EPIDEMIOLOGY

Associations of Social Phobia and General Anxiety with Alcohol and Drug Use in a Community Sample of Adolescents

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Abstract — Aims: This study explores whether associations between anxiety and alcohol and other substance use are already evident in middle adolescence, and whether general anxiety or symptoms of social phobia affect continuity of frequent alcohol use, frequent drunkenness and cannabis use. Methods: Data from the Adolescent Mental Health Cohort Study, a school-based Finnish survey among adolescents aged 15–16 years at baseline, was utilized to assess prevalence, incidence and continuity of symptoms of social phobia, general anxiety, frequent alcohol use, frequent drunkenness and cannabis use (which in this context was smoked ‘hashish’ of unknown constituency), and the associations between the substance use variables and the anxiety variables in 2-year follow-up. Results: Anxiety preceded substance use while no reciprocal associations were observed. Depression mediated the associations between anxiety and substance use. Symptoms of social phobia did not elevate the incidence of substance use, but general anxiety did. Frequent drunkenness was less significantly associated with anxiety than the other two substance use variables. Co-morbid general anxiety increased the persistence of frequent alcohol use while co-morbid social phobia decreased its persistence. Continuity of frequent drunkenness and cannabis use were unaffected by co-morbid anxiety. Conclusions: General anxiety in middle adolescence places adolescents at risk for concurrent and subsequent substance use. The risk may, however, be associated with co-morbid depression. Social phobia in middle adolescence may protect from substance use. Adolescents with internalizing symptoms may need guidance in coping with the symptoms even if the symptoms do not fulfil the criteria of mood or anxiety disorder.

INTRODUCTION

Three stages of adolescence, early, middle and late, are experienced by most individuals, but the age at which each stage is reached may vary. These different rates of maturation are connected to physical and cognitive development, and hormone balance. Middle adolescence (age 15–17 years) is the time when the proportion of alcohol users increases (Duncan et al., 2006; Lintonen et al., 2000). While for a majority of persons initiating heavy alcohol consumption in middle adolescence the behaviour may subside towards young adulthood (Mags, 2005), early age of onset of frequent alcohol use may signal later development of alcohol dependence (Grant et al., 2006). Also, regular cannabis use in adolescence may link with a higher tendency for continuation into adulthood (Patton, 2002; Perkonigg et al., 2008). Co-morbid behaviour-internalizing disorders may be related to trajectories characterized by steep increases in illicit substance use during adolescence and high rates of illicit substance use over time (Lansford et al., 2008).

Anxiety symptoms tend to increase from middle adolescence to late adolescence (Van Oort, 2010). Anxiety disorders have repeatedly been found to be associated with alcohol misuse and substance use disorders. Longitudinal studies suggest that anxiety disorders usually precede substance use problems (Buckner et al., 2008; Costello et al., 2003; Deas, 2006; Zimmermann, 2003). The self-medication theory suggests that alcohol and other substances may be used to alleviate symptoms of anxiety (Gilman, 2008; Sher, 2005; Viveros et al., 2005). An alternative order of progression may be explained by substance use altering brain functions, making them more vulnerable to stress, thus creating a state of anxiety (Wand, 2008). The order of progression is, thus, not yet fully understood. Since both substance use and anxiety may peak in adolescence, longitudinal studies using pure adolescent samples may be needed to ascertain the order of progression. Further, the natural course of these symptoms can only be studied in community samples.

