A longitudinal examination of alcohol, marijuana, and cigarette perceived norms among middle school adolescents

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Abstract

Background—Adolescents tend to overestimate the prevalence of substance use among their peers and these perceived norms are associated with their current and future use. However, little is known about how perceived norms change over time during middle school, a developmental period when adolescents are at-risk for initiating substance use.

Method—We examined changes in perceived norms of alcohol, marijuana, and cigarettes over a two year period among a large and diverse sample of 6th and 7th grade youth (N = 6,097; 50.1% female; 54% Hispanic). Participants completed a baseline survey and two subsequent annual surveys. Participants estimated the percentage of their peers they believed used each substance, as well as indicated levels of personal use, offers to use from peers, and exposure to peers who were using each substance.

Results—Perceived norms of all three substances increased over time. Increases were somewhat attenuated when controlling for demographic factors, personal use, and peer factors, but remained significant. Female adolescents and those reporting non-Hispanic White ethnicity experienced the greatest increase in perceived norms over time.

Conclusion—Normative perceptions of substance use increase greatly during the middle school years, an effect which cannot be fully explained by demographics, personal use, or peer factors. Given that perceived norms are often associated with personal use, early interventions with middle school youth are warranted to prevent the growth of these influential factors during this developmental period.

Keywords

alcohol; marijuana; cigarettes; adolescents; perceived norms

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1. INTRODUCTION

During the middle school years in the U.S., many youth initiate alcohol, marijuana, and cigarette use (DeWit et al., 1997; Gfroerer et al., 2002; Labouvie and White, 2002; Wittchen et al., 2008). By 8th grade (about 13 to 14 years old), 33% of adolescents report having initiated drinking, 16% report marijuana initiation, and 18% report cigarette initiation (Johnston et al., 2013). Early initiation can lead to concurrent and future substance use problems (Brook et al., 2002; D'Amico et al., 2005; Ellickson et al., 2005; Kandel and Chen, 2000; Merline et al., 2008).

Peer approval, direct offers to use, peer pressure, and spending time with friends who use substances are strongly associated with individual use (Brown et al., 2008; Mason et al., 2010; Maxwell, 2002; Schinke et al., 2008). Another factor influencing substance use among youth is the role of perceived norms. Perceived norms are beliefs individuals hold about substance use behavior of their peers. There is a substantial body of research on perceived alcohol norms among college students (Borsari and Carey, 2003; Lewis and Neighbors, 2006) and, to a lesser extent, high school students (e.g., Olds et al., 2005; Page et al., 2002; Primack et al., 2007), demonstrating a strong association between perceptions and actual drinking behavior. Targeting misperceptions of peer norms early on may help individuals form more accurate perceptions throughout middle school (D'Amico and Edelen, 2007), which may then help decrease future use. However, despite the potential importance of this information for creating prevention efforts with this population, very little is known about the development of perceived norms for alcohol and other substances among younger adolescents.

Adolescents in 8th grade and high school greatly overestimate prevalence of alcohol, marijuana, and cigarette use compared to actual rates of use. In cross-sectional work, adolescents perceived rates of alcohol, marijuana, and cigarette use by their school peers at rates two to three times the actual prevalence (Page et al., 2002) and high school adolescents were more likely to initiate alcohol, marijuana, and cigarette use if they perceived that more of their peers used these substances (Olds et al; 2005; Primack et al., 2007). Although findings provide important information on how norms affect use, previous research is limited by its cross-sectional nature and focus on older adolescents. In one of the few studies involving middle school students, D'Amico and McCarthy (2006) found that 6th, 7th, and 8th graders were more likely to initiate use during the course of a school year if they perceived that more of their peers used alcohol and marijuana. In addition, Juvonen and colleagues (2007) found that perceptions of peer alcohol and marijuana use in 7th grade predicted alcohol and marijuana use in 8th grade, though this effect was attenuated when other factors (e.g., own use, offers to use, contact with peers who use) were taken into account.

Recent data from the NSDUH (2012) show that as youth get older, there is an increase in the percentage of those who believe that "all or most" of the other students in their grade level at their school use substances. For example, in between-subjects reports, the prevalence of youth who believed all or most of their peers used marijuana rose from 7% among 12-13 year olds to 26% among 14-15 year olds, and the prevalence of youth perceiving all or most of their peers used alcohol rose from 10% among 12-13 year olds to 40% among 14-15 year olds. Thus, while actual substance use does increase during this developmental period, adolescents' perceived norms of use are growing at much faster rates (i.e., a three-fold increase in just 2 years), emphasizing the importance of prevention efforts to target these misperceptions.

Given existing evidence that perceived norms are highly influential in adolescence and continue to be so into young adulthood (Borsari and Carey, 2003; D'Amico and McCarthy, 2006; Juvonen et al., 2007; Lewis and Neighbors, 2006), studies are needed to assess how perceptions grow during middle school when students may be most at risk for initiation of substances. While general rates of perceived norms increase, it is unclear from within-person longitudinal research to what extent and why these norms change over time. Some work has shown that females, those in higher grade levels, and White and Latino(a) adolescents report greater perceptions of peer substance use behavior (D'Amico and McCarthy, 2006; Juvonen et al., 2007). Situational factors such as exposure to alcohol and drugs through peers that are using and through direct offers to use also associate with greater perceptions among 7th graders (Juvonen et al., 2007; Kandel and Chen, 2000). Similarly, those who use a substance more frequently may believe that others are similar to them, known as the *false consensus effect* (Ross et al., 1977). However, longitudinal empirical data indicating how and why norms change over time in adolescence are lacking.

