Is Smoking Associated with Depression and Anxiety in Teenagers?

ABSTRACT

Objectives. An association of smoking with depression and anxiety has been documented in adult smokers. This study examines this association in a representative group of teenage smokers.

Methods. A two-stage cluster sample of secondary school students in Victoria, Australia, were surveyed by using a computerized questionnaire, which included a 7-day retrospective diary for tobacco use and a structured psychiatric interview.

Results. Subjects reporting high levels of depression and anxiety were twice as likely to be smokers after the potential confounders of year level, sex, alcohol use, and parental smoking were controlled for. Regular smokers were almost twice as likely as occasional smokers to report high levels of depression and anxiety. In a stratified analysis, an association between regular smoking and psychiatric morbidity was found in girls of all ages but for boys only in the youngest group.

Conclusions. The cross-sectional association is consistent with the use of smoking by teenage girls as self-medication for depression and anxiety. Therefore, future health promotional campaigns might consider strategies that attend to perceived psychological benefits of smoking. (*Am J Public Health.* 1996;86:225–230)

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Introduction

High levels of depressive and anxiety symptoms reported by adult smokers, as well as high lifetime rates of major depression, indicate a substantial relationship between tobacco use and mental health.[1–4] Surveys of psychiatric patients have similarly demonstrated high rates of smoking by comparison with community norms.[5] The link has often been taken to reflect a causal relationship, with poor mental health predisposing to regular tobacco use. Recent studies of cessation of and relapse in tobacco use in adults have supported this hypothesis. Smokers with self-reported depressive symptoms are, for example, less likely to quit if negative affect is identified as the reason for continuing.[3,6] Dysphoric mood is similarly a common antecedent of smoking relapse.[7,8]

The influence of depressive and anxiety symptoms on initial experimentation and progression to regular smoking during the teen years has attracted less attention.[9] Earlier surveys of adolescents reported links between smoking and neuroticism,[10] neurotic symptoms,[11] poor coping skills,[12] and low self-esteem.[13] A 10-year follow-up of an adolescent cohort found that self-report of minor depressive symptoms in nonsmokers at 15 years significantly predicted smoking at 25 years.[14] Despite this evidence, there remains uncertainty as to whether the findings reflect a link with psychiatric symptoms or associated personality characteristics. Possible mechanisms of influence also remain unclear. Adolescent smoking is a dynamic process, with many experimenting but fewer going on to regular use.[15] Mental health might influence the process of becoming a smoker at various points: initiation of smoking, transition to regular use, and the process of quitting. The aim of this study was to examine and quantify associations between the common psychiatric symptoms of depression and anxiety and teenage smoking at each transition point.

Methods

Procedure and Sample

Data were collected from subjects in a statewide survey of adolescent health in Victoria, Australia, between August and November 1992. This state has a population of 4.4 million, of whom 63% live in the capital city, Melbourne.[16] A two-stage cluster sampling procedure was used to define the study population. At stage 1, 60 schools were chosen at random from a stratified frame of government, Catholic, and independent schools with a probability proportional to the number of year 7, 9, and 11 students in the schools in each stratum in the state (total numbers were 59 746, 60 905, and 59 133, respectively). These correspond to the 8th, 10th, and 12th years of full-time education, respectively. Five schools declined participation, and each was replaced by a previously defined school from the equivalent stratum. At stage 2, a single intact class was selected at random from each of years 7, 9, and 11 in selected schools. The sample

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TABLE 1—Characteristics of Survey Population of Victorian Secondary School Students (n = 2525), by School Year Level and Sex

	Year 7		Year 9		Year 11	
	Male (n = 479)	Female (n = 477)	Male (n = 437)	Female (n = 474)	Male (n = 301)	Female (n = 357)
Mean age (SD), y	12.5 (0.6)	12.5 (0.6)	14.5 (0.6)	14.5 (0.5)	16.6 (0.8)	16.4 (0.6)
Smoking status, %						
Never smoked	85	82	68	69	64	54
Ex-smokers (>1 mo)	4	5	7	6	3	5
Occasional (≤2 days/week)	10	10	11	14	17	17
Regular (≥3 days/week)[a]	1	3	13	11	15[b]	24[b]
Psychiatric morbidity, %[c]						
CIS score of 0–5	64	55	60	43	51	32
CIS score of 6–11	21	22	23	23	16	22
CIS score of 12–17[d]	9	8	8	16	17	20
CIS score of ≥18[d]	6	15	9	18	17	25
Alcohol consumption, %[e]						
Nondrinkers	85	87	59	63	34	34
Light	15	12	37	32	49	49
Heavier[f]	0	1	4	5	17	17
Parental smoking, %						
Nonsmokers	62	62	64	60	66	58
Occasional	14	9	10	9	13	14
Regular	24	29	25	31	22	28

