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A 10-year prospective study of respiratory disease and depression and anxiety in adulthood

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ABSTRACT

Background: Several cross-sectional studies have found an association between respiratory disease and increased mood or anxiety disorders among adults. Little is known about the nature of these associations over time or the role of potential confounders in these links.
Objectives: To investigate the association between respiratory disease and incident and persistent depression or anxiety disorders 10 years later and to examine potential pathways of these associations.
Methods: Data were drawn from the Midlife Development in the United States survey, a representative sample of adults in the United States ages 18 to 74 years. Participants (N = 2,101) were interviewed on a range of health domains at baseline at wave 1 (1994) and again at wave 2 (2005).
Results: Respiratory disease was associated with increased odds of depression and anxiety disorders cross-sectionally at both time points. Respiratory disease at wave 1 was not associated with incident depression or anxiety disorders at wave 2. Respiratory disease at wave 1 was associated with increased odds of persistent depression or anxiety disorders 10 years later among those with depression or anxiety disorders at wave 1. Associations were not explained by differences in demographic characteristics, secondhand smoke exposure, cigarette smoking, or history of exposure to childhood maltreatment.
Conclusion: Findings shed new light on the association between respiratory disease and depression or anxiety disorders. Individuals with respiratory disease appear to have higher prevalence of concurrent depression or anxiety disorders and persistent depression or anxiety disorders compared with those without respiratory disease. However, a history of respiratory disease does not appear to confer increased risk of new onset of depression or anxiety disorders.

Introduction

Numerous studies have documented an association between respiratory disease and mood or anxiety disorders among adults.[1–4] For example, Patten and colleagues[5] found that the presence of major depression at baseline was associated with increased incidence of several persistent medical conditions, including asthma, chronic bronchitis, and emphysema. Depressive symptoms were also found to be positively associated with asthma prevalence and increased the risk of asthma among middle-aged adults.[6] Estimates of depression in patients with chronic obstructive pulmonary disease (COPD) range from 16% to 74%.[7,8] Furthermore, clinical data suggest that depression and anxiety may be associated with poorer treatment outcomes in patients with chronic respiratory health problems (eg, COPD).[9–12]

Several questions remain about the nature of these associations over time. It is not known whether having a respiratory disease is associated with subsequent onset of depression or anxiety or with the persistence of depression or anxiety among individuals. In addition, mood or anxiety disorders and some respiratory diseases, such as asthma, are thought to have variable waxing and waning courses, spanning years or decades,[13,14] making the nature of these associations over time even more challenging to discern. Understanding these long-term links has potentially profound implications for early intervention and prevention of secondary mental health comorbidity among those with physical conditions. For

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example, if respiratory disease confers an increased risk of mental health problems among adults, screening could be implemented in both general and specialty practices. This could have significant implications for the diagnosis of depression in various clinical practices, which is among the most commonly underdiagnosed major health problems worldwide.[15]

Further compounding the assocation between respiratory disease and depression or anxiety are a number of potentially mediating factors. Cigarette smoking is strongly linked with depression and anxiety and is a risk factor for adult-onset respiratory disease (eg, adult-onset asthma, chronic bronchitis, COPD)[16–19]; however, in a study on smokers, no clear association was found between depression or anxiety and asthma, suggesting further investigation is necessary.[5] Exposure to secondhand smoke is also suggested to be a risk factor for both respiratory disease and depression or anxiety.[20,21] Moreover, studies have found associations between more distal factors, such as exposure to trauma (eg, childhood physical abuse) and increased risk of both respiratory disease and depression or anxiety disorders. A comprehensive investigation into possible pathways of these associations is needed and should include both distal and proximal factors.

The current study had three aims. First, the study investigated cross-sectional associations between respiratory disease and depression or anxiety at 2 time points: wave 1, which occurred from 1994 to 1995, and wave 2, which occurred from 2005 to 2006 (to confirm previous findings). Second, the study examined the association between respiratory disease at wave 1 (1994) and incident depression or anxiety disorders among adults in the community 10 years later at wave 2 (2005) and persistent depression or anxiety disorders among adults in the community 10 years later at wave 2 (2005). Finally, the study assessed demographic characteristics, secondhand smoke exposure, and exposure to childhood physical abuse as possible confounders and cigarette smoking as a possible mediator of these associations among adults in the United States.