To date, there are no long-term longitudinal examinations of growth of normative perceptions during early adolescence. This study addresses this gap by longitudinally assessing how normative perceptions of alcohol, marijuana, and cigarette use change over three years among a large, diverse sample of 6th and 7th grade middle school students. In addition, we examine several factors that may affect the rapid increase of perceptions during adolescence. We first evaluated demographic factors of age, gender, and race/ethnicity and hypothesized based on previous work that older youth, females, and Hispanic/Latino(a) adolescents would report higher norms of each substance over time. Next, we evaluated how personal substance use and other peer factors, such as being around others who use and receiving offers to use, contributed to the growth of perceived norms over time. We hypothesized that increases in perceived norms over time would be explained by participants' actual use, being around others who use, and receiving offers to use.

2. METHOD

2.1 Participants and Procedure

The sample consisted of 6,097 adolescents initially in 6th and 7th grade at 16 middle schools across three school districts in Southern California. These participants completed measures as part of a larger research project evaluating CHOICE, a voluntary after-school prevention program (D'Amico et al., 2012). The analytic sample consists of data obtained from three waves of data collection collected every spring for three consecutive years. Participants who were in 6th grade at baseline (wave 1; spring 2009) progressed to 8th grade at wave 3 (spring 2011), while 7th grade participants progressed to 9th grade. Survey responses were protected by an NIH Certificate of Confidentiality. All materials and procedures were approved by the research institution's Institutional Review Board.

2.2 Measures

In addition to reporting demographic information regarding gender, age, grade-level, school, and race/ethnicity, participants completed survey items on their use, perceived norms, how often they spent time with others who use, and offers from peers.

2.2.1 Substance use behaviors—Alcohol, marijuana, and cigarette use were assessed using three single-item measures used in previous large-scale studies of youth such as the California Healthy Kids Survey (WestEd, 2008) and Project ALERT (Ellickson et al., 2003). The items asked participants to indicate how many days in the past month (30 days) they had used alcohol/marijuana/cigarettes on a 7 point scale from 0 days to 20-30 days. Due to

low prevalence of use in this population, this item was recoded to reflect a dichotomous variable indicating use or no use in the past 30 days for each substance.

2.2.2 Perceived norms—Participants were asked to think about a group of 100 students (the size of about three classrooms) in their grade and indicate how many students had (1) drank alcohol at least once a month, (2) ever tried marijuana, and (3) smoked cigarettes at least once a month. Response options ranged from 0 to 100 with multiples of 10 as anchors (WestEd, 2008). Responses were recoded to percentages to match prevalence of actual behavior in the sample.

2.2.3 Exposure to peer use—Participants reported how often they were with kids who (1) drink alcohol, (2) use marijuana, and (3) smoke cigarettes. Response options ranged from 0 = never to 3 = often (Ellickson et al., 2003).

2.2.4 Peer offers—Offers to use were assessed with one item for each substance asking participants how often in the past month (30 days) they were offered alcohol, marijuana, and cigarettes. Response options ranged from 0 = never to 7 = 20 or more times (Ellickson et al., 2003).

2.3 Analytic Plan

We used growth models, within a multilevel modeling framework (Rabe-Hesketh and Skrondal, 2005; Singer and Willett, 2003), to examine rates of change in perceived norms and predictors of perceived norms. We fitted separate models for alcohol, marijuana, and cigarette norms. In the first instance we fitted a model with three measurements one year apart (Model 1; time = 0 (year 1), 1 (year 2), and 2 (year 3)). Time invariant (i.e., person-level) covariates were age, gender, race/ethnicity, and school (school was dummy coded with 15 categories). Before interpreting parameter estimates, we fit three models for each outcome: models with random intercepts only, random intercept and random slope coefficients, and random intercept and slope with slope-intercept covariance. We selected this latter model as the most appropriate for all three substances based on the AIC coefficients (Bozdogan, 1997). We then estimated models with time varying covariates to determine if the rate of change in perceived norms over time was associated with change in covariates (Model 2). Specifically, we included time varying covariates of past month use, peer use, and offers from peers to use each substance. If increases in perceived norms were associated with increases in one of the covariates, then we would expect the time effect to be reduced or removed when the time varying covariate is introduced. For example, the effect for time would reduce to non-significance if the change in norms over time was due to an increase in personal use, peer use, or offers from peers. In Model 3, we examined the interaction between gender and time to determine if rates of change were evident between males and females. Finally, in Model 4, we included the interaction effect between race/ethnicity and time to examine if there were differences in changes of perceived norms over time between racial/ethnic groups. The use of the longitudinal multilevel model provides estimates that are consistent and unbiased in the presence of missing data.

