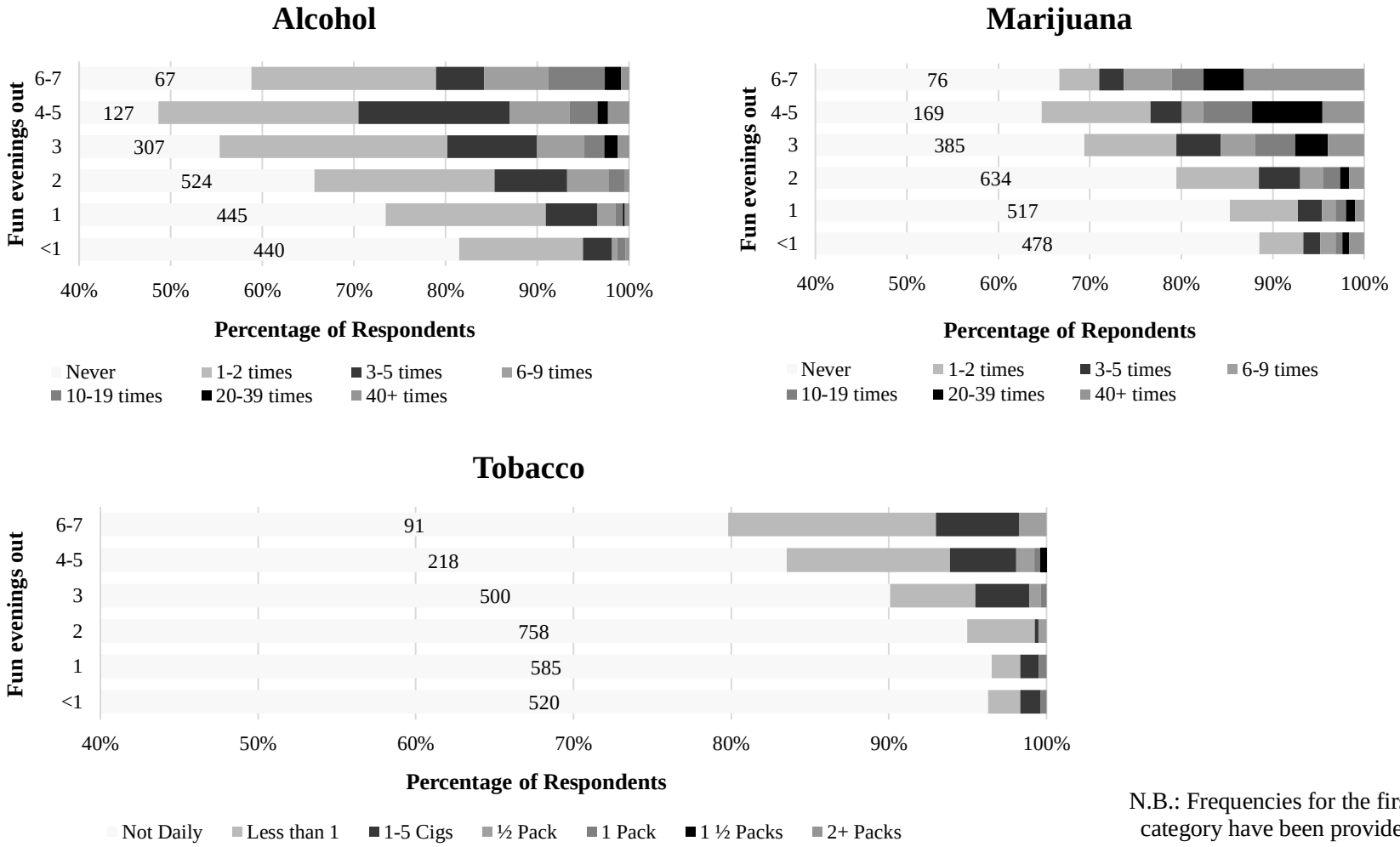
Table 6. Pairwise comparisons for differences in marijuana use between different races/ethnicities.

	A	B
A. White		
B. Black	0.165	
C. Hispanic	2.525*	1.375

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) $p<.05$, (**) $p<.01$, (***) $p<.001$. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Unstructured Time

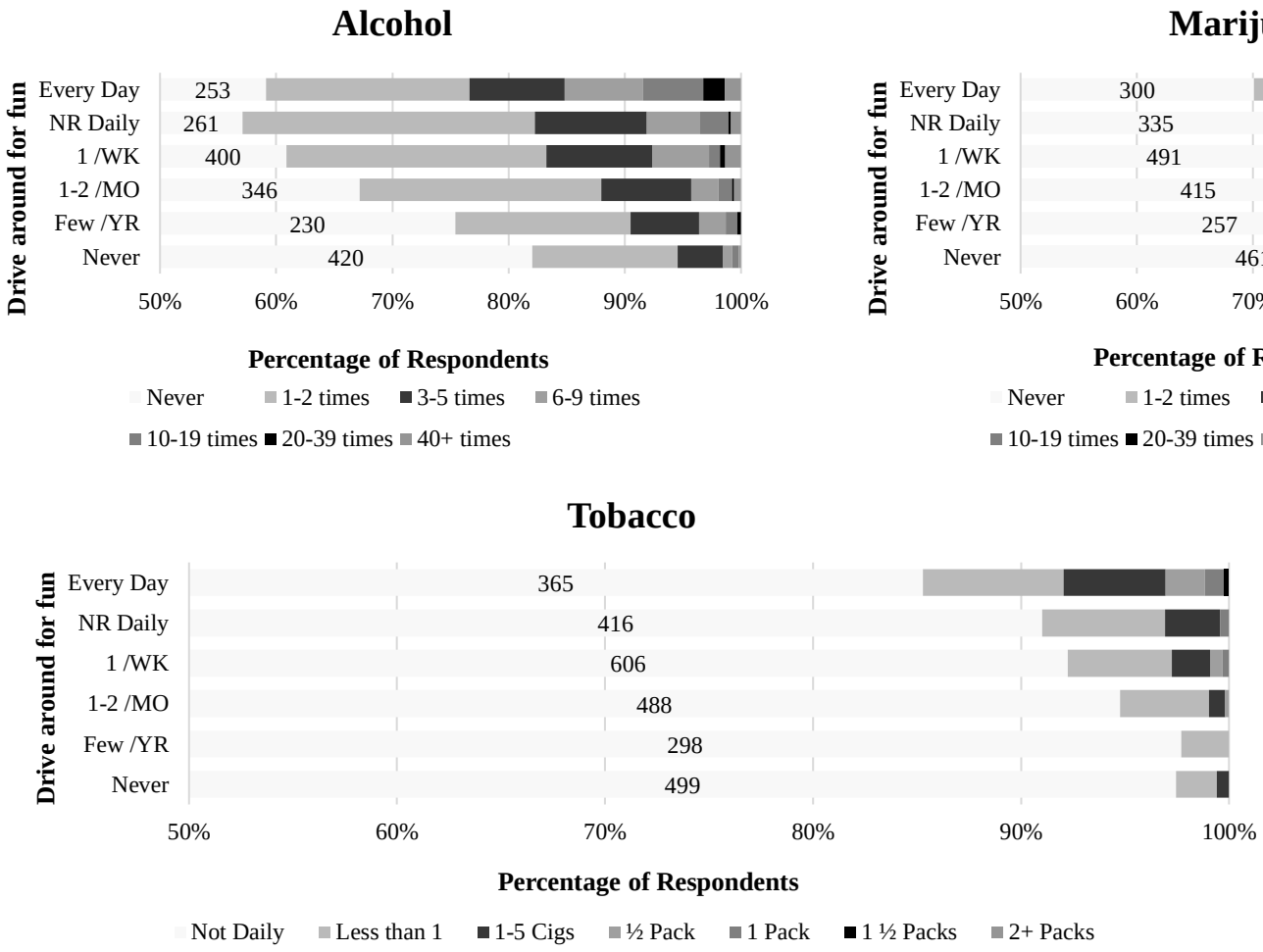
The next three variables discussed relate to the amount of time the seniors spent on unstructured activities, namely evenings out for fun, driving around for fun, and going to parties. Starting with evenings out for fun, it was found that the more seniors went out, the higher the rate of substance use was (see Figure 5). A Spearman's correlation test showed that there was a statistically significant weak, positive correlation between how often seniors went out for fun and tobacco use (ρ=.159, p<.001). Both alcohol and marijuana use also increased as evenings out increased, however, the percentage of seniors who smoked was lower for those spending 6-7 evenings out per week, as compared to those going out 4-5 times in a week (see Figure 5). Having said that, seniors who went out 6-7 evenings a week were more likely to smoke marijuana 40+ times in the last 30 days than any other subgroup, at 13.2%. The Spearman's correlation test showed that there was a weak, positive correlation between evenings out for fun and alcohol use, which was statistically significant (ρ=.230, p<.001). The last test found that there was a weak, positive correlation between evenings out for fun and marijuana use, which was also statistically significant (ρ=.207, p<.001).



N.B.: Frequencies for the first category have been provided for context.

Figure 5. Evenings out for fun in the previous week and substance use in the preceding 30 days.

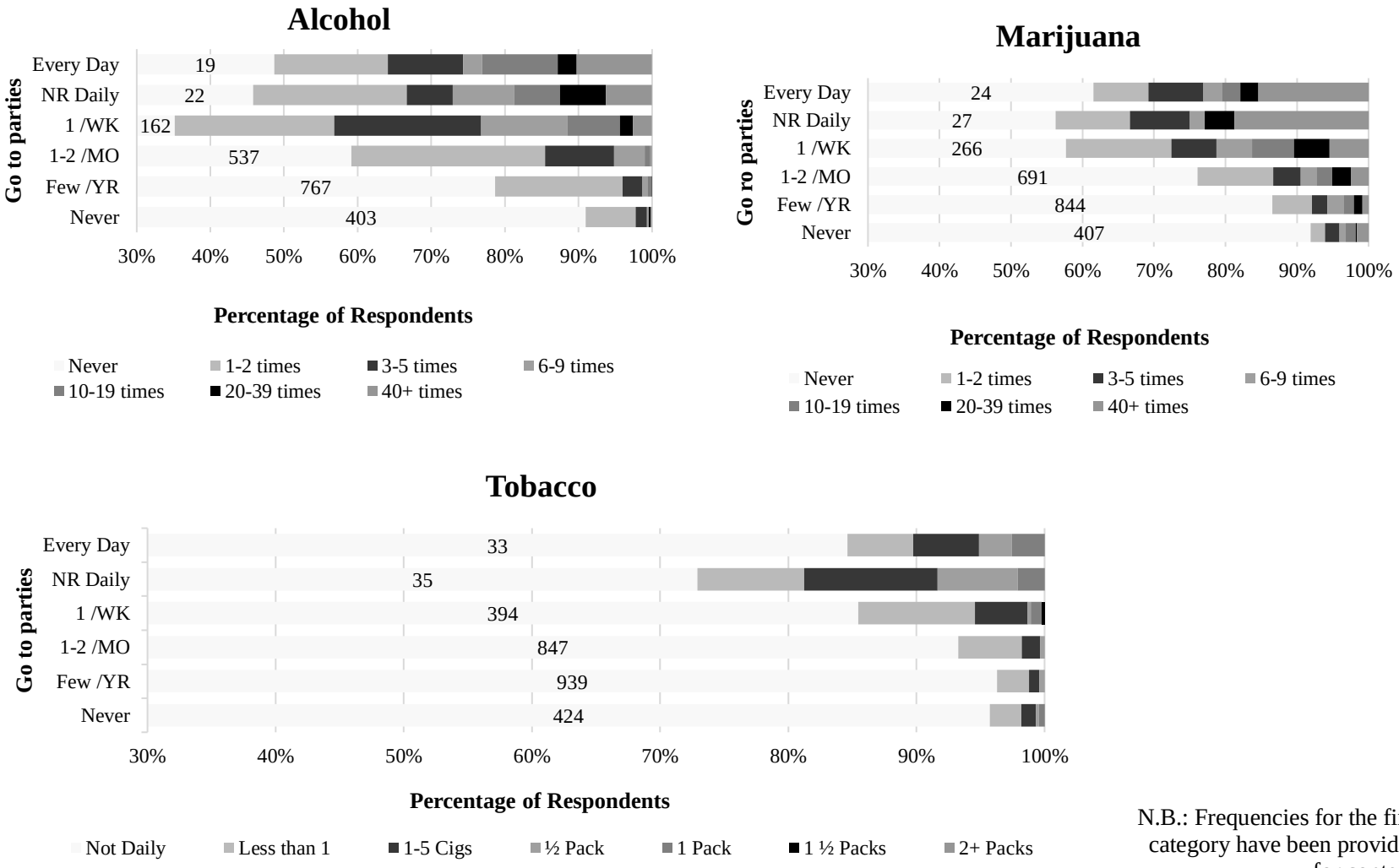
The next unstructured time variable considered is driving around for fun. Results showed that, the more a senior drove around for fun, the more substance use in the preceding 30 days they reported. This association appeared linear for both marijuana and tobacco use but a slight dip was detected for alcohol use in the highest-frequency category (i.e., driving around for fun every day; see Figure 6). For marijuana, a high percentage of those who reported driving around for fun every day (9.7%) reporting using 40+ times in the previous 30 days. The first Spearman's correlation test showed that there was a weak, positive correlation between driving around for fun and marijuana use, which was statistically significant (ρ=.169, p<.001). There were also significant weak, positive correlations between driving around for fun and tobacco use (ρ=.152, p<.001), and between driving around for fun and alcohol use (ρ=.192, p<.001).



