

# Mental Disorders and Asthma in the Community

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**Objective:** To determine the association between asthma and mental disorders among adults in the community.

**Setting:** Germany.

**Participants:** Representative sample of the general population aged 18 to 65 years.

**Main Outcome Measures:** Diagnoses of current (the past 4 weeks) and lifetime asthma were based on physician diagnosis; current and lifetime *DSM-IV* mental disorders were assessed using the Composite International Diagnostic Interview.

**Results:** Current severe asthma (the past 4 weeks) was associated with a significantly increased likelihood of any anxiety disorder (odds ratio [OR], 2.65; 95% confidence interval [CI], 1.35-5.18), specific phobia (OR, 4.78; 95% CI, 2.35-4.05), panic disorder (OR, 4.61; 95% CI, 1.09-9.4), and panic attacks (OR, 4.12; 95% CI, 1.32-12.8). Lifetime severe asthma was associated with the increased likelihood of any anxiety disorder (OR, 2.09; 1.3-3.36), panic disorder (OR, 2.61; 95% CI, 1.29-5.25), panic attacks (OR, 2.84; 95% CI, 1.66, 4.89), social phobia (OR, 3.28; 95% CI, 1.42, 7.59),

specific phobia (OR, 2.93; 95% CI, 1.71-5.0), generalized anxiety disorder (OR, 5.51; 95% CI, 2.29-13.22), and bipolar disorder (OR, 5.64; 95% CI, 1.95-16.35). Current nonsevere asthma was associated with the increased likelihood of any affective disorder (OR, 2.42; 95% CI, 1.03-5.72); and lifetime nonsevere asthma was associated with increased odds of any anxiety disorder (OR, 1.51; 95% CI, 1.0-2.32), anxiety disorder not otherwise specified (OR, 2.08; 95% CI, 1.03-4.23), and any somatoform disorder (OR, 1.7; 95% CI, 1.14-2.53).

**Conclusions:** To our knowledge, these findings are consistent with and extend the findings of previous reports by providing the first available information on the association between physician-diagnosed asthma and *DSM-IV* mental disorders in a representative population sample of adults. Our results suggest an association between asthma and a range of mental disorders. Longitudinal studies that can examine the sequence of onset and the role of genetic and environmental factors in the association between asthma and affective and anxiety disorders are needed next to further elucidate possible shared causative mechanisms.

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**P**REVIOUS DATA from clinical and community settings suggest that asthma and mental disorders co-occur more often than would be expected by chance.<sup>1-15</sup> Several studies have found elevated rates of anxiety disorders, including panic attacks and symptoms of generalized anxiety disorder (GAD), among clinical samples of patients with asthma.<sup>1-10,14,16</sup> Several studies have also noted elevated rates of asthma among psychiatric inpatients and outpatients with anxiety disorders.<sup>11</sup> For instance, Koltek et al<sup>11</sup> found a higher than expected rate of asthma among adolescent psychiatric inpatients who have posttraumatic stress disorder. Further, a growing number of epidemiological

studies among adults and youths have found linkages between asthma and mental disorders.<sup>12,13</sup> In a recent study, an association between respiratory diseases and panic attacks was documented among adults in the United States.<sup>15</sup> Ortega et al<sup>12</sup> similarly found higher rates of social phobia, separation anxiety disorder, and overanxious disorder among 1285 youths with asthma in the community compared with their nonasthmatic peers and compared with youths with other chronic medical illnesses.

