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The Influence of Comorbid GAD on ER Utilization in Urban Youth with Asthma

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The Influence of Comorbid Generalized Anxiety Disorder on Emergency Room Utilization in Urban Youth with Asthma

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Abstract

Current literature indicates a strong association between asthma and the early onset of comorbid generalized anxiety disorder (GAD) in minors and their primary caregivers. Studies show that asthma prevalence increases with certain demographic factors, such as ethnicity, socioeconomic status, and housing quality. Evidence also suggests that GAD influences decision-making, especially when deciding to utilize emergency room (ER) services for asthma-related concerns. This study analyzed the effect of comorbid GAD on minors with asthma and ER utilization. The data were provided by an earlier Stress & Justice Study (S&J) baseline survey, an investigation aimed at understanding the impact of parental criminal justice system involvement (CJSI) on the mental health of their children. The S&J study was conducted through the Global Psychiatric Epidemiology Group at the New York State Psychiatric Institute. Our study found that asthma in minor participants was associated with a significant increase in the number of GAD symptoms in their primary caregivers, but not in the minors themselves. Additionally, a significant correlation with a moderate positive trend was observed between the number of reported GAD symptoms in the children and the number of trips to their local ER within the year before the survey. In contrast to many modern studies, this study does not provide strong evidence for associations between comorbid asthma and GAD in minors. Future studies on comorbid GAD and asthma should consider recruiting participants from rural counties for similarities in morbidity with participants from urban environments.

Keywords: asthma, GAD, emergency room services, decision-making, urban environments, Stress & Justice

The Implications of Generalized Anxiety Disorder and Comorbid Asthma in Urban Youth

Children living with chronic illness often report feelings of anxiety and depression (Adrian-Arrieta et al., 2018; Verhoof et al., 2014). Healthy coping mechanisms allow individuals to process stressful events and make the appropriate adjustments to their lives (Sears & Kraus, 2009; Chiang et al, 2009). Feelings of panic or anxiety can trigger asthma attacks (e.g., Pateraki et al., 2018). Panic and asthma attacks share many symptoms, including shortness of breath, choking sensations, chest tightness, and chest pain (Rietveld et al., 2005). Individuals with asthma are more prone to express symptoms of panic (Rietveld et al., 2005). Worrying excessively can lead to generalized anxiety disorder (GAD) in patients with chronic illnesses, such as asthma (Agnafors et al., 2019; Dudeney et al., 2017; Katon et al., 2004; Licari et al., 2008; McGrady et al., 2010; Mohammadi et al., 2020; Rietveld et al., 2005; Sztein & Lane, 2016). A study by Ortega et al. (2002) demonstrated that longer the participants history of asthma with comorbid GAD, the more severe their GAD. GAD diagnosis increases worry in children and utilization of emergency services (Bardach et al., 2019; Chatkin et al., 2000; Fredrickson et al., 2008; Molgaard., 2004). Therefore, GAD can result in increased visits to the ER in minors when comorbid with chronic illness. In dire situations, these individuals may need to utilize emergency room (ER) services. Emergency rooms provide valuable services to the public but are often overcrowded resulting in long waiting periods. This study focused specifically on the prevalence of GAD in minors with asthma and their primary caregivers, as it is among the most commonly diagnosed chronic illnesses in urban youth populations. If there exists an association between asthma and GAD, then it will be beneficial to educate these individuals on more effective ways to deal with their asthma-related anxiety.

Demographic factors such as race, geographical location, and being born in the United States are large contributors to the risk of developing asthma (Claudio et al., 2006; Keet et al., 2014; Keet et al., 2015; Northridge., 2010; Hu et al., 1997). Parental education level, multiple residents sharing bedrooms, and prior asthma-related hospitalizations were predictive factors for ER visits (Claudio et al., 2006; Hu et al., 1997; Keet et al., 2015). Black individuals were shown to be significantly more likely to visit the ER or be hospitalized as a result of their asthma compared to other ethnicities (Hu et al., 1997). Parental cigarette smoking, exposure to mold, and parental use of crack cocaine were also each significantly associated with childhood asthma. (Hu et al., 1997). In a study assessing the relationship between childhood asthma and housing quality, public housing was also associated with a higher prevalence of asthma in children from urban cities (Northridge et al., 2010). Children are often in a position where they share rooms with their siblings or parents, which reduces air quality in a confined area (Chatkin et al., 2000).

Claudio et al. (2006) sent a questionnaire to the parents of students attending 26 public elementary schools in Manhattan. The survey was designed to assess the relationship between asthma prevalence and asthma-related hospitalization rates. Of 5,250 Manhattan parents surveyed, the prevalence of asthma was 13% in their children. Children from families of lower socioeconomic status were 70% more likely to have asthma regardless of ethnicity. Common environmental factors shown to increase the risk of developing asthma are low socioeconomic status, housing quality, and exposure to air pollutants and rodents (Brew et al., 2018; Chatkin et al., 2000; Claudio et al., 2006; Hu et al., 1996; Keet et al., 2015; Northridge et al., 2010; Ortega et al., 2004). Three or more psychosocial adversities, such as physical or sexual abuse during childhood, were also significantly associated with asthma (Breslau et al., 1991; Park et al., 2014; Scott et al., 2011).

