

## ASTHMA AND MENTAL HEALTH

**Asthma and mental health among youth in high-risk service settings**Renee D. Goodwin, PhD, MPH,<sup>1,2</sup> Kate Hottinger, MA<sup>3</sup>, Lillian Pena, BA<sup>1</sup>, Anil Chacko, PhD<sup>1</sup>, Jonathan Feldman, PhD<sup>3,4</sup>, Marianne Z. Wamboldt, MD<sup>5</sup>, and Christina Hoven, DrPH<sup>6</sup><sup>1</sup>Department of Psychology, Queens College, City University of New York (CUNY), NY, USA, <sup>2</sup>Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA, <sup>3</sup>Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY, USA, <sup>4</sup>Department of Epidemiology and Population Health, Albert Einstein College of Medicine, Bronx, NY, USA, <sup>5</sup>Department of Psychiatry, University of Colorado, Health Sciences Center and The Children's Hospital, Denver, CO, USA, and <sup>6</sup>Department of Child Psychiatry, Columbia University College of Physicians and Surgeons and New York State Psychiatric Institute, New York, NY, USA**Abstract**

**Objective:** To investigate the prevalence of asthma and mental health problems among representative samples of youth in high-risk service settings and the community, and to examine the relationship between asthma and mental health in these groups. **Methods:** Data were drawn from the Alternative Service Use Patterns of Youth with Serious Emotional Disturbance Study (SED) ( $n = 1181$ ), a combined representative, cross-sectional sample of youth in various clinical settings and the community. Multiple logistic regression analyses were used to examine the association between asthma and mental disorders. Demographic characteristics were investigated as potential confounders. **Results:** Asthma was common among 15.2% of youth in service settings and 18.8% of youth in the community. The prevalence of mental disorders was extremely high among youth with and without asthma in all service settings, and asthma was associated with increased prevalence of mental disorders among youth in the community, but not among youth in service settings. The relationship between asthma and internalizing disorders among youth in the community does not appear entirely attributable to confounding by demographics. **Conclusions:** Findings are consistent with and extend previous data by showing that both asthma and mental disorders are disproportionately common among youth in high-risk service settings. Almost half of youth with asthma in service settings meet diagnostic criteria for a mental disorder. Clinicians and policy makers who are responsible for the health care of youth in these high-risk groups should be aware that asthma is common, and that the prevalence of internalizing disorders are especially common among those with asthma.

**Keywords**

Adolescent health, anxiety, chronic disease, community service settings, depression, epidemiology, respiratory disease

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In recent years, there has been increasing interest in the relationship between asthma and mental disorders among youth [1–6]. Evidence to date suggesting an association between asthma and mental health disorders among youth has come mainly from three sources. First, data from clinical samples of pediatric asthma patients show higher levels of behavioral problems, as well as depression and anxiety symptoms in youth with moderate-to-severe asthma compared to controls with other medical illnesses [7–10]. Second, data from psychiatric samples of youth show higher than expected levels of asthma among those with anxiety disorders [11, 12]. For instance, Koltek et al. [11] found a higher than expected rate of asthma in adolescent psychiatric inpatients with PTSD, compared to a control group, but diabetes was not similarly elevated in this sample. A third line of evidence comes from

epidemiologic data, which have reported an association between asthma and anxiety disorders among youth in community samples. Specifically, Ortega et al. [13] found a higher rate of separation anxiety disorder, overanxious disorder, and phobia among youth with asthma in a community sample, compared to those with diabetes and other chronic illnesses. Similarly, findings from another study using the same sample show a statistically significant association between asthma and the increased likelihood of panic attacks [14].

