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Childhood respiratory symptoms and mental health problems: The role of intergenerational smoking

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SUMMARY

Objective—The aim of this study was to investigate the potential role of youth smoking, parental cigarette smoking and parental anxiety/depressive disorders in the relationship between respiratory symptoms and mental health problems among youth.

Working hypothesis—Adjusting for both parental smoking and parental anxiety/depressive disorders in the association between respiratory symptoms and mental health problems among young persons will significantly reduce the strength of the observed relationship.

Study design—Prospective cohort study.

Patient-subject selection—Data were drawn from a school-based sample of 1709 young persons in Oregon.

Methodology—Physical and mental health data were collected on youth.

Results—Respiratory symptoms were associated with significantly increased odds of mental health problems among youth. After adjusting for youth smoking, the relationship between respiratory symptoms and depressive disorders was no longer statistically significant. The relationships between respiratory symptoms and anxiety and depressive disorders were no longer significant after adjusting for parental smoking. Parental anxiety/depressive disorders did not appear to influence these relationships.

Conclusions—These results provide initial evidence that exposure to parental smoking may play a role in the observed co-occurrence of respiratory and mental health problems in youth, and youths' own smoking appears to influence the link with depressive disorders, but not anxiety disorders.

Keywords

Asthma; Epidemiology; Anxiety; Depression; Smoking

INTRODUCTION

In recent years, there have been an increasing number of studies on the association between childhood respiratory health problems and mental health problems. Findings suggesting a

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FINANCIAL DISCLOSURES

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relationship between respiratory problems and anxiety among youth have come from a range of studies. First, clinical studies have shown higher levels of anxiety symptoms among pediatric asthma patients with moderate-to-severe respiratory symptoms compared to youth without any chronic illness and pediatric patients with other chronic medical problems.^{1,2} In addition, studies on pediatric patients receiving psychiatric treatment have found higher than expected levels of respiratory symptoms among youth with anxiety.^{3,4} Second, epidemiologic data have shown an association between respiratory problems and anxiety, depression and suicidal thoughts/behaviors among youth in the community.⁵⁻⁹ Third, longitudinal associations have been found between respiratory symptoms early in life and a range of mental disorders in early adolescence,¹⁰ panic/agoraphobia in later adolescence¹¹ and anxiety disorders in adulthood.¹²

Despite growing evidence showing an association between respiratory health problems and mental health problems among young persons, the potential mechanisms of this association are not known. There are three main possibilities. One, the observed comorbidity could be due to report bias/measurement error. The consistency of results to date suggests that a methodological error is unlikely to be the explanation in that studies have consistently found a link when using a range of measurement strategies for asthma and mental disorders. Two, there could be a causal relationship between the two (in either or both directions).¹³ Three, the comorbidity may be due to shared risk factors for both. Studies to date have failed to find evidence of a causal link between the two,¹⁰ and the weight of the evidence suggests that the association may result from exposure to common risk factors for both. Evidence from a twin study does not tend to support a genetic vulnerability to both.¹⁴ Specifically, one study found that the association between respiratory symptoms and anxiety/depressive disorders was no longer significant after adjusting for a wide range of social, family and environmental factors,¹⁰ yet this study could not identify precisely what factors explained this association. However, this study did not examine all possible common risk factors for respiratory symptoms and mental health problems in youth. Specifically, the role of exposure to parental cigarette smoking, a documented risk factor for respiratory problems in children, in the relationship between respiratory symptoms and depression/anxiety problems in young persons was not examined. Cigarette smoking is also strongly associated with mental disorders among adults,¹⁵ and mental disorders among adults are associated with increased risk of mental problems in offspring.¹⁶ As such, it is conceivable that the co-occurrence of respiratory health problems and mental health problems among youth may be due to intergenerational influences resulting from the co-occurrence of cigarette smoking and anxiety/depressive disorders among parents. Specifically, parental smoking has been shown to result in increased exposure to environmental tobacco smoke (ETS) among youth¹⁷ which is associated with increased risk of respiratory symptoms in infants and children,¹⁸⁻²⁰ and parental anxiety disorders are associated with increased risk of anxiety disorders in offspring, as has been previously demonstrated through a familial/genetic mechanism.²¹⁻²³ In addition, smoking in youth is associated both with increased anxiety/depression^{24,25} and respiratory symptoms.^{26,27} Therefore, youths' own smoking might be a common causal factor related to the co-occurrence of respiratory health problems and anxiety/depressive disorders.