Note. Values are weighted prevalence estimates.
[a]Significant increase in regular smoking across year levels: males $\chi^2_1 = 62$, $P < .001$; females $\chi^2_1 = 101$, $P < .001$.
[b]Significant sex difference in regular smoking at year 11: $\chi^2_1 = 6.5$, $P < .02$.
[c]Significant increase across year levels in proportion scoring ≥12 on CIS: males $\chi^2_1 = 34$, $P < .001$; females $\chi^2_1 = 50$, $P < .001$.
[d]Significant sex difference in high psychiatric morbidity (≥12 on CIS): Mantel–Haenszel $\chi^2_1 = 49$, $P < .001$.
[e]Significant increase in any alcohol use across year levels: males $\chi^2_1 = 206$, $P < .001$; females $\chi^2_1 = 223$, $P < .001$.
[f]Significant increase across year levels: males $\chi^2_1 = 165$, $P < .001$; females $\chi^2_1 = 14.5$, $P < .001$.

was designed to have a standard error of 0.02 after adjustment for the effects of clustering.

The survey was presented as dealing with important health issues for adolescents and included questions on a broad range of health-related issues. Active consent for participation, including written parental permission, was sought. Laptop computers were used to administer the questionnaire to each class. Computer administration has been shown to enhance disclosure of health risk behaviors in adolescents.[17]

Measures

Tobacco use was categorized by using a 7-day retrospective diary. To reduce exposure to unnecessary questions, never-smokers and self-defined ex-smokers who had not smoked a cigarette in the previous month did not complete the diary. Smoking was categorized on the basis of frequency, so that a subject who reported smoking on 3 or more days in the past week was defined as a regular smoker.[18,19] Those smoking on 2 or fewer days in the past week were categorized as occasional smokers. Self-defined ex-smokers, who reported not smoking in the month before the survey, were categorized as ex-smokers. Those who reported giving up smoking in the last 4 weeks were categorized as occasional smokers.

Mental health status was evaluated with a computerized form of the Clinical Interview Schedule (CIS)-R,[20–22] a structured interview designed for the assessment of symptoms of anxiety and depression in nonclinical populations. The CIS has been used as a criterion measure for the definition of psychiatric "caseness" in teenage groups[23] and has an ease of reading consistent with its suitability for the younger group (Flesch Reading Ease = 78.5, Flesch Grade Level = 7.1). The CIS generates scores (1–4) on 14 subscales covering the common psychiatric symptoms found in nonclinical populations. These were summarized into a total score and stratified into four levels of psychiatric morbidity: level 1 (0–5), level 2 (6–11), level 3 (12–17), and level 4 (≥18). The stratification incorporates a suggested threshold of 12 or higher for caseness, corresponding to the point where a general practitioner might be concerned about a subject's mental health.[20,21,23]

Alcohol consumption was assessed with self-evaluation of current drinking status and a 7-day retrospective drinking diary. The alcohol diary used a beverage-specific approach and detailed types of drink (e.g., low-alcohol beer, normal-alcohol beer, wine, spirits, mixed drinks) as well as the quantities consumed according to a range of relevant measures (e.g., small bottles [375 mL], large bottles [750 mL], glasses, cans). Nine grams of ethanol was taken as a standard unit.

Three levels of consumption were defined on the basis of reported consumption in the previous week: nondrinking, light drinking, and heavier drinking. Subjects consuming in excess of 50% of National Health and Medical Research Council recommended guidelines for adults[24] were classified as heavier drinkers (i.e., males consuming at least 14 units/week and females consuming at least 7 units/week).

Parental smoking was assessed with two questions dealing with current maternal and paternal smoking patterns, respectively. Parental smoking was defined on three levels: at least one parent smoking daily, at least one parent smoking less than daily, and both parents not smoking.