3. RESULTS

3.1 Descriptive analyses

The majority of participants completed all three waves of data (69%). Ninety-one percent of participant completed wave 1, 87% completed wave 2, and 81% completed wave 3. Eighty-one percent completed wave 1 and wave 2, 74% completed wave 1 and wave 3, and 73% completed wave 2 and wave 3. Sample demographics can be found in Table 1. As expected, 7th graders at baseline were older and reported more use, offers, and exposure to peers who

were using. Figure 1 depicts perceived and actual rates of alcohol use for 6th and 7th graders. For both grades, perceptions of peer alcohol use increased rapidly over time, whereas alcohol use increased at a less dramatic rate. A similar pattern for marijuana (Figure 2) and cigarettes (Figure 3) emerged.

3.2 Multilevel analyses modeling perceived norms over time

3.2.1 Alcohol—A significant time effect revealed perceived norms for alcohol increased over time by approximately 0.57 units on the measure used (an estimated 5.7 percentage point increase) on average per year (Table 2). Time invariant covariates showed the mean difference between perceived norms of different groups. On average, older adolescents had higher perceived norms of alcohol, with each year associated with an increase of 0.58 (5.8 percentage point increase). Females reported higher perceived norms than males. Compared to participants reporting Hispanic/Latino(a) ethnicity, Whites reported higher perceived norms, whereas Asian participants and "other" participants reported lower perceived norms.

As shown in Table 2, for Model 2 adding the adolescent's own alcohol use, peer alcohol use, and alcohol offers from peers to the model attenuated the effect for time, but it remained statistically significant (coefficient =0.36). The effects for gender and ethnicity (i.e., the comparison between White and Hispanic/Latino(a)) remained statistically significant as well, indicating that differences in these demographic factors were not explained by increases in use, peer use, and offers from Time 1 to Time 3. The effects for comparisons between Asians and Hispanic/Latino(a) and between "other" race/ethnicity and Hispanic/Latino(a)s were smaller and no longer statistically significant.

In Model 3 (Table 2) we entered the gender × time interaction effect to test the difference in slopes between males and females. The effect of time in Table 2 in this model demonstrates the effect for the reference group (female). The effect of Male × Time is the estimated difference between the slopes for males and females; hence the coefficient for males represents a 0.15 lower increase in perceived norms per year than for females (a slope of 0.42).

Finally, we entered the race/ethnicity × time interaction in Model 4 (Table 2). There were no statistically significant interaction effects.

3.2.2 Marijuana—A significant time effect revealed perceived norms for marijuana increased over time by approximately 0.68 per year (an estimated 6.8 percentage point increase) (Table 3). On average, older adolescents had higher perceived norms of marijuana, at 0.62 per year. Males had lower perceived norms than females. Compared to participants reporting Hispanic/Latino(a) ethnicity, Whites reported higher perceived norms on average, whereas Asian participants reported lower perceived norms.

The time varying covariates of adolescents' own marijuana use, peer marijuana use, and marijuana offers from peers (Model 2 in Table 3) were all highly significant, and the effect for time was attenuated but remained statistically significant (coefficient=0.41). The effects for gender and ethnicity also remained statistically significant.

In Model 3 of Table 3, we entered the gender × time interaction and found that the effect of time on increases in perceived norms was significantly greater for females than males, with a difference in the increase of 0.14. Females increased perceived norms by approximately 0.48 (4.8 percentage points) per year, while males increased by approximately 0.34 (3.4 percentage points) per year.

In Model 4 (Table 3), we entered the race/ethnicity × time interaction. There were statistically significant interaction effects for the comparison between being Asian vs. Hispanic/Latino(a), as well as between other race/ethnicity and being Hispanic/Latino(a). Hispanic/Latino(a) participants increased perceived norms by approximately 0.45 per year, whereas Asian participants increased by approximately 0.32 per year. Other race/ethnicity participants increased by approximately 0.32 per year.

3.2.3 Cigarettes—A significant time effect revealed perceived norms for cigarettes increased over time by approximately 0.31 on average per year (Table 4). Older adolescents reported higher perceived norms of cigarettes and females had higher perceived norms than males. Compared to participants reporting Hispanic/Latino(a) ethnicity, Whites reported higher perceived norms on average, whereas Asian participants reported lower perceived norms of peer cigarette use.

When we adjusted for adolescents' own cigarette use, peer cigarette use, and cigarette offers from peers in Model 2 (Table 4), the effect for time reduced but remained statistically significant (coefficient=0.23). The effects for gender and ethnicity remained statistically significant as well.

We next entered the gender × time interaction in Model 3 (Table 4) and found that the effect of time on increases in perceived norms was greater for females compared to males. Females increased perceived norms by approximately 0.27 per year, whereas males increased by approximately 0.19 per year.

Finally, we entered the race/ethnicity × time interaction (see Table 4, Model 4). There was a significant interaction effect for the comparison between other race/ethnicity and being Hispanic/Latino(a). Hispanic/Latino(a) participants increased perceived norms by approximately 0.25 per year, while other ethnicity participants increased by approximately 0.15 per year.