While most evidence to date suggests a link between asthma and mental disorders,<sup>1-15</sup> several methodological features of previous studies limit the generalizability of these data. First, previous community-based studies have relied on

**Table 1. Study Physician's Decisions in Making the Asthma Diagnosis and Asthma Severity\***

Response in Self-report Questionnaire	Physician's Decision on Lifetime Asthma Diagnosis		Total
	Yes	No	
Yes	213	62	275
No	13	3729	3742
Don't know or missing	10	154	164
<b>Total</b>	<b>236</b>	<b>3945</b>	<b>4181</b>

\*Physician's decisions were made on the basis of the following questions: (1) "Did you ever receive an asthma diagnosis by a physician (physicians generally trained for epidemiological studies, ie, no specialized pulmonologists)?" (2) "If yes, how was this assessed?" (Clinical interview only, additional respiratory function test and/or additional allergy test.) (3) "What kind of asthma was diagnosed?" (allergic, nonallergic, or mixed) (4) "Did you utilize 1 of the following services owing to an asthma attack within the last 12 months: Hospital? Emergency? Doctor?" (no, once, more than once) (5) "Do you take corticosteroid medication owing to asthma?" (no, occasionally, constantly) (6) "Did you experience asthma attacks as life threatening?" (never, rarely, often) (7) "How many asthma attacks did you have within the last 12 months?" (none, 1-3, 4-12, >12, daily). To differentiate between severe and nonsevere asthma in further analyses, we assigned the label "severe asthma" if at least 1 of the following was present: hospital or emergency room admittance owing to asthma within the last 12 months, taking corticosteroid medication constantly, having experienced asthma attacks as life threatening, or having had more than 12 asthma attacks within the last 12 months. This resulted in 93 cases of severe asthma (39% of lifetime cases and 51% of the current [the past 4 weeks] cases).

self-report diagnoses of asthma rather than based on clinical examination by a physician. Therefore, findings to date may be influenced by self-bias. Second, previous community-based studies have reported on a limited number of mental disorders and psychiatric symptoms, yet there is no available information on the association between asthma and the range of mental disorders in adults. Third, it is also possible that information bias related to help seeking could influence the knowledge about a diagnosis of asthma on which epidemiological prevalence studies are based. The goal of the current study was to investigate the relationship between asthma and mental disorders among adults in the community, overcoming limitations of previous studies. Specifically, the study will examine the relationship between asthma and mental disorders (current [the past 4 weeks] and lifetime), using physician-diagnosed asthma and mental disorders assessed with a well-validated structured interview, among adults in a representative community sample.

## METHODS

### SAMPLE

The sample of this core survey was drawn from the population registries of subjects aged 18 to 79 years living in Germany in 1997. It represents a stratified random sample from 113 communities throughout Germany with 130 sampling units. The first sampling step was the selection of communities; the second step was the selection of sampling units; and the third step was the selection of the inhabitants. As a result a representative gross sample of 13 222 persons were eligible according to the age, sex, and community-type criteria. The response

rate (completing the total assessment) was 61.4% (n=7124). The response rate including subjects completing only parts of the assessment was 77.8%. Reasons for nonparticipation, analyses of nonrespondents, and further information on samples and weighting are provided elsewhere.<sup>17</sup>

Mental disorders were assessed using the German National Health Interview and Examination Survey–Mental Health Supplement (GHS-MHS).<sup>18</sup> For financial and logistical reasons, data on mental disorders were gathered using a 2-stage design. The first stage entailed the administration of a screening questionnaire for mental disorders at the end of the medical examination for the core survey described earlier. The second stage involved the administration of a complete, structured, clinical interview used to obtain DSM-IV mental disorder diagnoses to all participants from the core survey who screened positive and 50% of those who screened negative for a mental disorder. Owing to the resulting oversampling of those who screened positive on the GHS-MHS, data were weighted in the later analyses. Most interviews occurred within 2 to 4 weeks of the core survey medical examination to ensure that data gathered in both examinations were contemporaneous.

The GHS-MHS included only persons from the age of 18 to 65 years. Core survey participants aged 66 to 79 years were excluded because the psychometric properties of the Composite International Diagnostic Interview (CIDI) have not yet been satisfactorily established for use in older populations.<sup>19</sup> The conditional response rate of the GHS-MHS was 87.6%, resulting in a total of 4181 respondents (aged 18-65 years) who completed both the core survey (physical assessment) and GHS-MHS. A detailed description of the design and methods of both the core survey and GHS-MHS is available elsewhere.<sup>18</sup>

## MEDICAL ASSESSMENT

In brief, the core survey consisted of (1) a self-report questionnaire, (2) a standardized computer-assisted medical interview, (3) anthropometric and blood pressure measurements and the collection of blood and urine samples, and (4) a screening for mental disorders, which served as the first stage of the GHS-MHS (see "Sample" subsection of the "Methods" section). The examination occurred in special centers at the study sites and started with a self-report questionnaire to evaluate subjects' current and past somatic symptoms and complaints, health care utilization, and impairments and disabilities.

