Perceived Academic Performance and Alcohol, Tobacco and Marijuana Use: Longitudinal Relationships in Young Community Adolescents

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Abstract

Objective: To study longitudinal relationships between perception of academic performance (PAP) and alcohol, tobacco and marijuana use at age 13 and 15 years.

Method: Self-report data from students in 27 schools in South Australia (*n* =1579) was analysed with ANCOVA and logistic regression, controlling for confounding factors (socio-demographic, parenting, depressive symptoms, anxiety, self-esteem, antisocial behaviour).

Results: Persistent or increasing perception of academic ʻfailureʼ (self-rated failing or below average performance), compared to improving or stable perception of average (or above) performance, from age 13 to 15 years, predicts more than weekly alcohol and tobacco use at age 15 (3- to 4-fold risks), in addition to increased risks from early substance use (e.g., 12- to 15-fold for triple combinations), controlling for confounders. Increased risks for more than weekly marijuana use at age 15 are 3-fold in those with increasing perception of failure; though relationships are fully mediated by antisocial behaviour in those with persistent perceptions of failure.

Conclusion: Interventions to maintain or improve academic self-esteem in early adolescence may reduce risks for accelerating substance use in mid-adolescence.

Keywords: adolescents; alcohol; tobacco; marijuana; perceived academic performance

1. Introduction

Substance use in adolescents is a widespread and potentially hazardous activity, increasing risks for dependence and abuse, and other adverse physical and psychosocial outcomes (Lewinsohn, Rohde, & Brown, 1999). Although US Monitoring the Future 2003 data suggest that alcohol, tobacco and marijuana use is in decline for older adolescents, the trend is less clear among 8th graders, perhaps reflecting a generational shift (Johnston, O'Malley, Bachman, & Schulenberg, 2004). Further, age of initiation is becoming younger (Degenhardt, Lynskey, & Hall, 2000); and early onset drug use is associated with both greater likelihood of continuation (Chen & Kandel, 1998) and greater long-term harm and dependence (Grant & Dawson, 1997).

Not all substance users in adolescence progress to problematic levels, and psychosocial risk models describe a complex interplay between individual and personality factors, environmental social and family factors, and drug-taking behaviour (Jones & Heaven, 1998). Twin studies show that environmental and social rather than genetic factors influence substance initiation and use (Han, McGue, & Iacono, 1999; Lynskey et al., 2003). Specifically, known risk factors include antisocial behaviour and substance using or delinquent peers (e.g., Hops, Davis, & Lewin, 1999); depressive symptomatology (Rohde, Lewinsohn, & Seeley, 1996); family functioning, parenting style and expectancies (Cohen & Rice, 1997); and childhood abuse (Bergen, Martin, Richardson, Allison, & Roeger, 2004). Substance use may also increase risks for other drug-taking. Gateway theory describes the increased likelihood of progression from one substance to another, though the exact sequencing and causal attribution to associations are issues still in debate (Kandel, 2002).

Substance use as early as grade 6 or 7 is associated with, and possibly causes, adverse outcomes in academic motivation and later achievement (Ellickson, Tucker, & Klein, 2001; Jeynes, 2002). Conversely, poor academic achievement in grades 6 and 7, as well as problem behaviour, and low engagement with and negative perceptions of school, predict later alcohol initiation and misuse (Diego, Field, & Sanders, 2003; Sobeck, Abbey, Agius, Clinton, & Harrison, 2000). Global and academic self-esteem from age 9 to 13 (McGee & Williams, 2000) and academic and social behaviour at age 7–9 (Hops et al., 1999) predict health compromising behaviour and substance use at age 15. In contrast, high engagement with school is protective against alcohol misuse (Aunola, Stattin, & Nurmi, 2000). Structural equation modelling of relations between cigarette use and school factors from 8th to 12th grade, suggest that the direction of influence is from school experience to cigarette use (Bryant, Schulenberg, Bachman, O'Malley, & Johnston, 2000).