Methods

Data were drawn from the 2 waves of the Midlife Development in the United States (MIDUS) survey.[22] The University of Wisconsin Institutional Review Board approved the study. The MacArthur Midlife Research Network conducted the first phase of data collection (wave 1) from 1994 to 1995, which consisted of a nationally representative multistage probability sample (main sample) of community-dwelling English speakers in the continental United States (n = 3,485). Participants completed a 30-minute telephone interview, and a self-administered questionnaire was mailed to them. Approximately 70% of participants who took part in the first phase (wave 1) partcipated in the second phase (wave 2), which occurred between 2004 and 2006. Surveys taken during wave 2 were conducted by the Institute on Aging at the University of Wisconsin–Madison supported by the National Institute on Aging between 2004 and 2006. Respondents who participated in the telephone interview were mailed a self-administered questionnaire. The response rate from the mailed questionnaire was 86.6%, yielding an overall response rate of 61% and an overall sample size of 3,302 for the wave 1 main sample. Of the 3,032 respondents from wave 1, a total of 2,101 completed the wave 2 telephone surveys (response rate of 69.5%). For this study, wave 1 data were drawn from respondents who completed the telephone and mail surveys, and Wave 2 data were drawn from respondents who completed the telephone interviews only. We analyzed only data from those who participated in the wave 1 main sample who completed both the telephone and mail-in surveys, participated in the wave 2 survey, and had complete information for wave 2 outcome variables (N = 2,101).

Respiratory Disease

The MIDUS wave 1 and 2 included questions regarding the presence of 27 health problems or medical conditions during the preceding 12 months. All these questions began with the same stem ("In the past 12 months, have you experienced or been treated for …?"). The question concerning "asthma, bronchitis or emphysema" was used to determine the presence or absence (presence = 1, absence = 0) of "respiratory disease" in the past 12 months at each wave.

Depression and Anxiety Disorders

Major depression, generalized anxiety disorder (GAD), and panic attacks in the MIDUS were based on the Composite International

Table 1
Demographic correlates of remitted, adult-onset, and persistent RD among adults

Characteristic	No RD wave 1, No. (%)[a] (n = 1352)	RD wave 1, No. (%) (n = 111)	OR (95% CI)[b]	RD wave 2, No. (%) (n = 129)	OR (95% CI)[b]	RD wave 1 and wave 2, No. (%) (n = 89)	OR (95% CI)[b]
Age, mean (SD), y	45.4 (12.8)	46.6 (12.7)	1.0 (0.99–1.0)	47.7 (12.0)	1.0 (0.99–1.03)	44.8 (12.8)	0.99 (0.97–1.01)
Sex							
Male	636 (47.0)	34 (30.9)	1.0	56 (43.3)	1.0	18 (20.5)	1.0
Female	716 (53.0)	76 (69.1)	**1.98 (1.30–3.01)**	73 (56.6)	1.15 (0.80–1.66)	70 (79.5)	**3.45 (2.03–5.86)**
Race							
Black	74 (5.5)	6 (5.5)	0.98 (0.42–2.33)	10 (7.9)	1.44 (0.42–2.87)	3 (3.7)	0.71 (0.22–2.33)
Native American	6 (0.4)	0	0	2 (1.6)	3.56 (0.71–17.87)	2 (2.4)	**5.89 (1.16–29.73)**
Asian or Pacific Islander	11 (0.8)	0	0	1 (0.8)	0.97 (0.12–7.60)	3 (3.7)	**4.82 (1.31–17.68)**
Other	21 (1.6)	0	0	0	0	4 (4.9)	**3.36 (1.12–10.08)**
Multiracial	5 (0.4)	3 (2.8)	**7.32 (1.72–31.07)**	0	0	1 (1.2)	3.53 (0.40–30.68)
White	1,220 (91.2)	100 (91.7)	1.0	114 (89.8)	1.0	69 (84.1)	1.0
Educational level							
Some grade school	161 (11.9)	12 (10.8)	1.0	28 (21.9)	1.0	19 (21.6)	1.0
High school graduate	453 (33.5)	38 (34.2)	1.12 (0.57–2.20)	39 (30.5)	**0.49 (0.29–0.83)**	22 (25.0)	**0.41 (0.21–0.78)**
Some college	361 (26.7)	31 (27.9)	1.15 (0.57–2.30)	32 (25.0)	**0.51 (0.29–0.87)**	26 (29.5)	0.61 (0.32–1.13)
BS+	206 (15.2)	19 (17.1)	1.23 (0.58–2.62)	19 (14.8)	**0.53 (0.28–0.98)**	12 (13.6)	0.49 (0.23–1.04)
Marital status							
Married	956 (70.7)	66 (60.0)	1.0	85 (66.4)	1.0	51 (58.6)	1.0
Separated	21 (1.6)	1 (0.9)	0.69 (0.09–5.20)	1 (0.8)	0.53 (0.07–4.03)	2 (2.3)	1.78 (0.40–7.82)
Divorced	180 (13.3)	26 (23.6)	**2.09 (1.29–3.38)**	27 (21.1)	**1.68 (1.06–2.67)**	21 (24.1)	**2.18 (1.28–3.72)**
Widowed	96 (7.1)	12 (10.9)	1.81 (0.94–3.46)	7 (5.5)	0.82 (0.36–1.82)	7 (8.0)	1.36 (0.60–3.09)
Never narried	99 (7.3)	5 (4.5)	0.73 (0.28–1.85)	8 (6.2)	0.90 (0.42–1.93)	6 (6.9)	1.13 (0.47–2.71)