4. DISCUSSION

In the present study, we found significant changes in perceived alcohol, marijuana, and cigarette use norms over time for a large, ethnically diverse sample of 6th and 7th grade middle school adolescents. Results also indicated large discrepancies between perceived peer use and actual peer use within each grade. For alcohol, marijuana, and cigarettes, females reported the highest perceived norms and growth in perceived norms was stronger for females than males for all three substances. There is recent evidence that girls are "catching up with the boys" regarding substance use; with girls overtaking boys in past 30-day prevalence of alcohol use by the 8th grade (Johnston et al., 2013). Thus, norms among adolescent females may be increasing, in part, due to the increase in the number of adolescent girls actually using substances. Findings emphasize the importance of targeting norms in prevention programs for younger adolescent girls (Botvin et al., 1999; Schinke et al., 2009, 2008). We also found that White youth reported greater perceived norms than Hispanic/Latino youth, who in turn reported greater perceived norms than Asian and "other" ethnicity participants. These findings are consistent with prior studies (D'Amico and McCarthy, 2006; Juvonen et al., 2007) and college student research suggests that the association between ethnicity-specific norms and alcohol use is stronger for White students than for Hispanic/Latino(a) students (LaBrie et al., 2012). It is possible that certain adolescent groups may benefit most from interventions that target ethnicity-specific norms. Future research with these ideas is warranted.

Our results mirror findings in older samples of adolescents and college students, where youth overestimate the prevalence of substance use to be over twice as prevalent as actual use (e.g., Ellickson et al., 2005; Juvonen et al., 2007; Page et al., 2002). The discrepancies observed between perceived peer use and adolescents' actual use were consistent but larger than those found in other samples. One reason for this may be that our sample was younger than other samples and discrepancies between actual and perceived use may become smaller as more youth begin to use substances as they age. Longer-term longitudinal within-person research is needed to track students from middle school throughout young adulthood to further elucidate the connection between perceived norms and actual use.

Counter to our hypotheses, despite controlling for demographic information, own use, peer use, and offers from peers, the growth of perceived norms over time remained significant. These findings can be interpreted in several ways. First, it is possible that we did not measure a covariate that explains this rapid increase in perceived norms over time. For example, researchers have suggested that youth may learn misperceived norms through viewing adolescent peers and young adults drinking on TV/movies, advertisements, and in pictures on social media websites such as Facebook (de Dios et al., 2010; Gordon et al., 2010; Perkins and Craig, 2003). We did control for age in our analyses, which by proxy may have been a factor related to increased media exposure (i.e., older youth may have more access to TV and social media). Additionally, perceived norms may increase due to highly publicized alcohol and drug incidents at one's school, such as the arrest of a peer on campus. Frequent discussions of these incidents may make them seem more typical than actual. However, it may also be that perceived norms are simply a pervasive developmental process; that is, norms are a crucial component of how youth interpret what is going on around them during this developmental period when peers become more influential. Indeed, it is clear from a large body of empirical research that perceived norms affect the choices that adolescents make. Therefore, there is value in continuing efforts to correct these misperceptions among youth.

The finding that perceived norms of alcohol, marijuana, and cigarettes increase dramatically during early and middle adolescence is significant for several reasons. First, norms are increasing at a rapid rate during the period of adolescence when youth begin to initiate substance use. There is potential for these perceived norms to continue growing at rapid rates and influence further substance use behavior. Overall, perceived norms rapidly increase in adolescence; continue to increase in young adulthood, and influence current and future substance use behavior (Kilmer et al., 2006; Larimer et al., 2011; Quinn and Fromme, 2011; Stappenbeck et al., 2010). However, the vast majority of social norms interventions and research is directed at the college student population. Encouragingly, interventions with middle school and high school youth that have included corrections of perceived peer norms have been successful in producing short-term reductions in drinking and preventing initiation of alcohol use (Caria et al., 2011; D'Amico et al., 2012; Haines et al., 2003; Hansen and Graham, 1991). Importantly, D'Amico and Edelen (2007) demonstrated that perceived norms of alcohol and marijuana increased at significantly slower rates over time for middle school youth exposed to an alcohol and marijuana school-based intervention that provided normative information. Moreover, perceptions of norms also increased to a slower degree school wide (regardless of exposure to intervention or not) for schools who received the intervention. This suggests that interventions focused on norms education may have broad effects on individuals and school-wide perceptions. More research and intervention efforts are needed, preferably in early adolescence, to combat the increasing perceived norms during this developmentally risky time. Early correction of misperceived norms may help prevent the continued increase and influence of these misperceptions.

4. 1 Limitations

This study is limited by self-report data as students may have underreported use or exposure to peers who were using due to fear of repercussions. However, we informed participants that their responses were protected with a Certificate of Confidentiality and researchers involved in the study ensured that teachers and parents were separated from data collection procedures. In addition, our data match national norms (SAMHSA, 2012), which gives us confidence in the data collection confidentiality procedures utilized. As in all longitudinal studies, attrition is a limitation. Analyses examining all variables revealed only two differences between dropouts and non-dropouts at waves 2 and 3 (note it is possible for a participant to dropout at wave 2, but then continue in wave 3). Specifically, females and lighter marijuana users were more likely to have completed wave 2 data collection given that they completed wave 1, and females were more likely to complete wave 3, given that they completed wave 1. However, our analytic strategy provides unbiased estimates when outcome data are missing at random; thus the results are not influenced by youth who may have provided data at only one or two data points versus all data points. Also, in asking about general peer norms we did not gather information about perceived close friend norms, which may be an important correlate with drinking (Song et al., 2012). Thus, asking students about their perceptions of other grade levels or their close friends may provide further insight into the growth of perceptions over time.