Against this background, the current study proposes to investigate the impact of parental smoking and parental anxiety/depression in the association between childhood respiratory problems and mental health problems. First, we will examine the relationship between respiratory problems and mental health problems among youth. Next, we will examine the impact of parental smoking and anxiety/depression on the strength of this relationship. We will also examine the role of youths' own smoking on this relationship. We hypothesize that adjusting for both parental smoking (as a proxy for ETS) and parental anxiety/depressive

disorders in the association between respiratory symptoms and mental health problems among young persons will significantly reduce the strength of the observed relationship.

MATERIALS AND METHODS

Participants

Participants were originally randomly selected from nine senior high schools in Western Oregon. A total of 1,709 adolescents (ages 14–18; mean age at initial assessment=16.6 years, SD=1.2) completed the initial assessment (Time 1), which consisted of an interview and questionnaires, between 1987 and 1989. Approximately 1 year later (time 2), 1,507 participants (88.2%) participated in a reassessment that used the same interview questions and questionnaires (mean interval between Time 1 and Time 2=13.8 months, SD=2.3) (additional details are provided elsewhere).²⁸ As probands from the Oregon Adolescent Depression Project reached their 24th birthdays, participants with a history of major depressive disorder at Time 2 (N=360), those with a history of non-depressive disorder at Time 2 (N=284), and a subset of those with no history of mental disorder at Time 2 (N=457) were invited to participate in a Time 3 interview.

Of the 1,101 young adults selected for Time 3 interviews, 940 participated (85.4%). Of those participants, 57.2% were female, 89.0% were white, 34.1% were married, 96.8% had graduated from high school, and 31.4% had a bachelor's degree or a higher educational level. Their average age at Time 3 was 24.2 years (SD=0.6). Women were more likely than men to complete the Time 3 assessments (88.9% versus 81.0%) ($\chi^2=13.55$, df=1, N=1,101, $p<0.001$). Differences in Time 3 participation as a function of other demographic characteristics or Time 2 diagnostic status were not significant. For the current analyses, we used data from the first time point as we are interested in early onset of respiratory symptoms and mental health problems, which is most strongly linked to early life exposures. Mental disorders (lifetime) were assessed in parents only at Time 3 and these data were used in conjunction with Time 1 data on youth.

Measures

Youth mental disorders—Participants (youth) were interviewed with a version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS) that combined features of the epidemiologic version²⁹ and the present episode version and included additional items to derive DSM-III-R diagnoses.³⁰ Most diagnostic interviewers had an advanced degree in clinical or counseling psychology or social work, and all were extensively trained before data collection. Inter-rater reliability for lifetime diagnoses in a randomly selected subsample was moderate to excellent: kappa=0.86 for major depressive disorder, and kappa=0.53 for any anxiety disorder at Time 1.

Youth respiratory symptoms—At Time 1, youth respondents were asked (yes/no) whether they had problems with “persistent shortness of breath.” Among those who responded in the affirmative, respondents were asked how often they experienced this symptom on a Likert scale of 1–4. For the purposes of these analyses, those with respiratory symptoms were defined as those who responded that they experienced symptoms most days or every day in the past 12 months, compared with those with infrequent or no symptoms. We used this measure in order to increase the likelihood of capturing a sample with respiratory disease, rather than fleeting symptoms.

Youth cigarette smoking—Participants were asked whether and how often they smoked cigarettes in the past 12 months. Those who smoked cigarettes “daily” were classified as “smokers,” compared with lifetime nonsmokers.

Parental anxiety/depressive disorders and cigarette smoking—Lifetime psychopathology was assessed in the first-degree relatives (older than 13 years) of the participants at Time 3. Diagnostic data were sought from at least two sources, among the family members. Of the 1101 probands selected for a Time 3 interview, family diagnostic information was available for 840 (76%). Of the 940 probands with Time 3 data, family data were available for 802 (85%). Family data were also available for 38 probands who were selected for, but did not complete the Time 3 evaluation. Of the 2750 relatives with diagnostic data, direct interviews were obtained from 1744 (63%). At least two sources of data were available for all but 440 relatives (16%). Inter-rater reliability for major depression ($\kappa=0.94$) any anxiety disorder ($\kappa=0.90$) were quite good. For this report, we only examined diagnostic data on the mother and father of the proband, and only looked at anxiety/depressive disorders and cigarette smoking in mother and/or father (from assessment of nicotine dependence) as a proxy measure for exposure to environmental tobacco smoke.