In the United States, more than 2 million ER visits annually are related to asthma (Naomi et al., 2019). Receiving a serious diagnosis such as chronic asthma is life-altering (Adrián-Arrieta & Casas-Fernández de Tejerina, 2018). It can easily affect self-perception and confidence, and intensify feelings of anxiety (Wichowski & Kubsch, 1997). Narmandakh et al. (2020) investigated possible biological and psychosocial risk factors for anxiety disorders in adolescents. This study involved 1,584 Dutch participants of the TRacking Adolescents' Individual Lives Survey (TRAILS). 25.7% of participants had an anxiety disorder diagnosis by age 19, while 4% of the anxiety disorders were specifically diagnosed as GAD. Anxiety disorders were seen in girls twice as often as in boys. Gender, parental depression and anxiety, temperamental frustration, and low effortful control were all independent factors associated with anxiety disorders in these adolescents. Although clinical diagnoses of GAD in minors are not commonly observed, many self-report surveys indicate many participants experience a substantial level of subclinical anxiety (Pilipenko et al., 2016; Pateraki et al., 2018).

Most affective disorders tend to emerge between ages 21–35 (de Lijster et al., 2017). A longitudinal study conducted by Moffitt et al. (2007) followed a birth cohort of 1,032 individuals through their first 32 years, assessing childhood risk factors for developing depression and GAD. The data showed that GAD was associated with an adverse family environment such as low socioeconomic status and neglect by the parents. The behaviors associated with GAD in children were internalizing problems, conduct disorder, and inhibited temperament. Family psychiatric history was also significantly associated with GAD. Low socioeconomic status was also found to be an independent risk factor for asthma (Moffitt et al., 2007). Musa et al. 2021 found that internalizing disorders, such as GAD, were 38.01% in children from subsidized housing.

A pattern of GAD diagnoses is observed in siblings and caregivers of children with asthma. Licari et al. (2019) demonstrated a significant correlation between uncontrolled asthma in children and maternal anxiety using a cross-sectional analysis. A lack of anxiety in mothers was observed for children with controlled asthma (Licari et al., 2019). Adolescents with regulated asthma who received treatment had lower Hospital Anxiety and Depression Scale – Anxiety subscale (HADS-A) scores than adolescents with untreated asthma. Familial coaggregation of GAD occasionally occurs in siblings of a child diagnosed with asthma (Licari et al., 2019). Brew et al. (2018) collected information from parents of twins. They found that siblings of children with asthma are 39% more likely to develop GAD. No significant differences in rate of GAD development were observed between dizygotic and monozygotic twins, suggesting that genetics are not a factor contributing to familial coaggregation. This contrasts with the observation that anxiety and atopic diseases tend to occur together in families (Agnafors et al., 2019; Brew et al., 2018).

Studies have reported significant associations between anxiety and asthma-related ER use. Naomi et al. (2019) reported that 24.7% of 65,000 ER patients with asthma-related concerns met criteria for either anxiety, depression, or both. Recent studies show an average of 22.7% prevalence of comorbid GAD and among inner-city urban children with asthma (Sheffield et al., 2015; Claudio et al., 2006; Dudeney, et al. 2017; Keet et al., 2015; Katon et al. 2004; McGrady). Generally, the population of minors with clinically diagnosed GAD is low. Since these studies focus on the prevalence of GAD in children, the number of children with clinically diagnosed GAD appear higher. This is common among most of the aforementioned studies relating to childhood comorbid GAD. If children are greatly worried about their health, they may develop chronic illness-related anxiety (Pao & Bosk, 2011). Anxiety often negatively affects the severity

of asthma symptoms in adolescents (Baron & Marcotte, 1994). People with a comorbid anxiety disorder have an increased risk of asthma-related ER visits and asthma-related hospitalizations (Pilipenko et al., 2016). Individuals with asthma who also have undiagnosed GAD may associate their feelings of panic or anxiety with their asthma (Baron & Marcotte, 1994).

As a chronic illness, asthma can trigger intense feelings of anxiety and dread, especially relating to the individual's health (Butz & Alexander, 1993; Cohen et al., 2003). Minors may not have the coping mechanisms to manage an excessive amount of stress (Sears & Kraus, 2009; Chiang et al, 2009). Instead, they may condition themselves to be fearful in anticipation of their next asthma attack (Wichowski & Kubsch, 1997). If children are continuously worried about their health, they may develop GAD, which may affect their treatment protocol (Lebowitz et al., 2016; Mcgrady et al., 2010; Licari., 2019). GAD has the ability to affect children's perceptions of their quality of life (Barrera et al., 2009; Edge et al., 2020). Bareera et al. (2009) found that 14% of individuals with a chronic illness, such as asthma, experience feelings of severe anxiety.

It should now be evident that anxiety is a risk of developing GAD in individuals with asthma, and their immediate families. In order to expand on these topics, we have constructed four hypotheses. This study's first hypothesis states that a diagnosis of asthma in minors will be associated with increased severity of anxiety in those same minors and their primary caregivers. Severity of anxiety was measured through the number of GAD-related symptoms reported. The data contained information relating to anxiety for both the minor and their primary caregiver participants. We split hypothesis 1 into two sub-hypotheses, 1a and 1b. Sub-hypothesis 1a states that a diagnosis of asthma in minors will be associated with increased severity of anxiety by their primary caregivers. Sub-hypothesis 1b states that a diagnosis of asthma in minors will be associated with increased severity of anxiety in the minors themselves.

To further evaluate these results, our second hypothesis is that the presence of asthma in minors will also be associated with increased risk of receiving an actual diagnosis of GAD. Asthma in minors may also be associated with increases in the rate of GAD diagnosis in their primary caregivers, as they may excessively worry about their children's health. Hypothesis 2 used a binary outcome variable for GAD diagnosis instead of the continuous variable used in Hypothesis 1. Whereas our first hypothesis focused on symptomatology, our second hypothesis focused on the actual rate of GAD diagnosis. Our second hypothesis was also split into two sub-hypotheses. Sub-hypothesis 2a states that a diagnosis of asthma in minors will be associated with increased rates of GAD diagnosis in their primary caregivers. Similarly, sub-hypothesis 2b states that a diagnosis of asthma in minors will be associated with increased rates of GAD diagnosis in the minors themselves.