In addition, we assessed frequency of perceived norms and did not examine other types of norms, which may grow over time. Other studies have included quantity of drinks as a measure of descriptive norms (e.g., Neighbors et al., 2006; Olds et al., 2005) and perceived quantity may have displayed a different pattern than frequency. Work with college students has included perceived injunctive norms (i.e., perceptions about peers' attitudes regarding the acceptability of a behavior) (Larimer et al., 2004; Lewis et al., 2010). Perceived injunctive norms have received little attention in the adolescent literature and represent an area of future research. This is especially important given that the findings regarding the impact of injunctive norms is inconsistent, with some research finding a strong role of these norms on behavior and others finding limited influence (Kuther and Higgins-D'Alessandro, 2003; Larimer et al., 2004; Neighbors et al., 2008). Still, the majority of norms-focused interventions with youth contain presentation of descriptive norms only and more work is needed to determine how presentation of injunctive norms can influence changes in youth behavior.

4. 2 Conclusions

The present study provides an important first look at perceived norms among a diverse sample of younger adolescents as they transition through middle school. Normative perceptions increase greatly during this developmental period, independent of adolescents' own use, offers from peers, and exposure to peers who are using. The mechanisms by which these norms increase is not well understood and further research is needed to assess potential factors that may affect both the development and subsequent increase in these important beliefs.