N.B.: Frequencies for the first category have been provided for context.

Figure 6. Drive around for fun and substance use in the preceding 30 days.

The last unstructured time variable considered was going to parties. Figure 7 shows this variable was associated with higher rates of substance use when compared with the other two unstructured time variables. Alcohol reached 64.9% usage among seniors who went to parties once a week, tobacco use 27.1% for those going nearly daily, and marijuana use 43.7% also for seniors who reported going to parties nearly daily. Like before, although the percentage of those never using was higher for those who engaged in the unstructured activity more often, the percentage of those using at higher rates (e.g., 40+ times in the previous 30 days) was also much higher. A series of Spearman's correlation tests detected a significant moderate, positive correlation between going to parties and alcohol use (ρ=.407, p<.001), as well as significant weak, positive correlations between going to parties and tobacco use (ρ=.149, p<.001) and going to parties and marijuana use (ρ=.271, p<.001).

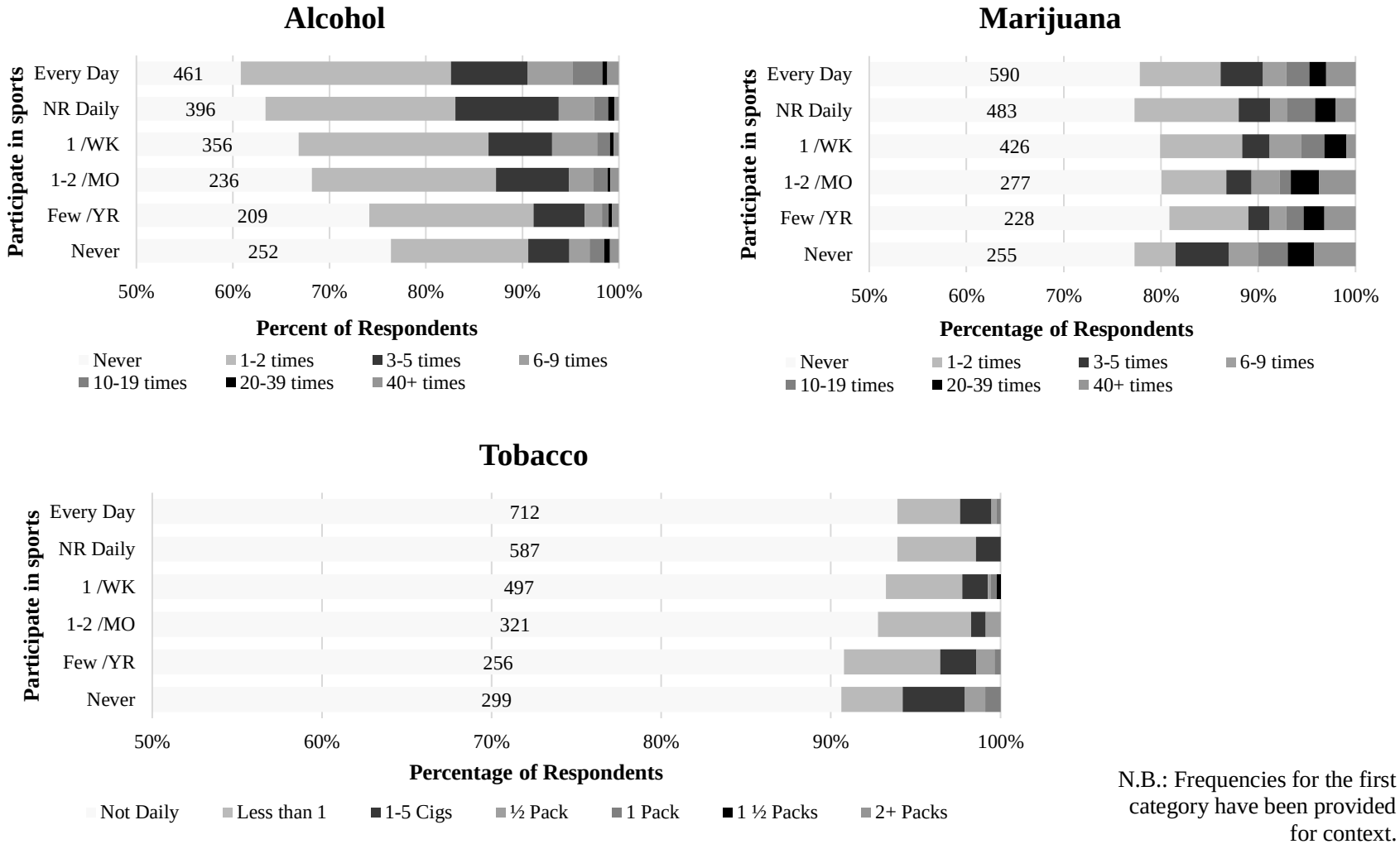


N.B.: Frequencies for the first category have been provided for context.

Figure 7. Go to parties and substance use in the preceding 30 days.

Structured Time

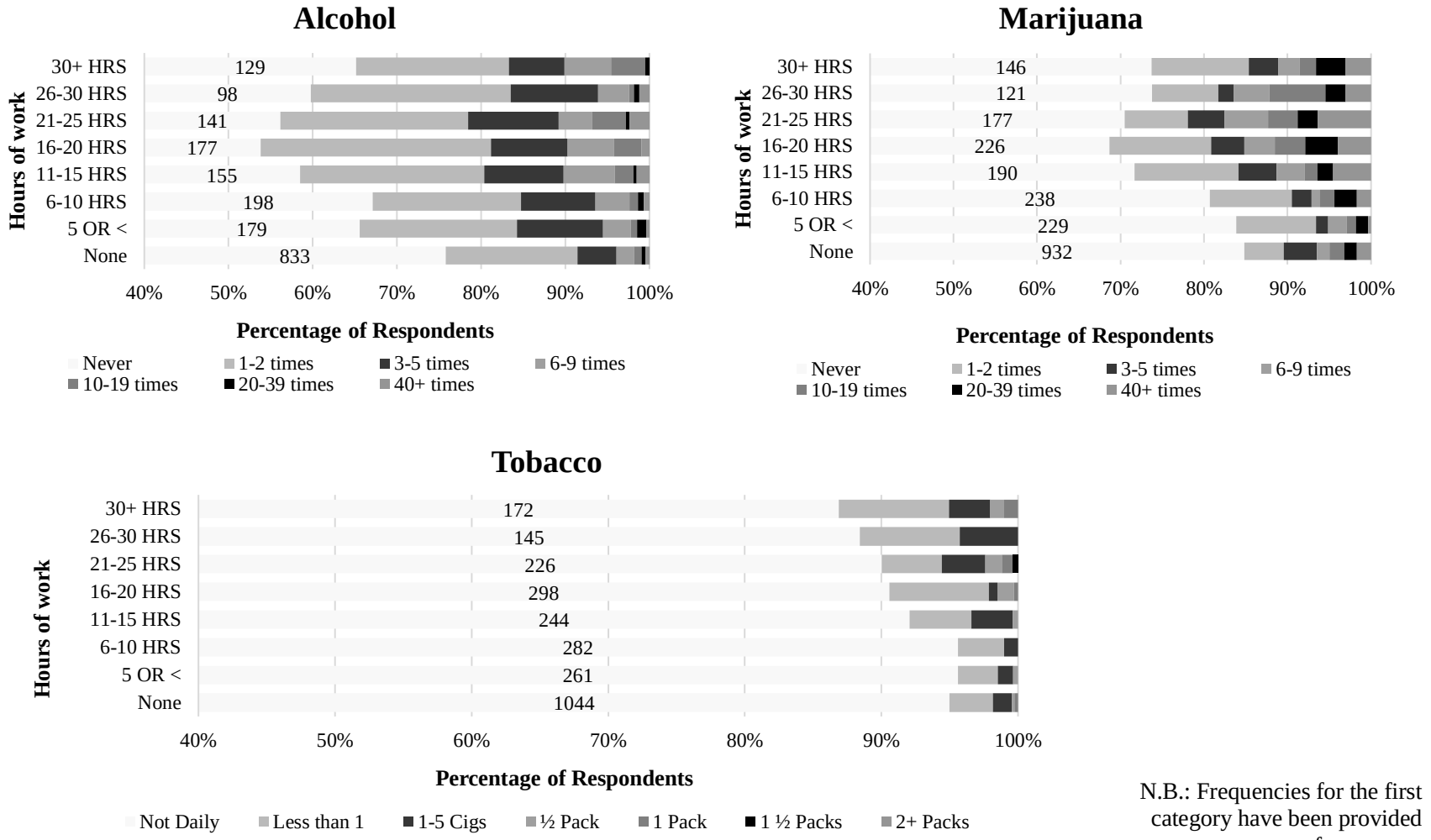
Two proxies of unstructured time were considered: participation in sports and time spent in paid work. Contrary to routine activity perspective expectations, but consistent with previous research findings, alcohol use increased with sports participation (see Figure 8). A Spearman's correlation test showed that there was a statistically weak, positive correlation between the two variables ($\rho=.112$, $p<.001$). In contrast, as participation in sports increased, tobacco use decreased, although the association was very weak ($\rho=-.045$, $p<.05$). Marijuana use stayed fairly consistent around 20% for any participation in sports; in this case, the relationship was not statistically significant ($\rho=.009$, ns).



N.B.: Frequencies for the first category have been provided for context.

Figure 8. Participate in sports and substance use in the preceding 30 days.