The anxiety caused by asthma-related health concerns may have an impact on healthcare utilization. Thus, our third overall hypothesis is that asthma-related anxiety will influence asthma-related ER utilization. Hypothesis 3 was divided into three sub-hypotheses. Sub-hypothesis 3a states that the number of GAD-related symptoms in the primary caregivers of minors with asthma will be associated with increased asthma-related ER utilization. Similarly, sub-hypothesis 3b states that the number of GAD-related symptoms in the minors with asthma will also significantly influence asthma-related ER utilization. Finally, sub-hypothesis 3c states that minor and primary caregiver anxiety levels will each uniquely contribute to any significance effects found with ER utilization. To that end, a multiple regression analysis of both minor and caregiver anxiety as predictors of ER utilization was conducted.

For our fourth overall hypothesis, we used a binary variable for GAD diagnosis instead of the number of GAD-related symptoms. Hypothesis 4 was also split into three sub-hypotheses,

similar to hypothesis 3. Sub-hypothesis 4a states that GAD diagnosis in the primary caregivers of minors with asthma will significantly increase ER utilization. Sub-hypothesis 4b states that a diagnosis of GAD in the minors with asthma will also significantly increase ER utilization. Similar to sub-hypothesis 3c, another linear regression analysis was performed for sub-hypothesis 4c, using binary indices of GAD diagnoses as predictors, rather than the continuous variables employed in Hypothesis 3.

Method

Survey

The survey requested information relating to positive GAD diagnoses by medical professionals before the administration of the original Stress & Justice (S&J) baseline survey conducted by the Global Psychiatric Epidemiology Group (GPEG). This survey was administered between 2014 and 2016 as a baseline to the parental criminal justice system involvement (CJSI) from the S&J study. Exposure includes any arrest or detainment made by the criminal justice system. Information relating to GAD and asthma were confirmed by the research assistants who administered the DISC-IV for the baseline S&J study. Surveys were administered verbally and were recorded through the computer's recording software, the Dialogix system. The DISC-IV provided the number of GAD symptoms. The total number of participants to meet inclusion criteria included 250 minors and their primary caregivers.

Procedure

Research assistants of GPEG administered the original S&J survey to minors between 9 and 16 years of age, as well as their primary caregivers. The participants' survey and interview data were kept anonymous when utilized for this current study. This study utilized data related only to GAD, asthma, age, and demographics. The S&J survey contained a section for assessing

common mental health conditions within the DISC-IV, child and parent versions. The DISC-IV also documented information relating to participants' demographics, healthcare-related history, family and social history, and previous family-use of emergency services for asthma-related concerns. Primary caregivers are able to provide reliable information about their children because they spend a considerable amount of time together. Participants were placed into experimental and control groups depending on the hypothesis being tested. For example, for the first and second hypotheses, minors were placed into the control group if they did not have a diagnosis of asthma, while minors with asthma were placed into the experimental group. Each group was assessed for any association with GAD diagnosis and severity. For the third and fourth hypotheses of this study, participants were placed in the control group if they did not have a diagnosis of GAD, while those with GAD were placed into the experimental group. Each group was then also assessed for any association with the number of visits to their local ER within the year prior to the survey.

Participants

Participants were originally recruited for an S&J study performed by GPEG over a two-year period from 2014 to 2016. In the S&J study, exposed respondents, who at some point in their lives had contact with the criminal justice system, were excluded from the study. Participants without any CGSI contact, labeled as the control group for the S&J study, were utilized to avoid possible confounding variables. Respondents from outside the five boroughs of NYC were excluded from the study. The original data was filtered for information relating only to asthma, anxiety, and personal demographics of the participants. Although there were originally minors who were represented by only their secondary caregivers, these participants were excluded because many participants did not have secondary caregivers. After exclusion criteria,

participant total reduced from 346 to 250 minor (aged 9–16) and primary caregiver (aged 28–83) pairs. The analyses for the third and fourth hypotheses required that the minor participants to have a positive diagnosis of asthma. Therefore, those without asthma were excluded for the analyses related to the third and fourth hypotheses, bringing the total count of participants to 88. To keep the probability of utilizing ER services equal among participants, 24 participants without health insurance were excluded from the third and fourth hypotheses, which asked for information relating to ER utilization. This brought the total number of participants to 64 for the third and fourth hypotheses. However, the first and second hypothesis required data relating only to GAD and asthma diagnosis and severity. Therefore, all 250 participants were included in the analyses related to the first two hypotheses. Minors were represented by their primary caregivers, who were required to be the minors' legal guardians. Primary caregivers were whom the minor participants spent with most of their time.

Materials

Primary measures were self-reports for asthma in the minor, self-reports for the number of ER visits, and the DISC-IV. The DISC-IV, a section in the original S&J survey, is a structured diagnostic interview that measures the severity of many common psychiatric disorders, including GAD. Secondary measures focused on demographics, such as participant age, ethnicity, and gender. Statistics were performed using jamovi version 1.6 (The jamovi project (2021). jamovi (Version 1.6) [Computer Software]. Retrieved from https://www.jamovi.org). Tables were created using jamovi, while graphs were created with GraphPad Prism version 8.0.0 for Windows (GraphPad Software, San Diego, California USA, www.graphpad.com).

