Section 6. Sociology

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ARE DEMOGRAPHIC CHARACTERISTICS AND SOCIAL NETWORK ASSOCIATED WITH ILLICIT DRUG USE? – A MULTINOMIAL LOGISTIC REGRESSION ANALYSIS

Abstract. Illicit drug use among adolescents, including the abuse of illegal drugs and/or the misuse of prescription medications or household substances, has become a public health concern. It is found that, by the 12th grade, about half of adolescents have misused an illicit drug at least once. The most commonly used drug is marijuana. In this study, we categorized adolescent students' drug use status into 3 levels: no drug use, use of marijuana only, and use of other illicit drugs. We aimed to explore if adolescents' demographic characteristics and social network are associated with drug use, using data of a nationally representative sample from the Youth Risk Behavior Surveillance System (YRBSS). We found that older age, higher grade, female gender, and having negative social network are associated with higher risk of marijuana or other drugs. There are also racial/ethnic differences.

Keywords: Illegal drug use, adolescent, logistic regression, model, social network.

1. Introduction

Illicit drug use among adolescents, including the abuse of illegal drugs and/or the misuse of prescription medications or household substances, has become a public health concern. It is found that, by the 12th grade, about half of adolescents have misused an illicit drug at least once [1]. The most commonly used drug is marijuana. Although some states have legalized marijuana use over the past decade, marijuana use remains illegal under federal laws [2]. Other harmful substances include cocaine, glues, aerosols etc.

Early use of drugs has been linked to a several times greater risk of developing substance dependence, as the majority of Americans aged 18–30 admitted for substance abuse treatment initiated alcohol or drug use before the age of 18.

Research has associated socio-demographic characteristics with drug use, including male gender, lower education, parents' marital status such as divorced/separated [3; 4]. Meanwhile, social networks such as peer influence are important for young adults [3]. For example, Gomez et al. found that negative social network including having friends who did not use alcohol, having friends who use opiates regularly increased substance use among homeless young people.

In this study, we categorized adolescent students' drug use status into 3 levels: no drug use, use of marijuana only, and use of other illicit drugs. We aimed to explore if adolescents' demographic characteristics and social network are associated with drug use, using data of a nationally representative sample from the Youth Risk Behavior Surveillance System (YRBSS).

2. Research Methods

2.1 Data source

The YRBSS was developed in 1990 by the Centers for Disease Control and Prevention (CDC),

aiming to monitor health-related behaviors that contribute to deaths and disabilities among youth and adults. It includes national, state, territorial, tribal government, and local school-based surveys of representative samples of students in 9th through 12th grade. These surveys are conducted every two years.

YRBSS monitors six categories of health-related behaviors:

- Behaviors that contribute to unintentional injuries and violence;
- Sexual behaviors related to unintended pregnancy and sexually transmitted diseases, including HIV infection;
- Alcohol and other drug use;
- Tobacco use;
- Unhealthy dietary behaviors;
- Inadequate physical activity.

For this study, we used the most recent data from year 2017. A total of 14,765 students in 9th through 12th grades were included in this year's data.

2.2. Variables of interest

2.2.1 Variables on drug use status:

In YRBSS, students were asked the following questions:

Q46. During your life, how many times have you used marijuana?

Q49. During your life, how many times have you used any form of cocaine, including powder, crack, or freebase?

Q50. During your life, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high?

Q51. During your life, how many times have you used heroin (also called smack, junk, or China White)?

Q52. During your life, how many times have you used methamphetamines (also called speed, crystal, crank, or ice)?

Q53. During your life, how many times have you used ecstasy (also called MDMA)?

Q54. During your life, how many times have you used synthetic marijuana (also called K2, Spice, fake weed, King Kong, Yucatan Fire, Skunk, or Moon Rocks)?

Q55. During your life, how many times have you taken steroid pills or shots without a doctor's prescription?

Q56. During your life, how many times have you taken a prescription drug (such as OxyContin, Percocet, Vicodin, codeine, Adderall, Ritalin, or Xanax) without a doctor's prescription?