Completion of the questionnaires was followed by a structured interview by a study physician to reexamine and reevaluate these data from the self-report packet. This interview was computer assisted for standardization and integrity purposes. Diagnoses of physical disorders were then made. These diagnoses were revised on the basis of the laboratory test results that became available 2 weeks later. The mean period of the overall assessment was 2 hours.

## ASTHMA DIAGNOSIS

After the study physician, who was trained to assess a variety of medical conditions in epidemiological studies but was not a pulmonologist, had reviewed the self-report questionnaires ("yes," "no," or "don't know" to the question: "Do you have asthma?"), a standardized, specific examination for the presence of asthma was carried out as described in **Table 1**. Each study physician's interview resulted in a diagnostic decision as to whether a specific disorder had been present during the last 4 weeks (current) or anytime before (lifetime). As given in Table 1, study physicians assigned an asthma diagnosis to 13 participants who did not report having asthma on the self-report questionnaire and to 10 participants who had said they did not know whether they had asthma. Sixty-two of the participants who

had self-reported asthma diagnoses were reassigned by study physicians to the category of “no asthma” cases. As the severity of asthma may play a role in the association with mental disorders, the asthma group was dichotomized into “severe” and “nonsevere” (ie, asthma diagnosis present but not severe).

#### ASSESSMENT OF MENTAL DISORDERS

Psychopathological and diagnostic assessments were based on the computer-assisted version of the Munich Composite International Diagnostic Interview (DIA-X/M-CIDI).<sup>19-21</sup> The DIA-X/M-CIDI is a modified version of the World Health Organization CIDI, Version 1.2, supplemented with questions to cover *DSM-IV* and *International Classification of Diseases, 10th Revision* criteria. The DIA-X/M-CIDI is a fully structured interview that allows for the assessment of symptoms, syndromes, and 4-week and lifetime diagnoses of *DSM-IV* mental disorders.<sup>22</sup> Statistical comparisons were performed between asthma and the following diagnoses: substance disorders (abuse or dependence of any substance without nicotine), affective disorders (unipolar major depression–dysthymia or bipolar disorders), anxiety disorders (panic disorder with or without agoraphobia), social phobia, any specific phobia, other phobias (agoraphobia without panic attacks or anxiety disorder not otherwise specified), GAD, somatoform disorders (somatization disorder, subthreshold somatization disorder, somatoform pain disorder, or hypochondriasis). For anxiety disorders, lifetime diagnoses were only available for panic disorder, while 12-month diagnoses were available for social phobia, specific phobia, agoraphobia, GAD, and anxiety disorder not otherwise specified.

As the severity of impairment associated with mental disorders may also be related to the strength of the association with asthma, we introduced an additional severity criterion and created a variable to assess any severe mental disorder. Included are all of the above diagnoses that fulfill at least 1 of the following additional requirements: (1) reported disability or productivity cutback due to emotional problems within the 4 weeks prior to core survey or GHS-MHS; (2) having sought professional help due to mental health problems; or (3) having been recommended to seek professional mental health treatment by a health care professional.