Statistical Analyses

For this study's first hypothesis, two Independent-samples t-tests were able to measure the effects of the diagnosis of asthma in minors on the number of GAD symptoms reported. For simplicity, the first hypothesis was split into two sub-hypotheses. Sub-hypothesis 1a states that the primary caregivers of minors with asthma will report more GAD-related symptoms compared to primary caregivers of minors without asthma. Sub-hypothesis 1b is specifically focused on the minors, and states that minors with asthma will report more GAD-related symptoms compared to minors without asthma. The DISC-IV, parent and child versions, provided the number of GAD symptoms through a survey. The first Independent-samples t-test checked for any associations between asthma in minors and the number of GAD symptoms reported by the minors. The second Independent-samples t-test checked for any associations between asthma in the minors and the number of GAD symptoms reported by the primary caregivers of the minors with asthma.

Our second overall hypothesis states that asthma in minors will increase that rate of GAD diagnosis among minors and primary caregivers. The first hypothesis measured anxiety through a continuous variable, such as the number of GAD-reported symptoms. To check for validity, we replaced the continuous dependent variable in the first hypothesis with a binary dependent variable, GAD diagnosis. We then split the second hypothesis into two sub-hypothesis, as we did in our first hypothesis. To complete this analysis, we used two nonparametric chi-square tests for independence. With the chi-square test for independence, it is possible to analyze the relationship between two categorical variables. For sub-hypothesis 2a, the two categorical variables compared were an asthma diagnosis in minors and a GAD diagnosis in the primary caregivers of minors. If the minor participant has asthma, then a "yes" is placed into the asthma diagnosis

category. This is repeated for GAD. The first chi-square test for independence can confirm if GAD in primary caregivers and asthma in minors are significantly associated. Sub-hypothesis 2b then analyzed asthma diagnosis in minors and GAD diagnosis in minors using another chi-square test of independence. Similarly, if the primary caregiver was diagnosed with GAD, a "Yes" was assigned to that category. Otherwise, a "No" was assigned. Each category involved in the chi-square tests of independence were answered with either a "Yes" or "No". Asthma diagnosis was confirmed by a medical professional prior to the original S&J study perform by GPEG. GAD diagnosis was then confirmed by the DISC-IV during the S&J study.

This study's third overall hypothesis is that the number of asthma-related ER visits and GAD symptoms will be significantly correlated. The third hypothesis was split into three sub-hypotheses, so that each variable could be accurately tested without interference. This required two Pearson's correlation matrices and a linear regression analysis. The first sub-hypotheses, 3a, states that the number of reported GAD symptoms by the primary caregivers of minors with asthma will be significantly correlated with the number of visits to their local ER for asthma-related concerns. Sub-hypothesis 3a focused on the primary caregivers of minors with asthma, while sub-hypothesis 3b is focused on the minors with asthma. Sub-hypothesis 3b states that the number of reported GAD symptoms by minors with asthma will be significantly correlated with the number of visits to their local ER. This allowed for any trend lines between asthma-related ER visits and GAD symptoms for both the primary caregivers and minors to appear. Although a trend line may suggest a correlation, it does not necessarily represent causation. A significant effect could be falsely interpreted as a result of combine effect from minor and primary caregiver anxiety. Sub-hypothesis 3c demonstrates that both primary caregiver anxiety and minor anxiety

can each independently predict the outcome of asthma-related ER utilization. A linear regression analysis would then be appropriate for the analysis of sub-hypothesis 3c.

Our fourth hypothesis states that there will be a significant association between the frequency of asthma-related ER visits and diagnosis of GAD. The fourth hypothesis was also split into three sub-hypotheses. Sub-hypothesis 4a states that the diagnosis of GAD in the primary caregivers of the minors with asthma will significantly increase ER visits for asthma-related concerns. Sub-hypothesis 4b then state that the diagnosis of GAD in the minors will also significantly increase asthma-related ER visits. Two Independent-samples t-tests are needed to analyze sub-hypotheses 4a and 4b. For these sub-hypotheses, only minors with asthma were included because the dependent variable, asthma-related ER visits, required the minor to be diagnosed with asthma. Therefore, all the minor participants included in the analyses for hypotheses 3 and 4 were previously diagnosed with asthma, bringing the total number of minor and primary caregiver pairs down to 64 (n = 64). Within these 64 minors, 57 minors had asthma but no GAD. This means that there were only 7 minors with comorbid asthma and GAD. This caused a significant Levene's test due to unequal variances in sub-hypothesis 4b. The Independent-samples t-tests was replaced with a conservative Welch's Independent-samples t-test to correct for the significant Levene's test. Similar to sub-hypothesis 3c, sub-hypothesis 4c states that both primary caregiver GAD and minor GAD can each predict the frequency of asthma-related ER utilization, requiring another linear regression analysis. The analysis for sub-hypothesis 4c demonstrated that primary caregiver GAD and minor GAD have a collective significant effect in predicting the frequency of asthma-related ER utilization.

Results

This study's first hypothesis is that a diagnosis of asthma will cause an increase in reported GAD symptoms in primary caregivers and minors. The first overall hypothesis was split into two sub-hypotheses. Each sub-hypothesis required an Independent-samples t-test. Sub-hypothesis 1a assessed the effect of asthma in minors on the number of GAD symptoms reported by their primary caregivers. Sub-hypothesis 1b assessed the effect of asthma in minors on the number of GAD symptoms reported by the minors. A significant association was found between a positive diagnosis of asthma in the minors and the number of GAD symptoms reported for their primary caregivers ($M = 3.20$, $SEM = .248$, $SD = 2.41$; $t(248) = 0.067$, $p = .003$) (Figure 1; Table 1), but not for the minors ($M = 2.65$, $SEM = .214$, $SD = 2.08$; $t(248) = 1.78$, $p = .947$) (Figure 2).