Abbreviations: CI, confidence interval; OR, odds ratio; RD, respiratory disease.
[a]Comparison group.
[b]Bold values indicate $P < .05$.

Table 2
RD and depression or anxiety disorders at wave 1

Variable	No RD at wave 1, No. (%) (n = 1810)	RD at wave 1, No. (%) (n = 242)	OR (95% CI)[a]	AOR[a,b] (95% CI)	AOR[a,c] (95% CI)	AOR[a,d] (95% CI)
Physical activity at wave1	96 (5.3)	44 (18.2)	**4.0 (2.7–5.8)**	**3.6 (2.4–5.3)**	**4.3 (2.9–6.4)**	**4.6 (3.0–7.2)**
MDD at wave 1	235 (13.0)	61 (25.2)	**2.3 (1.6–3.1)**	**2.1 (1.5–2.9)**	**2.2 (1.6–3.1)**	**2.1 (1.5–3.1)**
GAD at wave 1	54 (3.0)	15 (6.2)	**2.1 (1.2–3.9)**	**1.9 (1.02–3.4)**	**2.1 (1.2–3.9)**	**2.5 (1.3–4.7)**

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; GAD, generalized anxiety disorder; MDD, major depressive disorder; OR, odds ratio; RD, respiratory disease.
[a]Bold values indicate $P < .05$.
[b]Adjusted for age, sex, and educational level.
[c]Adjusted for history of childhood physical abuse.
[d]Adjusted for daily cigarette smoking at wave 1.

Diagnostic Interview–Short Form (CIDI-SF) scales, a diagnostic-specific scale that was developed from item-level analyses of the CIDI questions used in the National Comorbidity Survey.[23] The CIDI-SF scales were designed to reproduce the full CIDI diagnoses as exactly as possible, with only a small subset of the original questions. Validity data suggest a strong association between diagnoses based on the CIDI-SF and the full CIDI.[24] Past 12-month major depression, GAD, and panic attacks were assessed using the CIDI-SF depression scale in waves 1 and 2.

Child Abuse

Physical abuse categories were modeled after the Conflict Tactics Scale,[23] using 15 different item measures from the MIDUS self-administered questionnaire. Respondents were asked how frequently their mother or father had engaged in physical abuse or aggression (eg, "smashed or kicked something in anger" or "pushed, grabbed, or shoved" them). Response categories ranged in frequency from *never* to *often* for each parent; respondents who reported experiencing abuse as *sometimes* or *often* were coded as 1, and those who reported experiencing abuse as *never* or *rare* were coded as 0.

Cigarette Smoking and Secondhand Smoke

Participants were asked whether they were "currently regular cigarette smokers—meaning at least a few cigarettes a day" at waves 1 and 2. At wave 2, participants were asked whether they currently lived with someone who smokes regularly in the home. Those who answered in the affirmative were considered positive for secondhand smoke exposure in adulthood (for wave 2 analyses).

Statistical Analysis

Logistic regression was used to determine differences in demographic characteristics between those with and without respiratory disease at wave 1, wave 2, and both waves 1 and 2 (persistent respiratory disease) and provide estimates of the association between respiratory disease at wave 1 and panic attacks, depression, and GAD at wave 1. Analyses were adjusted for age, sex, and educational level and subsequently for childhood physical abuse and daily cigarette smoking at wave 1. Analogous cross-sectional analyses were run for wave 2. Similar procedures were used to examine the association between respiratory disease at wave 1 and new onset of panic attacks, depression, and GAD at wave 2. Logistic regression was also used to estimate the association between respiratory disease at wave 1 and persistence of panic attacks, depression, and GAD at wave 2 among those with these disorders at wave 1. Analyses were adjusted for demographic differences, adulthood exposure to secondhand smoke, childhood physical abuse, and daily cigarette smoking.