Q57. During your life, how many times have you used a needle to inject any illegal drug into your body?

Based on these questions, we created a "drug use status" variable with 3 levels:

- no drug use;
- marijuana use only;
- other drug use (may or may not have marijuana use).

2.2.2 Variables on social network:

In the YBRS survey, there was no question that directly measures social network such as peer relationship of the participant. Therefore, we used the following question as a proxy of social network:

Q9. During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?

A. 0 times B. 1 time C. 2 or 3 times D. 4 or 5 times E. 6 or more times

A "negative social network" variable is created: 0=if answer is "0 times"; 1=If the answer is 1 time or more

2.2.3 Demographic variables

- Age, Gender, Grade: 9–12, and Race/ethnicity

2.3 Statistical Analysis

This includes 3 parts of analysis.

Descriptive analysis: We first described the study sample's profile of demographics, social network, and drug use status, using mean values for continuous variables (e.g., age) and percentages for categorical variables (e.g., gender).

Bivariate analysis: We then examined the percentage of drug use by studnets' demographics and social network status.

Multivariate analysis: *Multinomial Logistic Regression Model*

Multinomial Logistic Regression is an extension of binomial logistic regression when the dependent variable has more than two levels.

In the model, not using condom is the outcome "y". The explanatory variable "x" included age, gender, race/ethnicity, and grade level, and social network.

Log odds of event= β 0+social network* β 1 + age* β 2+gender* β 3+race/ethnicity* β 4+grade* β 5.

The main output from Logistic Regression is regression coefficient b and odds ratio.

In this study, two levels of outcomes (marijuana use, and other drug use) are to be compared with "no drug use". β is regression coefficient for a specific X. The relationship between OR and β is OR= e^{β}

- If β >0, OR= e^{β} will be larger than 1, meaning that the predictor is related to a higher probability/ odds of the event.
- If β <0, OR= e^{β} will be smaller than 1, meaning that the predictor is related to a lower odds of the event.

3. Results

3.1 Descriptive analysis results

After limiting to variables with non-missing values, the study sample included 12,706 high school students.

The average age was around 16 years. Only 23 and 13 students aged 12 and 13, so we combined them with students aged 14 years. Below are age group composition:

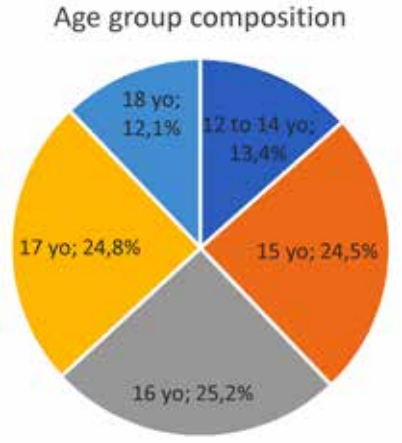

Figure 1.

51% were females and 49% were males. Students were proportionately from each grade of 9, 10, 11, and 12, with around 25% from each grade.

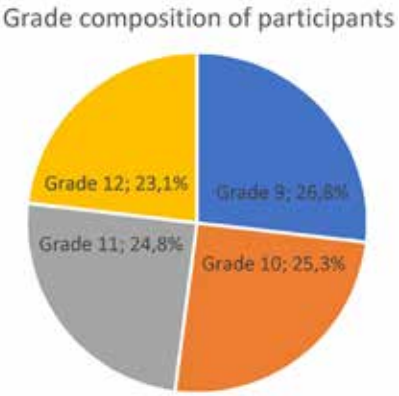

Figure 2.

In terms of race/ethnicity, the study sample included 48% Whites, 18% African Americans, and others.

Table 1.

Asian	Black
0.04761530	0.18322053
Hispanic/Latino Multiple – Hispanic/Latino	
0.10569810	0.14103573
Others	White
0.07484653	0.44758382

Overall 15% reported having negative social network.