According to the Diagnostic and Statistical Manual on Mental Disorders, 4th edition (DSM-IV), seven types of anxiety disorders can be distinguished in children and adolescents (Bernstein, 1997). Of these, among the most important clinically are social phobia and generalized anxiety disorder. The core symptom of social phobia is a marked and persistent fear of one or more types of social situations, leading to excessive anxiety or avoidance of such situations. Generalized anxiety disorder is characterized by disproportional, uncontrollable and often irrational worry about everyday matters. Because of the differences in symptomatology, specific types of anxiety disorders may have different kinds of associations with substance use. General anxiety may, for example, lead to self-medication with alcohol, while social phobia may lead to avoidance of noisy, drinking peer groups, thus decreasing the urge to drink alcohol. Cross-sectional studies have suggested that social anxiety may be associated with lower levels of substance use (Myers, 2003; Stewart, 2006). With regard to prospective studies, most have follow-up periods spanning from middle or late adolescence to adulthood, typically assessing substance use outcomes in adulthood. In general, these studies suggest that some anxiety disorders are associated with subsequent alcohol misuse or substance use, while others are not (Buckner et al., 2008; Zimmermann, 2003), and that the associations may not be reciprocal (Patton, 2002).
Also, associations between a specific type of anxiety and different substance use variables may vary. A recent report suggests an association between alcohol abuse and anxiety disorders but not between cannabis abuse and anxiety among adolescents (Low et al., 2008). The associations between anxiety disorders and substance use may be modified by such factors as developmental stage or legal regulations governing access to alcohol. In Finland, alcohol purchase and possession is prohibited for adolescents under the age of 18 years. Despite this, a significant percentage of adolescents report using alcohol (Lintonen et al., 2004), meaning they have to make special arrangements with older adolescents or adults to obtain access to alcohol. Cannabis is an illegal drug in Finland, yet repetitive use of cannabis is reported by 14–22% of middle adolescents (Korhonen, 2008; Poikolainen, 2001). Social phobia may, however, be hypothesized to hinder purchasing illegal drugs.

This study explores whether associations between anxiety and alcohol and other substance use are already evident in middle adolescence, and whether general anxiety or social phobia affect continuity of frequent alcohol use, frequent drunkenness and cannabis use. Using a community sample of adolescents aged 15–16 at baseline, and followed up for 2 years, the study posed four questions:

(a) Are symptoms of social phobia and general anxiety associated with current and subsequent alcohol and cannabis use?
(b) Are the associations of anxiety with substance use different by the type of anxiety (general anxiety vs. symptoms of social phobia)?
(c) Do the associations differ by type of substance use?
(d) Do co-morbid conditions show stronger continuity than non-co-morbid conditions?

METHODS

Procedures

The present study is part of an ongoing prospective follow-up study entitled the ‘Adolescent Mental Health Cohort Study’. Ninth grade students (aged 15–16 years) from all Finnish-speaking secondary schools in two Finnish cities, Tampere (200,000 inhabitants) and Vantaa (180,000 inhabitants), filled in a person-identifiable questionnaire during a school lesson supervised by a teacher. The questionnaires were returned in sealed envelopes and collected by a member of the research team. Thus, the teacher did not have access to the responses. Questionnaires with two reminders were mailed to students absent from school on the day of the survey. The final T1 sample consisted of 1609 girls and 1669 boys, with a mean age of 15.5 (SD 0.39). The response rate was 94%. The procedures for the baseline (T1) data collection are described in detail elsewhere (Fröjd et al., 2006).

Subjects responding to the first survey were contacted through their current educational institutes, by post and finally through the Internet to seek their participation in the 2-year follow-up survey (T2). A total of 2082 responses were received. Two participants responded twice, once at the educational institute and once on the Internet, and so their Internet responses were excluded. Ten respondents were excluded as they were judged by the researchers to have been completed facetiously. The final T2 sample (2070 respondents) represented 63% of the adolescents who responded to the first survey, with a mean age of 17.6 (SD 0.41). Of the surveys received, 54% were completed while at educational institutes, 44% were sent by post and 2% were completed via the Internet.

Sample and dropout

The sample consisted of 903 boys and 1167 girls. Of the adolescents, 27% lived in a non-intact family and 34% in families where neither of the parents had completed college or high school. Of the adolescents, 10% consumed alcohol at least once a week, 3% reported frequent drunkenness, 3% reported cannabis use, 4% exceeded the cut point for general anxiety and 9% exceeded the cut point for social phobia at baseline.