Rarely explored, however, is that general societal pressure to succeed, high parental expectation of academic achievement, and associated perception of failure may contribute to ineffective coping mechanisms such as substance use. A report on Canadian female adolescent health risk behaviour raises the question that schools may contribute to these problems, and that "a supportive school environment and less emphasis on academic achievement are needed" (King, 1998). Further, Kumpulainen and Roine (2002) found that early (age 12) perception of school failure and low self-esteem in girls, and interpersonal problems and aggressive tendencies in boys, were more important predictors of heavy alcohol use at age 15 than early depressive symptomatology. Sutherland and Shepherd (2001) found strong relationships between social factors and substance use outcomes in 11–16 year olds (n = 4516), with

perceived academic performance ranking third in importance after 'concurrent second or third substance use', and 'having been in trouble with police' as predictors of substance use.

This investigation explores new directions in associations between perceived academic performance (PAP) and substance use, extending the study of Kumpulainen and Roine (2002), who appealed for more investigation into academic expectations and alcohol use in young adolescents. First, PAP is a psychosocial construct related to school, family and individual expectations, academic self-esteem and current mood. It may or may not be related to actual achievement, thus possibly encompassing cognitive distortions as well. We construct PAP trajectories from assessments at age 13 and 15, categorising perception of academic performance broadly as one of 'failing at both times', 'average at both times', 'improving from failing to average', or 'declining from average to failing'; this enables longitudinal tracking over the crucial 13–15 years period.

Second, we consider combinations of alcohol, tobacco and marijuana use, enabling comparison of abstainers at age 13 with users of single, double or triple combination(s) at age 13, in regard to associations with more than weekly substance use at age 15. This ensures control for early substance use, which is important and sometimes not taken account of in other studies.

Third, to elucidate any unique contribution that PAP may make to substance use at age 15, we control for other known risk factors such as antisocial behaviour, depressive symptoms and anxiety, family functioning, parenting style and family living arrangement.

2. Methods

This work derives from the Early Detection of Emotional Disorders (EDED) program, a 3-year repeated measures longitudinal study of young adolescents, focussing on early detection of suicidal behaviours, and risk and protective factors implicated in later suicide. Details of the study procedure have been published (Bergen et al., 2004). Average age of participants in year 8 high school (wave one) was 13 years ($N = 2603$); in wave two 14 years (N = 2485); and in wave three 15 years ($N = 2296$). Data used in this longitudinal analysis is drawn from wave one (T1) and wave three (referred to here as T2) ($N = 1579$).

2.1. Measures

Items of interest reported here form part of a larger composite questionnaire, and details of specific measures have been published (Martin, Richardson, Bergen, Roger, & Allison, 2005; Richardson, Bergen, Martin, Roeger, & Allison, in press).

Perceived academic performance (PAP) was assessed by asking, "How would you rate your overall academic performance: failing, below average, average, or above average". Responses at T1 and T2 were recoded into a 4 categorical variable, 'PAP trajectory', as follows: 'failing or below average at T1 and T2'; 'average or above at T1, and failing or below at T2'; 'failing or below at T1, and average or above at T2'; 'average or above at T1 and T2'.

Substance use was assessed by asking, "Which of the following drugs have you used in the last year? alcohol; tobacco; marijuana; acid or LSD; sniffed glue, petrol, or

solvents; injected illegal drugs (heroin, speed); oral stimulants (speed, crack, or ecstasy); magic mushrooms". Responses were rated: never (score 0), less than once per month (score 1), one to three times a month (score 2), once a week (score 3), more than once a week (score 4). Based on substance use at T1, seven mutually exclusive categories were constructed. Due to the high (normative) frequency of alcohol use ever, the base rate was taken as less than once per month rather than never used; base rates for tobacco and marijuana were taken as never used. Categories were derived for the variable 'substance use' as follows, (alcohol score, tobacco score, marijuana score): none (≤ 1, 0, 0); alcohol only (>1, 0, 0); tobacco only (≤ 1, ≥ 1, 0); marijuana with or without alcohol but no tobacco (>0, 0, ≥ 1); alcohol and tobacco (>1, ≥ 1, 0); tobacco and marijuana (≤ 1, ≥ 1, ≥ 1); alcohol, tobacco and marijuana (>1, ≥ 1, ≥ 1). Second, three dichotomous variables were constructed for more than weekly use of alcohol, tobacco and marijuana at T2. Third, alcohol, tobacco and marijuana scores were summed at each time to give two new continuous variables for use with repeated measures ANCOVA; range is 0–12; at T1, $M = 1.32$, SD=1.87; at T2, $M = 2.90$, SD=2.92. Reliability for the 3-item scale is: at T1, α =.72; at T2, α =.78.