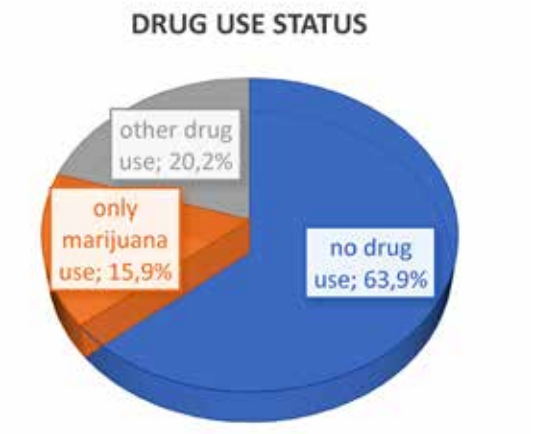

Figure 3.

3.2 Bivariate analysis

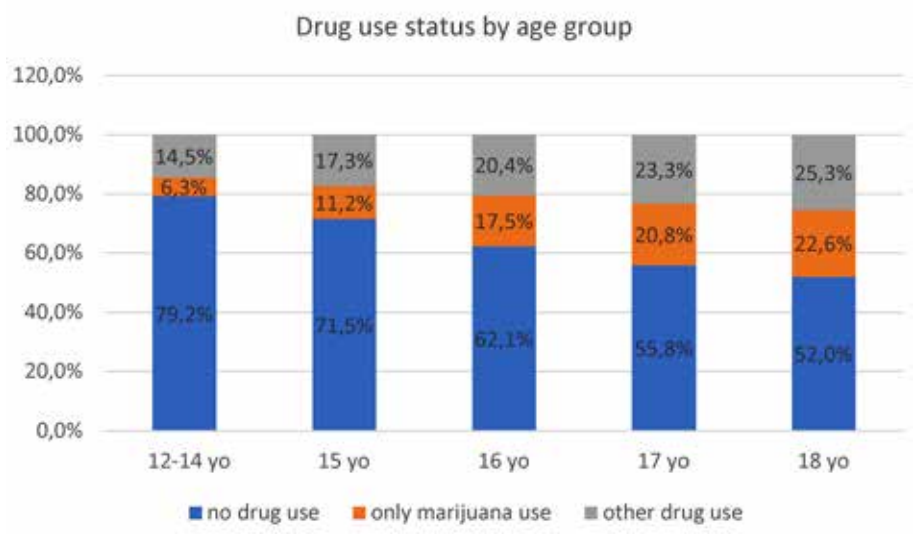

Figure 2.

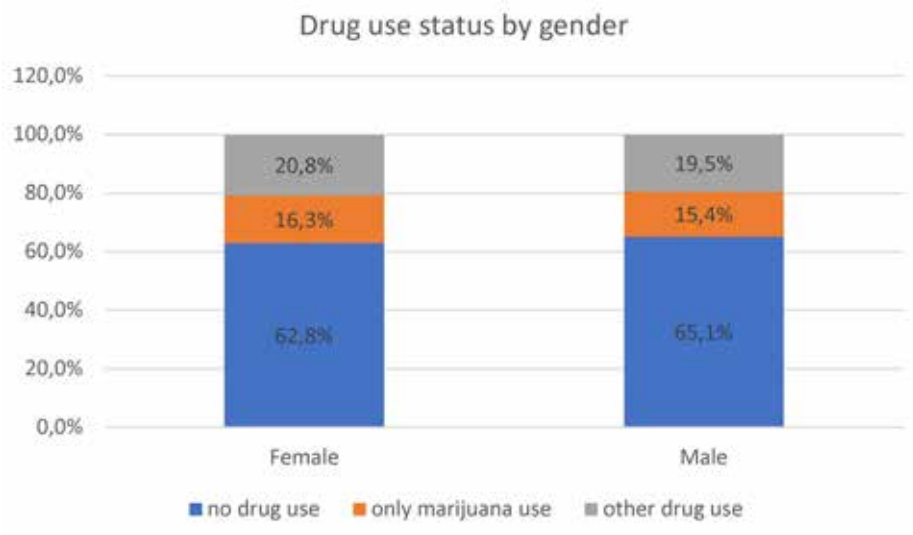

Figure 5.