Our first overall hypothesis assessed GAD through a continuous variable, the number of reported GAD-related symptoms. Instead, our second hypothesis uses a binary variable for GAD diagnosis instead of a continuous variable. Hypothesis 2 states that asthma in minors will results in an increased rate of GAD diagnosis in both the primary caregivers and minors. Similar to our first hypothesis, our second hypothesis was split into two sub-hypotheses. Sub-hypothesis 2a assessed the effect of asthma in minors on the rate of GAD diagnosis reported by their primary caregivers. Sub-hypothesis 2b assessed the effect of asthma in minors on the rate of GAD diagnosis in those same minors. To observe the relationship between the two categorical variables, asthma diagnosis and GAD diagnosis, two separate chi-square tests of independence were performed. A significant relationship was found between asthma in minors and GAD in their primary caregivers [X^2 (1, $N = 250$) = 3.96, $p = .047$] (Figure 3, Table 2 & 3). This indicates that asthma in minors is significantly associated with a GAD in their primary caregivers. A significant relationship was not found between asthma in minors and GAD in minors [X^2 (1, N =

250) = .193, p = .661] (Figure 4, Table 4 & 5). This suggests that the diagnosis for GAD and the diagnosis for asthma in comorbid minors are independent and are not significantly associated.

This study's third hypothesis states that health-related anxiety will influence participants to increase their utilization of asthma-related ER services. To test our third hypothesis, we simplified it into three sub-hypotheses. Sub-hypothesis 3a states that the number of reported GAD symptoms in primary caregivers of minors with asthma will be significantly correlated with increased asthma-related ER visits. Sub-hypothesis 3b states that the number of reported GAD symptoms in minors with asthma will also be significantly correlated with asthma-related ER visits. Two correlation matrices were performed to test for possible correlations between asthma in minors and possible GAD in minors and their primary caregivers. The variables created for this statistical analysis include the number of asthma-related ER visits, the number of GAD symptoms for the minor, and the number of GAD symptoms for the primary caregiver. The number of asthma-related ER visits and GAD symptom counts for the primary caregivers were not found to be correlated, $r(64) = 0.107$, $p = .399$ (Figure 5). The number of asthma-related ER visits and the number of reported GAD symptoms in the minor were, however, found to be moderately correlated, $r(64) = 0.349$, $p < .01$ (Figure 6). Sub-hypothesis 3c states that each predicting variable, such as the number of GAD symptoms in primary caregivers or in the minors, will have a unique effect on the outcome, asthma-related ER visits. The unique contribution of each variable to the outcome can be observed through a linear regression analysis. Without this analysis, it would be uncertain if any observed significant effects are due to a collective effort from both primary caregiver and minor anxiety levels on asthma-related ER visits, or from each variable independently. The linear regression indicated that there was a collective significant effect between anxiety in primary caregivers of minors with asthma,

anxiety in minors with asthma, and asthma-related ER visits, ($F(2,61) = 4.31$, $p < .05$, $R^2 = .124$). Each predictor was then individually examined further. This examination provided two more findings. First, it indicated that GAD symptom counts for the primary caregivers ($t = .407$, $p = .685$) (Table 6) was not a significant predictor of asthma-related ER visits. Second, the examination indicated that GAD symptom count in minors with asthma ($t = 2.80$, $p = .007$) (Table 6) was found to a significant predictor for the number of asthma-related ER visits, even after controlling for the effects of caregiver symptoms.

Our third set of analyses found a moderate correlation between number of GAD symptoms reported by the minor and the number of asthma-related ER visits. To further examine this association, we constructed a fourth hypothesis. Our fourth hypothesis states that there will be a significant association between the frequency of asthma-related ER visits and diagnosis of GAD. Similar to hypothesis 3, hypothesis 4 was also split into three sub-hypotheses. Sub-hypotheses 4a and 4b each required an Independent-samples t-test to test for any significant associations. Sub-hypothesis 4a states that a diagnosis of GAD in primary caregivers of minors with asthma will be significantly associated with increased asthma-related ER visits. Sub-hypothesis 4b states that a diagnosis of GAD in minors with asthma will be significantly associated with increased asthma-related ER visits. An Independent-samples t-test showed that a significant association was not found between a diagnosis of GAD in the primary caregivers of minors with asthma and the number of asthma-related ER visits, ($M = .500$, $SEM = .133$, $SD = .960$; $t(62) = .540$, $p = .591$) (Figure 7; Table 7 & 8). Another Independent-samples t-test showed that a significant association was found between a diagnosis of GAD in minors with asthma and the number of asthma-related ER visits, ($M = .404$, $SEM = .100$, $SD = .960$; $t(62) = .3.27$, $p = .002$) (Figure 8; Table 9 & 10). To correct for the unequal variances of the Levene's test of

homogeneity in sub-hypothesis 4b, we used the more conservative Welsh's Independent-samples t-test. The Welch's t-test showed that a significant association was not found between a diagnosis of GAD in minors with asthma and the number of asthma-related ER visits, ($M = .404$, $SEM = .100$, $SD = .960$; $t(6.29) = 1.78$, $p = .124$) (Figure 7; Table 8 & 9). The conservative Welch's Independent-samples t-test indicated that a diagnosis of GAD did not cause an increase in the use of asthma-related ER services. Lastly, sub-hypothesis 4c also required a linear regression for the same purpose as sub-hypothesis 3c. This linear regression analysis showed that primary caregiver GAD diagnosis and GAD diagnosis in minors do have a collective significant effect on asthma-related ER visits ($F(2,61) = 5.30$, $p < .01$, $R^2 = .148$). GAD diagnosis for the primary caregivers ($t = .294$, $p = .770$) (Table 11) was not a significant predictor. Second, the examination indicated that GAD diagnosis in minors with asthma ($t = 3.203$, $p = .002$) (Table 11) was found to a significant predictor for the number of asthma-related ER visits, even after controlling for GAD diagnoses in caregivers.