2.2. Data analysis

Data analysis was conducted with SPSS v11. Multivariate analyses included repeated measures ANCOVA and hierarchical logistic regression analyses. In the latter, independent variable predictors PAP trajectory and substance use at T1 were entered directly, followed by forward stepwise conditional entry ($P<.05$) of covariates (antisocial behaviour, gender and changed family living arrangement) to control for confounding effects, onto each of three dichotomous outcome variables – more than weekly use of alcohol, tobacco or marijuana at T2. Preliminary analyses indicated other known risk factors for substance use and socio-demographic variables did not add significantly to regression models.

TABLE 1
Prevalence of alcohol, tobacco and marijuana use; and perceived academic performance at times T1 (age 13 years) and T2 (age 15 years)

Substance use in past year	N (%)		
	Alcohol	Tobacco	Marijuana
T1			
Less than 1/month	625 (39.6)	159 (10.1)	112 (7.1)
1–3 times/month	163 (10.3)	55 (3.5)	36 (2.3)
Weekly	65 (4.1)	24 (1.5)	20 (1.3)
More than weekly	16 (1.0)	40 (2.5)	16 (1.0)
T2			
Less than 1/month	629 (39.8)	243 (15.4)	281 (17.8)
1–3 times/month	420 (26.6)	92 (5.8)	112 (7.1)
Weekly	143 (9.1)	45 (2.8)	66 (4.2)
More than weekly	73 (4.6)	156 (9.9)	94 (6.0)
Perceived academic performance	Failing/below average	Average	Above average
T1	99 (6.3)	1090 (69.0)	370 (23.4)
T2	141 (8.9)	1045 (66.2)	381 (24.1)

Percentages of total (N =1579) include missing values of up to 4%.

TABLE 2
Associations between perceived academic performance (PAP) trajectory and weekly use of alcohol, tobacco and marijuana at T1 (age 13 years); and between PAP trajectory and more than weekly use at T2 (age 15 years)

PAP Trajectory	N (%) weekly use at T1		
	Alcohol	Tobacco	Marijuana
Both failing/below ($n=36$)	4 (12.5)	6 (20.0)	4 (12.5)
Decline to fail/below ($n=101$)	6 (6.4)	7 (7.6)	4 (4.5)
Improve from fail/below ($n=60$)	4 (7.3)	5 (9.1)	2 (3.7)
Both average/above ($n=1350$)	63 (4.8)	43 (3.3)	23 (1.8)
Kendall's tau-b (T)	ns	−2.933**	−2.215*

PAP Trajectory	N (%) more than weekly use at T2		
	Alcohol	Tobacco	Marijuana
Both failing/below ($n=36$)	6 (17.6)	12 (35.3)	8 (24.2)
Decline to fail/below ($n=101$)	20 (20.2)	34 (34.7)	22 (22.2)
Improve from fail/below ($n=60$)	5 (8.6)	9 (15.8)	4 (6.9)
Both average/above ($n=1350$)	40 (3.1)	92 (7.1)	56 (4.3)
Kendall's tau-b (T)	−4.698***	−6.138***	−4.661***

Percentages of total (not including missing values) within PAP trajectory, e.g., of those with PAP trajectory of both failing/below (derived from assessments at T1 and T2), 20% are using tobacco weekly or more at T1. ns $P > .05$, *$P < .05$, **$P < .01$, ***$P < .001$.