The second structured activity considered was the hours a week the seniors worked. Contrary to expectations, hours worked were positively associated with all three substances, although correlations were weak in all cases, especially for tobacco use (ρ=.099, p<.001). Having said that, as discussed in the literature review, employment could impact substance use in different ways, depending on the mechanism. On the one hand, more hours in a structured activity would be associated with less deviance; on the other hand, any income from this employment will create opportunities for purchasing these substances. Because hours worked and income were strongly correlated with each other (ρ=.813, p<.001), it is possible the opposing mechanisms may result in the non-linear relationships observed for alcohol and marijuana. In both cases, substance use peaked at the 16 to 20-hour work week—where a senior might have enough disposable income and free time—and then began to decrease—as the senior's free time gets too limited. Spearman's correlation tests still revealed statistically significant weak, positive correlations for both alcohol (ρ=.159, p<.001) and marijuana use (ρ=.141, p<.001). The linear association between hours worked and cigarette smoking may be explained by this being an activity that would be socially acceptable during work breaks—as opposed to drinking alcohol or smoking marijuana.



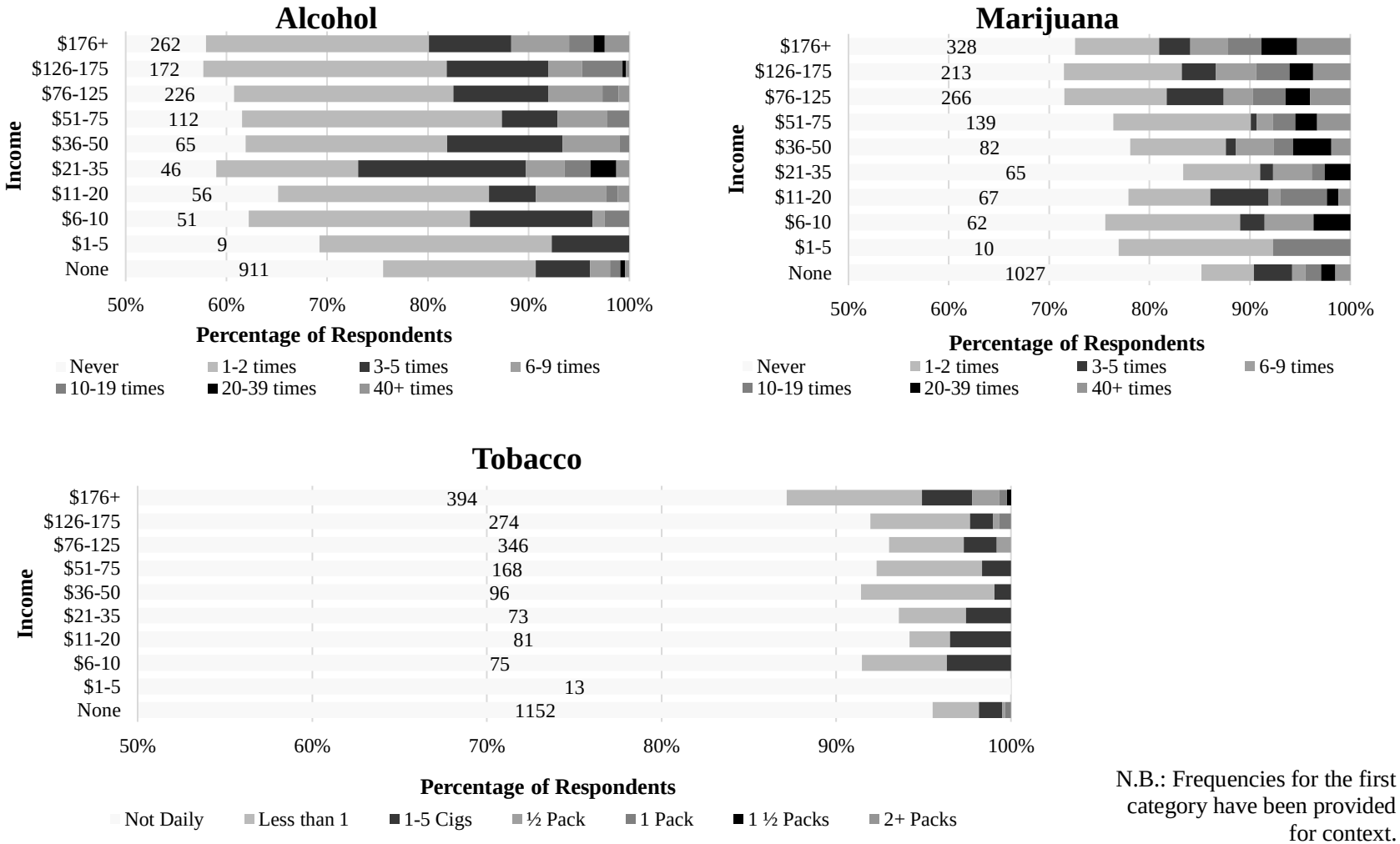
N.B.: Frequencies for the first category have been provided for context.

Figure 9. Hours a week you work and substance use in the preceding 30 days.

Income

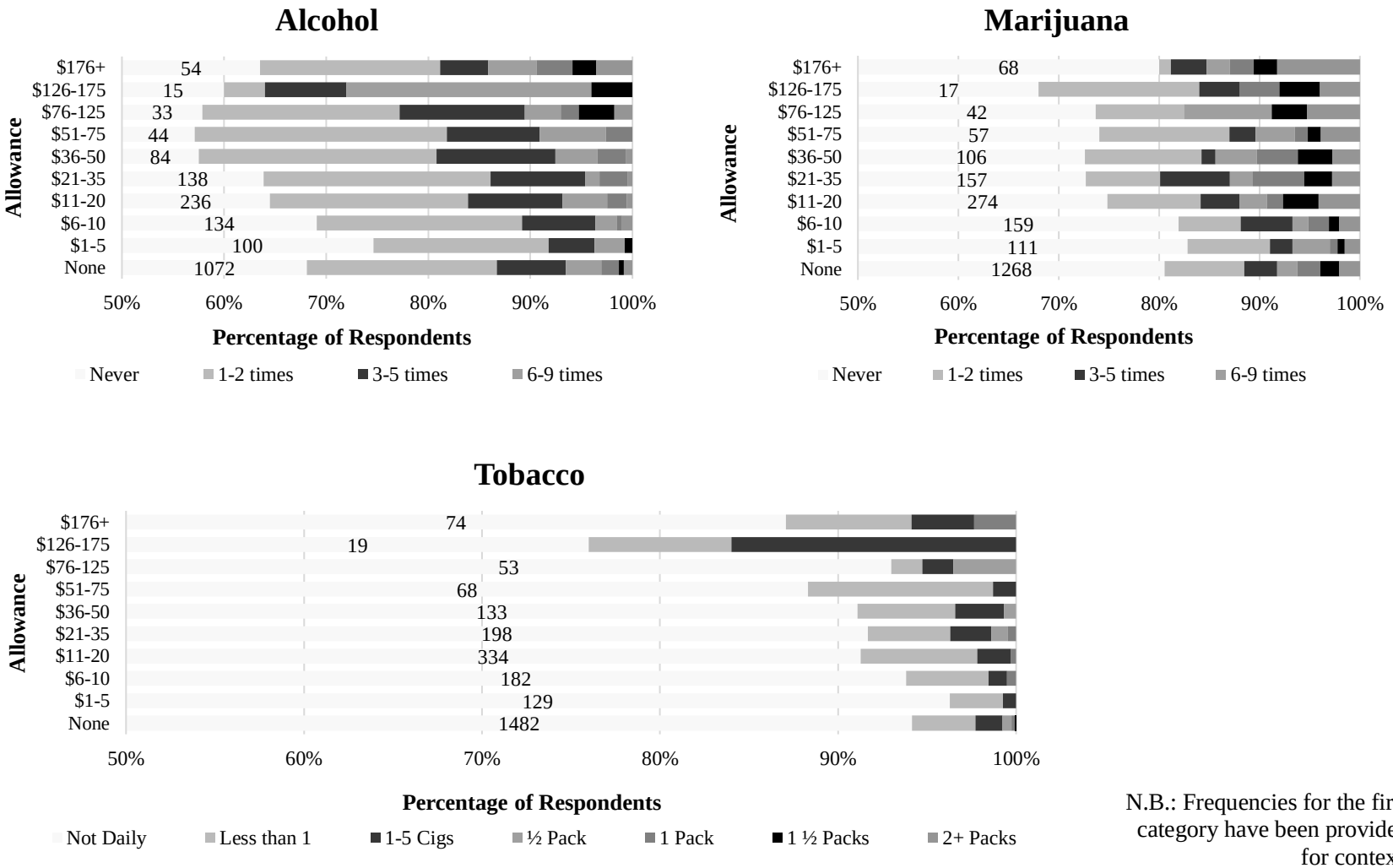
The last two variables discussed relate to income from work and from allowances. Significant weak, positive correlations were detected between income from work and all three substances, although the trends did not seem to be fully linear (see Figure 10). As income from work increase, so did the usage rates of alcohol (ρ=.165, p<.001), tobacco (ρ=.103, p<.001), and marijuana (ρ=.143, p<.001).

Similar patterns were detected for allowance, although the relationships were weaker in this case (see Figure 11). As income increased, so did the usage rate of tobacco (ρ=.073, p<.001) and marijuana (ρ=.069, p<.001). Overall (i.e., any) alcohol use appeared to peak around the $51-75 point to then decrease for higher allowances. The last Spearman's correlation test found there was a weak, positive correlation between allowance and alcohol use, which was statistically significant (ρ=.060, p<.01).



N.B.: Frequencies for the first category have been provided for context.

Figure 10. Income from work and substance use in the preceding 30 days.



N.B.: Frequencies for the first category have been provided for context.

Figure 11. Allowance and substance use in the preceding 30 days.

Multivariate Analyses

To estimate the effect of each of the explanatory variables after all other variables were controlled for, separate OLS regression models were run for each of the three outcome variables (i.e., alcohol, tobacco, and marijuana use). No multicollinearity issues were detected but, after a small number of outliers or otherwise problematic cases were identified (30 for alcohol, 58 for tobacco, and 29 for marijuana), the regression analyses were repeated after deleting these cases. The pattern of results did not vary greatly, so it is the results based on the original sample of 2,874 that are reported here (the results of the three regression tests with the reduced samples can be found in Appendix C and, where differences in the patterns were detected, these were highlighted). Each regression model included the seven independent variables and the three control variables. The regression models yielded coefficients for each of the predictors that allowed us to determine whether each independent variable had a significant effect on each of the dependent variables, when everything else was kept constant.

Alcohol Use

The first regression model showed the predictors explained 20.4% of the variance for alcohol use (Adjusted R^2 =.204, F(11, 2862)=67.803, p<.001; see Table 7). When everything else was considered, the time spent in all three types of unstructured activities were shown to predict alcohol use, as did the income received from work. However, in most cases the effect sizes were small. For example, a unit increase in the partying variable scale (the highest effect size detected, with ß =.357) was associated with just over a third of a unit increase (b=.361) in the alcohol use scale. When the regression was re-run without the 30 outlier/problematic cases, only the work income variable was

affected by dropping in significance level from p<.01 to only being marginally significant (see Appendix C), so this finding should be interpreted with caution.

Table 7. OLS regression with alcohol use as the outcome variable

	b	SE	ß	t
Unstructured activities				
Go out for fun	0.041	0.015	0.052	2.776**
Drive for fun	0.040	0.012	0.061	3.380**
Party	0.361	0.019	0.357	19.373***
Structured activities				
Sports	-0.005	0.011	-0.008	-0.457
Work	0.010	0.012	0.023	0.868
Income				
Work	0.020	0.007	0.071	2.733**
Allowance	0.012	0.008	0.028	1.596
Control variables				
18+ years	0.091	0.037	0.042	2.498*
Male	-0.004	0.037	-0.002	-0.100
Black	-0.391	0.064	-0.105	-6.088***
Hispanic	-0.241	0.042	-0.098	-5.731***
				F(11, 2874)= 67.803, p<.001, Adjusted R^2=.204

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001

Marijuana Use

The next regression model had marijuana use as the outcome. It was found the predictors explained 10.7% of the variance in marijuana use (Adjusted R^2=.107, F(11, 2862)=32.235, p<.001; see Table 8). The six predictors yielding statistical significance (i.e., going out for fun, driving around for fun, going to parties for fun, time spent in

sports, income from work, and male) were mostly associated with small effect sizes again. As was the case with alcohol, the variable going to parties was found to have the highest effect size on marijuana use (ß =.185). When the regression was re-run after deleting the 29 outlier/problematic cases, driving around for fun was the only variable that dropped in significance level, from p<.01 to p<.05 (see Appendix C).