Discussion

This study seeks to analyze GAD and the utilization of asthma-related ER services for significant associations. Our study illustrates the effects of comorbid asthma and GAD on ER use by minors and their primary caregivers. Anxiety about the uncertain outcome of their children's asthma exacerbations may motivate the use of emergency services by their primary caregivers more often than necessary. Providing mental health resources to the primary caregivers and minors with asthma can help to mitigate health-related anxiety and provide some emotional relief. Due to the nature of anxiety, GAD may affect decisions regarding the use emergency services such as an emergency room (ER). Therefore, the relationship between GAD and emergency room utilization warrants additional research.

Before discussing asthma-related ER utilization and GAD, we started with a focus on the relationship between a diagnosis of asthma in minors and the risk for the early onset of GAD in those same minors. We then attempted to highlight any significant associations between asthma and the development of early onset GAD in minors or typical GAD in their primary caregivers. If asthma does increase levels of anxiety then we should expect to see an increased number of reported GAD symptoms in minors with asthma and in their primary caregivers. For simplicity, it was easier to split the first hypothesis in two distinct sub-hypotheses, each requiring an Independent-samples t-tests to be performed. Sub-hypotheses 1a and 1b are similar, as they both share the same dependent variable, which is the number of asthma-related ER visits. They differ, however, in their independent variables. Sub-hypothesis 1a states that asthma in minors will increase the number of GAD symptom in their primary caregivers. Primary caregivers are the legal guardians of the minor participants. It is reasonable that a chronic health condition in their children may increase the primary caregivers' general level of anxiety. In fact, we found a significant association between a positive diagnosis of asthma in the minors and the number of GAD symptoms reported for their primary caregivers. This result is congruent with most of the modern research between chronic illness in children and resulting anxiety disorders in their parents. Sub-hypothesis 1b, then, searched for a positive association between asthma in minors and the number of GAD symptoms in those same minors. Interestingly, the same significant association observed in the primary caregivers was not found for the minors with asthma. Most current literature on the topic suggests that feelings of anxiety in both the minors and their primary caregivers would be significantly associated with chronic illness in the minors. In this study, that association is only evident with the primary caregivers. Primary caregivers are generally responsible for the decision to utilize ER service for asthma-related concerns in their

children. Increased anxiety in the primary caregivers may motivate them to utilize ER services for asthma-related health concern in their children more readily than primary caregivers with lower levels of anxiety. The anxiety, in this case, would be triggered by an intense fear for their children's health and safety. No significant association was observed between a diagnosis of asthma and the number of GAD symptoms in the children, which challenges existing evidence on the association between anxiety and asthma.

Although the results from sub-hypothesis 1a showed that severity of anxiety in primary caregivers was significantly associated with asthma in their children, severity of anxiety may be considered slightly objective. Therefore, we converted the continuous dependent variable for anxiety into a binary independent variable. In other words, instead of using number of GAD-related symptoms, we used an actual diagnosis of GAD. GAD diagnosis was provided by the Diagnostic Interview Schedule for Children (DISC-IV). To receive a positive diagnosis of GAD, either the primary caregiver or the minor needed to report at least 6 GAD-related symptoms on the DISC-IV. Hypothesis 2 was also split into two sub-hypotheses. Sub-hypotheses 2a and 2b each required a chi-square test of independence. Sub-hypothesis 2a states that a diagnosis of asthma in minors will increase the rate of GAD diagnosis in their primary caregivers. This analysis demonstrated a significant relationship between asthma in minors and GAD in their primary caregivers. The second sub-hypothesis, 2b, states that a diagnosis of asthma in minors will increase the rate of GAD diagnosis in those same minor participants. Our results confirmed that a diagnosis of asthma in the minors does not guarantee an increase in the risk of GAD diagnosis in the minors. The first chi-square test of independence revealed that a diagnosis of asthma in minors does guarantee an increase in the probability of developing GAD in their primary caregivers. This provides evidential support that primary caregivers may develop GAD

from worrying excessively about their children's asthma-related health concerns. Our second test showed that GAD in minors and asthma in minors were not significantly associated. The results of the second test also opposes current literature (Agnafors et al., 2019; Dudeney et al., 2017; Katon et al., 2004; Licari et al., 2008; McGrady et al., 2010; Mohammadi et al., 2020; Rietveld et al., 2005; Sztein & Lane, 2016). The results for sub-hypotheses 2a and 2b mirrored the results of sub-hypotheses 1a and 1b, which was expected due to their similarities. This analysis validated the results from the first set of analyses and provided another angle to view the associations between asthma in minors and the resulting risk for GAD.

After analyzing for associations between asthma in minors and GAD in the same minors and their primary caregivers, we shifted our focus to the impact of GAD on asthma-related ER utilization. Hypotheses 3 and 4 required addition exclusion criteria compared to hypotheses 1 and 2. Since hypotheses 3 and 4 were interested in asthma-related ER utilization, only minors with asthma and their primary caregivers were included. Minors without asthma and their primary caregivers were excluded from hypotheses 3 and 4. This is why there is a large difference of participants between the datasets for hypotheses 1 and 2 and hypotheses 3 and 4. After reorganizing the data, we decided to check for possible correlations between severity of anxiety and the number of visits to their local ER for asthma-related health concerns. Our third overall hypothesis states that the number of GAD symptoms will be significantly correlated with the number of visits to the ER for asthma-related concerns. Hypothesis three was then further split into three sub-hypotheses. To check for associations between two continuous variables, we decided to perform a series of correlation matrices for sub-hypotheses 3a and 3b. Sub-hypothesis 3a states that the number of reported GAD symptoms in primary caregivers of minors with asthma will be significantly correlated with increased asthma-related ER visits. The first