Analysis. Prevalences were weighted by geographic area to allow for chance undersampling in particular areas of the state. We adjusted confidence intervals (CIs) for prevalence estimates using random-effects procedures in ML3E software[25] to take into account the effect of the two-stage survey design on effective sample size. Prevalence estimates and odds ratios (ORs) are presented with 95% confidence intervals. Analysis was conducted with the Epi Info[26] and SAS programs[27] and logistic regression analyses exploring the interrelationships between smoking and psychiatric morbidity in GLIM.[28]

Results

Sample Characteristics

Time limitations restricted school numbers to 46 in year 7, 45 in year 9, and 36 in year 11. Twenty-six participating schools were government, 11 were Catholic, and 9 were independent and private. Stratum weights for the overall estimation of prevalence rates were less than 1.5 for all but two of the 12 geographic regions of Victoria (2.3 in metropolitan west Melbourne, 2.1 in rural north Victoria).

A total of 2525 students completed the survey: 956 in year 7, 911 in year 9, and 658 in year 11. The overall response rate was 83%. However, the response rate for year 11 (79%) was significantly lower than it was for year 7 (85%) and year 9 (84%) ($\chi^2_1 = 12.9$, $P < .001$). Reasons for nonparticipation were as follows: nonreturn of consent form (10.2%), absence on survey day (3.5%), and parental refusal (3.3%). Higher nonresponse rates in year 11 resulted from a higher rate (13.7%) of nonreturn of consent forms. The sex ratio (males year 7: 50.0%; year 9: 47.0%; year 11: 43.8%) was similar to that in Victorian schools.[29] Table 1 presents characteristics of the survey population.

Both smoking participation and regular smoking rates rose across year levels for males and females. Within the smoking group, the proportion of regular smokers rose across year levels for both males ($\chi^2_1 = 6.8$, $P < .01$) and females ($\chi^2_1 = 10.4$, $P < .005$).

With a cutoff point of 12 and above for CIS scores, psychiatric morbidity rates rose substantially across year levels, with significantly higher scores for females. Alcohol use also rose across year levels, with nondrinkers in the minority in the year 11 group. The likelihood of a drinker falling into the heavier-consumption category was higher in the upper-year levels for both sexes. Overall rates of smoking in one parent were 27% for reported daily smoking and 11% for less-than-daily smoking, with no significant difference across year levels.

Regular Smoking and Psychiatric Morbidity by Age and Sex

The association between psychiatric morbidity and regular smoking was modest for teenage males but substantial for teenage females (Table 2). Across year levels, 38% of male regular smokers fell into the high-morbidity group, compared with 19% of others. Fifty-nine percent of regular female smokers fell into the high-morbidity group, compared with 29% of others. An examination of the homogeneity of odds ratios with logistic regression demonstrated a significant interaction between year level and psychiatric morbidity for males ($\chi^2_1 = 7.05$, $P < .05$) but not females ($\chi^2_1 = 0.54$). This result supports the impression given by the stratum-specific odds ratios that there may be little association of regular smoking with psychiatric morbidity for males in the two higher year levels.

TABLE 2—Percentages of Regular Smokers among Subjects Reporting High and Low Levels of Psychiatric Symptoms, by School Year Level and Sex

	Males (n = 1217)			Females (n = 1308)		
Year	Low Levels, % (n = 965)	High Levels, % (n = 252)	OR[a] (95% CI)	Low Levels, % (n = 886)	High Levels, % (n = 442)	OR[a] (95% CI)
7 (n = 956)	1	7	8.5 (2.3, 32)	2	10	4.7 (1.8, 12)
9 (n = 911)	15	19	1.3 (0.6, 2.7)	8	25	3.5 (2.0, 6.2)
11 (n = 658)	17	24	1.5 (0.8, 3.1)	18	46	3.8 (2.3, 6.5)
Mantel–Haenszel weighted OR			1.7 (1.03, 2.8)			3.8 (2.6, 5.6)

Note. A high level of psychiatric symptoms was defined as a score above a cutoff point of ≥ 12 on the CIS. OR = odds ratio; CI = confidence interval.
[a]Significant interaction between year level and psychiatric morbidity for males ($\chi^2_2 = 7.05$, $P < .05$).