While evidence of a link between asthma and mental health problems among youth is mounting [1,4,15], previous studies have not examined whether and to what degree these associations are generalizable to populations of youth who are most likely to be seen in health care settings and, commonly, to be in greatest need of screening for mental health problems—and who may not routinely see a pediatrician or have extensive resources for health care. For instance, Gillapsy et al. [16] examined psychological problems in at-risk, low socio-economic status (SES) youth with asthma, and found that adolescents with asthma from low SES

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backgrounds had higher rates of psychological distress including anxiety and depression compared to those without. Although results provide evidence of asthma as a risk-factor for mental health issues in at-risk adolescents, these results cannot be generalized to a sample of adolescents within service groups. The prevalence of psychiatric disorders has been shown to be higher in young people within these high-risk groups compared to youth from the community [17–20]. These service groups include juvenile justice, child welfare, mental health treatment, substance use treatment, and special education. As such, it is plausible that the prevalence of asthma is higher than expected among youth in these settings. If this is the case, this is important information for those who treat these youth. To our knowledge, no previous study has examined asthma and mental health among youth in a wide range of service settings.

The goal of the present study was to examine the prevalence of asthma and mental health problems among representative samples of youth across five service groups: juvenile justice, child welfare, mental health treatment, substance use treatment, and special education, in a comparable community-based sample. The study also examined the relationship between asthma and specific mental disorders among youth in these settings, as well as the potentially confounding role of demographic characteristics. As mental disorders are common within the service sectors, and asthma is regularly combined with mental health problems, we hypothesized that asthma is also prevalent within these service groups.

## Methods

### Samples

1. Methods for the Epidemiology of Child and Adolescent Mental disorders (MECA Study) [21]. This four-site community sample (New York ( $n=360$ ), Connecticut ( $n=314$ ), Puerto Rico ( $n=312$ ), Georgia ( $n=299$ )) consists of 1285 youth, including 604 girls and 681 boys aged 9–17 years. The community sample in the MECA study constitutes a randomly selected representative sample [21–23]. The New York MECA sample was drawn from Westchester County.

2. Alternative Service Use Patterns of Youth with Serious Emotional Disturbance (Westchester County Study, Principal Investigator: Christina Hoven) [24–26]. This is an epidemiological-services study ( $n=936$ ) of psychopathology of children and adolescents in five service systems (juvenile justice, special education, child welfare, mental health, substance use;  $n=763$ ), and in the community ( $n=173$ ) from Westchester County, New York. In this study, 391 girls and 545 boys aged 9–17 years and their parent/guardian were interviewed. Both studies from which data are used in this study were approved by the Institutional Review Boards (IRB) of Columbia University and the New York State Psychiatric Institute; informed consent and assent were given by caregivers and children.

To collect data on the service samples, 62 representative service agencies were selected from all five child service systems, according to the number and proportion of youth served by that agency. Youth were then randomly selected from each of the representative agencies/schools. Representative public schools with special education programs

were selected according to school district size and geographical location. Random samples were recruited from the entire juvenile justice and child welfare systems. Mental health and substance use agencies were selected to obtain representation by size, level of service intensity, and geographical location.

Data for the 1458 children from the combined community samples (1285 children from the MECA study and 173 children from the Westchester County Study) and the 763 children from service systems are included in this study ( $n=2221$ ).

## Measures

### Mental disorders

Both the MECA and Westchester County Studies used essentially the same instruments [21, 22, 25]. Child psychiatric diagnoses were measured by DISC 2.3, [27] which is based on Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised (*DSM-III-R*) criteria for psychiatric disorders.

In the MECA and Westchester County Studies, Child medical conditions were measured by the Service Utilization and Risk Factors (SURF) Interview [21]. Methods used to establish the presence of mental disorders were completely independent of the criteria used to establish history of asthma.

### Procedures

A computer-assisted version of the DISC-2.3 [27] was administered in both studies. To collect data on service system samples, representative agencies and schools were selected from the five child service systems in Westchester County, New York, according to the number and proportion of children and adolescents served [24–26]. Youth were randomly selected from each of the representative agencies or schools.

Procedures for the community sample in the Westchester County Study replicated procedures for the MECA study in terms of sampling methodology, instruments, and field procedures. The same team collected data on the Westchester County sample and New York MECA sample. In this study the MECA and Westchester County Samples are combined to increase power of statistical tests. There were no dropouts in the study because only one interview session was conducted. The compliance rate of the MECA study is 86%. The compliance rate of Westchester County Study is 89.6%.

### Asthma

Asthma measured by the Service Utilization and Risk Factors (SURF) Interview [21] SURF interview included parent reports on the life history of the child's asthma. Each parent/guardian was asked whether the youth had ever been diagnosed with asthma by a physician.