Statistical Analysis

First, logistic regression analyses were used to calculate odds ratios with 95% confidence intervals examining the relationships between respiratory symptoms and any depressive disorder, any anxiety disorder and major depression. Next, analyses were adjusted for youth smoking and subsequently for parental smoking and for parental anxiety/depressive disorders.

RESULTS

Any anxiety disorder, any depressive disorder and major depressive disorder were significantly more common among those with respiratory symptoms, compared to those without (see Table 1). These associations remained statistically significant after adjusting for age and sex. After adjusting for youth daily smoking, the associations between respiratory symptoms and any depression were no longer statistically significant though the relationship between respiratory symptoms and any anxiety disorder remained. The relationships between respiratory symptoms and mental disorders were not statistically significant after adjusting for parental smoking. Finally, the strength of these relationships was attenuated but remained significant after adjusting for parental anxiety/depressive disorders.

DISCUSSION

The findings of this study are consistent with and extend existing knowledge on the relationship between respiratory symptoms and depressive and anxiety disorders among youth. First, consistent with previous studies, respiratory symptoms are associated with increased depressive and anxiety disorders among young persons. Second, the relationship between respiratory symptoms and anxiety/depressive disorders among youth is no longer statistically significant after adjusting for parental smoking. Third, youths' own smoking appears to explain much of the relationship between respiratory symptoms and depressive disorders in this sample, but the relationship between respiratory symptoms and anxiety disorders appears unaffected by this factor.

Numerous previous studies have observed a link between respiratory health and mental health problems in youth.^{2,3,7–11,31} Our results suggest one possible mechanism contributing to this link: that exposure to parental cigarette smoking may be a common risk factor for both respiratory symptoms and anxiety/depressive disorders, leading to their co-occurrence. This finding is consistent with previous findings on this topic which have failed to find evidence of a causal link between the two and have suggested that common risk factors may explain the association.¹⁰ Yet, no previous study has specifically investigated the role of

parental smoking in this relationship. As such, these findings extend and build on previous work by providing one possible pathway for the intergenerational transmission of these problems. Specifically, risk of respiratory symptoms may increase due to exposure to ETS (due to the presence of parental smoking). In parallel, it may be that the risk of mental health problems is increased among offspring of parents who smoke and may have nicotine dependence. To our knowledge, whether and to what degree nicotine dependence in parents is associated with increased mental health risks in offspring as has been demonstrated for other parental substance use disorders, has not been directly tested. This seems to be an overlooked area that should be addressed in future work. Alternately, it is also possible that exposure to ETS via parental smoking leads to increased risk of depression directly, as a number of recent studies have suggested this link may exist.^{32,33} As these are observational data, they clearly cannot confirm this mechanism, but do offer evidence that is consistent with this pathway being a plausible mechanism. Future studies with more precise measures of ETS and cotinine levels in youth will be needed to further test this pathway and distinguish exposure to ETS vs. youths' own smoking. It is of interest that adjustment for youths' own smoking attenuated the relationship between respiratory symptoms and depressive disorders, but not anxiety disorders. It is conceivable that these may operate via different pathways.

It is less likely that dyspnea/breathlessness is a symptom of major depression per se, and therefore this distinction may be important. Given the persistence of the relationship with anxiety, one of the most interesting findings for future research may be that depression could be associated with respiratory symptoms via smoking whilst other mental health conditions such as anxiety may relate through other pathways.

The results we observe are also biologically plausible, although the present study does not test the pathway at this level. Previous clinical and preclinical work has shown that exposure to ETS is associated with changes in pulmonary functioning^{34–37} and increases the risk of respiratory symptoms in youth where none previously existed. This has also been shown in preclinical studies.^{38,39} There are, however, alternate possible explanations for the observed findings. There could be factors that were not controlled for that are associated with both parental smoking and respiratory symptoms in offspring which actually explain this association. Yet, since we adjusted for SES and previous studies have adjusted for a wide range of social and environmental factors and did not identify any of those factors to explain the link, this explanation seems less likely. It is conceivable that there is a common genetic vulnerability to both respiratory disease and anxiety/depression that explains this association, although to our knowledge, the only study to date on that topic failed to find evidence of a genetic link.¹⁴ Alternatively, it is conceivable that another factor such as prenatal smoking, which is also linked with increased risk of respiratory symptoms in youth^{20,38,40} and with mental health problems in youth^{41,42} may explain the relationship. We were unable to measure prenatal smoking in this study but future studies should investigate this possibility.