Results

Respiratory Disease and Demographic Characteristics

Demographic characteristics and respiratory disease diagnoses for study participants in wave 1 and 2 samples are reported in Table 1. Significantly more females had respiratory disease at wave 1 (odds ratio [OR], 1.98; 95% confidence interval [CI], 1.30–3.01) and persistent respiratory disease (wave 1 and 2 time points) (OR, 3.45; 95% CI, 2.03–5.86). Significantly fewer individuals of Native American and Asian/Pacific Islander descent reported persistent respiratory disease (OR, 5.89; 95% CI, 1.16–29.73; OR, 4.82; 95% CI, 1.31–17.68); and (OR, 3.36; 95% CI, 1.12–10.08, respectively), and there was a greater prevalence of multiracial individuals reporting respiratory disease at wave 1 in our sample (OR, 7.32; 95% CI, 1.72–31.07). Individuals with respiratory disease at wave 2 had significantly less education, and significantly fewer individuals with persistent respiratory disease had graduated high school (OR, 0.41; 95% CI, 0.21–0.78). Higher rates of respiratory disease were found among divorced individuals at wave 1 (OR, 2.09; 95% CI, 1.29–3.38), wave 2 (OR, 1.68; 95% CI, 1.06–2.67), and waves 1 and 2 (OR, 2.18; 95% CI, 1.28–3.72). Last, individuals with persistent respiratory disease reported greater rates of major depressive disorder at wave 1 (OR, 3.02; 95% CI, 1.87–4.89) and wave 2 (OR, 4.09; 95% CI, 2.54–6.60) and panic attacks at wave 1 (OR, 5.15; 95% CI, 2.96–8.95) and wave 2 (OR, 3.06; 95% CI, 1.68–5.57).

Respiratory Disease and Wave 1 Depression or Anxiety

Respiratory disease at wave 1 was associated with significantly increased odds of panic attacks, depression, and GAD at wave 1

Table 3
RD and depression or anxiety disorders at wave 2

Variable	No RD at wave 2, No. (%) (n = 1526)	RD at wave 2, No. (%) (n = 227)	OR (95% CI)[a]	AOR (95% CI)[a,b]	AOR (95% CI)[a,c]	AOR (95% CI)[a,d]	AOR (95% CI)[a,e]
Physical activity at wave 2	99 (6.5)	30 (13.2)	**2.2 (1.4–3.4)**	**2.0 (1.3–3.1)**	**2.3 (1.5–3.6)**	**2.2 (1.4–3.5)**	**2.1 (1.3–3.5)**
MDD at wave 2	170 (11.1)	57 (25.1)	**2.7 (1.9–3.8)**	**2.5 (1.7–3.5)**	**2.7 (1.9–3.9)**	**2.8 (1.9–4.0)**	**2.3 (1.6–3.5)**
GAD at wave 2	42 (2.8)	16 (7.0)	**2.7 (1.5–4.9)**	**2.4 (1.2–4.5)**	**2.6 (1.4–4.9)**	**3.7 (1.9–7.1)**	**2.8 (1.4–5.5)**

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; GAD, generalized anxiety disorder; MDD, major depressive disorder; OR, odds ratio; RD, respiratory disease.
[a]Bold values indicate $P < .05$.
[b]Adjusted for age, sex, and educational level.
[c]Adjusted for adult exposure to secondhand smoke.
[d]Adjusted for history of childhood physical abuse.
[e]Adjusted for daily cigarette smoking at waves 1 and 2.

Table 4
RD at wave 1 and depression or anxiety disorders at wave 2

Variable	No RD at wave 1, No. (%) (n = 1574)	RD at wave 1, No. (%) (n = 181)	OR (95% CI)
New-onset MDD at wave 2	132 (8.4)	18 (9.9)	1.2 (0.7–2.0)
New-onset physical activity at wave 2	88 (5.1)	14 (7.1)	1.4 (0.8–2.5)
New-onset GAD at wave 2	35 (2.0)	6 (2.6)	1.3 (0.6–3.2)

Abbreviations: CI, confidence interval; GAD, generalized anxiety disorder; MDD, major depressive disorder; OR, odds ratio; RD, respiratory disease.

(Table 2). These associations were slightly, but not substantially, affected by adjusting for demographic characteristics (eg, age, sex, educational level), past physical abuse, and daily cigarette smoking at wave 1.