### Statistical analyses

First, multiple logistic regression analyses were used to investigate the relationships between asthma and mental disorders in the combined community and service setting samples ( $n=1181$ ). Estimates of these associations are reported in odds ratios (with 95% confidence intervals). The same method was also used to estimate the associations

between asthma and mental disorders: (a) within each service setting; (b) in any service setting; (c) in the community. Next, chi-square analyses were used to calculate *p*-values discerning differences in the prevalence of any mood, anxiety, and disruptive disorders and asthma between the community and service settings. These analyses were then adjusted for age, gender, race, Medicaid status, maternal education, and single parent household. We initially adjusted for age, sex, and race in one analysis and then Medicaid, maternal education and single parent status in a second, as the cell sizes were too small to permit inclusion of all variables simultaneously in a single model.

## Results

### Prevalence

Asthma was common among 15.2% of youth in service settings and 18.8% of youth in the community. Demographically, asthma was significantly more prevalent among those with minority racial status and from single parent households (See Table 1).

### Asthma and mental disorders among adolescents

The prevalence of mood (OR = 1.5; 95% CI = 1.1–2.1) anxiety (OR = 1.5; 95% CI = 1.2–1.9), externalizing and disruptive disorders (OR = 1.2; 95% CI = 1.0–1.6) was significantly higher among youth with, compared to without, asthma (Table 2). The strongest associations emerged between asthma and any internalizing disorder (OR = 1.5;

Table 1. Demographic characteristics associated with asthma among youth in clinical and community settings.

	No asthma (1846)	Asthma (375)	<i>p</i> Value
Age	13.1	13.0	<i>p</i> = 0.4
Mean (SD)	(2.6)	(2.6)	
Gender	(1005)	(221)	
Male	54.4%	58.9%	<i>p</i> = 0.1
Female	(841) 45.6%	(154) 41.1%	
Medicaid	(484) 26.2%	(110) 29.3%	<i>p</i> = 0.2
Minority racial status	(985) 53.4%	(253) 67.5%	<i>p</i> < 0.0001
Single parent household	(607) 32.9%	(167) 44.5%	<i>p</i> < 0.0001
<b>Community</b>	(1001) 54.2%	(180) 48.0%	<i>p</i> = 0.01
<b>Service settings</b>			
Juvenile justice	(189) 10.2%	(33) 8.8%	
Special education	(178) 9.6%	(40) 10.7%	
Child welfare	(156) 8.5%	(44) 11.7%	
Mental health	(148) 8.0%	(37) 9.9%	
Substance use treatment	(174) 9.4%	(41) 10.9%	

Table 2. Mental disorders among adolescents with and without asthma.

	No asthma (1846)	Asthma (375)	OR (95% CI)
Any anxiety disorder	(412) 22.3%	(116) 30.9%	<b>1.5 (1.2–1.9)</b>
Any mood disorder	(221) 12.0%	(66) 17.6%	<b>1.5 (1.1–2.1)</b>
Any disorders	(720) 39.0%	(170) 45.3%	<b>1.2 (1.0–1.6)</b>
Any internalizing/externalizing emotional disorder	(692) 37.5%	(165) 44.0%	<b>1.3 (1.0–1.6)</b>
Any externalizing/disruptive disorder	(387) 21.0%	(96) 25.6%	<b>1.2 (1.0–1.6)</b>
Any internalizing disorder	(509) 27.6%	(137) 36.5%	<b>1.5 (1.1–1.9)</b>
Any disruptive disorder	(387) 21.0%	(96) 25.6%	<b>1.2 (1.0–1.6)</b>
Any 2+ disorders	(427) 23.1%	(115) 30.7%	<b>1.4 (1.1–1.8)</b>

Bold values signify *p* < 0.05.

95% CI = 1.1–1.9) and any anxiety disorder (OR = 1.5; 95% CI = 1.2–1.9).