Table 2.

data_2017_final$drug_use_status				
data_2017_final$grade	no drug use	only marijuana use	other drug use	Row Total
1	2	3	4	5
9	2589	279	538	3406
	0.760	0.082	0.158	0.268
10	2129	476	606	3211
	0.663	0.148	0.189	0.253
11	1844	620	684	3148
	0.586	0.197	0.217	0.248
12	1559	646	736	2941

1	2	3	4	5
	0.530	0.220	0.250	0.231
Column Total	8121	2021	2564	12706
	0.639	0.159	0.202	

Table 3.

data_2017_final$drug_use_status				
data_2017_final$race_ethnicity	**no drug use**	**only marijuana use**	**other drug use**	**Row Total**
Asian	506	34	65	605
	0.836	0.056	0.107	0.048
Black	1398	522	408	2328
	0.601	0.224	0.175	0.183
Hispanic/Latino	835	228	280	1343
	0.622	0.170	0.208	0.106
Multiple– Hispanic/ Latino	1050	302	440	1792
	0.586	0.169	0.246	0.141
Others	566	161	224	951
	0.595	0.169	0.236	0.075
White	3766	774	1147	5687
	0.662	0.136	0.202	0.448

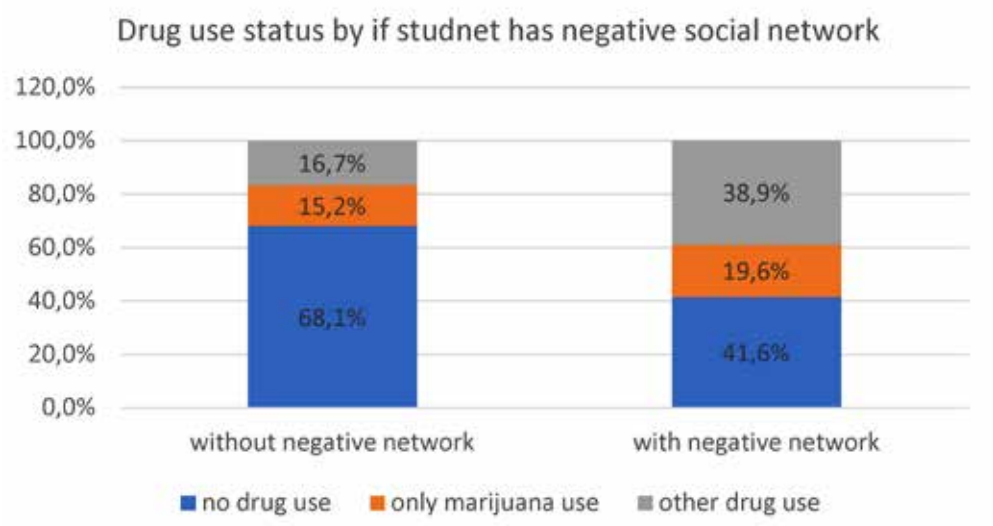

Figure 6. Drug use status by if student has negative social network

3.3 Multinomial Logistic Regression model results

Two tables are created, with regression coefficients and Odds ratios for "marijuana use" and "other drug use", respectively. Factors that are associated with higher risk of the outcome is highlighted in orange, while those associated with lower risk are highlighted in green.

- Older age is associated with higher risk of marijuana or other drugs.
- For example, compared with the youngest age group, those aged 15 years are 1.65 times more

likely to use marijuana, and 1.22 times more likely to use other drugs;

- Males are slightly less likely to use marijuana or other drugs;
- Compared with White Americans, Asians are less likely to use illicit drugs, while other racial/ethnic groups are more likely to use drugs;
- Similar with age, higher grade is associated with higher risk of drug use;
- Those who have negative social network are 2.1 and 3.8 times more likely to use marijuana or other drugs, respectively.