Respiratory Disease and Wave 2 Depression or Anxiety

Respiratory disease at wave 2 was associated with significantly increased odds of panic attacks, depression, and GAD at wave 2 (Table 3). These associations were slightly, but not substantially, affected by adjusting for demographic characteristics (eg, age, sex, educational level), past physical abuse, daily cigarette smoking, and adult exposure to secondhand smoke.

Wave 1 Respiratory Disease and Wave 2 Depression or Anxiety

Respiratory disease at wave 1 was not associated with increased odds of panic attacks (OR, 1.4; 95% CI, 0.8–2.5), major depression (OR, 1.2; 95% CI, 0.7–2.0), or GAD (OR, 1.3; 95% CI, 0.6–3.2) (among those without a history of the respective disorder at wave 1) at wave 2. Slightly but not significantly greater percentages of new-onset panic attacks (7.1%), major depression (9.9%), and GAD (2.6%) were reported at wave 2 compared with 5.1%, 8.4%, and 2.0% of those without reported respiratory disease, respectively (Table 4).

Wave 1 Respiratory Disease at Wave 1 and Wave 2 Persistent Depression or Anxiety

Among those with depression and GAD at wave 1, respiratory disease at wave 1 was associated with significantly increased odds of persistence of depression and GAD, respectively, at wave 2 (Table 5). These associations remained significant after adjusting for confounders (eg, age, sex, educational level, history of physical abuse, and adult exposure to secondhand smoke) and daily cigarette smoking. Among those with panic attacks at wave 1, respiratory disease at wave 1 was not associated with persistence of panic attacks at wave 2.

Discussion

This study had 3 aims: (1) to confirm associations between respiratory disease and depression or anxiety disorders cross-sectionally using a nationally representative sample, (2) to investigate the association between respiratory disease and depression or anxiety disorders 10 years later and the persistence of depression or anxiety disorders; and (3) to investigate the role of potential confounders and mediators in these associations. Consistent with previous studies, we found significant associations between respiratory disease and depression or anxiety disorders cross-sectionally at both waves. This finding extends prior knowledge by suggesting that, among individuals without a history of depression or anxiety, respiratory disease is not associated with onset of depression or anxiety disorders 10 years later. However, among those with depression or anxiety disorders, respiratory disease appears to be a strong predictor of the persistence of depression and GAD 10 years later. This association is not found for panic attacks.

Our findings that respiratory disease is associated with persistence of depression or anxiety is also supported by the literature on other medical illnesses, such as diabetes mellitus, cardiovascular disease, cancer, and cerebrovascular disease.[24,25] Whereas the prevalence rate of depression in the general population is approximately 6.7%,[26] patients with chronic medical illnesses were found to have 2 to 3 times higher rates of major depresssion than age- and sex-matched controls.[27–29] Patients with diabetes had estimated prevalence rates of depression of 12% to 18%,[27] and those with coronary heart disease had prevalence rates of 15% to 23%.[28,29] Individuals with cancer have similarly higher prevalence rates of depression compared with the general population (22%–29%).[25] Although less is known about the association between anxiety disorders and chronic medical illnesses, researchers have found similar results, with studies indicating significant associations between anxiety disorders and cardiac disorders, hypertension, gastrointestinal problems, genitourinary disorders, and migranes.[30,31]

On the basis of the signficant cross-sectional associations reported in the literature and in the current study, screening measures for depression and GAD may be suggested in primary care or specialized respiratory disease clinics. Health care costs and medical care use are higher among patients with depression and GAD than among those with subthreshold or no psychiatric diagnoses, even when controlling for medical comorbidity.[32] Therefore, targeting this population, in which we have demonstrated a 10-year—and perhaps longer—persistence of psychiatric disorders, may have substantial cost-saving benefits.

The lack of an observed association between respiratory disease and persistence of panic attacks at wave 2 is also of note because panic attacks are commonly observed among patients with anxiety disorders.[33] Studies have suggested that symptoms of respiratory disease, such as difficulty breathing and elevated levels of perceived breathlessness during bronchoconstriction, result in increased risk of panic.[34] Alternatively, an association via anxiogenic treatments for respiratory diseases (eg, glucocortioids and β-adrenergic agnoists) has been suggested.[35] Taken together, these findings suggest that respiratory disease likely predisposes individuals to later

Table 5
RD at wave 1 and persistence of depression or anxiety disorders at wave 2 (among those with disorders at wave 1)