#### ANALYTIC STRATEGY

Multiple logistic regression analyses were used to determine the association between current and lifetime nonsevere and severe asthma and each mental disorder assessed during the corresponding period. Associations between asthma and severe mental disorders were computed using the same procedure. Age, sex, and sampling weights were adjusted for in each analysis to produce estimates generalizable to the population. To account for the weighting scheme as well as the stratified sampling design by screening status, 95% confidence intervals (CIs) were calculated by the Huber-White sandwich method.<sup>23-25</sup> This was done with *Stata Statistical Software: Release 6.0*.<sup>26</sup>

### RESULTS

#### PREVALENCE AND SOCIODEMOGRAPHIC CHARACTERISTICS ASSOCIATED WITH ASTHMA

The prevalence of asthma was 2.7% (current) and 5.74% (lifetime), which is consistent with prevalence estimates from other Western countries.<sup>27</sup> Respondents with current asthma did not differ significantly from those without asthma for age (mean [SD], 41.1 [14.0] years), sex (59% female vs 41% male patients), marital status (58%

married, 4% separated, 28% single, 6% divorced, and 4% widowed), and social class (29% lower, 50% middle, and 21% upper classes<sup>28</sup>).

#### ASSOCIATION BETWEEN ASTHMA AND MENTAL DISORDERS

Current (the past 4 weeks) nonsevere asthma was associated with the increased likelihood of any affective disorder (odds ratio [OR], 2.42; 95% CI, 1.03-5.72) and any severe mental disorder (OR, 2.17; 95% CI, 1.1-4.28). Current severe asthma (the past 4 weeks) was associated with a significantly increased likelihood of any anxiety disorder (OR, 2.65; 95% CI, 1.35-5.18), specific phobia (OR, 4.78; 95% CI, 2.35-4.05), panic disorder (OR, 4.61; 95% CI, 1.09-19.4), and panic attacks (OR, 4.12; 95% CI, 1.32-12.8) (**Table 2**).

Lifetime nonsevere asthma was consistently associated with increased odds of any anxiety disorder (OR, 1.51; 95% CI, 1.0-2.32), anxiety disorder not otherwise specified (OR, 2.08; 95% CI, 1.03-4.23), any somatoform disorder (OR, 1.7; 95% CI, 1.14-2.53), and any severe mental disorder (OR, 1.58; 95% CI, 1.07-2.33). Lifetime severe asthma was associated with the increased likelihood of any anxiety disorder (OR, 2.09; 95% CI, 1.3-3.36), panic disorder (OR, 2.61; 95% CI, 1.29-5.25), panic attacks (OR, 2.84; 95% CI, 1.66-4.89), social phobia (OR, 3.28; 95% CI, 1.42-7.59), specific phobia (OR, 2.93; 95% CI, 1.71-5.0), GAD (OR, 5.51; 95% CI, 2.29-13.22), bipolar disorder (OR, 5.64; 95% CI, 1.95-16.35), and any severe mental disorder (OR, 1.64; 95% CI, 1.03-2.61).

#### COMMENT

The goal of this study was to determine the association between asthma and mental disorders, extending available data from previous studies by using improved methods (ie, physician-diagnosed asthma and standardized measures of mental disorders) among adults in a general population sample. These findings suggest an association between asthma and a range of affective and anxiety disorders and add to the available knowledge in many ways. Specifically, to our knowledge, this study is the first to investigate the link between asthma and mental disorders using physician-diagnosed asthma in a representative sample rather than relying on respondent self-report data. Evidence of a link between asthma and mental disorders presented herein suggests that this association is not likely to be the result of a self-report bias, which has previously been suggested as a possible explanation for this association. Moreover, to our knowledge, these data are the first to examine the relationship between asthma and mental disorders using a standardized instrument, which has been well validated in cross-national samples, to assess a wide-range of *DSM-IV* mental disorders while previous studies have focused largely on the relationship between asthma and psychological symptoms of anxiety and depression.