Dropout from follow-up

Altogether 28% of the girls and 46% of the boys responding to the baseline survey dropped out in the follow-up. Attrition was significantly associated with the adolescents’ socio-demographic background and also with the outcome variables. Those with an intact family (65 vs. 58%; \(P<0.001\)) and those with better educated parents (66 vs. 58% for paternal, and 66 vs. 56% for maternal educational level, \(P<0.001\) for both associations) responded to the follow-up survey more frequently. Responding was not associated with symptoms of social phobia, whereas general anxiety was associated with a lower probability of responding (53 vs. 64%; \(P=0.011\)). Higher levels of substance use were associated with a lower probability of responding (frequent alcohol use: 52 vs. 65%, frequent drunkenness: 48 vs. 64%, cannabis use: 48 vs. 64%, \(P<0.001\) for all associations).

Measures

General anxiety

General anxiety was measured by a single question focusing on the cognitive aspect of being anxious. An item formulated analogously to the 13 items of the Revised Beck Depression Inventory, a Finnish modification (Raitasalo, 2007) of the short Beck Depression Inventory (Beck and Beck, 1972), was used. The respondents were asked to rate the alternative that best describes them today: ‘I don’t easily lose my nerve or get anxious’ (=0)/’I don’t feel anxious or nervous’ (=0); ‘I get anxious and nervous rather easily’ (=1); ‘I get very easily distressed, anxious or nervous’ (=2): ‘I am constantly anxious and distressed, my nerves are always on edge’ (=3).

The measure has been used in previous studies of large community samples of adolescents (Fröjd et al., 2007; Harma, 2002). As in earlier studies, scores of 2–3 were taken as symptomatic of significant anxiety.

Social phobia

Symptoms of social phobia were measured by the Social Phobia Inventory (SPIN; Connor et al., 2000): the SPIN is a 17-item Likert-type self-report questionnaire for measuring fear, avoidance behaviours and physiological discomfort in

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performance or social situations. It has been used among diverse adolescent populations, including Finnish adolescents, and evidence of good reliability and validity in these groups has been reported (Johnson et al., 2006; Ranta et al., 2007; Vilete et al., 2004). A cut-off score of 24, based on earlier psychometric analyses among Finnish adolescents (Ranta et al., 2007), was used to indicate clinically significant symptoms of social phobia.

Substance use

The questions concerning substance use have been widely used in The School Health Promotion Study, an annual survey among Finnish teenagers about their health, health behaviour and school experiences carried out since 1995 (Lavikainen, 2009; Torikka et al., 2001). Identical questions were used both at baseline and in the follow-up.

Frequent alcohol use

Frequency of drinking alcoholic beverages was elicited: ‘How often do you use alcoholic beverages?’ (once a week or more often/approximately once or twice a month/less often/never). To measure drinking patterns that cannot be deemed normal adolescent experimentation with alcohol (Lavikainen, 2009; Torikka et al., 2001), ‘once a week or more often’ was used as the cut point for frequent use in our study.

Frequent drunkenness

Frequency of drinking to intoxication was elicited by the question: ‘How often do you drink alcohol until you are really drunk?’ (once a week or more often/approximately once or twice a month/less often/never). To measure drinking patterns that cannot be deemed normal adolescent experimenting with alcohol, ‘once a week or more often’ was used as the cut point for frequent drunkenness in our study. Self-reports of drinking have shown reasonable validity and reliability among Finnish adolescents (Lintonen and Rimpelä, 2001; Lintonen et al., 2004).

Cannabis use

The study enquired about cannabis use by asking: ‘During the last two years, have you tried or used hashish?’ The response alternatives were never/once/2–4 times/5 times or more. To estimate use rather than trials, the responses were dichotomized into cannabis use (yes/no). ‘Yes’ indicates having used hashish five times or more. In Finland, smoking hashish constitutes the majority of cannabis use (Rönkä and Virtanen, 2009).