Associations between regular smoking and dimensions of psychopathology were examined with logistic regression to estimate odds ratios per unit step on the ordinal scale 0–4 for the 14 subscales of the CIS. All subscales other than Worry about Physical Health (OR = 1.05, 95% CI = 0.87, 1.26) had a significant association with regular smoking. The highest associations were with panic (OR = 1.5, 95% CI = 1.3, 1.7), depression (OR = 1.4, 95% CI = 1.3, 1.6), irritability (OR = 1.4, 95% CI = 1.3, 1.6), impaired concentration (OR = 1.4, 95% CI = 1.2, 1.6), and sleep disturbance (OR = 1.4, 95% CI = 1.2, 1.6).

Multivariable Analyses

Three separate logistic regression analyses examined the association of psychiatric morbidity with current smoking (current smokers vs nonsmokers), current regular smoking (regular vs occasional smokers), and continuing smoking (current smokers vs ex-smokers) (Table 3). These correspond to the transition points of smoking initiation, development of regular smoking, and smoking cessation. It should be noted that the first and third comparisons are not statistically independent. Four potential confounding variables were included in these models: year level, sex, alcohol consumption, and parental smoking. Both alcohol consumption and parental smoking are known to be associated with higher rates of teenage smoking and psychiatric morbidity.[30–32]

Current smokers compared with nonsmokers. Subjects in the higher CIS groups had a twofold increased risk for smoking. There was a significant linear trend of increasing risk with CIS level (likelihood ratio $\chi^2_1 = 35.5$, $P < .001$), with the greatest difference between those scoring 12–17 and those scoring 6–11. A modest association with school year level persisted, but the association with sex disappeared when psychiatric morbidity was added to the model. A strong relationship between drinking and smoking was evident, particularly for those in the heavy-drinking category, who had an over 15-fold associated risk. Students who reported that at least one parent smoked on a daily basis had a twofold increased risk. No significant two-way interactions between CIS scores and year level, sex, alcohol use, or parental smoking were found, although this analysis did not attempt to incorporate the three-way interaction of age, sex, and CIS suggested by Table 2.

Regular smokers compared with occasional smokers. Subjects in the high-psychiatric-morbidity group were almost twice as likely to fall into the regular-smoking group, but this association was significant only for those scoring 18 or higher on the CIS. There was a significant linear trend for increasing risk with CIS level (likelihood ratio $\chi^2_1 = 8.5$, $P < .01$). Parental smoking and year level had the strongest associations with regular smoking status, confirming that regular smoking was more likely in the later years of

TABLE 3—Adjusted Odds Ratios from Multiple Logistic Regression Models of Smoking Outcomes in Victorian Teenagers

Smoking Groups	Adjusted ORs (95% CI)		
	Current Smokers[a] (n = 551) vs Nonsmokers (n = 1974)	Regular Smokers (n = 221) vs Occasional Smokers (n = 330)	Current Smokers[a] (n = 551) vs Ex-Smokers (n = 114)
School year level			
7 (n = 956)	1.0[b]	1.0	1.0
9 (n = 911)	1.4 (1.05, 1.9)	3.6 (1.9, 6.6)	1.03 (0.62, 1.7)
11 (n = 658)	1.4 (1.02, 1.9)	4.2 (2.2, 7.9)	1.8 (0.96, 3.3)
Sex			
Male (n = 1217)	1.0	1.0	1.0
Female (n = 1308)	1.1 (0.87, 1.3)	1.1 (0.73, 1.6)	1.1 (0.7, 2.3)
Psychiatric morbidity[c]			
CIS score of 0–5 (n = 1312)	1.0	1.0	1.0
CIS score of 6–11 (n = 539)	1.2 (0.93, 1.8)	1.5 (0.89, 2.6)	1.0 (0.6, 1.8)
CIS score of 12–17 (n = 319)	1.9 (1.4, 2.7)	1.7 (0.99, 2.9)	1.1 (0.6, 3.4)
CIS score of 18+ (n = 355)	2.3 (1.7, 3.1)	2.1 (1.3, 3.4)	1.3 (0.7, 2.4)
Alcohol consumption			
Nondrinkers (n = 1598)	1.0	1.0	1.0
Light (n = 771)	5.1 (4.0, 6.5)	1.8 (1.1, 2.8)	1.7 (1.06, 2.6)
Heavier (n = 156)	16 (11, 25)	2.9 (1.6, 5.4)	4.8 (1.9, 19)
Parental smoking			
Nonsmokers (n = 1632)	1.0	1.0	1.0
Occasional (n = 2271)	0.92 (0.63, 1.3)	2.4 (1.2, 4.6)	0.9 (0.4, 1.8)
Regular (n = 622)	2.0 (1.5, 2.5)	3.8 (2.5, 5.8)	1.7 (1.05, 2.7)