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Figure 1.
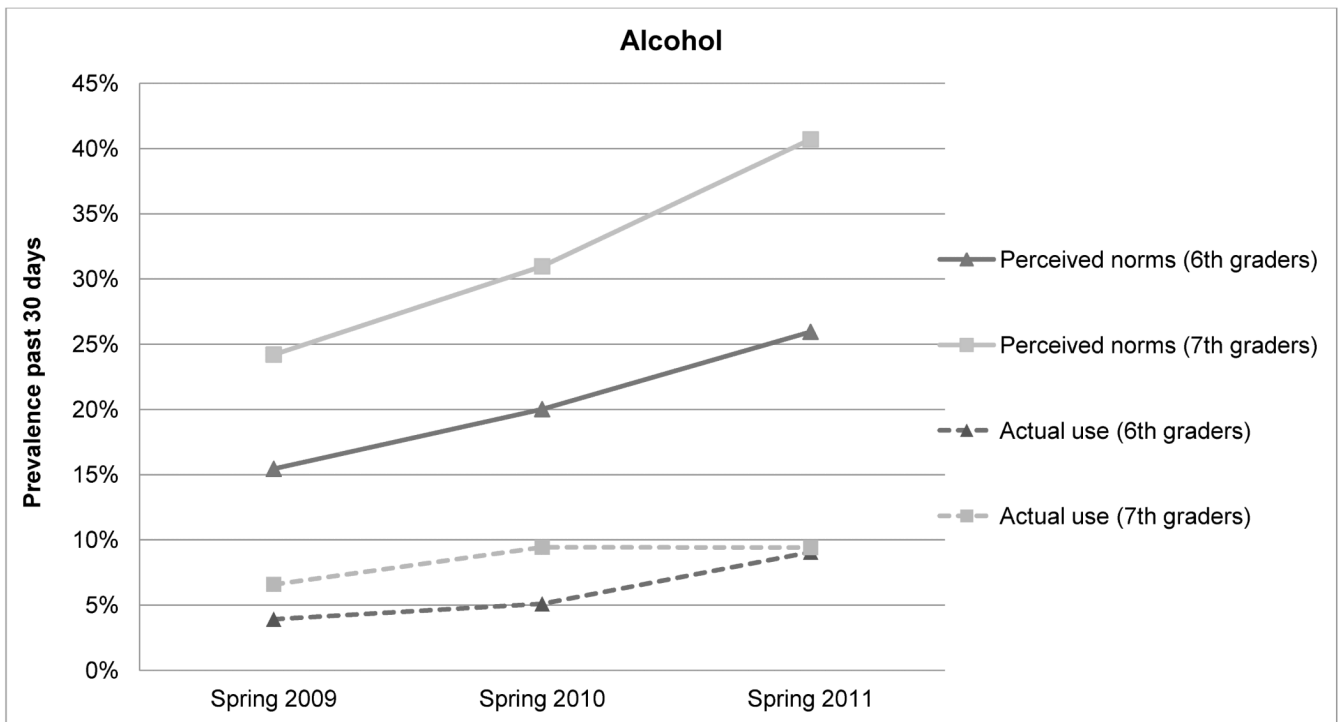Change in perceived prevalence of alcohol use and actual alcohol use prevalence over two-year period by baseline grade level
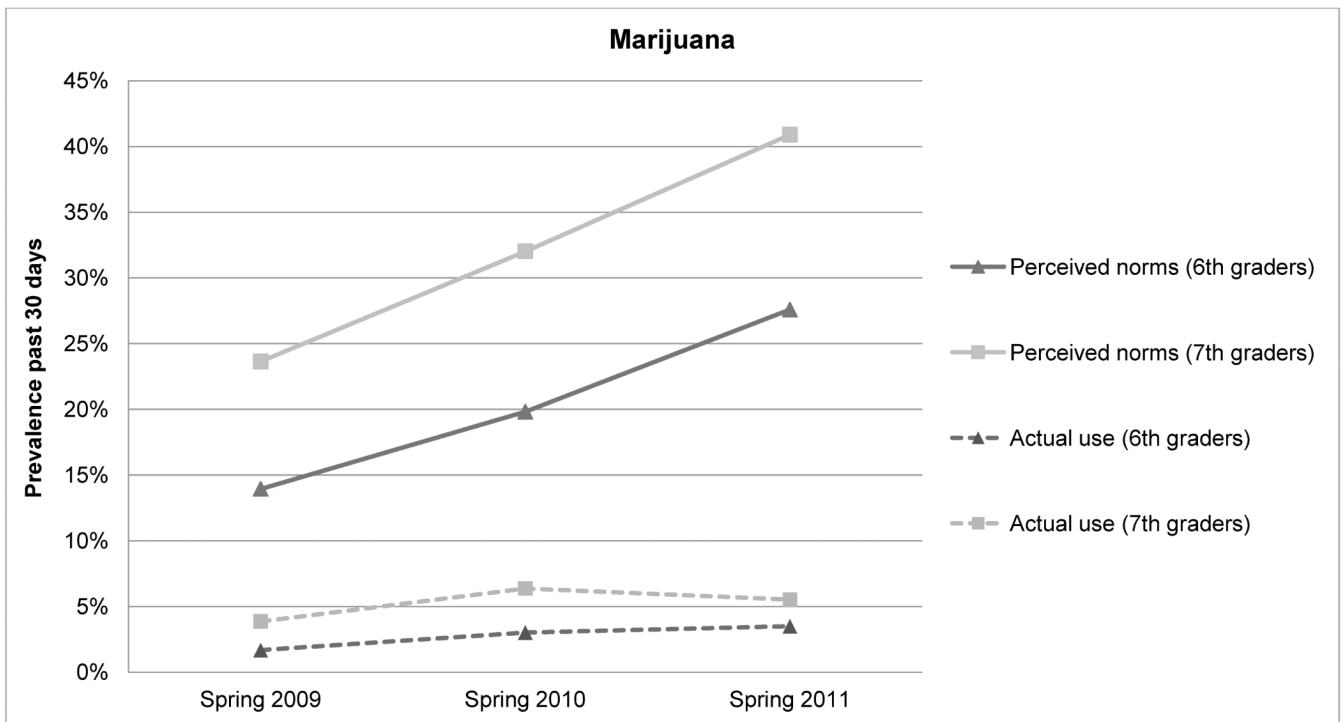
Figure 2.
Change in perceived prevalence of marijuana use and actual marijuana use prevalence over
two-year period by baseline grade level
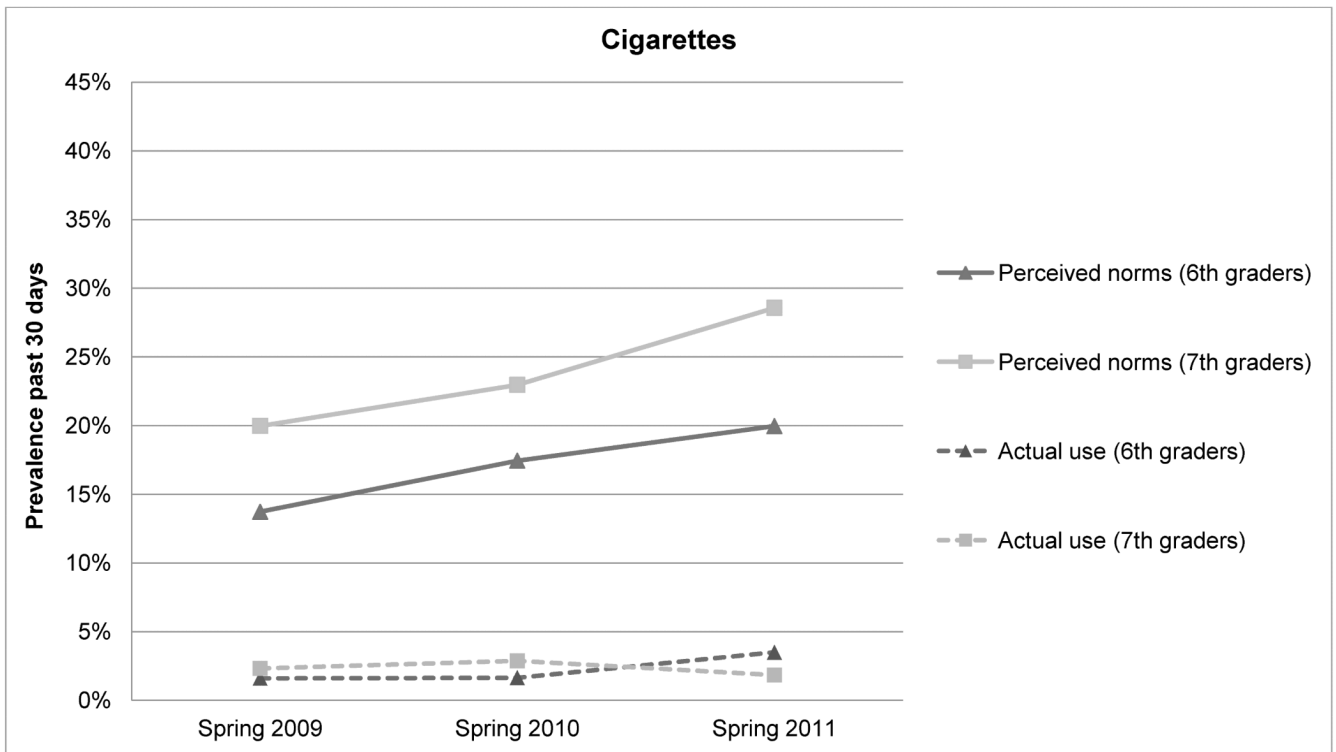
Figure 3.
Change in perceived prevalence of cigarette use and actual cigarette use prevalence over two-year period by baseline grade level