Confounders

Depression (at baseline)

Depression is strongly associated with both anxiety symptoms and substance use in adolescence (Couwenbergh et al., 2006; Torikka et al., 2001). Also, depression at baseline was significantly associated with concurrent and subsequent general anxiety in the present data (data available at request). Hence, in estimating the associations between substance use and anxiety, depression at baseline was controlled for. A Finnish modification of the 13-item Beck Depression Inventory (Raitasalo, 2007) was used to assess depression. The 13 items indicating different feelings, cognitions and physical symptoms related to depression were scored 0–3 (3 indicating the greatest severity), and the scores were summarized (theoretical range 0–39). A cut-off point of 8 indicates moderate to severe depression (Beck and Beck, 1972). Thus, 8 or more points in total was given the value 1 (=yes) and below 8 points the value 0 (=no), thus forming a dichotomous variable measuring depression (Kaltiala-Heino et al., 1999).

Socio-demographic background (at baseline)

Family structure. At T1 the adolescents were asked with whom they live: mother and father, mother and stepfather, father and stepmother, mother only, father only, with some other legal guardian. For the multivariate analyses, the family structure was re-coded into a dichotomous variable ‘non-intact family’ (0= mother and father, 1= all other alternatives).

Parental educational level. Parental educational levels were ascertained (T1) by asking the highest level of education that the parent had completed for both parents separately. The alternatives were comprehensive school only/vocational school/college level/university degree. Dichotomous variables were computed: maternal/paternal educational level non-academic yes/no (if highest education completed was lower than college level).

Statistical methods

Frequency (%) of reporting non-intact family structure, non-academic parental education, anxiety and substance use at baseline and in follow-up was tallied. Associations between the baseline variables and dropout were studied with \( \chi^2 \) statistics or Fisher’s exact test, where appropriate.

Associations between anxiety and substance use were expressed in the number of cases and percentages at baseline (prevalence) and the number of cases and percentages of new cases at the 2-year follow-up (incidence). Logistic regression analyses were performed to analyse the multivariate effects of the determinants on the prevalence at baseline and incidence at the 2-year follow-up. Results are given as odds ratios (ORs) in prevalence cases and as incidence odds ratios (IORs) in incident cases, with 95% confidence intervals (95% CI). To evaluate the relative importance of socio-demographic and mental health covariates for inclusion in the multiple logistic regression models, we computed two logistic regression models. In the first model, sex, family structure and parental educational level were entered as confounders. In the second model, depression at baseline was additionally entered into the model. A third model was computed replacing depression at baseline with depression at follow-up, but this did not affect the results and was therefore left out of this report (results are available on request).

Continuity of anxiety and substance use outcomes from baseline to end of follow-up (2 years) is reported as the number of cases and percentages. The significance of changes in anxiety and substance use from the baseline to the point of the follow-up were tested by the McNemar test.

All analyses were carried out with the SPSS16.0 software package.
RESULTS

Concurrent co-morbidity of anxiety and substance use

General anxiety was associated with a higher prevalence of substance use even when sex, family structure and parental educational levels were accounted for, but statistical significance was lost when additionally controlling for depression. In general, substance use was not associated with concurrent social phobia. Controlling for sex, family structure, parental educational level and depression revealed a lower prevalence of frequent alcohol use among adolescents with social phobia (Table 1).

Prospective associations between anxiety and substance use

General anxiety was associated with a higher incidence of frequent alcohol use, whereas social phobia was associated with a lower incidence of frequent alcohol use. The associations remained significant when sex, family structure, parental educational levels and depression were controlled for (Table 2).

Neither type of anxiety increased the incidence of frequent drunkenness. However, the association of social phobia with lower incidence of frequent drunkenness gained significance in the multivariate analyses. General anxiety was associated with higher incidence of frequent alcohol use and cannabis use when sex, family structure and parental educational levels were controlled for, and even when additionally controlling for depression (Table 2).