Before proceeding with a discussion of the possible clinical significance of these results, the limitations of this study should be noted and considered when interpreting these data. According to standards set by the American Tho-

**Table 2. Mental Disorders (Weighted Percentages) Among 4181 Adults in the Community (Aged 18-65, GHS-MHS) With and Without Asthma\***

Mental Disorders (DSM-IV)	Past 4 Weeks								Lifetime					
	No Asthma (n = 4074)		Nonsevere Asthma (n = 52)		Severe Asthma (n = 55)		No Asthma (n = 3945)		Nonsevere Asthma (n = 143)		Severe Asthma (n = 93)			
	OR†	95% CI	OR†	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI		
Any affective disorder	6.1	13.6	2.42‡	1.03-5.72	12.5	2.03	0.89-4.69	18.3	25.9	1.44	0.94-2.19	23.0	1.21	0.75-1.98
Unipolar	5.5	12.2	2.41	0.97-6.04	10.0	1.72	0.72-4.15	17.0	24.6	1.48	0.96-2.29	18.1	0.97	0.59-1.62
Bipolar	0.5	1.4	2.31	0.30-17.82	2.5	4.75	0.65-34.67	0.9	1.3	1.37	0.41-4.59	4.9	5.64‡	1.95-16.35
Any anxiety disorder§	8.7	14.1	1.56	0.70-3.46	21.0	2.65‡	1.35-5.18	15.1	22.8	1.51‡	1.00-2.32	28.8	2.09‡	1.30-3.36
Panic disorder	1.1	1.1	0.97	0.13-7.26	4.9	4.61‡	1.09-19.40	3.7	3.6	0.88	0.37-2.08	10.0	2.61‡	1.29-5.25
Social phobia	1.2	NA	NA	NA	3.6	2.81	0.67-11.91	1.9	1.9	0.94	0.29-3.07	6.3	3.28‡	1.42-7.59
Specific phobia	4.5	8.2	1.67	0.61-4.58	18.9	4.78‡	2.35-4.05	7.2	11.5	1.51	0.88-2.58	19.7	2.93‡	1.71-5.00
Agoraphobia without panic	1.0	2.1	1.82	0.25-13.50	1.9	1.67	0.22-12.52	1.5	3.4	2.06	0.79-5.33	2.9	1.71	0.56-5.21
Anxiety disorder NOS	1.3	3.5	2.65	0.77-9.18	1.7	1.26	0.28-5.65	3.3	7.2	2.08‡	1.03-4.23	3.0	0.83	0.32-2.18
Generalized anxiety disorder	1.1	2.0	1.85	0.24-14.61	4.0	3.14	0.67-14.70	1.4	1.7	1.21	0.34-4.32	7.6	5.51‡	2.29-13.22
Panic attacks	1.8	4.4	2.39	0.81-7.07	7.5	4.12‡	1.32-12.80	7.5	10.9	1.41	0.83-2.40	20.0	2.84‡	1.66-4.89
Any substance use disorder	2.8	5.1	1.89	0.53-6.76	6.7	3.08	0.84-11.23	9.8	13.1	1.58	0.91-2.75	8.2	0.98	0.43-2.27
Any somatoform disorder	7.3	14.5	2.07	0.91-4.69	8.7	1.1	0.43-2.81	15.8	25.4	1.70‡	1.14-2.53	21.7	1.34	0.78-2.31
Any of the above (severe)	12.2	24.1	2.17‡	1.10-4.28	19.5	1.63	0.84-3.18	21.7	31.7	1.58‡	1.07-2.33	32.9	1.64‡	1.03-2.61

Abbreviations: CI, confidence interval; GHS-MHS, German National Health Interview and Examination Survey–Mental Health supplement; NA not applicable; NOS, not otherwise specified; OR, odds ratio.

\*"Severe asthma" is defined as having one of the following: hospital or emergency due to asthma within last 12 months, taking corticosteroid medication constantly, having experienced asthma attacks as life threatening, or having had more than 12 asthma attacks within last 12 months; "nonsevere asthma" diagnosis but not severe. These values are given as weighted percentages.

†Odds ratios from logistic regression; reference group was no asthma; controlled for age and sex.

‡ $P < .05$ .