[a]Current smoking combines occasional and regular smoking.
[b]1.0 indicates the reference category for a subsequent odds ratio.
[c]Significant linear trend in relationship with smoking for current smokers vs nonsmokers ($\chi^2_1 = 35.5, P < .001$) and for regular smokers vs occasional smokers ($\chi^2_1 = 85, P < .01$).

secondary school. The association with parental smoking held whether a parent was reported to smoke on an occasional or a daily basis.

Continuing smokers. Little difference was found between continuing and ex-smokers in psychiatric morbidity. Heavier use of alcohol was the strongest factor associated with continuing smoking. There was a weaker association with reported parental daily smoking.

Discussion

Tobacco use rose across the teenage years both in frequency and in quantity, so that by late secondary school one in five teenagers fell into a regular-smoking category. The rise in smoking for females was more marked, with older teenage females having a higher likelihood of smoking regularly. Self-reported depression and anxiety were more evident in later secondary school, a pattern consistent with reported higher rates of depression and anxiety disorders in older adolescents.[33,34] Females were twice as likely as males to fall into a high-psychiatric-morbidity group.

An association between symptoms of depression and anxiety, observed in studies of adult smokers,[1–4] also characterized teenage smokers at an early point in their smoking careers. The link was particularly evident in the youngest teenage group. Earlier studies of teenagers have consistently demonstrated differences in the mental health of teenage smokers but have largely relied on indirect measures such as low self-esteem, poor coping strategies, and neuroticism.[10,12,13] One Australian[1] and two American surveys[35,36] demonstrated an association between symptoms of depression and anxiety and smoking in teenage groups. The current study has confirmed the link in a large, representative teenage population and demonstrated a twofold rise in the risk for smoking in the high-psychiatric-morbidity group. Within the smoking group, teenagers with a high level of psychiatric symptoms had a further twofold increase in the risk for regular smoking. The link of smoking with psychiatric morbidity, although evident for young males, was most pronounced in young females.

This study population, although drawn from a representative sample of secondary schools in Victoria, is open to three potential sources of selection bias. Five of the 60 originally sampled schools declined participation and were replaced. Survey time constraints further reduced school numbers, particularly at the year 11 level. Although findings for expected age and geographic distribution of participants suggest that minimal bias resulted, this possibility cannot be totally excluded. Second, there is evidence that early school leavers, not included in the sampling frame, have high levels both of substance use and of psychiatric morbidity.[37] A high school-retention rate to year 11 of 93.3% for Victoria in the year of the survey[29] should have minimized this bias. Nevertheless, it is possible that the observed prevalence rates of smoking and psychiatric morbidity underestimate true population rates, with further potential for misspecification of the association between tobacco use and psychiatric morbidity. The evidence that absentees have high rates of smoking by comparison with school attenders[30] raises a possible third source of bias. However, satisfactory response rates at all year levels, with low rates of absenteeism (<4%), should have minimized nonparticipation bias.

The computerized administration of the questionnaire permitted the collection of detailed information on psychiatric symptoms and teenage smoking.[38] The cutoff point of 3 days per week for regular smoking was chosen to reflect a degree of nicotine dependence and was supported by the probability that most regular users at year 11 smoked an average of more than five cigarettes per day. The stratification of psychiatric morbidity was designed to define a level of anxiety and depressive symptoms likely to cause a general practitioner concern and used a lower threshold for caseness than for major depression or the specific anxiety disorders outlined in *The Diagnostic and Statistical Manual of Mental Disorders,* 4th edition.