Table 8. OLS regression with marijuana use as the outcome variable

	b	SE	ß	t
Unstructured activities				
Go out for fun	0.134	0.020	0.130	6.571***
Drive for fun	0.061	0.016	0.071	3.701***
Party	0.245	0.026	0.185	9.492***
Structured activities				
Sports	-0.092	0.016	-0.109	-5.892***
Work	0.020	0.017	0.034	1.233
Income				
Work	0.024	0.010	0.064	2.330*
Allowance	0.016	0.011	0.027	1.450
Control variables				
18+ years	-0.050	0.051	-0.018	-0.989
Male	0.192	0.051	0.068	3.774***
Black	-0.004	0.089	-0.001	-0.047
Hispanic	-0.098	0.058	-0.031	-1.685
				F(11, 2874)= 32.235, p<.001, Adjusted R^2=.107

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001.

Tobacco Use

The last regression test being looked at was tobacco, with Table 9 below showing the coefficient results of the regression. It was found the model explained 7.2.% of the

variance in tobacco use (Adjusted R^2 =.072, F(11, 2862)=21.402, p<.001). As with alcohol and marijuana, all three unstructured activity variables were found to be significant predictors. This time, it was income from allowances, rather than paid employment, that yielded a significant coefficient. This time, the largest effect size was detected for time spent in sports (ß =-.128). When the regression was run without the 58 outlier/problematic cases identified, drive around for fun dropped in significance level, from p<.001 to p<.01, and the hours worked variable was no longer significant (see Appendix C).

Table 9. OLS regression with tobacco use as the outcome variable

	b	SE	ß	t
Unstructured activities				
Go out for fun	0.024	0.007	0.074	3.648***
Drive for fun	0.027	0.005	0.099	5.061***
Party	0.046	0.008	0.109	5.478***
Structured activities				
Sports	-0.034	0.005	-0.128	-6.775***
Work	0.012	0.005	0.064	2.289*
Income				
Work	-0.001	0.003	-0.010	-0.365
Allowance	0.009	0.003	0.051	2.705*
Control variables				
18+ years	0.018	0.016	0.020	1.08
Male	0.026	0.016	0.029	1.605
Black	-0.130	0.029	-0.084	-4.538***
Hispanic	-0.102	0.019	-0.100	-5.432***
				F(11, 2874)= 21.402, p<.001, Adjusted R^2=.072

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001

For ease of comparison, the standardized coefficients (and associated significance levels) from the three regressions models are shown in 10. Overall, the alcohol model had a higher proportion of the variance explained (R^2=.204) and several predictors yielded significant coefficients in all models. However, the effect sizes observed were small throughout. All three unstructured activity variables explained some amount of variation in substance use for all three substances, with the time spent partying having the greatest predictive power. Time spent in sports was associated with lower cigarette and marijuana use; in contrast, time spent at work was positively associated with tobacco use and unrelated to alcohol or marijuana use. Income from work was positively associated with alcohol and marijuana use while the opposite pattern was observed for allowance (i.e., positively associated with tobacco use only). Lastly, when the control variables are considered, both Black and Hispanic seniors appeared to be less likely to use alcohol and tobacco than their White counterparts, with no significant differences being observed for marijuana use. Older seniors were slightly more likely to use alcohol and males more likely to use marijuana.

Table 10. Standardized coefficients from three OLS regression models.

	Alcohol	Marijuana	Tobacco
	ß	ß	ß
Unstructured activities			
Go out for fun	0.052**	0.130***	0.074***
Ride for fun	0.061**	0.071***	0.099***
Party	0.357***	0.185***	0.109***
Structured activities			
Sports	0.008	-0.109***	-0.128***
Work	0.023	0.034	0.064*
Income			
Work	0.071**	0.064*	-0.010
Allowance	0.028	0.027	0.051*
Control variables			
18+ years	0.042*	-0.018	0.020
Male	0.002	0.068***	0.029
Black	-0.105***	-0.001	-0.084***
Hispanic	-0.098***	-0.031	-0.100***
Adjusted R^2	**0.204**	**0.107**	**0.072**

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001

V. DISCUSSION

In line with routine activity theory, it was predicted that illegal substance use among high school seniors would increase with unstructured time and income. It was also predicted adolescents' structured time would be negatively related to substance use. Overall, the hypotheses were only partially supported, with the amount of time spent in all three unstructured activities (evenings out for fun, driving around for fun, and going to parties) being positively and significantly associated with all three substances considered (alcohol, tobacco, and marijuana use). In contrast, the structured time and income variables produced mixed results.

Consistent with expectations, participation in sports, as a form of structured activity, was negatively and significantly associated with both marijuana and tobacco use. However, the relationship between this variable and alcohol use in our sample was positive, although not statistically significant. When looking at the second structured activity of hours spent in employment, it was found that adolescent use of tobacco was positively and significantly associated with hours worked, against our predictions.

It is possible the relationship between sports participation and substance use is moderated by the short-term impact of the substance on physical performance. For example, regular use of either tobacco or marijuana could impact lung capacity, while alcohol would not (Mathers et al., 2006). If a juvenile knows their performance will be affected by a certain substance, they may choose to avoid it. Smoking (tobacco or marijuana) may also be less socially desirable than alcohol use among athletes (Lisha & Sussman, 2010). A possible reason there is an increase in alcohol use with sports participation that is in line with RAT is that drinking is encouraged by the sports culture,

and this creates more opportunities (e.g., by being readily available at get-togethers; Lisha & Sussman, 2010). While sports are a structured activity involving practices and games that allow less time to consume alcohol, the overall environment may be detrimental. When watching professional sports, or when partaking in games themselves, people often celebrate a win with alcohol. This may give the appearance that the culture of sports is more accepting of alcohol consumption than of the other two substances.

As for the structured activity of hours worked, it was expected that there would be a decrease in substance use as the hours at work increased, but the opposite was found for tobacco use, with no significant association detected for alcohol or marijuana. These findings should be interpreted in conjunction with those for the income from work variable, as they are closely related. It was found that both alcohol and marijuana use were significantly and positively associated with income from work, but not tobacco use. This pattern of results may be the outcome of the two opposing mechanisms that are activated with employment. On the one hand, employment is a structured activity that should act as a protective barrier, given the presence of capable guardians. On the other hand, employment offers an income that allows for more opportunity, in that the adolescent would now have the ability to purchase illicit substances. It is possible the detrimental impact of income is canceling out the potentially beneficial impact of supervised hours, although it is difficult to know from the present results.

A possible explanation for the positive association between tobacco use and hours worked (but not between tobacco use and income) is that many jobs allow for short breaks where people may step out and smoke a cigarette; if a juvenile were to have breaks with their coworkers, the juvenile may have the opportunity to bum a cigarette

from these smoking, and likely older, individuals. While older coworkers may be old enough to buy cigarettes, they may unknowingly or knowingly break the law by providing these to the juveniles they work with. To further explore the positive association detected for employment and illicit substance use among juveniles, future research could investigate whether job type (e.g., food industry, retail, etc.) moderates the relationship observed.

The last variable considered was income from an allowance where it was found that tobacco use was the only substance use that was positively and significantly associated with it, when all other variables were taken into account. While only tobacco use was found to have a significant relationship, both alcohol and marijuana use were in the expected direction despite not being significant.

Alternative Theoretical Interpretations

This study was a test of routine activity theory, but the results may be interpreted through the lens of alternative theoretical approaches such as Hirschi's social control theory (Hirschi, 1969). Specifically, the finding that participation in sports was negatively and significantly associated with both marijuana and tobacco use could be viewed as evidence of the beneficial effect of involvement. Hours spent in sports would be a good measure for involvement as it would fall into the category of conventional activities. Any senior participating in a sport must go to the practices and games, which means they would not have as much time or opportunity to engage in deviant behavior. However, no significant relationship was found between sports involvement and alcohol use. Further, the hours spent at work—another type of conventional activity—were only significantly associated with tobacco use and this was in the opposite direction of what the theory

would predict (i.e., more hours at work were associated with higher levels of smoking).

The variables used to measure the hours spent at work—if we assume a senior who works more hours has a more "serious" job—and the income from such work could be used as proxies for commitment. These would be good measures for commitment as they are things the senior would stand to lose if their deviant behavior were to lead to a criminal conviction or otherwise came to the attention of their employer. However, as stated above, the relationship between hours of work and substance use was positive for tobacco and non-significant for alcohol and marijuana. Work income was positively and significantly related to both alcohol and marijuana use, which would go against the predictions of social control theory (but which supported the routine activity perspective).

These variables could be used as proxies for the involvement and commitment constructs of social bond theory but variables other than the one considered in this study would be needed to model attachment and belief and thus conduct a full test of the theory. Previous studies have indeed tested social control theory using data from the MTF study. For example, Li (2004) used MTF data from YEAR and used the following variables: 1) as a proxy for attachment, they considered whether the adolescents enjoyed (or hated) being in school and whether they found schoolwork interesting; 2) for commitment, they considered the perceived importance of graduating from high school, going to college, and graduating from college; 3) for involvement, trying to do their best work in school, participation in community affairs, time spent on homework in and out of school, and GPA; and, finally, 4) as a proxy for belief, they considered whether the adolescent disproved of smoking cigarettes or marijuana regularly, trying crack cocaine occasionally, or drinking nearly every day. Li (2004) found that, with the exception of

commitment, all social bonds had a significant negative effect on crime.

Limitations

Like any other study, there are aspects of the current research that could have affected our findings. This research focused on cigarette use but, given its lower usage rates, as compared to both alcohol and marijuana use, it might have been prudent to also include electronic cigarettes and vape use, both of which have grown in popularity the past few years (Cullen et al., 2018). In addition, although an effort was made to choose the time frame of the substance use (i.e., the previous 30 days), the research uses data from a cross-sectional survey, so temporal order cannot be established. It is possible that a senior has a substance use problem, so they decide to get a job in order to fund their habit. Consequently, the test used in this research would be able to detect a relationship between two variables but unable to ascertain which of the two variables came first. Further, while this research does explain some of the variation in illegal substance use, much of the variance remains unexplained.

There are always unmeasured variables that explain some of these relationships but it also important to keep in mind how some of these unmeasured variables could be acting as mediators or moderators of the associations identified. For example, the association between tobacco use and hours of work may be mediated by the development of friendships with smoking coworkers. The more a senior works, the more time they spend with coworkers that may smoke (during but also outside of work), and this would then lead to the senior picking up the habit. An example of a moderating variable in the relationship between alcohol use and sports participation could be gender; prior research has reported this relationship to be strongest among females from lower socioeconomic

status schools and males from higher socioeconomic status ones (Hoffman, 2006). The analyses presented here simply measured the independent effect of each predictor on the outcomes, so it was not possible to measure this type of more complex association.

While some of the findings reported here were statistically significant, caution should be used when generalizing these to the entire U.S. population or other countries. The data in this study will be subject to random sampling error as well as some sampling bias. As mentioned in the methods section, the data used in this study missed students that had either dropped out of high school or were not present when the study was conducted. These missing students, aside from lowering overall substance use rates (as it would be reasonable to expect these students to be more likely to use such substances), could explain some of the weak correlations that were found (due to decreased variation in the outcome variables). Cross-population generalizability may also be affected by cultural differences.