### Prevalence of asthma and mental disorders across service groups

The prevalence of mood (Mental Health: 33.1% versus Community: 7.8%, Child Welfare: 11.5% versus Community: 7.8%, Substance Use: 23.5% versus Community: 7.8%, Special Education 15.7% versus Community: 7.8%, Juvenile Justice: 20.9% versus Community: 7.8%; *p* < .0001), anxiety (Mental Health: 36.5% versus Community: 18.5%, Child Welfare: 30.7% versus Community: 18.5%, Substance Use: 33.5% versus Community: 18.5%; *p* < 0.0001) with the exception of juvenile justice and disruptive behavior disorders (Mental Health: 40.5% versus Community: 10.9%, Child Welfare: 21.1% versus Community: 10.9%, Substance Use: 30.0% versus Community: 10.9%, Special Education: 44.9% versus Community: 10.9%, Juvenile Justice: 34.9% versus 10.9%; *p* < 0.0001) was significantly higher among youth in service settings than among those in the community (Table 3).

### Asthma and mental disorders in each service setting

We examined the relationship between asthma and mental disorders among each service setting sample. Any anxiety disorder (47.5% versus 27.0%; *p* < 0.05) and any internalizing disorder (50.0% versus 32.6%; *p* < 0.05) were significantly more common among those with asthma versus youth without asthma in child welfare settings. No other statistically significant differences were found in the prevalence of mental disorders among youth with and without asthma in specific service settings.

### Adjusted association between asthma and mental disorders in any service groups

Among youth in service settings, there were no significant associations between asthma and mental disorders (Table 4), except that those with asthma were more likely to have two or more mental disorders, compared with those without asthma (OR = 1.4; 95% CI = 1.0–1.9). This association was no longer statistically significant after adjusting for Medicaid, single parent household and maternal education.

### Asthma and mental disorders among youth in the community

Asthma was associated with significantly increased odds of any internalizing (OR = 1.6; 95% CI = 1.1–2.3), mood (OR = 1.9; 95% CI = 1.1–3.2) and anxiety disorder

Table 3. Prevalence of asthma and mental disorders across service groups.

	Community (n = 1181)	Mental health (n = 222)	Child welfare (n = 218)	Substance use (n = 200)	Special education (n = 185)	Juvenile justice (n = 215)	p Value
Any anxiety disorder	(219) 18.5%	(81) 36.5%	(67) 30.7%	(61) 30.5%	(62) 33.5%	(38) 17.7%	<0.0001
Any mood disorder	(92) 7.8%	(49) 22.1%	(25) 11.5%	(47) 23.5%	(29) 15.7%	(45) 20.9%	<0.0001
Any disruptive disorder	(129) 10.9%	(90) 40.5%	(46) 21.1%	(60) 30.0%	(83) 44.9%	(75) 34.9%	<0.0001
Asthma	(180) 15.2%	(33) 14.9%	(40) 18.3%	(44) 22.0%	(37) 20.0%	(41) 19.1%	0.002

Table 4. Adjusted association between asthma and mental disorders among youth in service groups.

	No asthma (845)	Asthma <sup>1</sup> (195)	OR (95% CI)	AOR <sup>a</sup> (95% CI)	AOR <sup>b</sup> 95% CI)
Any mood disorder	(152) 18.0%	(43) 22.1%	1.2 (0.8–1.8)	1.3 (0.8–1.9)	1.2 (0.8–1.8)
Any anxiety disorder	(240) 28.4%	(69) 35.4%	1.3 (0.9–1.9)	1.3 (0.9–1.9)	1.3 (0.9–1.8)
Any internalizing disorder	(301) 35.6%	(83) 42.6%	1.3 (0.9–1.8)	1.3 (0.9–1.8)	1.2 (0.9–1.7)
Any disruptive disorder	(281) 33.3%	(73) 37.4%	1.2 (0.8–1.6)	1.2 (0.8–1.6)	1.1 (0.8–1.6)
Any externalizing/disruptive disorder	(281) 33.3%	(73) 37.4%	1.2 (0.8–1.6)	1.2 (0.8–1.6)	1.1
Any 2+ disorders	(292) 34.6%	(83) 42.6%	<b>1.4 (1.0–1.9)</b>	<b>1.4 (1.0–1.9)</b>	1.3 (0.9–1.8)

AOR<sup>a</sup> = adjusted for child age, sex, and race.