The association between smoking and psychiatric morbidity has most commonly been interpreted as mental health influencing the uptake and course of tobacco use.[32,39] An alternative interpretation is that smoking has a negative impact on mental health.[33] Nicotine's influence on neurotransmission pathways implicated in affective disorders provides a potential mechanism for such a causal influence.[40–42] A survey of adult smok-

ers,[43,44] which reported that heightened dysphoria persisted only as long as smoking continued, lent support to this view. In the current study, however, the mental health of ex-smokers was similar to that of continuing smokers rather than to that of never-smokers. It indicates a persistence of psychiatric symptoms despite smoking cessation and therefore is not consistent with a negative impact of smoking on mental health. It remains possible that in the longer term psychiatric morbidity has an impact on the likelihood of smoking relapse.[3,7]

The possibility of a common origin for both smoking and depression in environmental influences or genetic predisposition has also been noted.[32] Heavy alcohol use in young people has been both associated with higher levels of psychiatric symptoms[2,31] and strongly correlated with cigarette smoking.[30] Similarly, parental smoking is an established risk factor for teenage smoking[45,46] and is predictive of higher rates of major depression in offspring.[32] Parental smoking had an independent association with teenage smoking, with a key influence on the transition to regular smoking. Alcohol use similarly demonstrated a strong association with both current and continuing smoking status.

Social-learning theorists have argued that the development of smoking is strongly influenced by peers and the need to establish close peer bonds. A young person with a high level of depressive symptoms and associated poor self-esteem and self-confidence might be particularly vulnerable to the influences of a smoking peer group.[46] Similarly, advertising messages that link smoking to sexual attractiveness, fitness, and independence appeal to a young person with a poor self-image.

Psychiatric morbidity was associated with smoking frequency when regular and occasional smokers were compared. According to the self-medication hypothesis, harmful substance use may develop and be maintained as an attempt to cope with psychological distress and feelings of depression.[12,47,48] Smoking is commonly perceived as beneficial in areas commonly affected by psychiatric disorder, including control of situational anxiety, improvement in concentration, and facilitation of social communication.[44,48] Perceived improvement in well-being and psychological functioning is a potentially powerful motivating factor for the young smoker. However, much experimental evidence indicates that this popular view may be mistaken, with perceived benefits in functioning possibly arising from alleviation of withdrawal symptoms.[44,49,50]

Smoking in young women is a source of concern because of both its high prevalence and the particular health risks of cervical cancer, early menopause, complications of oral contraceptive use, unfavorable outcomes of pregnancy, and vulnerability to lung carcinoma.[51,52] Prominent among explanations for the high prevalence of smoking have been the loosening of societal stigma against female smoking and its use as an adjunct to weight control.[53–55] The level of psychiatric symptoms is a further possible explanation. The sex difference in regular smoking was found only for those with a high level of psychiatric symptoms. This result was further borne out in the logistic regression analyses, where sex was no longer associated with smoking when the level of psychiatric symptoms was added to the model. The findings are consistent with a view that psychiatric morbidity, or some closely associated factor, accounts for the sex difference in regular smoking rates in this age group.

Conclusion

Symptoms of anxiety and depression are strongly associated with teenage smoking and should be considered in future health promotional activity and preventative clinical services targeting young smokers.[56] For those with high symptom levels, the perceived psychological and social benefits of smoking may outweigh distant, future health risks and may explain why health educational programs for teenagers, though effective in raising knowledge of the health consequences, have demonstrated little or no effect on smoking patterns.[57]

A health promotional strategy that draws attention to misperceived psychological benefits of smoking with encouragement to adopt alternative coping strategies in dealing with psychological symptoms would seem fruitful. A further approach might focus on the diminished self-efficacy that commonly accompanies depression and anxiety.[58] Health promotional messages that enhance perceptions of personal control, combined with encouragement and practical advice about alternative strategies for negotiating social situations where the risk of smoking is high, would seem important elements of an effective campaign against smoking in young people. □