Table 4.

Odds Ratios for "only marijuana use"						
	beta	**standard error of beta**	**p-value**	**Odds Ratio**	**lower CI**	**Upper CI**
Age						
Refrence: 12–14yo						
15 yo	0.50	0.13	< 0.001	1.65	1.28	2.12
16 yo	0.85	0.15	< 0.0001	2.35	1.74	3.17
17 yo	0.98	0.17	< 0.0001	2.67	1.91	3.73
18 yo	1.08	0.19	< 0.0001	2.96	2.04	4.28
Gender						
male vs female	– 0.12	0.05	0.02	0.89	0.80	0.98
Race/ethnicity						
reference: white						
Asian	– 1.11	0.18	< 0.0001	0.33	0.23	0.47
Black	0.59	0.07	< 0.0001	1.80	1.58	2.05
Hispanic/Latino	0.25	0.09	< 0.001	1.28	1.08	1.52
Multiple– Hispanic/Latino	0.30	0.08	< 0.001	1.35	1.16	1.57
Others	0.41	0.10	< 0.0001	1.51	1.24	1.84
Grade						
reference: 9						
10	0.34	0.11	< 0.001	1.41	1.15	1.73
11	0.56	0.13	< 0.0001	1.75	1.35	2.26
12	0.63	0.15	< 0.0001	1.88	1.40	2.53
negative_network						
yes vs. no	0.74	0.07	< 0.0001	2.10	1.83	2.40

Table 5.

Odds Ratios for "other drug use"						
	beta	**standard error of beta**	**p-value**	**Odds Ratio**	**lower CI**	**Upper CI**
1	***2***	***3***	***4***	***5***	***6***	***7***
Age						
Refrence: 12–14yo						
15 yo	0.20	0.10	0.04	1.22	1.01	1.48
16 yo	0.42	0.12	< 0.0001	1.52	1.19	1.94
17 yo	0.50	0.14	< 0.0001	1.65	1.25	2.19

1	*2*	*3*	*4*	*5*	*6*	*7*
18 yo	0.55	0.16	< 0.0001	1.73	1.25	2.38
Gender						
male vs female	– 0.11	0.05	0.02	0.90	0.82	0.98
Race/ethnicity						
reference: white						
Asian	– 0.80	0.14	< 0.0001	0.45	0.34	0.59
Black	– 0.06	0.07	0.35	0.94	0.82	1.07
Hispanic/Latino	0.03	0.08	0.67	1.03	0.89	1.21
Multiple– Hispanic/Latino	0.27	0.07	< 0.001	1.31	1.14	1.49
Others	0.35	0.09	< 0.0001	1.42	1.19	1.69
Grade						
reference: 9						
10	0.14	0.09	0.12	1.15	0.97	1.37
11	0.30	0.12	< 0.0001	1.35	1.07	1.70
12	0.45	0.14	< 0.0001	1.57	1.20	2.07
negative_network						
yes vs. no	1.34	0.06	< 0.0001	3.83	3.42	4.29

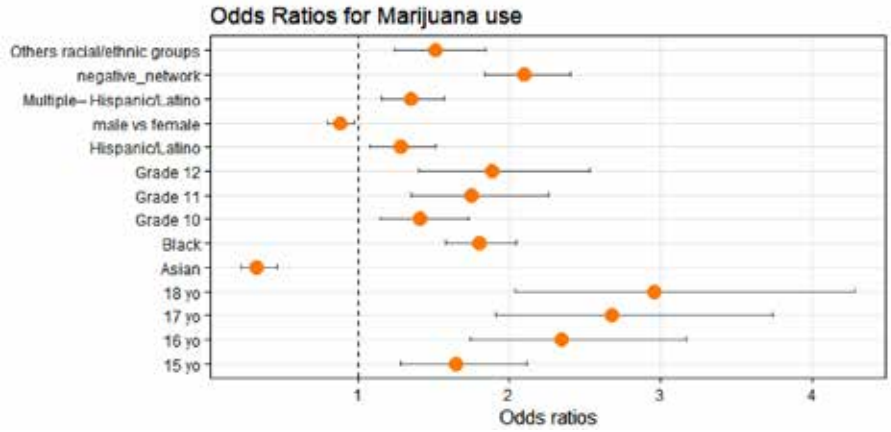

Figure 7.