Implications for Policy and Practice

There are some measures that may be implemented to reduce illicit substance use based on these findings. For instance, given that sports involvement seems to have a beneficial effect, at least in regards to tobacco and marijuana use, youth could be encouraged to engage in such activities. Another measure that may be taken is to increase the availability of more unpaid employment opportunities, such as internships (which would add structured hours but keep income constant), or to limit the number of hours an adolescent is able to work a week, especially for adolescents who are deemed to be more at risk. This would still allow for juveniles to acquire work experience but limit their

opportunity for purchasing illicit substances as well as their interactions with (older) people who may use these substances.

Conclusions

The present research provided a further test of the routine activity perspective, thus expanding the evidence base on how opportunity may play a role in explaining substance use among high school seniors. Although the data appeared to indicate the effect of income and time spent on structured and structured activities may not be as straight-forward as first predicted, some of the study findings may still be used to provide support for existing interventions, including internships and involvement in sports. As always, further research should be conducted to replicate and further explain the patterns observed in this study.

APPENDIX SECTION

TEXAS STATE UNIVERSITY

The rising STAR of Texas

October 5, 2020

Tristan McPherson
c/o Dr. Lucia Summers
School of Criminal Justice
Texas State University
San Marcos, TX 78666

Dear Tristan,

Your recently submitted IRB Determination Request Form was reviewed by Research Integrity and Compliance (RIC).

According to the provisions in 28 CFR § 46.102 "human subject" is defined as "a living individual about whom an investigator conducting research obtains (1) Data through intervention or interaction with the individual, or (2) Identifiable private information."

It is understood your research project exclusively involves the examination of secondary "data that was collected by anonymous surveys that were collected by researchers Richard A. Miech, Lloyd D. Johnston, Jerald G. Bachman, Patrick M. O'Malley, John E. Schulenberg." It is understood the dataset is anonymous and publicly available. Furthermore, RIC is under the assumption the study does not involve interaction with living individuals or access to identifiable information. Therefore, RIC concluded your research does not use human subjects and is not regulated by the provisions in 28 CFR § 46.102.

If the subject pool or intent of your project changes in the future, please contact RIC to initiate an IRB assessment.

Feel free to contact me if you have any questions.

Regards,

Cristina A. Mendoza

Cristina A. Mendoza
Compliance Specialist
Research Integrity and Compliance
Texas State University
(512) 245-2314

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ANALYSES BASED ON LARGER SAMPLE

This section presents the same bivariate analyses from the Results section but, in this case, all cases for which data were available, for each variable combination, were employed. This resulted in sample sizes ranging from 4,396 to 13,077.

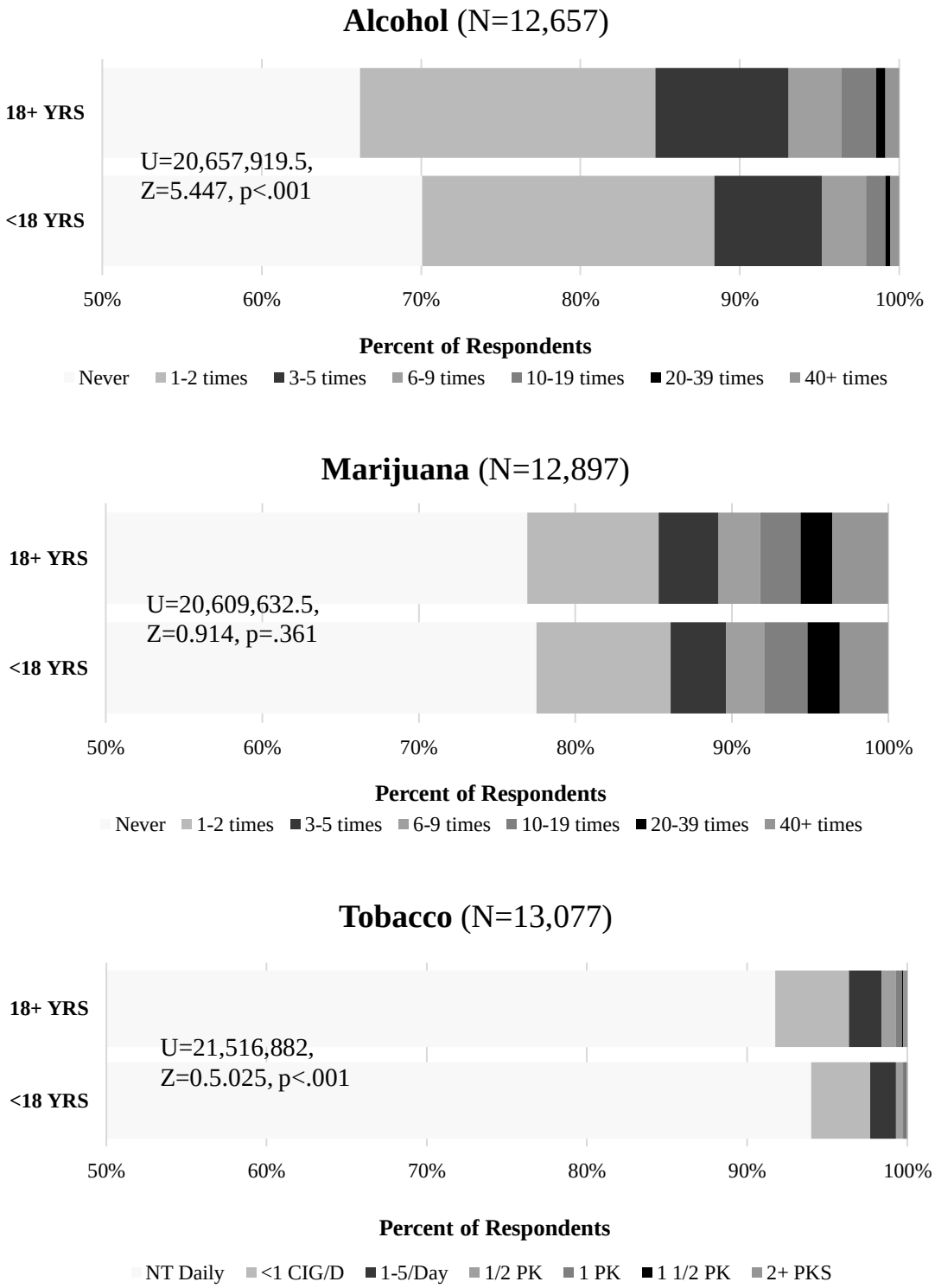


Figure B.1. Age of respondent and substance use in the preceding 30 days, with Mann-Whitney test results.

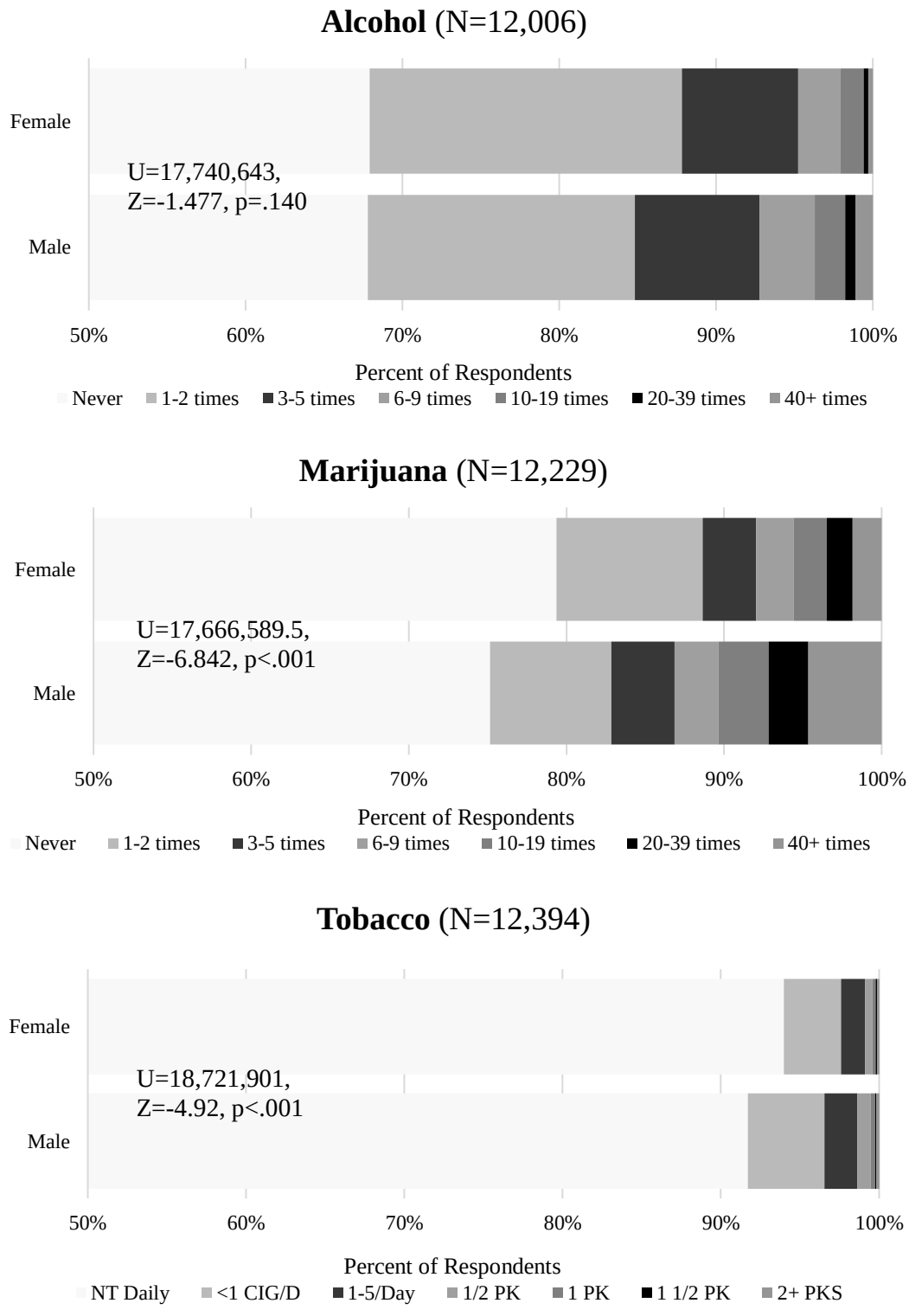
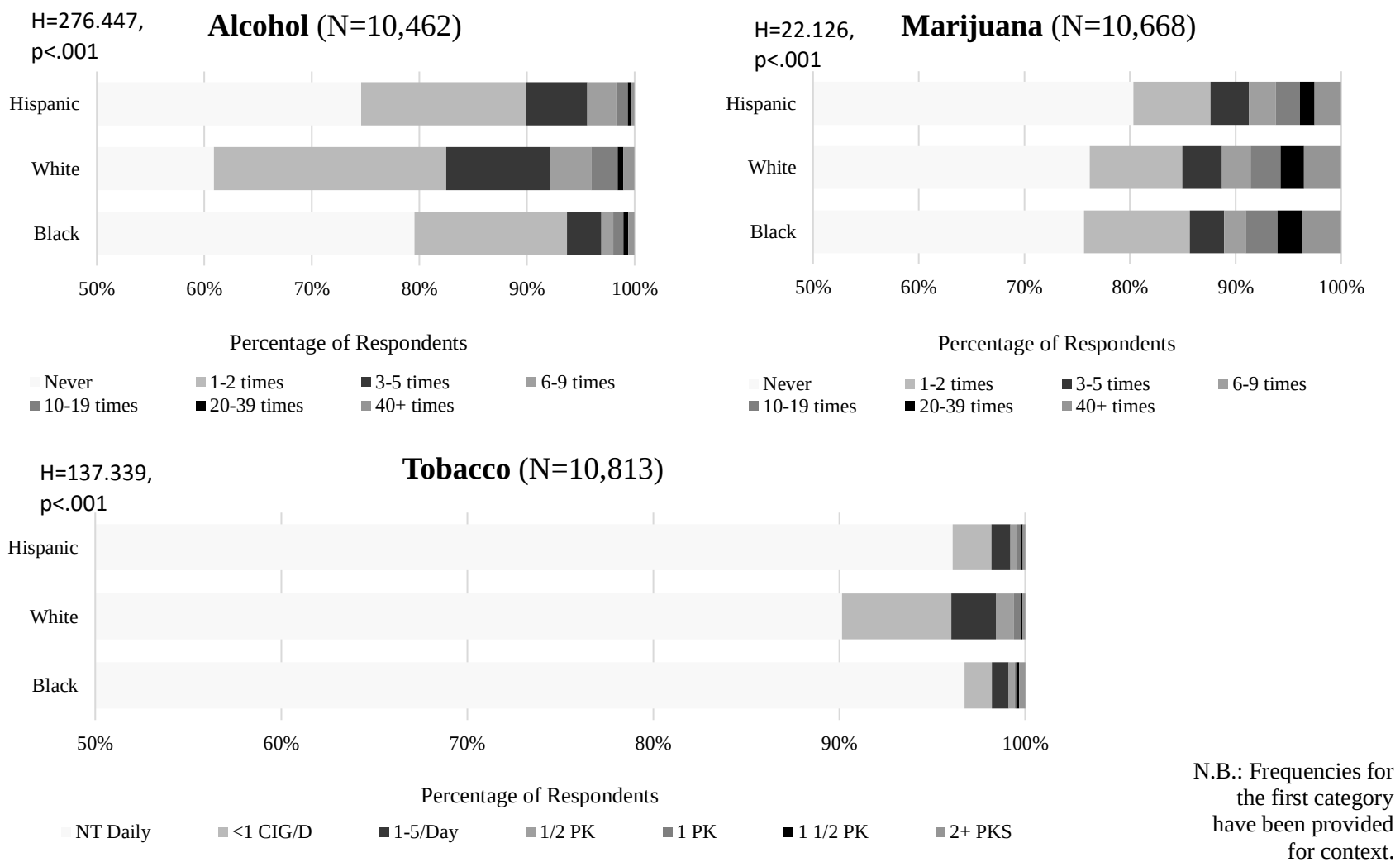