correlation matrix rejected this hypothesis as GAD severity in primary caregivers did not correlate with the number of visits to the ER for asthma-related concerns. Sub-hypothesis 3b states that the number of reported GAD symptoms in minors with asthma will also be significantly correlated with asthma-related ER visits. Results from the second correlation matrix showed that GAD symptom counts in minors with asthma was significantly correlated with asthma-related ER visits. The third sub-hypothesis, 3c, functions to establish that each of the predicting variables can independently predict the outcome. In other words, we hypothesized that both GAD symptom counts in primary caregivers and GAD symptoms counts in minors can each independently predict number of asthma-related ER visits. A linear regression analysis confirmed that a significant collective effect exists between primary caregiver GAD symptom counts, minor GAD symptoms counts, and asthma-related ER visits. In fact, GAD symptom counts in minors with asthma was still found to be significantly correlated with asthma-related ER visits, regardless of primary caregiver GAD symptom counts.

Hypothesis 4 replaces the continuous independent variable in hypothesis 3 with a binary independent variable. This is similar to how we converted hypothesis one into hypothesis two, except here we are replacing the independent variable instead of the dependent variable. In both cases however, number of GAD symptoms was replaced with a diagnosis of GAD. For consistency, we also split hypothesis 4 into three sub-hypotheses, just as we did with hypothesis 3. We expected our results for hypothesis 4 to mirror those of hypothesis 3, just as hypothesis 2 mirrored hypothesis 1. For example, if the number of asthma-related ER visits and the number of reported GAD symptoms in the minor were found to be significantly associated in sub-hypothesis 3b, we would expect the same for rate of GAD diagnosis in those same minors in sub-hypothesis 4b. As we expected, the results of hypothesis 4 were found to mirror the results of

hypothesis 3. Instead of measuring for an association between two continuous variables as in hypothesis 3, we were now working with one categorical variable and a one continuous variable in hypothesis 4. Therefore, we performed two Independent-samples t-tests for sub-hypotheses 4a and 4b. The results from sub-hypothesis 4a showed that a significant association was not found between a diagnosis of GAD in the primary caregivers of minors with asthma and the number of asthma-related ER visits. However, sub-hypothesis 4b demonstrated that a significant association was found between a diagnosis of GAD in minors with asthma and the number of asthma-related ER visits. The significant association found in analyzing sub-hypothesis 4b was also found to violate Levene's test for equality of variance. This was due to the difference in the number of participants between the control and experimental groups. The control group, minors with asthma but no GAD, had a total number of 57 participants. The experimental group, minors with comorbid asthma and GAD, had a total number of only 7 participants. To correct for the unequal variance between the control and experimental groups in sub-hypothesis 4b, we performed a more conservate t-test known as the Welch's Independent-samples t-test. This corrected the violation of equal variances but also removed the significant association found between a diagnosis of GAD in minors with asthma and the number of asthma-related ER visits. For the same purpose as in sub-hypothesis 3c, we performed another linear regression analysis for sub-hypothesis 4c. In this case, a diagnosis of GAD in the primary caregivers and a diagnosis of GAD in minors with asthma were found to have a collective significant effect of the number of visits to the ER for asthma-related health concerns in the minors. This suggests that primary caregiver anxiety and minor anxiety may have some interplay in the overall decision to utilize ER services for asthma-related concerns. This could also possibly mean that without the

diagnosis of GAD in the minor, GAD in the parent may not be sufficient enough to increase asthma-related visits to the ER.

Certain limitations in this study may help to explain why this study occasionally challenged existing research. Data were collected and provided by the Global Psychiatric Epidemiology Group (GPEG) at the NYSPI. The original study performed by GPEG was related to the long-term effects of parental criminal justice system involvement (CJSI). As part of the S&J study, clinical data relating to mental health and the development of chronic illness in parents and their immediate families were recorded. The primary focus of the S&J baseline study was parents and their children. Their children were surveyed to observe the impact of CJSI on their mental health. Since the S&J surveys were administered before our study occurred, it was impossible to alter the structure of the surveys and create questions specifically focused for our new study. A large amount of participants were excluded from the study for not meeting minimum criteria. Although this data originates from a study focused on contact with the criminal justice system, all participants who had contact with that system were excluded from this study to minimize possible confounding variables in respect to either asthma or GAD development. When working with archived and deidentified data, it may be challenging to assure equal variances among specific variables. Further research on this topic should prioritize equal variances between comorbid diagnoses for comorbid asthma and GAD and only asthma.

It is difficult to focus on a single population of minors because of exposure to different environmental factors in geographic locations. Urban areas are generally more exposed to increased air pollution and other potential cardiovascular irritants compared to suburban and rural areas. Since the S&J study recruited participants from only the five boroughs of NYC, it is possible that the higher levels of air pollution may play a role in the development of asthma.

Despite less pollution, individuals from rural areas are more likely to have decreased access to essential medical care due to geographic isolation. If rural individuals develop a chronic illness, they may struggle to obtain medication and experience additional hardships compared to urban individuals. Our study focused on minors and primary caregivers from urban environments; therefore, future studies should check for differences in associations between asthma, GAD, and ER utilization in suburban and rural populations in addition to urban backgrounds.

Other chronic illnesses such as amyotrophic lateral sclerosis (ALS) and Crohn's disease could also shed additional light on possible associations between the early onset of GAD in minors or their primary caregiver. In addition to GAD, it is possible that other mood disorders such as major depressive disorder or dysthymia may be associated with chronic illness. Expanding the list of chronic illnesses and anxiety disorders may help to expand on the association between chronic illness and the early onset of comorbid mental health conditions. Creating surveys targeted for chronic illnesses and mental health may help to further specify this topic.