Table 1

Sample characteristics at baseline

Variable	Overall						6th Graders (n=3035)						7th Graders (n=3062)						P-value
	N	%	Mean	SD	Min	Max	N	%	Mean	SD	Min	Max	N	%	Mean	SD	Min	Max	
AGE_YR1			11.6	0.7	9	16			11.1	0.5	9	16			12.1	0.5	10	15	<.0001
Gender																			0.2388
Male	3044	49.9					1538	50.7					1506	49.2					
Female	3052	50.1					1496	49.3					1556	50.8					
Race																			<.0001
Hispanic/Latino(a)	3261	53.5					1615	53.3					1646	53.8					
Non-Hispanic White	953	15.6					434	14.3					519	17.0					
Non-Hispanic Black	192	3.2					96	3.2					96	3.1					
Non-Hispanic Asian	1010	16.6					498	16.4					512	16.7					
Other ethnicity	677	11.1					390	12.9					287	9.4					
Alcohol																			
Drinker in past 30 days	292	5.3					108	3.9					184	6.6					<.0001
Perceived norms			10.0	18.3	0	100			5.4	13.4	0	100			14.2	20.9	0	100	<.0001
Peer use			0.3	0.8	0	3			0.2	0.6	0	3			0.5	0.9	0	3	<.0001
Offers			0.3	1.0	0	6			0.2	0.8	0	6			0.5	1.2	0	6	<.0001
Marijuana																			
User in past 30 days	154	2.8					46	1.7					108	3.9					<.0001
Perceived norms			9.0	17.8	0	100			3.9	11.6	0	100			13.6	21.0	0	100	<.0001
Peer use			0.3	0.8	0	3			0.2	0.6	0	3			0.5	0.9	0	3	<.0001
Offers			0.3	1.0	0	6			0.1	0.7	0	6			0.4	1.2	0	6	<.0001
Cigarettes																			
Smoker in past 30 days	109	2.0					44	1.6					65	2.3					<.0001
Perceived norms			7.0	14.5	0	100			3.7	10.9	0	100			10.0	16.6	0	100	<.0001
Peer use			0.3	0.7	0	3			0.2	0.5	0	3			0.4	0.8	0	3	<.0001

Variable	Overall						6th Graders (n=3035)						7th Graders (n=3062)						P-value
	N	%	Mean	SD	Min	Max	N	%	Mean	SD	Min	Max	N	%	Mean	SD	Min	Max	
Offers			0.2	0.8	0	6			0.1	0.7	0	6			0.3	1.0	0	6	<.0001

Table 2

Models predicting perceived norms of peer alcohol use

	Model 1 (Time + Person Level Covariates)			Model 2 (Model 1 + Time Varying Covariates)			Model 3 (Model 2 + Gender × Time Interaction)			Model 4 (Model 2 + Race/Ethnicity × Time Interaction)		
	Estimate	*SE*	*P*	*Estimate*	*SE*	*P*	*Estimate*	*SE*	*P*	*Estimate*	*SE*	*P*
Constant	−4.17	0.23	<0.001	−2.48	0.19	<0.001	−2.28	0.19	<0.001	−2.30	0.19	<0.001
Time	0.57	0.02	<0.001	0.36	0.02	<0.001	0.42	0.02	<0.001	0.36	0.02	<0.001
Age at baseline	0.58	0.02	<0.001	0.37	0.02	<0.001	0.35	0.02	<0.001	0.35	0.02	<0.001
Male	−0.49	0.03	<0.001	−0.31	0.03	<0.001	−0.30	0.03	<0.001	−0.28	0.03	<0.001
White	0.16	0.05	0.003	0.29	0.05	<0.001	0.28	0.05	<0.001	0.28	0.05	<0.001
Black	−0.12	0.10	0.216	0.13	0.08	0.121	0.13	0.08	0.122	0.12	0.08	0.133
Asian	−0.20	0.05	<0.001	0.02	0.04	0.655	0.02	0.04	0.664	0.01	0.04	0.793
Other	−0.13	0.06	0.027	0.01	0.05	0.756	0.01	0.05	0.756	0.01	0.05	0.834
Hispanic/Latino(a)	Reference	--	--	Reference	--	--	Reference	--	--	Reference	--	--
Alcohol Peer Use				0.82	0.02	<0.001	0.81	0.02	<0.001	0.81	0.02	<0.001
Alcohol Own Use				0.46	0.06	<0.001	0.47	0.06	<0.001	0.47	0.06	<0.001
Alcohol Offers				0.30	0.01	<0.001	0.30	0.01	<0.001	0.30	0.01	<0.001
Male × Time							−0.15	0.03	<0.001			
White × Time										0.05	0.04	0.215
Black × Time										−0.03	0.09	0.746
Asian × Time										−0.07	0.04	0.087
Other × Time										−0.07	0.05	0.158