Limitations of this study should be considered when interpreting these results. First, maternal and paternal smoking were used as proxies for exposure to ETS. Yet, we cannot be certain of the precise level of exposure since there may be other sources and/or parents may have limited their smoking within the home. Future studies would ideally include environmental data on ETS in examining this mechanism. Second, the onset assessment of parental smoking was retrospective and therefore it is not possible to know definitively when the child may have been exposed to ETS and whether this occurred prior to the onset of respiratory symptoms, since assessment of respiratory symptoms is also retrospective beginning at age nine. As smoking begins in adolescence in the majority of cases, and persists into adulthood, it seems fairly reasonable to believe that parents were smoking for

some years and did not begin just shortly prior to these interviews. Still, replication of this study with data assessing the timing of both respiratory symptoms and parental smoking prospectively from infancy and with greater precision is needed. Third, cell size was too small to look at relationships with anxiety disorders. Specific studies with larger samples will be needed for replication. Fourth, only lifetime prevalence of parental anxiety/depressive disorders were available. We did not find a relationship between parental anxiety/depressive disorders and respiratory symptoms and mental health among offspring, as predicted. This could be related to lifetime/nonspecific timeframe for parental disorders. This pathway could also be genetic (i.e., familial risk of depression),⁴³ and therefore not necessarily dependent on timing of the disorder in relation to offspring. Future studies that can tease out the timing and sequence of these disorders intergenerationally will be informative.

In this study, we examined the impact of exposure to both maternal and paternal smoking (as a proxy for ETS) and parental anxiety/depressive disorders in the co-occurrence of respiratory symptoms and mental health problems among youth. We found that there was an association between respiratory symptoms and mental health problems in youth and that the association between respiratory symptoms and mental health problems in youth was no longer significant after adjusting for parental smoking. As respiratory symptoms/respiratory disease and anxiety/depressive disorders are common, chronic, and debilitating, and having both is shown to be associated with poorer quality of life^{44–51} and higher rates of healthcare use,^{52–68} understanding the mechanism of this link is critical and can be used to inform the development and implementation of programs treating those at highest risk (e.g. youth with parents who smoke and who themselves smoke). Early prevention and intervention in terms of coping and mental health care may help to prevent subsequent problems or limit the severity of mental health problems in vulnerable youth.

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Abbreviations

ETS	environmental tobacco smoke
SD	standard deviation
K-SADS	Schedule for Affective Disorders and Schizophrenia for School-Age Children
df	degrees of freedom
T	time
N	sample size
DSM-III-R	Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised
ADHD	attention deficit hyperactivity disorder
ODD	oppositional defiant disorder
SES	socioeconomic status
OR	odds ratio
AOR	adjusted odds ratio

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Table 1

Respiratory symptoms and mental disorders among youth

	No respiratory symptoms (reference group) n=1605	Respiratory symptoms n=105	OR	AOR ¹	AOR ²	AOR ³	AOR ⁴
Any anxiety disorder	9.47% (152)	26.67% (28)	3.8 (2.19, 5.53)	2.8 (1.57, 4.87)	2.3 (1.2, 4.3)	2.2 (0.99, 4.72)	2.3 (1.19, 4.45)
Any mood disorder	18.94% (304)	40.95% (43)	3.0 (1.97, 4.47)	2.4 (1.42, 3.95)	1.6 (0.9, 2.9)	1.9 (0.97, 3.86)	1.9 (1.08, 3.50)
Major depressive disorder	17.08% (274)	39.05% (41)	3.1 (2.06, 7.70)	2.4 (1.44, 4.00)	1.7 (0.9, 3.1)	1.8 (0.88, 3.52)	1.8 (1.01, 3.32)

AOR¹ – adjusted for sex, ageAOR² – adjusted for sex, age, daily smokingAOR³ – adjusted for sex, age, parental smokingAOR⁴ – adjusted for sex, age, parental depression and anxiety disorders