2.3. Attrition analysis

Participants responding at T1 ($N = 2603$) were grouped according to presence ($n = 1579$) or absence ($n = 1024$) of responses at T2. Significant differences between groups were found. The longitudinal matched sub-sample underrepresents the extent of serious substance use, antisocial behaviour and perception of academic failure in the total sample. Our analysis, therefore, represents a best-case scenario. (Detailed analyses are available from the authors on request).

3. Results

Substance use and perception of academic failure increase from T1 to T2 (see Table 1). Associations between changes in perception of academic performance i.e., PAP trajectory, and frequent substance use at T1 and T2 are shown in Table 2.

Of interest are relatively large increases between T1 and T2 for the 'decline to fail/below' group, compared to the 'improve from fail/below' and 'both fail/below' groups. Further investigation with repeated measures ANCOVA, taking the sum of alcohol, tobacco and marijuana scores at T1 and T2 as dependent variables, adjusting for antisocial behaviour and depressive symptoms at T1 and T2, gender and living arrangement, reveals a large main effect for time $F(1,1336)=677.69$, $P < .001$, and a small between-subjects effect for PAP trajectory $F(3,1336)=4.1$, $P < .001$. Estimated marginal means indicate that at time T2, substance use in groups 'decline to fail/below', M = 4.11 (3.59–4.63), and 'both fail/ below', $M = 3.79$ (2.97–4.62), is significantly greater than the 'both average/above' group, $M = 2.71$ (2.59–2.84). See Fig. 1.

Logistic regression models, odds ratios (OR) and 95% confidence intervals (CI) are shown in Table 3, unadjusted, and adjusted for antisocial behaviour, gender, and family living arrangement.

Nagelkerke R^2 values indicate the models explain 26–43% of variance in the data. The predictive power of the models is reasonable. For alcohol, sensitivity (92%) and specificity (52.5%) at a cut-off level of 0.10 – overall correct percentage 90%; for tobacco, sensitivity (92%) and specificity (61%) at a cut-off of 0.2 – overall correct percentage 89%; and for marijuana, sensitivity (94%) and specificity (65%) at a cut-off of 0.15 – overall correct percentage 92%.
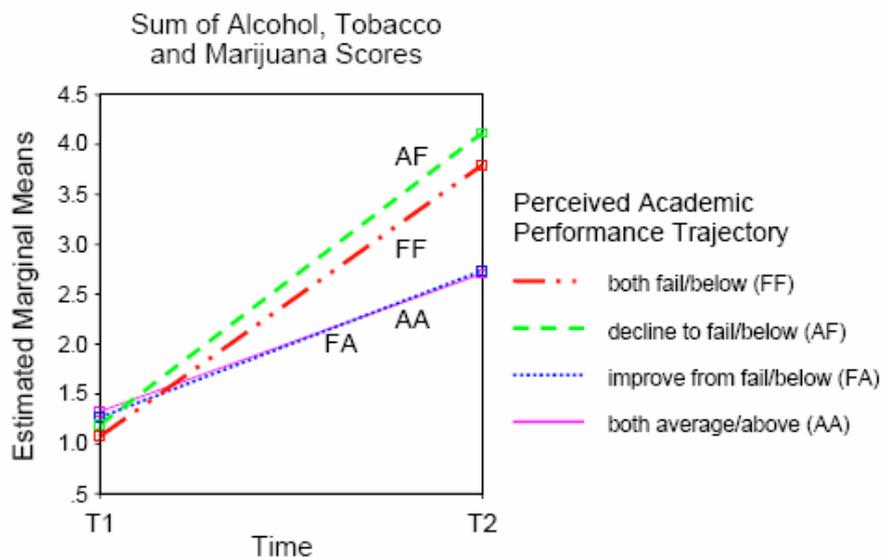

Fig. 1. Total scores for alcohol, tobacco and marijuana use at age 13 (T1) and age 15 (T2) (never (0), less than once/ month (1), 1–3 times/month (2), once/week (3), more than once/week (4)) for adolescents with perceived academic performance as failing or below average 'F', and average or above 'A', adjusted for depressive symptomatology, antisocial behaviour, gender and living arrangement.