Frequent alcohol use, frequent drunkenness and cannabis use were not associated with incidence of either type of anxiety (Table 3).

Course of anxiety and substance use

All outcomes studied showed significant persistence ranging from 32% (frequent drunkenness) to 56% (frequent alcohol use). Frequent alcohol use had the highest proportion of new cases (17%). The proportion of new cases in both social phobia and general anxiety, and frequent drunkenness and cannabis use were below 10%. Differences in the prevalence of all anxiety and substance use variables between the baseline and 2-year follow-up were statistically significant (Fig. 1).

Table 2. Incidence (n, %) of substance use in 2-year follow-up according to anxiety among Finnish adolescents 15–16 years at baseline, and risk (OR with 95% CI) for new cases of substance use in 2-years follow-up according to anxiety when sex, family structure and parental educational levels are controlled for (Model 1) and when depression is additionally controlled for (Model 2)

<table>
<thead>
<tr>
<th>Type of substance use</th>
<th>N</th>
<th>n</th>
<th>%</th>
<th>P</th>
<th>IOR (95% CI) Model 1</th>
<th>IOR (95% CI) Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence of frequent alcohol use</td>
<td>General anxiety</td>
<td>No</td>
<td>1781</td>
<td>287</td>
<td>0.012</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>60</td>
<td>17</td>
<td>2.5</td>
<td>1.3 (1.3-4.6)</td>
<td>2.4 (1.2-4.8)</td>
</tr>
<tr>
<td></td>
<td>Social phobia</td>
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<td>1678</td>
<td>288</td>
<td>0.025</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>171</td>
<td>18</td>
<td>0.6</td>
<td>0.3 (1.0)</td>
<td>0.5 (0.3-0.8)</td>
</tr>
<tr>
<td>Incidence of frequent drunkenness</td>
<td>General anxiety</td>
<td>No</td>
<td>1909</td>
<td>131</td>
<td>0.333</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>70</td>
<td>7</td>
<td>1.8</td>
<td>0.7 (4.3)</td>
<td>1.5 (0.6-3.9)</td>
</tr>
<tr>
<td></td>
<td>Social phobia</td>
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<td>179</td>
<td>132</td>
<td>0.090</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
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<td>1810</td>
<td>7</td>
<td>0.4</td>
<td>0.2 (1.0)</td>
<td>0.3 (0.1-0.8)</td>
</tr>
<tr>
<td>Incidence of hash use</td>
<td>General anxiety</td>
<td>No</td>
<td>1811</td>
<td>95</td>
<td>0.578</td>
<td>1.00</td>
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<td>Yes</td>
<td>64</td>
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<td>1.6 (8.9)</td>
<td>2.8 (1.0-7.6)</td>
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<td></td>
<td>Social phobia</td>
<td>No</td>
<td>1811</td>
<td>67</td>
<td>0.313</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>179</td>
<td>4</td>
<td>0.7</td>
<td>0.2 (1.9)</td>
<td>0.4 (0.1-1.3)</td>
</tr>
</tbody>
</table>

Table 3. Incidence (n, %) of anxiety in 2-year follow-up according to substance use among Finnish adolescents 15–16 years at baseline, and risk (OR with 95% CI) for new cases of anxiety in 2-year follow-up according to substance use when sex, family structure and parental educational levels are controlled for (Model 1) and when depression is additionally controlled for (Model 2)