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References

1. Waal-Manning HJ, de Hamel FA. Smoking habits and psychometric scores: a community study. *N Z Med J.* 1978;88:188–191.
2. Winefield HR, Winefield AH, Juggermann M, Goldney RD. Psychological concomitants of tobacco and alcohol use in young Australian adults. *Br J Addict.* 1989;84:1067–1073.
3. Glassman AH, Helzer JE, Covey LS, et al. Smoking, smoking cessation and major depression. *JAMA.* 1990;264:1546–1549.
4. Romans SE, McNoe BM, Herbison GP, Walton VA, Mullen PE. Cigarette smoking and psychiatric morbidity in women. *Aust N Z J Psychiatry.* 1993;27:399–404.
5. Hughes JR, Hatsukami DK, Mitchell JE, Dahlgren LA. Prevalence of smoking among psychiatric outpatients. *Am J Psychiatry.* 1986;143:993–997.
6. Glasgow RE, Klesges RL, Mizes, Perchacek TP. Quitting smoking: strategies used and variables associated with success in a stop smoking competition. *J Consult Clin Psychol.* 1985;53:905–912.
7. Anda RF, Williamson DF, Escobedo LG, Mast EE, Giovino GA, Remington PL. Depression and the dynamics of smoking. *JAMA.* 1990;264:1541–1545.
8. Schiffman S. Relapse following smoking cessation, a situational analysis. *J Consult Clin Psychol.* 1982;50:71–86.
9. Pierce JP, Levy SJ. Smoking and drinking problems in young Australians. *Med J Aust.* 1987;146:121–122.
10. Cherry N, Keirnan KE. A longitudinal study of smoking and personality. In: Thornton RE, ed. *Smoking Behaviour: Physiological and Psychological Influences.* New York, NY: Churchill Livingston; 1978.
11. Henderson S, Lewis IC, Howell RH, Rayner KJ. Mental health and the use of alcohol, tobacco, analgesics and vitamins in a secondary school population. *Acta Psychiatr Scand.* 1981;63:186–189.
12. Penny GN, Robinson JO. Psychological resources and cigarette smoking in adolescents. *Br J Psychol.* 1986;77:351–357.
13. Brynner JM. *The Young Smoker.* London, England: Her Majesty's Stationary Office; 1969.
14. Kandel DB, Davies M, Karus D, Yamaguchi K. The consequences in young adulthood of adolescent drug involvement. *Arch Gen Psychiatry.* 1986;43:746–754.
15. Dobbs J, March A. *Smoking among Secondary School Children.* London, England: Her Majesty's Stationary Office; 1983.
16. Australian Bureau of Statistics. *Census of Population and Housing 6 August 1991, Australia in Profile.* Canberra, Australia: Australian Government Publishing Service; 1991. ABS Cat No 2821.0.
17. Paperny DM, Aono JY, Lehman RM. Computer assisted detection and intervention in adolescent high-risk health behaviour. *J Paediatr.* 1990;116:456–462.
18. Flay BR. Adolescent smoking: onset and predisposition. *Ann Behav Med.* 1985;7:9–13.