4. Discussion

The findings of this longitudinal study of young adolescents indicate that perceptions of academic failure which persist from age 13 to 15 years, or arise within the two year period (following more optimistic self-assessments at age 13), are significantly associated with frequent alcohol, tobacco and marijuana use at age 15 years. The increased risk is independent of, and in addition to, the contribution from early substance use. After adjustment for antisocial behaviour at both ages, risk is reduced but remains significant for alcohol ($P <.05$) and tobacco use ($P <.01$). The independent association of perceived academic performance with frequent marijuana use is weaker, and appears to be fully mediated after adjustment for antisocial behaviour; not unexpected given the strong correlation of antisocial behaviour with use of illicit substances (Adalbjarnardottir & Rafnsson, 2002; Miller & Plant, 2002).

Of importance, those adolescents who believe they are failing or below average academically at age 13, but perceive improvement during the next two years, are not more likely than the majority who believe they are average or above, for later frequent alcohol, tobacco and marijuana use.

TABLE 3

Perceived academic performance (PAP) trajectory and substance use at T1 (age 13 years), associated with more than weekly alcohol, tobacco and marijuana use at T2 (15 years)

| | n (%) | Odds ratio (95% confidence interval) for more than weekly use at T2 | | | | | |
| | | Alcohol | | Tobacco | | Marijuana | |
		Unadjusted	Adjusted (1,2)	Unadjusted	Adjusted (2,3,4)	Unadjusted	Adjusted (2,3)
PAP trajectory							
Both fail/below	36 (2.3)	4.7 (1.5–14.7)***	3.6 (1.01–3.1)*	5.7 (2.2–15.0)***	3.9 (1.4–10.9)**	4.8 (1.7–13.4)**	ns
Decline to fail/below	101 (6.4)	6.3 (3.1–12.8)***	3.7 (1.7–8.0)***	6.8 (3.7–12.2)***	4.8 (2.6–8.8)***	5.4 (2.8–10.4)***	2.8 (1.3–5.9)***
Improve from fail/below	60 (3.8)	ns	ns	ns	ns	ns	ns
Both average/ above	1350 (85.5)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)
Substance use at T1							
None	1080 (68.4)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)	1.0 (referent)
Alcohol only	105 (6.6)	4.6 (2.0–11.0)***	4.9 (2.0–12.0)***	ns	ns	ns	ns
Tobacco only	88 (5.6)	ns	ns	ns	ns	ns	ns
Marijuana ± alcohol	46 (2.9)	ns	ns	ns	ns	11.2 (4.8–26.1)***	5.7 (2.1–15.5)***
Alcohol+tobacco	49 (3.1)	5.9 (2.2–16.2)***	6.2 (2.2–17.9)***	10.8 (5.2–22.4)***	8.0 (3.7–17.1)***	6.5 (2.5–16.5)***	3.8 (1.4–10.5)***
Tobacco+marijuana	62 (3.9)	ns	ns	10.4 (5.3–20.2)***	6.5 (3.2–13.1)***	11.0 (5.1–23.9)***	4.4 (1.8–10.5)***
Alcohol+tobacco+ marijuana	73 (4.6)	14.4 (7.0–29.6)***	12.6 (4.9–32.8)***	26.1 (14.5–47.1)***	15.0 (8.0–28.1)***	14.4 (7.2–28.8)***	4.2 (1.9–9.6)***
Model χ^2 (*df*)***		χ^2 (9)=87.6	χ^2 (11)=117.8	χ^2 (9)=214.7	χ^2 (12)=251.9	χ^2 (9)=128.4	χ^2 (11)=227.6
Nagelkerke R^2		.201	.268	.310	.359	.249	.426

Logistic regression models and odds ratios, unadjusted, and adjusted with forward stepwise conditional entry of covariates: 1, antisocial behaviour at T1; 2, antisocial behaviour at T2; 3, gender; 4, changed living arrangement.
ns $P >.05$, *$P <.05$, **$P <.01$, ***$P <.001$.