§Panic disorder with or without agoraphobia, social phobia, any simple phobia, other phobias (agoraphobia without panic attacks, anxiety disorders NOS), generalized anxiety disorder. Note: No lifetime diagnoses available in anxiety disorders except for the panic disorder (ie, anxiety disorders are 12-month diagnoses, but all others are lifetime); this results in an underestimation of lifetime anxiety disorders.

||Any of the above diagnoses that fulfill at least one of the following additional requirements: reported disability or productivity cutback due to emotional problems within 4 weeks prior to core survey or the GHS-MHS, having sought professional help because of mental health problems, or being recommended to do so by a health care professional.

racic Society, objective assessments of pulmonary function are necessary for the diagnosis of asthma because medical history and physical examination cannot objectively characterize the status of lung impairment.<sup>29</sup> The American Thoracic Society recommendations state that to make a diagnosis of asthma, a clinician should determine (1) the presence of episodic symptoms of airflow obstruction, (2) that airflow obstruction is at least partially reversible, and (3) that alternative diagnoses are excluded. Recommended methods for diagnosis include the following: (1) detailed medical history; (2) physical examination focusing on the upper respiratory tract, chest, and skin; and (3) spirometry to demonstrate reversibility of airflow obstruction. Spirometry measurements before and after the patient inhales a short-acting bronchodilator is recommended for patients with a possible diagnosis of asthma,<sup>30</sup> as this procedure helps to determine whether there is airflow obstruction and whether it is reversible over the short-term. A negative result helps to rule out asthma, although no single test is adequate to definitively diagnose asthma. Assessment in the current study included medical history and physical examination, but use of spirometry was impossible owing to practical limitations. Therefore, lack of pulmonary function tests is a weakness in the diagnostic procedure used in this study and should be considered when interpreting the results. In addition, small cell size in some of the comparisons may have limited our

ability to detect statistically significant differences for some of the less common mental disorders (eg, bipolar disorder).

Our results suggest a strong and consistent link between asthma and anxiety disorders. This association is evident across periods and levels of severity, yet the relationships appear strongest among those with more severe disorders in terms of both asthma and anxiety disorders. The reason for the association between asthma and mental disorders cannot be determined from these data alone; there are several possible explanations. First, it might be that having asthma, which can be a long-term and potentially life-threatening condition, may increase the levels of anxiety, which in some persons can lead to full-blown anxiety disorders. The strongest links appear between lifetime severe asthma and GAD, as well as panic attacks and panic disorder, which is consistent with data from previous clinical<sup>1-10,14,15</sup> and epidemiological<sup>13,15</sup> studies that have used self-reported asthma or clinically selected samples. From a clinical perspective, it is feasible that chronic severe asthma (ie, chronic and more likely to involve severe life-threatening episodes than mild asthma) could increase worry, a key feature of GAD, and panic experiences due to the episodic, often sudden exacerbations in asthma attacks, and severe nature of asthma, which could conceivably trigger panic in response to life-threatening episodes. It has been previously hypothesized that this link may be explained at least in part by

respiratory abnormalities common to both asthma and panic (ie, dyspnea),<sup>31,32</sup> which may contribute to the strength of this association. It is also possible that this relationship is related to a misinterpretation of asthma symptoms, attributing them to panic, or the reverse.<sup>33</sup>

As asthma medications have been shown to have some anxiogenic properties,<sup>34,35</sup> it is also conceivable that overuse of medications by individuals is stimulated by elevated levels of anxiety and also subsequently contributes to the onset of full-blown anxiety disorders. Previous clinical findings suggest links between high levels of anxiety and increased use of treatment.<sup>36,37</sup> For instance, Steptoe and Vogele<sup>38</sup> have reported a relationship between generalized anxiety and a subjective perception of increased shortness of breath, even in the absence of any objectively measured change in airway obstruction. It is possible that those with higher levels of anxiety overuse medications. In addition, Dirks et al<sup>37</sup> have reported that physicians prescribe higher doses of medication for patients with asthma who are anxious.