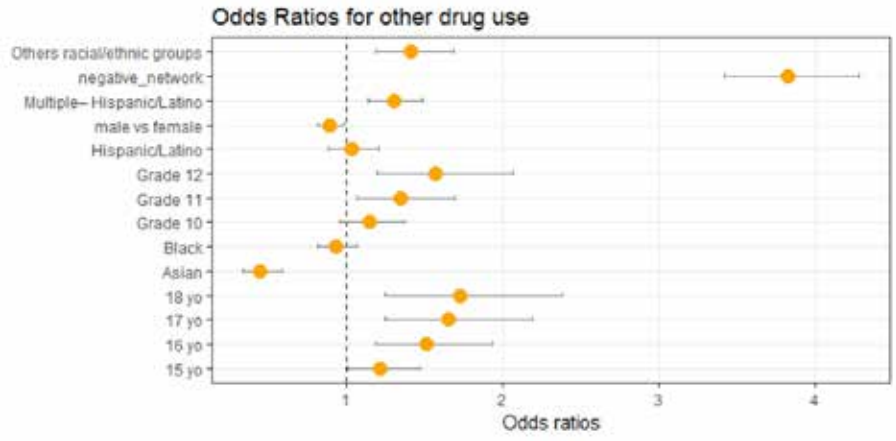

Figure 8.

To further illustrate the risk differences, we created two graphs of predicted probabilities.

Figure 1 is Predicted probability of drug use status by age and race/ethnicity for male students, grade 12, and without negative social network. It can be seen that: as age increases, the risk of drug use increases. Asian groups have highest probability of no drug use, while groups such as Black Americans have higher risk of marijuana or other drug use.