Our results support findings relating early academic self-esteem in girls and problem behaviour in boys, to later heavy alcohol use (Kumpulainen & Roine, 2002); school misbehaviour and low academic achievement to cigarette use (Bryant et al., 2000); where relationships may be indirect through general deviance and low self-esteem.

Causal inferences regarding our study findings cannot be determined, however. Initiation or progression of substance use after age 13 may contribute to an actual or perceived decline in academic self-esteem; perhaps due to influential peer associations. Alternatively, a decline in academic self-esteem caused by actual failure or, perhaps, by excessive parental/school/ individual expectations and apparent failure, may lead to initiation/progression of substance use. Either way, associations revealed in this analysis remain strong, and low academic self-esteem may be a useful means of identifying adolescents at risk of future substance misuse, in addition to those engaging in antisocial behaviour and early substance use.

Although not the primary focus of this study, the predictive effects of early

substance use are evident; particularly, the increased risks associated with early use of double (6- to 8-fold) and triple (12- to 15-fold) combinations of alcohol, tobacco and marijuana for progression to more frequent use, in agreement with other studies (Best et al., 2000; Sutherland & Shepherd, 2001). Further, early combined alcohol plus tobacco use shows a gateway effect in predicting later marijuana use; conversely, however, early tobacco plus marijuana use is not associated with later alcohol use. This latter finding is not commonly noted and requires further exploration.

In our sample, infrequent early use of single substances appears to carry less risk; for instance, at age 13 'use ever' of tobacco alone does not predict later more frequent use of tobacco, or anything else. However, more than monthly alcohol use at age 13 has a nearly 5-fold increased risk of more than weekly use of alcohol at age 15. Use of marijuana alone at age 13 was reported by very few respondents; thus in our analysis it was combined with the alcohol but not tobacco category; revealing a more than 5-fold increased risk of later frequent marijuana though not alcohol or tobacco use. Apparent inconsistencies between our findings and others (in which cigarette use predicted later alcohol use, and change in alcohol use predicted development of cigarette use, Duncan, Duncan, and Hops (1998)), may arise from sample differences; our larger sample was not restricted to non-users at mean age 13, and our analysis controls for antisocial behaviour. Prevalence rates in our sample, in which approximately 80% have used alcohol, 33% tobacco and 35% marijuana by age 15, are similar to Australian (Drug Info Clearinghouse, 2002) and slightly higher than US reports (Torabi, Bailey, & Majd-Jabbari, 1993).

Of interest, other symptomatology (depressive or anxiety), self-esteem, parenting and family measures appear not to explain any variance in the data not already accounted for by PAP, early substance use and antisocial behaviour. Changed living arrangement between age 13 and 15 was the only socio-demographic factor significantly associated. Not all known risk factors, such as peer and parental substance use and attitudes (Jones & Heaven, 1998) were included in models; the apparent independent association of perception of academic failure with later substance use may be due to these or other unknown factors.

Other limitations of this study include the lack of a measure of actual academic performance. This data would have enabled a comparison of actual and perceived performance, and may have given a clearer indication of those with cognitive distortions or dysfunctional coping.

Difficulty was experienced in matching respondents at wave one with those at wave two and wave three. Anonymity and confidentiality of study data was assured. Ethical responsibilities, however, required identification of adolescents at risk of suicidal behaviour, for further assessment and counselling or referral. This resulted in some students identified at wave one hiding their identity at wave two or three; thus the apparent attrition rate between waves is inflated.

In conclusion, although substance use from age 13 and 15 years shows an upward trend for all adolescents, those with concurrent or increasing perception of academic failure, compared to those with average or improving academic performance, have greatly increased risk for more than weekly substance use at age 15. Thus we propose that, in line with recommendations by Bryant et al. (2000), interventions aimed at improving and maintaining academic self-esteem in early adolescence may be effective in reducing risks for substance misuse in later adolescence.

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