The observed relationship between asthma and social phobia is consistent with previous studies among youths that have shown linkages between (1) behavioral inhibition and allergy, which co-occurs with asthma in most cases among youths<sup>39</sup>; (2) an association between shyness or social introversion and greater severity of asthma among youths<sup>40</sup>; and (3) social phobia and asthma among youths in the community.<sup>12</sup> Additionally, the link between specific phobia and asthma is consistent with results of previous studies among youths showing linkages between specific phobia and asthma in the community.<sup>12</sup> An alternative explanation is that a third outside factor such as a common genetic vulnerability to both asthma and anxiety disorders, or a common environmental risk factor such as lower socioeconomic status,<sup>41,42</sup> or childhood adversity such as childhood trauma has been shown to be associated with both asthma<sup>43</sup> and anxiety disorders<sup>44</sup> increases the risk of the co-occurrence of both asthma and anxiety disorders. Future longitudinal studies of the link between asthma and anxiety disorders, which include information on both environmental and genetic risk factors for both, may be useful in helping to uncover possible mechanisms of these linkages.

There was a strong and statistically significant association between severe, lifetime asthma and bipolar disorder and consistently strong point-estimates between asthma and bipolar disorder across measurement periods though not all associations reached statistical significance. Data from clinical samples have demonstrated changes in mood symptoms immediately following the administration of prednisone in patients with asthma.<sup>45</sup> Corticosteroid agents are thought to be responsible for this effect, as there is some evidence that these may be psychogenic predictors of affective disorders and psychosis.<sup>46,47</sup> For instance, Brown et al<sup>48</sup> have found that use of prednisone, a corticosteroid, was associated with increased manic symptoms, but not depression, among outpatients being treated for asthma. These findings are consistent with our results in the current study as severe asthma is associated with increased odds of bipolar disorder, but not major depressive disorder. This is also consistent with clinical evidence of psychopharmaco-

logical treatment for bipolar disorder improving symptoms of asthma<sup>49</sup> as well as evidence of an interactive effect of treatment for asthma on mood and somatic symptoms.<sup>46</sup> Those who reported the highest level of corticosteroid use are included in the severe group, while the less severe group, who report less frequent medicine use, do not show as strong an increased odds of bipolar disorder. Additionally, the observed link between asthma and bipolar disorder is consistent with previous clinical findings of an elevated level of respiratory disease among adults with comorbid bipolar disorder and panic attacks in the community.<sup>50</sup>

Overall, these data suggest that there is an association between asthma and mental disorders among adults in the community. While these associations appear stronger between both severe asthma and severe mental disorders, the patterns of association are relatively consistent across groups, especially strong among anxiety disorders, although not all associations reach statistical significance. The associations between lifetime asthma (both non-severe and severe) and lifetime anxiety disorders included assessment of only the past 12-month prevalence of anxiety disorders, with the exception of panic attacks and panic disorder that were measured for lifetime and the past 12-month prevalence. It is unclear, however, in what way the relations may be influenced by this difference in measurement period. Replication in future studies with lifetime prevalence of all disorders investigated may be informative. The strength of the observed links between lifetime asthma and lifetime panic attacks and panic disorder are consistent with previous data on associations between respiratory disease and past 12-month panic attacks among adults in the community.<sup>15</sup> The lack of association between asthma and somatoform disorders is of interest, as it might be expected that if the association between asthma and mental disorders resulted from a tendency toward somatization, overreporting of physical symptoms, or hypochondrical concerns, that there would be an observable link between asthma and somatoform disorders. Yet, only lifetime nonsevere asthma is associated with somatoform disorders and, in contrast to the strong linkages between lifetime severe asthma and anxiety disorders and bipolar disorder, the strength of these associations is relatively unremarkable.

## CONCLUSIONS

In this study we have investigated the association between asthma and affective and anxiety disorders using physician diagnosis of asthma and a well-validated diagnostic instrument for the assessment of mental disorders in a representative community sample of adults. Data suggest consistent links between asthma and affective and anxiety disorders, with generally stronger associations among disorders of greater severity. The mechanisms of the associations between asthma and mental disorders remain unknown. Future studies that use longitudinal data with additional information on genetic, familial, environmental, and psychosocial risk factors for both asthma and mental disorders are needed to uncover the mechanisms of these associations. Identification of common genetic or biological pathways for the development of asthma

and mental disorders could have important implications for future research and clinical treatment of both.

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