Table 3

Models predicting perceived norms of peer marijuana use

	Model 1 (Time + Person Level Covariates)			Model 2 (Model 1 + Time Varying Covariates)			Model 3 (Model 2 + Gender × Time Interaction)			Model 4 (Model 2 + Race/Ethnicity × Time Interaction)		
	Estimate	SE	P	Estimate	SE	P	Estimate	SE	P	Estimate	SE	P
Constant	−4.82	0.23	0	−3.01	0.19	<0.001	−2.72	0.19	<0.001	−2.74	0.19	<0.001
Time	0.68	0.02	<0.001	0.42	0.02	<0.001	0.49	0.02	<0.001	0.45	0.02	<0.001
Age at baseline	0.62	0.02	<0.001	0.41	0.02	<0.001	0.39	0.02	<0.001	0.39	0.02	<0.001
Male	−0.42	0.03	<0.001	−0.34	0.03	<0.001	−0.34	0.03	<0.001	−0.31	0.03	<0.001
White	0.25	0.06	<0.001	0.38	0.05	<0.001	0.36	0.05	<0.001	0.36	0.05	0.095
Black	−0.01	0.10	0.888	0.15	0.08	0.084	0.14	0.08	0.086	0.14	0.08	0.903
Asian	−0.21	0.05	<0.001	0.03	0.04	0.514	0.03	0.04	0.51	0.01	0.04	0.587
Other	−0.11	0.06	0.061	0.04	0.05	0.44	0.05	0.05	0.34	0.03	0.05	<0.001
Hispanic/Latino(a)	Reference	--	--	Reference	--	--	Reference	--	--	Reference	--	--
Marijuana Peer Use				0.92	0.02	<0.001	0.91	0.02	<0.001	0.91	0.02	<0.001
Marijuana Own Use				0.25	0.08	0.001	0.22	0.08	0.003	0.22	0.08	0.004
Marijuana Offers				0.36	0.01	<0.001	0.36	0.01	<0.001	0.35	0.01	<0.001
Male × Time							−0.14	0.03	<0.001			
White × Time										0.05	0.05	0.307
Black × Time										−0.01	0.09	0.926
Asian × Time										−0.13	0.04	0.003
Other × Time										−0.13	0.05	0.011

Table 4

Models predicting perceived norms of peer cigarette use

	Model 1 (Time + Person Level Covariates)			Model 2 (Model 1 + Time Varying Covariates)			Model 3 (Model 2 + Gender × Time Interaction)			Model 4: (Model 2 + Race/Ethnicity × Time Interaction)		
	Estimate	*SE*	*P*	*Estimate*	*SE*	*P*	*Estimate*	*SE*	*P*	*Estimate*	*SE*	*P*
Constant	−2.09	0.17	<0.001	−1.29	0.15	<0.001	−1.28	0.15	<0.001	−1.28	0.15	<0.001
Time	0.31	0.01	<0.001	0.23	0.01	<0.001	0.27	0.02	<0.001	0.25	0.02	<0.001
Age at baseline	0.35	0.01	<0.001	0.25	0.01	<0.001	0.25	0.01	<0.001	0.25	0.01	<0.001
Male	−0.32	0.03	<0.001	−0.24	0.02	<0.001	−0.25	0.02	<0.001	−0.24	0.02	<0.001
White	0.10	0.04	0.011	0.16	0.04	<0.001	0.16	0.04	<0.001	0.16	0.04	<0.001
Black	−0.10	0.08	0.182	0.02	0.07	0.813	0.02	0.07	0.817	0.01	0.07	0.926
Asian	−0.09	0.04	0.023	0.02	0.04	0.576	0.02	0.04	0.586	0.02	0.03	0.638
Other	−0.05	0.04	0.214	0.01	0.04	0.847	0.01	0.04	0.866	−0.01	0.04	0.955
Hispanic/Latino(a)	Reference	--	--	Reference	--	--	Reference	--	--	Reference	--	--
Cigarette Peer Use				0.68	0.02	<0.001	0.68	0.02	<0.001	0.68	0.02	<0.001
Cigarette Own Use				0.05	0.08	0.524	0.05	0.08	0.517	0.05	0.08	0.518
Cigarette Offers				0.26	0.01	<0.001	0.26	0.01	<0.001	0.26	0.01	<0.001
Male × Time							−0.07	0.03	0.005			
White × Time										−0.01	0.04	0.965
Black × Time										−0.09	0.07	0.242
Asian × Time										−0.02	0.04	0.484
Other × Time										−0.10	0.04	0.018