AOR<sup>b</sup> = adjusted for Medicaid, single parent household, maternal education.

Bold values signify  $p < 0.05$ .

Table 5. Adjusted association between asthma and mental disorders among youth in the community.

	No asthma (1001)	Asthma (180)	OR (95% CI)	AOR <sup>a</sup> (95% CI)	AOR <sup>b</sup> (95% CI)
Any mood disorder	(69) 6.9%	(23) 12.8%	<b>1.9 (1.1–3.2)</b>	<b>2.1 (1.2–3.5)</b>	<b>2.0 (1.2–3.4)</b>
Any anxiety disorder	(172) 17.2%	(47) 26.1%	<b>1.7 (1.1–2.4)</b>	<b>1.7 (1.2–2.5)</b>	<b>1.7 (1.1–2.5)</b>
Any internalizing disorder	(208) 20.8%	(54) 30.0%	<b>1.6 (1.1–2.3)</b>	<b>1.6 (1.1–2.4)</b>	<b>1.6 (1.1–2.3)</b>
Any disruptive disorder	(106) 10.6%	(23) 12.8%	1.2 (0.7–2.0)	1.1 (0.7–1.9)	1.1 (0.7–1.9)
Any externalizing/disruptive disorder	(106) 10.6%	(23) 12.8%	1.2 (0.7–2.0)	1.1 (0.7–1.9)	1.1 (0.7–1.9)
Any 2+ disorders	(135) 13.5%	(32) 17.8%	1.3 (0.9–2.1)	1.4 (0.9–2.2)	1.4 (0.9–2.1)

AOR<sup>a</sup> = adjusted for child age, sex, and race.

AOR<sup>b</sup> = adjusted for Medicaid, single parent household, maternal education.

Bold values signify  $p < 0.05$ .

(OR = 1.7; 95% CI = 1.1–2.4), compared with those without asthma in the community (Table 5). These associations persisted after adjusting for demographic characteristics, Medicaid, single parent household and maternal education. There was no significant association between asthma and externalizing/disruptive disorders or having more than two mental disorders.

## Discussion

Using data from five service systems and the Westchester community, the present study investigated the relationship between asthma and mood, anxiety and disruptive disorders among youth ages 9–17 years old. Our results are consistent with and extend previous data with three main findings. First, our data show that almost half of youth with asthma in service settings have a mental health disorder. Second, the prevalence of mental disorders was extremely high among youth in all service settings and few significant differences were found between those with and without asthma, perhaps due to a ceiling effect. Third, asthma is associated with a significantly increased prevalence of mental disorders among youth in the community. These associations do not appear to be attributable to confounding by demographic characteristics.

Our findings suggest that asthma is associated with any mood and any anxiety disorder among youth in the community. Yet, the associations between asthma and

externalizing/disruptive disorders are not significant. These findings are generally consistent with results from other studies [12–14] which suggest a link between asthma and internalizing disorders among young people in the community, but which have reported mixed results on the link with externalizing/disruptive disorders. Previous research using the MECA study data also suggest that children presenting with disruptive disorders are also more likely to utilize community mental health services than those with internalizing disorders such as depression [25].

To our knowledge, this is the first study to assess prevalence of asthma in a sample of youth at high risk for mental disorders enrolled in the community service settings of child welfare, juvenile justice system, special education, mental health treatment and substance use treatment. In addition to psychiatric illness, children in community service settings have been shown to be at particularly high risk of chronic medical illness including asthma [28] and obesity [29]. That the prevalence of asthma is significantly higher among psychiatrically high-risk youth is of interest from a clinical perspective and is also consistent with the hypothesis that being ‘‘high-risk’’ for internalizing disorders may also suggest a similarly high risk for some physical illnesses.

Prior studies have shown that mental disorders are common among young people in high-risk settings, with an estimated 20% meeting criteria for at least one *DSM-III-R* psychiatric diagnosis overall [17–19,30]. Due to this highly



elevated prevalence of mental disorders in these settings as compared to the community, a ceiling effect may account for the lack of significant associations found between asthma and psychopathology in the majority of these service settings. These very high rates of mental disorders suggest the need for screening of psychiatric disorders in service settings. It is possible that with larger sample sizes our data could reveal significant relationships between asthma and mental health disorders among young people in each service group.