Figure B.2. Sex and substance use in the preceding 30 days, with Mann-Whitney test results.



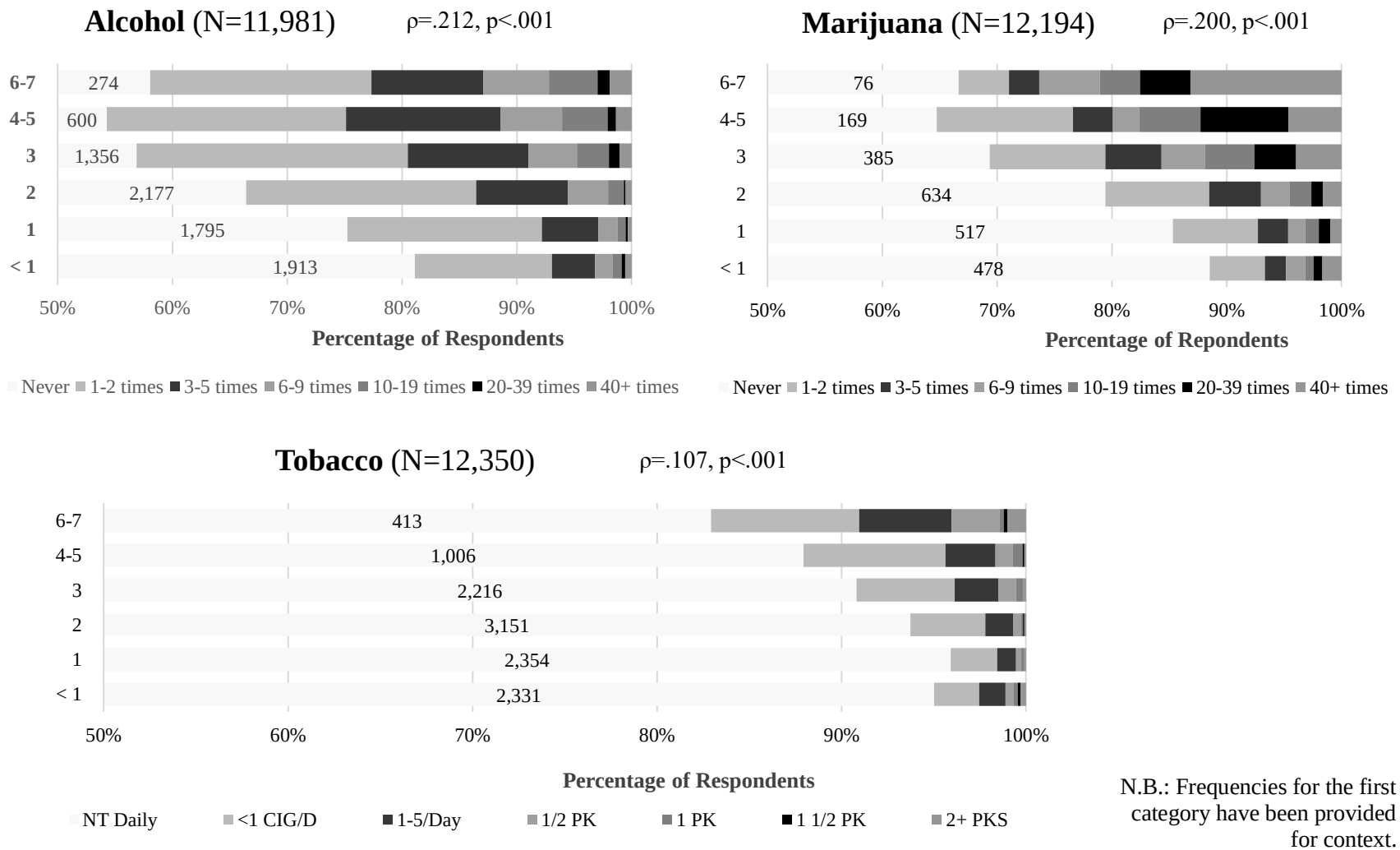
N.B.: Frequencies for the first category have been provided for context.

Figure B.3. Race/ethnicity and substance use preceding the past 30 days, with Kruskal-Wallis test results.

Table B.1. Pairwise comparisons for differences in alcohol, marijuana, and tobacco use between different ethnicities/races.

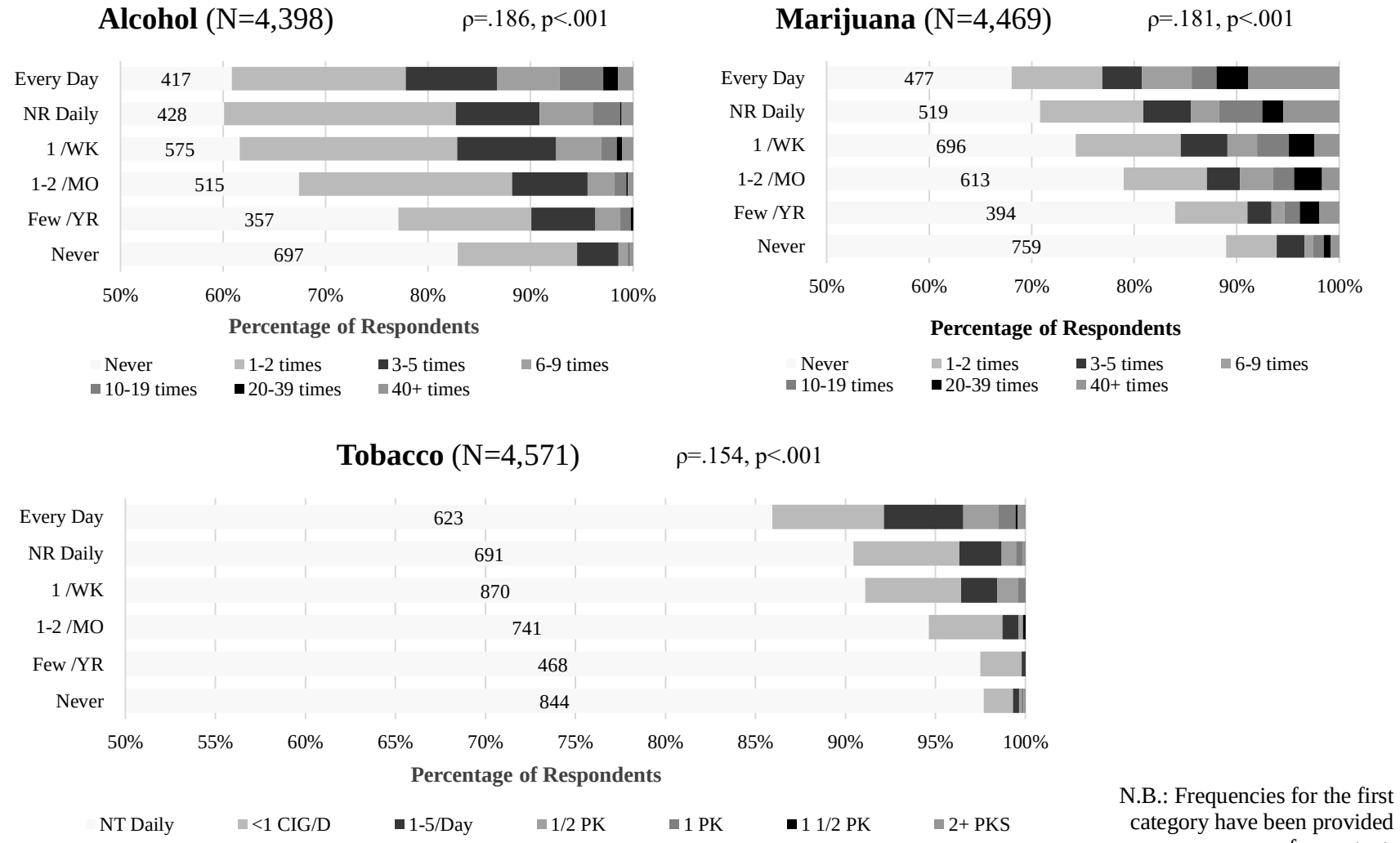
	Alcohol	Marijuana	Tobacco
A. Black-White	-12.827***	-7.996***	0.305
B. White-Hispanic	13.056***	10.102***	4.519***
C. Black-Hispanic	-3.202**	-0.703	3.230**

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) $p<.05$, (**) $p<.01$, (***) $p<.001$. Significance values have been adjusted by the Bonferroni correction for multiple tests.