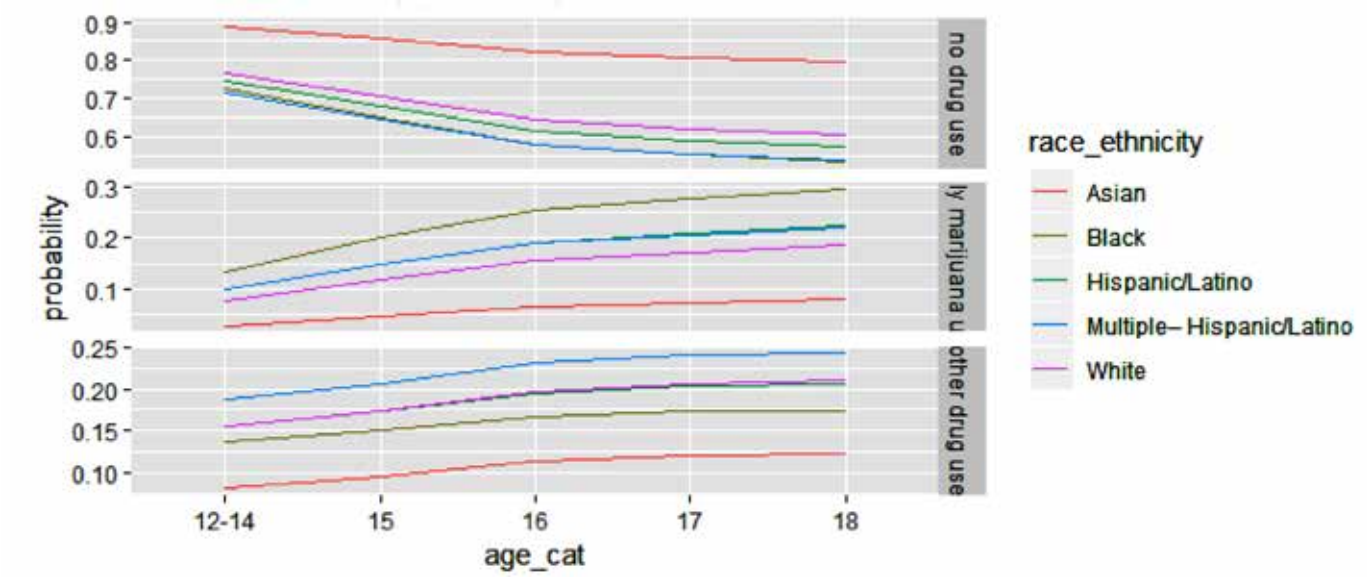

Figure 9. Predicted probability of drug use status by age and race/ethnicity for male students, grade 15and without negative social network

Figure 2 is Predicted probability of drug use status by grade and negative social network for male White students aged 12–14 yo. It can be seen that: as grade increases, the risk of drug use increases. Students with negative social network are more likely to use illicit drugs.

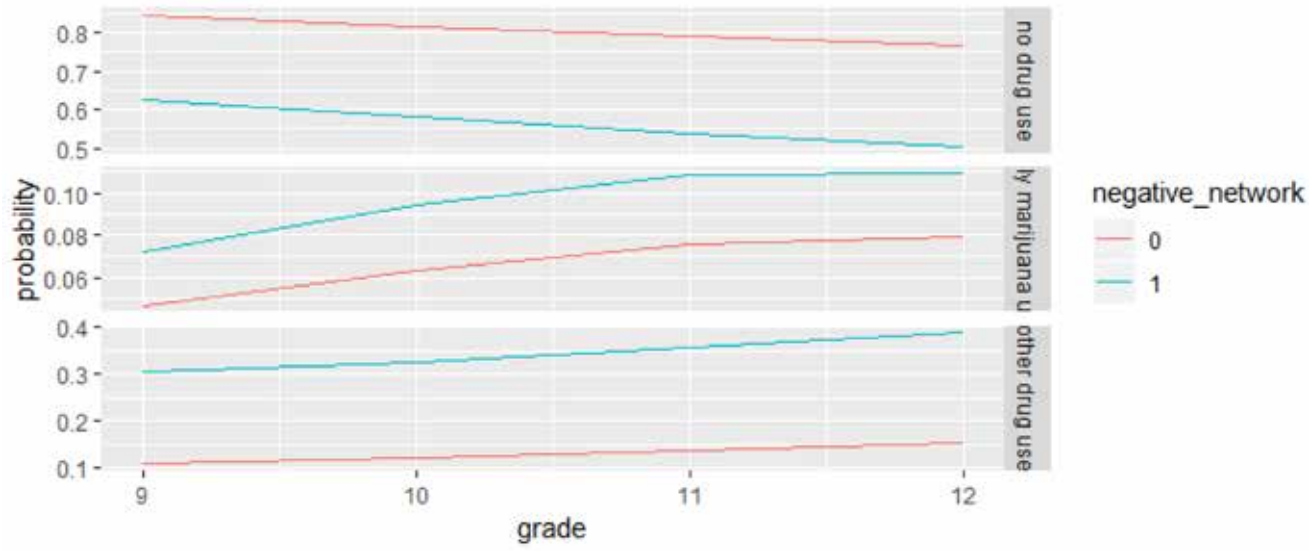

Figure 10. Predicted probability of drug use statys by grade and negative network

4. Discussion

We found that older age, higher grade, female gender, and having negative social network are associated with higher risk of marijuana or other drugs. There are also racial/ethnic differences. These findings are similar with previous studies.

Wang et al. found that peer substance was an important mediators accounting for variability in the prevalence of adolescent substance use by grade, race/ethnicity, and family structure [3].

5. Conclusion

We found that certain demographic characteristics such as age, race/ethnicity, grade, and gender. Meanwhile, having negative social network is associated with higher risk of marijuana or other drugs.

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