19. Escobedo LG, Marcus SE, Holtzman D, Govino GA. Sports participation, age at smoking initiation, and the risk of smoking among US high school students. *JAMA.* 1993;269:1391–1395.
20. Lewis G, Pelosi AJ, Glover E, Wilkinson G, Stansfeld SA, Williams PA. The development of a computerised assessment for minor psychiatric disorder. *Psychol Med.* 1988;18:737–745.
21. Lewis G, Pelosi AJ. *The Manual of CIS-R.* Institute of Psychiatry; 1992.
22. Goldberg DP, Cooper B, Eastwood MR, Kedward HB, Shepherd MA. A standardized psychiatric interview for use in community surveys. *Br J Soc Prev Med.* 1970;24: 18–23.
23. Mann AH, Wakeling A, Wood K, Monck E, Dibbs R, Szmukler G. Screening for abnormal eating attitudes and psychiatric morbidity in an unselected population of 15-year-old schoolgirls. *Psychol Med.* 1983; 13:573–580.
24. National Health and Medical Research Council. Is there a safe level of daily consumption of alcohol for men and women? Recommendation regarding responsible drinking behaviour. Canberra, Australia: Australian Government Publishing Service; 1987.
25. ML3 software for three-level analysis. London, England: Institute of Education, University of London; 1991.
26. Epi Info, version 5. Atlanta, Ga: Centers for Disease Control; 1991.
27. SAS version 6.03. Cary, NC: SAS Institute; 1988.
28. GLIM version 3.77. London, England: Royal Statistical Society; 1985.
29. Australian Bureau of Statistics. *Australia's Young People.* Canberra, Australia: Australian Government Publishing Service; 1993.
30. Hill D, Willcox S, Gardner G, Houston J. Tobacco and alcohol use among Australian secondary school children. *Med J Aust.* 1987;146:125–130.
31. Deykin EY, Levy EG, Wells V. Adolescent depression, alcohol and drug abuse. *Am J Public Health.* 1987;77:178–182.
32. Kendler KS, Neale MC, MacLean CJ, Health AC, Eaves LJ, Keassler RC. Smoking and major depression. *Arch Gen Psychiatry.* 1993;50:36–43.
33. Burke KC, Burke JD, Regier DA, Rae DS. Age at onset of selected mental disorders in five community populations. *Arch Gen Psychiatry.* 1990;47:511–518.
34. Peterson AC, Compas BE, Brooks-Gunn J, Stemmler M, Ey S, Grant KE. Depression in adolescence. *Am Psychol.* 1993;48:155–168.
35. Malkin SA, Allen DL. Differential characteristics of adolescent smokers and nonsmokers. *J Fam Pract.* 10:437–440.
36. Covey LS, Tam D. Depressive mood, the single-parent home, and adolescent cigarette smoking. *Am J Public Health.* 1990;80: 1330–1133.
37. Pirie PL, Murray DM, Lupter RV. Smoking prevalence in a cohort of adolescents including absentees, dropouts and transfers. *Am J Public Health.* 1988;78:176–178.
38. Martin GL, Newman IM. Assessing the validity of self-reported adolescent cigarette smoking. *J Drug Educ.* 1988;18:275–284.
39. Breslau N, Kilbey M, Andreski P. Nicotine dependence and major depression. *Arch Gen Psychiatry.* 1993;50:31–35.
40. Carmody TP. Affect regulation, nicotine addiction and smoking cessation. *J Psychoactive Drugs.* 1989;21:331–342.
41. Pomerleau OF, Pomerleau CS. Neuroregulators and the reinforcement of smoking, towards a biobehavioural explanation. *Neurosci Biobehav Res.* 1984;8:503–513.
42. Newhouse PA, Hughes JR. The role of nicotine and nicotinic mechanisms in neuropsychiatric disease. *Br J Addict.* 1991;86: 525–526.
43. Cox DB, Blaxter M, Buckle A. *The Health & Lifestyle Survey.* London, England: Health Promotion Trust; 1987.
44. West R. Beneficial effects of nicotine: fact or fiction? *Addiction.* 1993;88:589–590.
45. Murray M, Kingluk S, Swan AV. Relation between parents' and children's smoking behaviour and attitudes. *J Epidemiol Community Health.* 1985;39:169–174.
46. Goddard E. *Why Children Start Smoking.* London, England: Her Majesty's Stationary Office; 1990.
47. Khantzian EJ. The self-medication hypothesis of addiction disorder: focus on heroin and cocaine dependence. *Am J Psychiatry.* 1988;142:1259–1264.
48. Glass RM. Blue mood, blackened lungs, depression and smoking. *JAMA.* 1990;264: 1583–1584.
49. Snyder F, Davis F, Henningfield J. The tobacco withdrawal syndrome: performance decrements assessed on a computerised test battery. *Drug Alcohol Depend.* 1989;23:259–266.
50. Spilich G, June L, Renner J. Cigarette smoking and cognitive performance. *Br J Addict.* 1992;87:1313–1326.
51. Ernster EL. Women and smoking. *Am J Public Health.* 1993;83:1202–1207.
52. Risch HA, Howe GR, Jain M, Burch JD, Holowaty EJ, Miller AB. Are female smokers at higher risk for lung cancer than male smokers? *Am J Epidemiol.* 1993;138: 281–293.
53. Klesges RC, Klesges LM. Cigarette smoking as a dieting strategy in a university population. *Int J Eating Disord.* 1988;7:413–419.
54. Graham H. Women smokers and family health. *Soc Sci Med.* 1987;25:47–56.
55. Pirie PL, McBride CM, Hellerstedt W, et al. Smoking cessation in women concerned about weight. *Am J Public Health.* 1992;82: 1238–1243.
56. *Guidelines for Adolescent Preventive Services.* Chicago, Ill: American Medical Association; 1992.
57. Nutbeam D, Mavaskill P, Smith C, Simpson J, Catford J. Evaluation of two school smoking educational programmes under normal classroom conditions. *BMJ.* 1992; 306:102–107.
58. De Vries H, Kok GJ. From the determinants of smoking behaviour to the implications for a preventative programme. *Health Educ Res.* 1986;1:85–94.