Variable	No RD at wave 1, No. (%) (n = 1574)	RD at wave 1, No. (%) (n = 181)	OR (95% CI)[a]	AOR (95% CI)[a,b]	AOR (95% CI)[a,c]	AOR (95% CI)[a,d]	AOR (95% CI)[a,e]
MDD at time 2	74 (31.5)	(34) 55.7%	**2.7 (1.5–4.9)**	**2.5 (1.4–4.6)**	**3.2 (1.5–5.1)**	**2.8 (1.5–5.1)**	**2.6 (1.5–4.8)**
Physical activity at time 2	30 (31.2)	(16) 35.6%	1.2 (0.6–2.6)	1.2 (0.5–2.5)	1.6 (0.6–4.2)	1.3 (0.6–2.8)	1.2 (0.5–2.5)
GAD at time 2	7 (12.7)	(9) 60.0%	**10.3 (2.0–37.8)**	**14.7 (3.0–71.4)**	**9.7 (2.1–44.7)**	**11.8 (2.8–49.1)**	**16.1 (3.5–73.1)**

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; GAD, generalized anxiety disorder; MDD, major depressive disorder; OR, odds ratio; RD, respiratory disease.
[a]Bold values indicate $P < .05$.
[b]Adjusted for age, sex, and educational level.
[c]Adjusted for adult exposure to secondhand smoke.
[d]Adjusted for history of childhood physical abuse.
[e]Adjusted for daily cigarette smoking at wave 1 and wave 2.

incident or persistent panic attacks. Further analysis is needed regarding the association between respiratory disease and panic attacks and the potential pathophysiologic pathways involved.

Regarding the third study aim, the observed associations between respiratory disease and depression or anxiety do not appear to be fully explained by the confounders or mediators measured in this study. Our results suggest that the observed association between respiratory disease and depression or anxiety are not significantly affected by age, sex, educational level, or childhood abuse, which suggests that interventions aimed at decreasing the persistence or exacerbation of mental illnesses might be generalized to target a broader population. Furthermore, although the literature has suggested strong associations between smoking and depression, panic attacks, and respiratory disease,[14,19–21,36] we did not find adult secondhand smoke exposure to confound the association, and the association was not mediated by cigarette smoking in adulthood.

This study has several limitations. First, several study variables (eg, nature of lung disease, mental illness, child abuse, and smoking history) were assessed by self-report. We were unable to objectively confirm patients' reports of respiratory diseases and mood disorders. Second, the respiratory disease variable failed to discriminate among asthma, bronchitis, and emphysema, which may confound our understanding of disease progression. There may be clinically important differences in the pathways by which anxiety and depression influence outcomes in asthma vs COPD due to the episodic and reversible nature of asthma exacerbations versus the chronic and progressive dyspnea experienced in COPD. Nevertheless, some similarities may exist in these associations in that higher levels of anxiey have been linked to higher levels of perceived dyspnea in both asthma[37] and COPD.[38] Future studies should tease apart the independent effects of anxiety and depression on asthma from COPD. The use of a dichotomized variable limits the interpretability of the data in that we are unable to assess whether certain respiratory illnesses or variable severity of these illnesses are more closely associated with depression and anxiety. In addition, use of this measure instead of alternative means of assessing respiratory disease (eg, physician diagnosis of asthma) may underestimate the percentage of individuals with respiratory disease; those with mild asthma not treated for symptoms in the past year may select a negative response, thus being incorrectly excluded from the respiratory disease category. Third, although this study was longitudinal, only 2 time points were available. Therefore, a comprehensive understanding of the nuances of associations observed was not possible. For example, it is unclear whether wave 2 data represent disease improvement, worsening, or typical waxing and waning of disease morbidity. Fourth, we were limited in possible confounders that could be measured and adjusted for. Future studies on the association between respiratory disease and mental health should include additional factors, such as obesity, physical exercise, alcohol consumption, family history of mood disorders, and other trauma-related variables that may have contributed to the development of anxiety or depression.

Future studies investigating disease-specific associations, causality, and the pathophysiologic pathways are needed, and greater knowledge regarding the associations between respiratory disease and mood or anxiety disorders may assist in implementing preventive measures clinically. Use of objective measures of pulmonary function and desease-specific diagnoses may be helpful in describing the associations between respiratory disease morbidity and psychiatric disorders. Similarly, use of a study design with a greater number of assessment time points will likely provide increased understanding of the nature of these demonstrated associations. Last, future studies are needed to explain the underlying mechanism of these associations.

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