<table>
<thead>
<tr>
<th>Type of substance use</th>
<th>N</th>
<th>n</th>
<th>%</th>
<th>P</th>
<th>OR [95% CI] Model 1</th>
<th>OR [95% CI] Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence of general anxiety (N=1982)</td>
<td>Frequent alcohol use</td>
<td>No</td>
<td>1785</td>
<td>67</td>
<td>0.145</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>185</td>
<td>11</td>
<td>1.6</td>
<td>0.78 (3.4)</td>
<td>1.3 (0.6-2.8)</td>
</tr>
<tr>
<td></td>
<td>Social phobia</td>
<td>No</td>
<td>1911</td>
<td>74</td>
<td>0.572</td>
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</tr>
<tr>
<td></td>
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<td>56</td>
<td>3</td>
<td>1.2</td>
<td>0.3 (5.0)</td>
<td>0.8 (0.2-3.6)</td>
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<tr>
<td></td>
<td>Hash use</td>
<td>No</td>
<td>1916</td>
<td>75</td>
<td>0.857</td>
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<td></td>
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<td>2</td>
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<td>0.1 (3.6)</td>
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<td>Frequent alcohol use</td>
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<td>1673</td>
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</tr>
<tr>
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<td>189</td>
<td>17</td>
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<tr>
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<td>No</td>
<td>1801</td>
<td>140</td>
<td>0.215</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>57</td>
<td>7</td>
<td>1.4</td>
<td>0.5 (3.7)</td>
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<td>1808</td>
<td>144</td>
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<td>57</td>
<td>3</td>
<td>0.7</td>
<td>0.2 (2.4)</td>
<td>0.7 (0.2-2.2)</td>
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</tbody>
</table>

Table 1. Prevalence (n, %) of substance use according to anxiety among 15–16-year-old Finnish adolescents, and risk (OR with 95% CI) for concurrent substance use according to anxiety when sex, family structure and parental educational levels are controlled for (Model 1) and when depression is additionally controlled for (Model 2)

<table>
<thead>
<tr>
<th>Type of substance use</th>
<th>N</th>
<th>n</th>
<th>%</th>
<th>P</th>
<th>OR [95% CI] Model 1</th>
<th>OR [95% CI] Model 2</th>
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<tbody>
<tr>
<td>Prevalence of frequent alcohol use</td>
<td>General anxiety</td>
<td>No</td>
<td>1977</td>
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<tr>
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<td>77</td>
<td>17</td>
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<tr>
<td></td>
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<td>1872</td>
<td>188</td>
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<tr>
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<td>0.4 (1.4)</td>
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<td>General anxiety</td>
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<td>General anxiety</td>
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<td>1.3</td>
<td>0.6 (2.9)</td>
<td>0.9 (0.4-2.3)</td>
</tr>
</tbody>
</table>
Of the adolescents with frequent alcohol use at baseline, those with co-morbid general anxiety showed continuity in frequent alcohol use more often than those without co-morbid general anxiety (65 vs. 55%; \( P = 0.035 \)). Co-morbid social phobia was associated with lower proportions of persistence in frequent alcohol use (53 vs. 57%; \( P = 0.043 \)). Neither type of anxiety significantly affected the continuity of frequent drunkenness or cannabis use.

None of the substance use variables was significantly associated with persistence of general anxiety or social phobia. (data not shown).

**DISCUSSION**

Studying the order of progression of anxiety and substance use among Finnish middle adolescents revealed that anxiety preceded substance use while no reciprocal associations were observed. Depression mediated the associations between anxiety and substance use. In general, symptoms of social phobia did not elevate the incidence of substance use, but general anxiety did. Frequent drunkenness was less significantly associated with anxiety than the other two substance use variables. Both anxiety and substance use showed significant continuity in a 2-year follow-up. Co-morbid general anxiety increased the persistence of frequent alcohol use while co-morbid symptoms of social phobia decreased its persistence. Continuity of frequent drunkenness and cannabis use were unaffected by co-morbid anxiety.

Symptoms of social phobia were not significantly associated with any type of substance use, whereas general anxiety showed concurrent co-morbidity with all types of substance use. The associations were unaffected by socio-demographic variables. Depression, on the other hand, mediated them. Depression levelled out the significance of associations between general anxiety and all types of substance use, while a significant association emerged between symptoms of social phobia and lower prevalence of frequent drunkenness when depression was introduced into the multivariate analysis. It is possible that the individuals suffering from general anxiety are more likely to use substances to self-medicate if they also suffer from depressive symptoms.