Because our data showed a significant association between asthma and mental health issues in the child welfare service system, and larger sample sizes may reveal similar associations in other service groups, perhaps individuals with asthma in these high-risk service groups should be screened for mental health disorders and vice versa. A study by McGrady, Cotton, Rosenthal, Roberts, Brito and Yi [31] examining a sample of urban adolescents with asthma found that those suffering from both asthma and anxiety disorders had negative perceptions of their asthma symptoms, believing that their asthma symptoms had a negative impact on their daily life. Perhaps, negative perceptions of asthma symptoms caused by anxiety disorders may be a stronger mediator in the asthma-mental health link particularly among youth in high-risk service settings. If this is the case, screening for mental health issues among youth with asthma in these populations could be particularly helpful in decreasing adverse outcomes of asthma or symptom onset all together.

Overall, our data and previous study finding increased co-morbidity between asthma and psychiatric illness support the hypothesis of causality and reverse causality between asthma and mental health disorders. A meta-analysis conducted by Chida et al. 2008 [32] statistically confirmed the bidirectional relationship between atopic illness and psychiatric illness, although found more evidence to support of the effect of atopic disease on future mental illness than that of the effect of predisposing psychosocial factors on the development of atopic illness in the studies assessed [32]. Underlying mechanisms implicated in this bidirectional relationship include direct physiological pathways of the nervous and immune system, behavioral patterns, and social factors [33]. Future research is needed to continue to understand causality and reverse causality between asthma and mental illness.

There are several limitations to our study. First, due to small sample sizes representing each service system, we are limited in our ability to draw definitive conclusions regarding the relationship between asthma and mental health issues in these high-risk populations. As previously mentioned, due to the very high prevalence of mental illness across service settings, a ceiling effect may account for the lack of statistically significant association between asthma and psychopathology among youth in these settings. Our findings are preliminary, and thus further investigation is needed into the prevalence of asthma in these populations and the asthma-mental health relationship affecting at-risk youth. Also, we are limited in our ability to assess the prevalence of asthma and mental health disorders among youth nationwide adding to the potential for selection bias, although Westchester County is extremely diverse and therefore there is good reason to believe these results are widely generalized

to the community. Additionally, our data are cross-sectional, therefore we are unable to examine a possible causal relationship between asthma and mental health issues in these populations. Finally, another limitation is residual confounding as not all data of potential confounding variables was able to be collected. Specifically, we were unable to adjust for potential cofounders related to parental/family factors such as parental mental health, family stressors and other behavioral correlates with mental illness such as parental substance abuse and obesity. The absence of parent/family factors in the analyses as parent mental health and family stressors have been associated with the development of childhood asthma symptoms and early-onset psychopathology [34–36]. Future studies should address this limitation and assess the role of family functioning in the association between asthma and psychopathology in high-risk service settings.

Our findings are consistent with and extend previous data by showing that asthma is associated with increased mental disorders among youth and that these associations appear to persist independent of demographic differences. The association between asthma and mental disorders appears to be stronger among youth in the community, compared with service settings though this may be attributable to the high levels of mental disorders in those settings (and our limited sample size). These data suggest that youth in service settings are at high risk for asthma and should be carefully screened for mental health problems.

## Conclusions/key findings

This study investigated the prevalence of asthma and mental health problems among representative samples of youth in high-risk service settings and the community, and examined the relationship between asthma and mental health in these groups. Our findings suggest that the prevalence of mental health problems is extremely high among youth with and without asthma in all service settings and that the relationship between asthma and internalizing disorders among youth in the community does not appear entirely attributable to confounding by demographics. Both asthma and mental disorders appear to be disproportionately common among youth in high-risk service settings. Clinicians and policy makers who are responsible for the health care of youth in these high-risk groups should be aware that asthma is common, and that the prevalence of internalizing disorders are especially common among those with asthma.

## Declaration of interest

The authors have no conflicts of interest to declare.

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