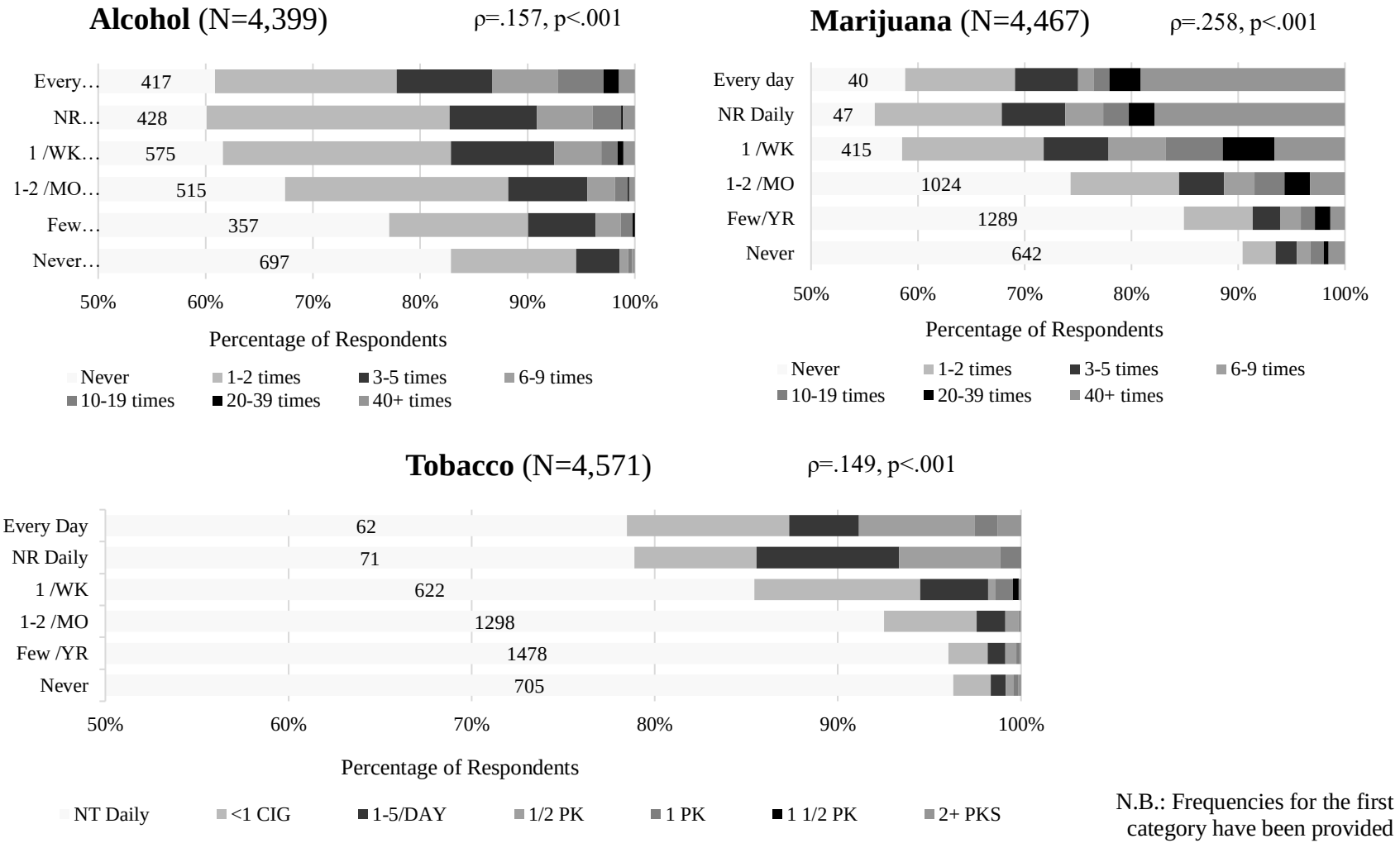
N.B.: Frequencies for the first category have been provided for context.

Figure B.4. Evenings out for fun in the previous week and substance use in the preceding 30 days with Spearman's correlation results.



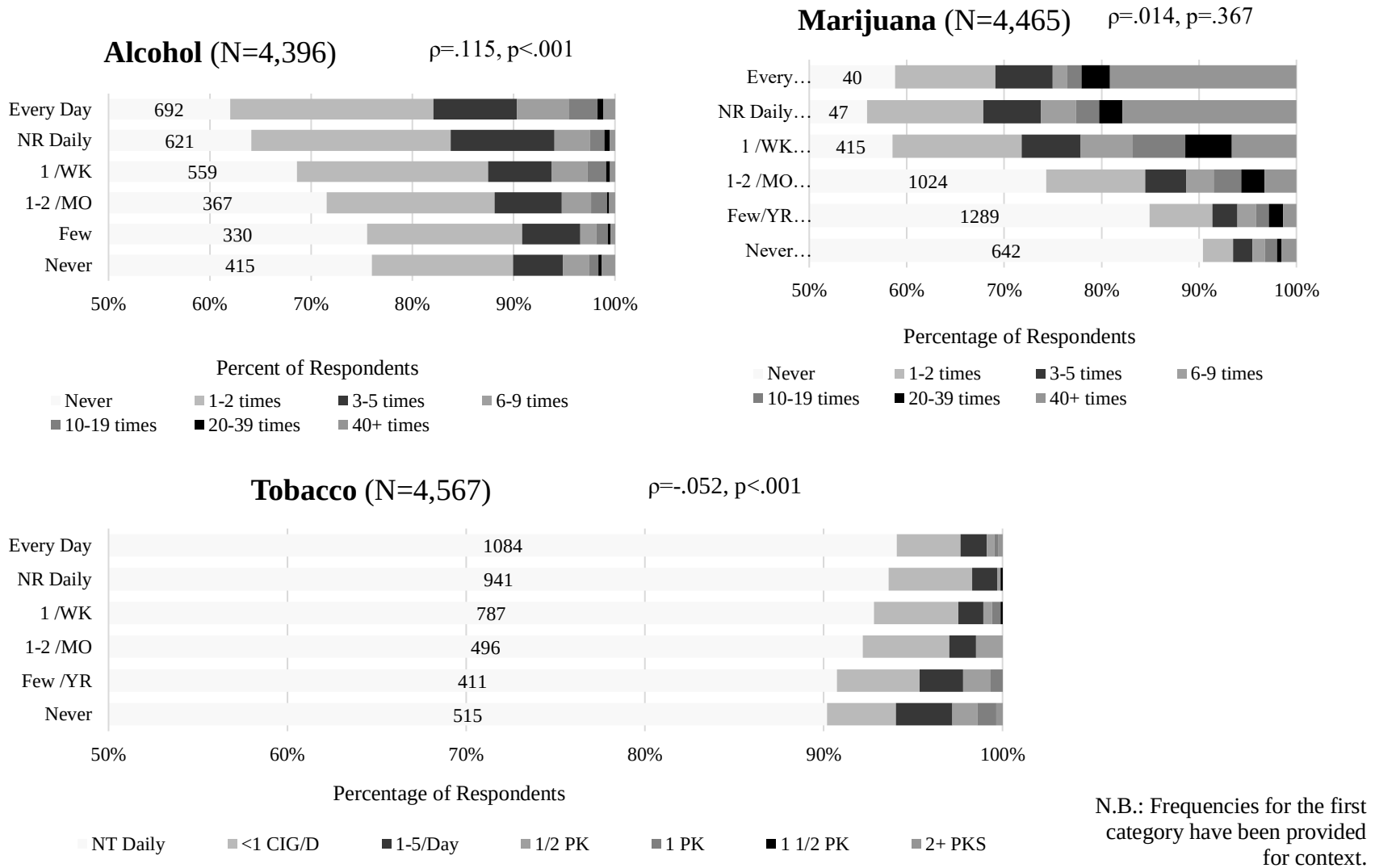
N.B.: Frequencies for the first category have been provided for context.

Figure B.5. Drive around for fun and substance use preceding the past 30 days, with Spearman's correlation results.



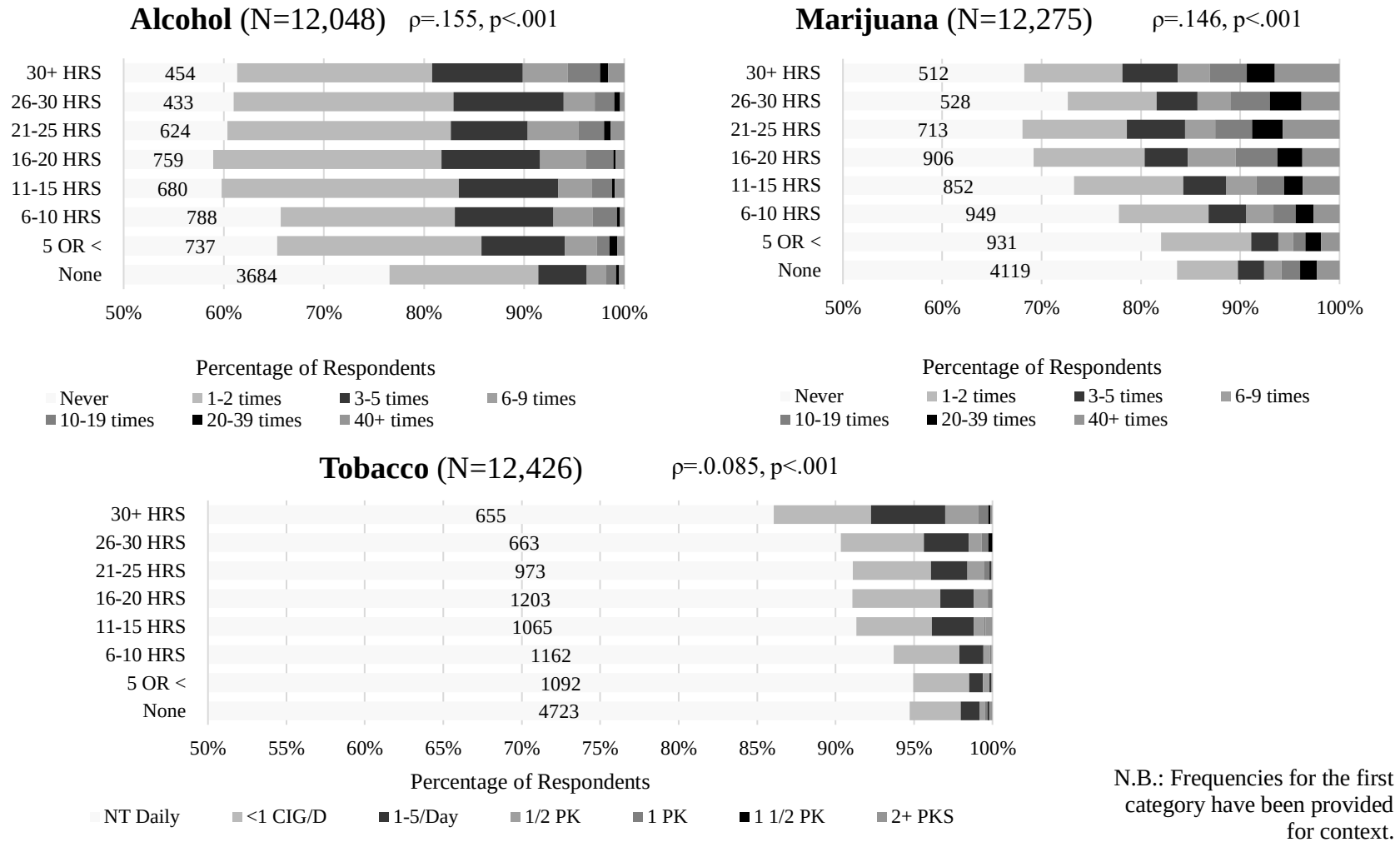
N.B.: Frequencies for the first category have been provided for context.

Figure B.6. Go to parties and substance use for the preceding 30 days, with Spearman's correlation results.