General anxiety at the age of 15–16 years was associated with almost a three-fold risk (IOR) for becoming a frequent alcohol user by the age of 17–18 years. Also, co-morbid general anxiety promoted the persistence of frequent alcohol use while co-morbid symptoms of social phobia decreased its persistence. Continuity of frequent drunkenness and cannabis use were unaffected by co-morbid anxiety.
cannabis use in the follow-up. There are several previous reports of specific associations between anxiety disorders and substance use outcomes. Generalized anxiety has not been significantly associated with subsequent alcohol disorders (Buckner et al., 2008; Zimmermann, 2003). Trait anxiety, on the other hand, has shown a cross-sectional association with substance use problems (Ste-Marie, 2006).

Anxiety preceding initiation of frequent alcohol use, and promoting persistence of frequent use seems to support the self-medication theory (Bolton et al., 2006; Gilman, 2008). This is especially plausible, since the association was found with frequent consumption, not with frequent drunkenness or cannabis use. Drinking a little all the time may be more acceptable behaviour than drinking into intoxication or using illicit drugs. Risk-taking behaviours such as drinking into intoxication, and behaviours opposing the rules of the society such as drug-related criminal activity may be related to externalizing behaviours rather than anxiety problems (Alati, 2005; Anderson et al., 2007; Couwenbergh et al., 2006). While it may, thus, be theoretically plausible to conclude that primary anxiety caused the secondary alcohol use, it is also possible that common underlying factors not assessed in the present study (e.g. genetic, biologic or psychosocial factors) may have contributed to the development of the outcomes studied (Saraceno, 2009).

With regard to other follow-up studies, perhaps surprisingly, symptoms of social phobia did not increase the risk for subsequent substance use in the present study. Quite the reverse: adolescents with symptoms of social phobia were less likely to start frequent alcohol use and cannabis use than adolescents without these symptoms. Also, adolescents with frequent alcohol use at the age of 15–16 years were less likely to continue the habit if they also suffered from symptoms of social phobia. This is in disagreement with previous findings concerning substance use and anxiety disorders in the general population (Bolton et al., 2006), and adolescents or young adults (Buckner et al., 2008; Zimmermann, 2003). These samples consisted of persons old enough to purchase alcohol legally. Thus, the association between social anxiety and alcohol use may partly be modified by the societal relations governing the age when purchase of alcohol independently of others is possible. In Finland, the legal age for purchasing alcoholic beverages is 18 years. Drugs, including cannabis, are illegal. Thus, acquiring alcohol or other substances may require social skills not possessed by adolescents with social phobia. Adolescents seldom drink alone. Lack of involvement with other adolescents who drink may prevent a drinking habit from developing (Guo et al., 2009; Yanovitzky et al., 2006). In the present study, the adolescents with symptoms of social phobia may also have suffered from schizoid and other personality disorders, and possibly other psychiatric traits decreasing social skills which could explain the association with lower frequency of substance use.

The present study concurs, however, with the findings of decreased substance involvement (Myers, 2003) and less alcohol consumption among students with higher levels of social anxiety (Guo et al., 2009; Saraceno, 2009). Also, it has been suggested that social anxiety is associated with drinking in certain situations rather than with drinking frequency or quantity (Buckner et al., 2006). Indeed, Morris et al. (2005) concluded on the basis of several studies on the relationship between social anxiety and problematic alcohol use among students that most studies that find a negative relationship have used quantity of alcohol consumption or frequency of use as an indicator of problematic use while studies finding a positive relationship have defined problematic use as negative consequences due to alcohol use (Morris et al., 2005). Substance use was not predictive of general anxiety or symptoms of social phobia in the present study. This is in concurrence with findings concerning the temporal sequence of anxiety and substance use disorders (Copeland, 2009; Costello et al., 2003; Lopez, 2005).