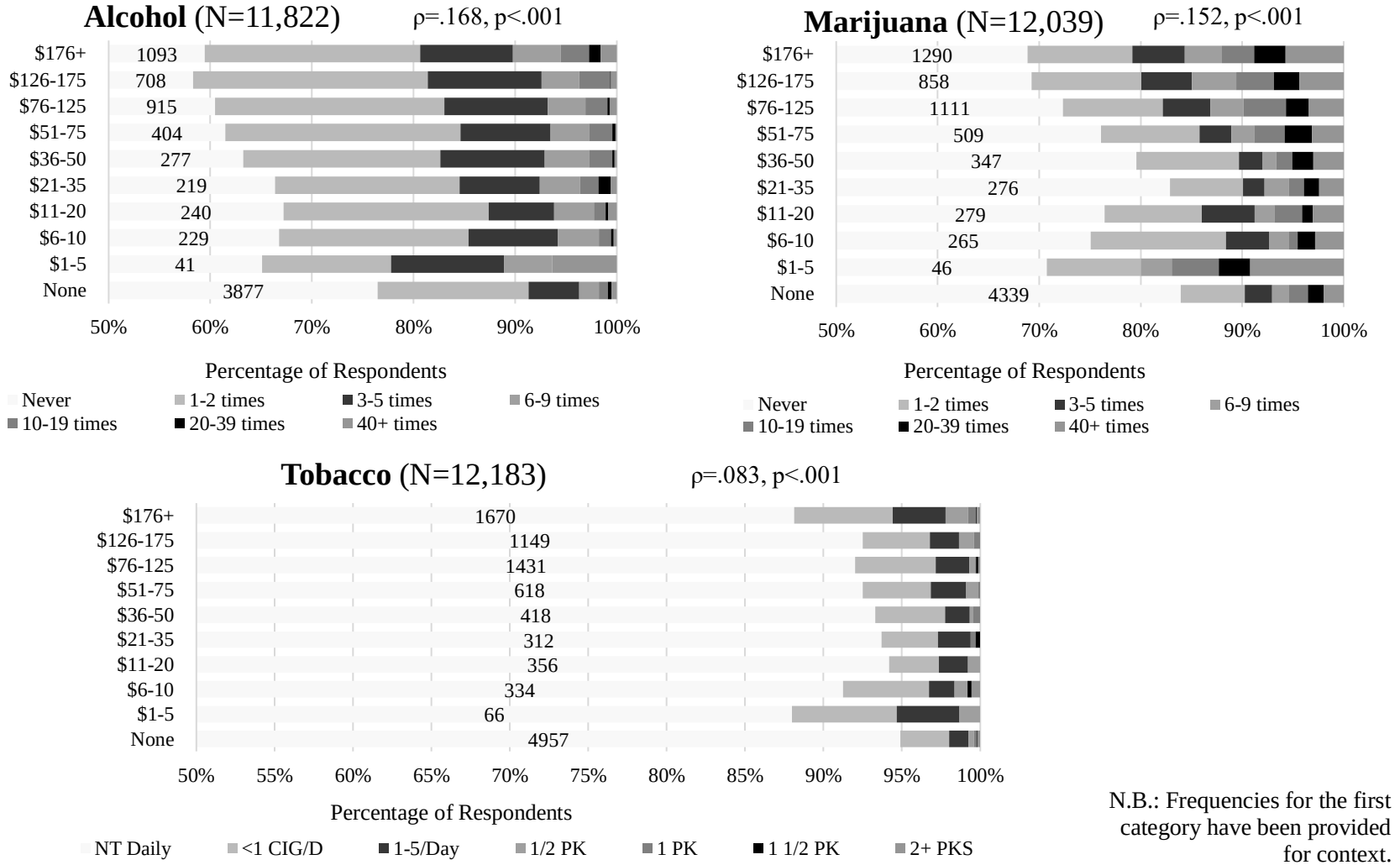
N.B.: Frequencies for the first category have been provided for context.

Figure B.7. Participate in sports and substance use in the preceding 30 days, with Spearman's correlation results.



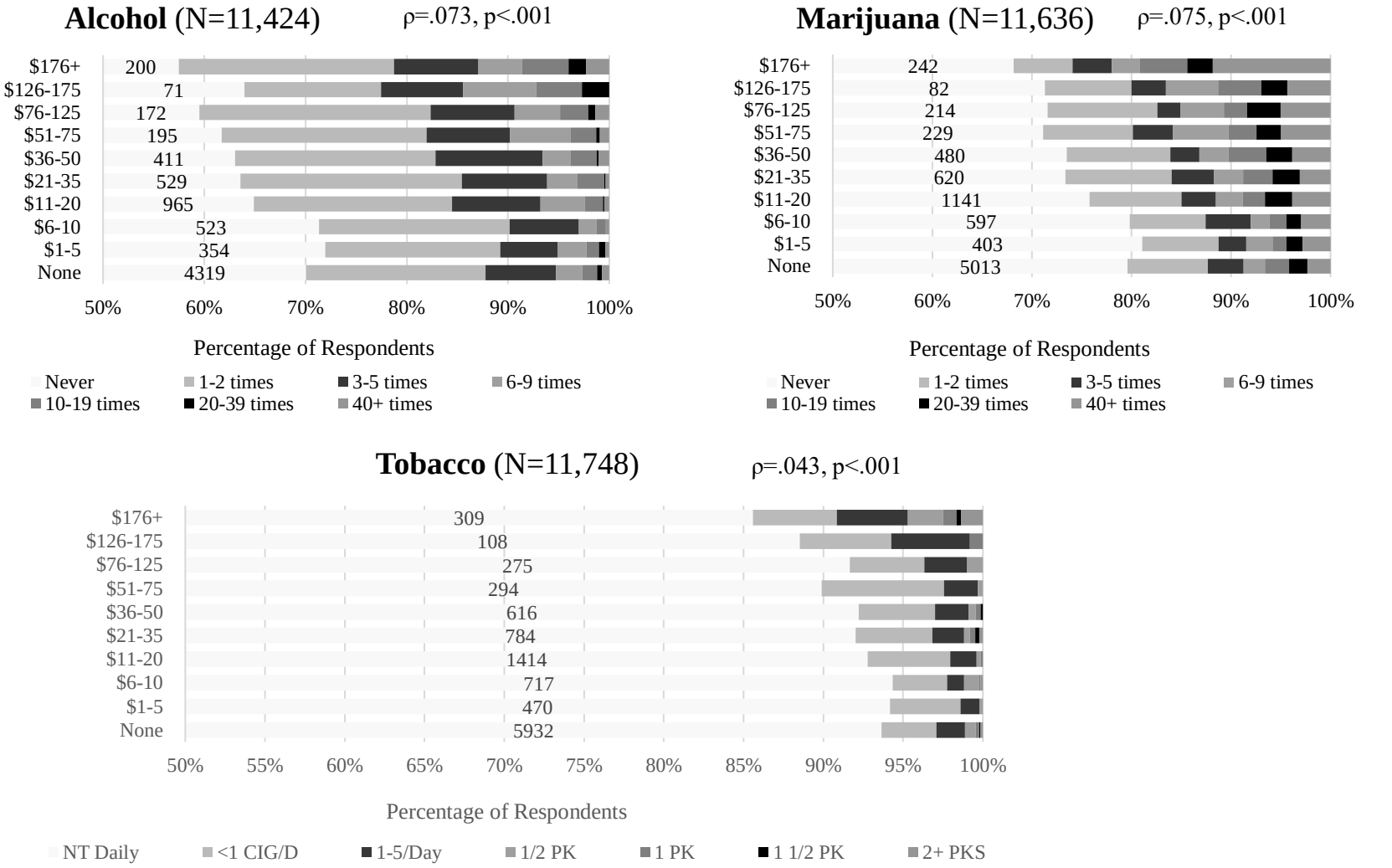
N.B.: Frequencies for the first category have been provided for context.

Figure B.8. Hours a week you work and substance use, with Spearman's correlation results.



N.B.: Frequencies for the first category have been provided for context.

Figure B.9. Income from work and substance use in the preceding 30 days, with Spearman's correlation results.



N.B.: Frequencies for the first category have been provided for context.

Figure B.10. Allowance and substance use, with Spearman's correlation results.

MULTIVARIATE ANALYSES WITHOUT OUTLIERS

For the multivariate analyses, two regression tests were run for each of the outcome variables, namely alcohol, tobacco, and marijuana. The first test included all 2,874 responses (these results were reported in the Results section), while the second test was run with the outlier or otherwise problematic cases deleted (30 for alcohol, 58 for tobacco, and 29 for marijuana). The results for the three regression test with the deleted outlier/problematic cases are reported below.

Table C.1. OLS regression with alcohol use as the outcome variable.

	b	**SE**	**ß**	**t**
Unstructured activities				
Go out for fun	0.037	0.013	0.053	2.787**
Drive for fun	0.034	0.011	0.06	3.258**
Party	0.314	0.017	0.347	18.604***
Structured activities				
Sports	0.005	0.01	0.009	0.522
Work	0.017	0.011	0.043	1.616
Income				
Work	0.013	0.007	0.05	1.905
Allowance	0.009	0.007	0.024	1.353
Control variables				
18+ years	0.068	0.033	0.035	2.069*
Male	-0.028	0.033	-0.015	-0.864
Black	-0.346	0.057	-0.105	-6.041***
Hispanic	-0.206	0.037	-0.095	-5.492***
				$F(11, 2844)= 63.513$, $p<.001$, Adjusted $R^2=.195$

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001

Table C.2. OLS regression with marijuana use as the outcome variable.

	b	SE	ß	t
Unstructured activities				
Go out for fun	0.140	0.019	0.146	7.395***
Drive for fun	0.049	0.015	0.061	3.193**
Party	0.257	0.024	0.207	10.684***
Structured activities				
Sports	-0.090	0.014	-0.114	-6.205***
Work	0.028	0.015	0.049	1.785
Income				
Work	0.019	0.010	0.055	2.008*
Allowance	0.018	0.010	0.032	1.770
Control variables				
18+ years	-0.033	0.047	-0.013	-0.710
Male	0.177	0.047	0.067	3.747***
Black	-0.008	0.083	-0.002	-0.097
Hispanic	-0.089	0.054	-0.030	-1.651
				$F(11, 2845)= 37.974$, $p<.001$, Adjusted $R^2=.125$

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001

Table C.3. OLS regression with tobacco use as the outcome variable.

	b	SE	ß	t
Unstructured activities				
Go out for fun	0.024	0.004	0.126	6.134***
Drive for fun	0.008	0.003	0.053	2.659*
Party	0.025	0.005	0.102	5.062***
Structured activities				
Sports	-0.016	0.003	-0.1	-5.206***
Work	0.006	0.003	0.052	1.832
Income				
Work	0.001	0.002	0.015	0.524
Allowance	0.005	0.002	0.042	2.206*
Control variables				
18+ years	-0.002	0.010	-0.003	-0.17
Male	0.007	0.010	0.014	0.77
Black	-0.065	0.017	-0.072	-3.841***
Hispanic	-0.040	0.011	-0.068	-3.644***
				$F(11, 2816)= 18.241$, $p<.001$, Adjusted $R^2=.063$

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001

Table C.4. Standardized coefficients from the three OLS regression models.

	Alcohol	Marijuana	Tobacco
	ß	ß	ß
Unstructured activities			
Go out for fun	0.053**	0.146***	0.074***
Ride for fun	0.060**	0.061**	0.099*
Party	0.347***	0.207***	0.109***
Structured activities			
Sports	0.009	-0.114***	-0.128***
Work	0.043	0.049	0.064
Income			
Work	0.050	0.055*	-0.010
Allowance	0.024	0.032	0.051*
Control variables			
18+ years	0.035*	-0.013	0.020
Male	0.002	0.068***	0.029
Black	0.105***	-0.001	-0.084***
Hispanic	0.098***	-0.031	-0.100***
Adjusted R^2	**0.195**	**0.125**	**.0630**

N.B.: Standardized test statistics have been reported to control for different subgroup sample sizes. (*) p<.05, (**) p<.01, (***) p<.001

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