Some studies have suggested that frequent cannabis use in adolescence increases the risk of later anxiety and depression symptoms in long follow-ups from adolescence to early adulthood (Hayatbakhsh et al., 2007; Patton, 2002). In the present study, general anxiety and symptoms of social phobia were unaffected by previous cannabis use. The difference in results may be due to differences in measures of cannabis use. The measure in the present study focused on smoked hashish. The lack of an effect of drug use on later anxiety may also be due to the low frequency of drug use studied here (Patton, 2002). Furthermore, cannabis use may need to be of a longer duration to show a significant effect on anxiety. Lag times between anxiety disorders and substance use disorders have been suggested to be as long as 7–16 years in the general population (Falk et al., 2008).

In keeping with earlier findings (Angst et al., 2009; Rohde, 2001; Ruscio, 2008), all types of substance use and anxiety showed substantial persistence or recurrence at the 2-year follow-up. Persistence of frequent drunkenness and cannabis use was unaffected by anxiety. Pure anxiety disorders have been suggested not to affect continuity of illicit substance use (Lansford et al., 2008). The present study suggests that symptoms indicating general anxiety, or social phobia may not be associated with maintaining a habit already developed by middle adolescence. On the other hand, general anxiety increased the persistence of frequent alcohol use. As in earlier analyses, frequent alcohol use and frequent drunkenness showed different results. These may, thus, be two distinct phenomena with frequent alcohol use more significantly associated with anxiety than frequent drunkenness.

Conclusion

General anxiety in middle adolescence places adolescents at risk for concurrent and subsequent substance use. The risk may, however, be associated with co-morbid depression. Social phobia in middle adolescence may protect from substance use. Adolescents with internalizing symptoms may need guidance in coping with the symptoms even if the symptoms do not fulfill the criteria of anxiety or mood disorder.

Limitations

The baseline sample in the present study can be considered representative of urban Finnish middle adolescents. However, dropout in the follow-up was significantly associated with general anxiety and the socio-demographic background. Caution is warranted when generalizing the findings of this study to rural adolescents and to adolescents with an adverse social background. In high-risk populations, the associations between anxiety and substance use may differ from the ones reported in the present study.
Responding to questions concerning substance use, especially illicit use may be problematic if an authority, such as the teacher, is present. To avoid this, the teachers were instructed to supervise the class from the front and not to interfere with responding. Responses were not available to teachers afterwards, either.

Symptoms, not psychiatric disorders, were measured in the present study. Substance use and social phobia were measured with reliable, validated methods. The assessment of general anxiety with the single item used does not, however, allow us to draw conclusions on the specific type of anxiety, whether it is related to panic attacks, post-traumatic anxiety or to worrying.

The measure of cannabis use referred to any type of hashish smoked. The constituents, and thus the levels of cannabidiol and delta-9-tetrahydrocannabinol, the main psychoactive compound of cannabis, could not be determined. It has been suggested that the effects of cannabis may vary according to the level of cannabidiol (Morgan et al., 2010).

The limitations of the study include that these data are based entirely on self-reports and may, thus, be subject to recall bias. This may not be a concern with the anxiety symptoms eliciting current cognitions and feelings, or variables assessing current alcohol consumption. Cannabis use, on the other hand, was instructed to assess for lifetime (T1) or for the past 2 years. However, the time lag between the age of hashish initiation and reporting is relatively short. Recall biases may be less likely over such a short period.

CONCLUSION

General anxiety in middle adolescence places adolescents at risk for concurrent and subsequent substance use in late adolescence. The risk may, however, be associated with co-morbid depression. If there is an association between substance use and later anxiety in adolescence, it may take longer than 2 years to develop. The development of the association between social anxiety and alcohol or substance use was not observed in middle and late adolescence, suggesting that there may be cultural differences in this association or that such possible mediators as free access to alcohol may be required to establish the associations. Alleviating general anxiety in adolescence may promote prevention of later substance use.

REFERENCES


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Rönki S, Virtanen A (eds) Finland drug situation 2009. 2009 NATIONAL REPORT TO THE EMCDDA by the Finnish National Focal Point, THL.