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Tables

Table 1

Means, Standard Deviations, and Standard Errors for Independent-samples t-tests in Figure 1

	Group	N	Mean	SD	SE
GAD Symptom Count for Minor	No Asthma	155	2.67	2.13	0.171
	Yes Asthma	95	2.65	2.08	0.214
GAD Symptom Count for Caregiver	No Asthma	155	2.33	2.05	0.165
	Yes Asthma	95	3.20	2.41	0.248

Note. This table shows descriptives relating to GAD symptom counts in minors and their primary caregivers. The term caregiver refers to the minor's primary caregiver. Minor refers to the underaged individual under the care of a primary caregiver. No asthma refers to a negative diagnosis of asthma. Asthma refers to a positive diagnosis of asthma. This table represents the descriptives for Figure 1.

Table 2

Chi-Square Results for the Effect of Asthma in Minors on GAD Diagnosis in Primary Caregivers

	Value	*df*	*p*
χ^2	3.96	1	0.047
N	250		

Note. This table represents the second chi-square test of independence. The variables tested for significance were a diagnosis of asthma in minors and a diagnosis of GAD in their primary caregivers. Both of the variables were answered with either a Yes or No. The p-value shown in this table represents statistical significance between the two variables ($p < .05$). This result shows that a positive diagnosis of asthma in minors does increase the risk for a positive diagnosis of GAD in their primary caregivers.

Table 3

F*requencies for the Chi-Square Analysis in Table 3*

	GAD Diagnosis in Primary Caregiver		
Asthma Diagnosis in Minors	**Yes**	**No**	**Total**
Yes	15	80	95
No	12	143	155
Total	27	223	250

Note. This table represents the statistics for the chi-square analysis from Table 2 and Figure 3. The variables tested for significance are a diagnosis of asthma in minors and a diagnosis of GAD in primary caregivers of the minors. Primary caregivers with GAD were assigned a Yes under the GAD Diagnosis in Primary Caregiver column, while those without GAD were assigned a No. Similarly, Minors who have reported a positive diagnosis of asthma are represented by a Yes under the Asthma Diagnosis in Minors column. Minors without asthma are given a No in the Asthma Diagnosis in Minors column.

Table 4

Chi-Square Results for the Effect of Asthma in Minors on the Early Onset of GAD in Minors

	Value	df	p
χ^2	0.193	1	0.661
N	250		

Note. This is another chi-square test for independence. The variables tested for significance are a diagnosis of asthma in minors and a diagnosis of GAD in minors. Both of the variables were answered with either a yes or no. The p-value shown in this table shows that there is no significance between a diagnosis of asthma in minors and GAD in those same minors ($p > .05$). In other words, a positive diagnosis of asthma in minors does not increase the risk for a positive comorbid diagnosis of GAD in minors.

Table 5

Frequencies for the Chi-Square Analysis in Table 4

	GAD Diagnosis in Minors		
Asthma Diagnosis	**Yes**	**No**	**Total**
Yes	10	80	90
No	15	145	160
Total	25	225	250

Note. This table represents the statistics for the chi-square analysis from Table 4 and Figure 2. Minors with GAD were designated beneath the Yes under GAD Diagnosis in Minors, while Minors without GAD are represented by the No under GAD Diagnosis in Minors. Similarly, minors who have asthma are represented by the Yes under the Asthma Diagnosis column. The minors without asthma are represented by the No under the Asthma Diagnosis column.

Table 6

Regression Coefficients of GAD Symptom Count on Number of ER Visits

Model Coefficients - Number of ER Visits

Predictor	Estimate	SE	t	p
Intercept	0.0822	0.2232	0.368	0.714
GAD Symptom Count (Caregiver)	0.0186	0.0457	0.407	0.685
GAD Symptom Count (Minor)	0.1455	0.0520	2.797	0.007

Note. This analysis represents each variable's ability to independently act as a predictor for a specific outcome. In this table, the predictor variables are GAD Symptom Count (Caregiver) and GAD Symptom Count (Minor). The outcome variable, or dependent variable, is Number of ER Visits. The p-value for Intercept is greater than .05. This indicates that there is no collective significant effect between anxiety in primary caregivers of minors with asthma, anxiety in minors with asthma, and asthma-related ER visits. After linear regression analysis, GAD Symptom Count (Caregiver) was not a significant predictor of Number of ER Visits. GAD Symptom Count (Minor) was still found to be significant after nonsignificant linear regression. This further reinforced the association between GAD symptom count in minors with asthma and the number of asthma-related ER visits.

Table 7

Results of Asthma-related ER Utilization by Primary Caregivers with GAD

Independent Samples T-Test

		Statistic	df	p
Number of ER visits Participant	Student's t	-0.540	62.0	0.591

Note. The p-value for this Independent-samples t-test shows that no significant association exists between a diagnosis of GAD in the primary caregivers of minors with asthma and asthma-related ER utilization. The variable number of ER visits accounts only for the asthma-related ER visits in the year prior to the survey.

Table 8

Means, Standard Deviations, and Sample Sizes for the Independent Samples t-test in Table 7

Group Descriptives

	Group	N	Mean	Median	SD	SE
Number of ER visits Participant	No	52	0.500	0.00	0.960	0.133
	Yes	12	0.667	0.00	0.985	0.284

Note. This table provides the descriptive analysis for Table 7. This table shows the number of primary caregivers who brought their children to their local ER within the year prior to the study for asthma-related concerns. The dependent variable in this analysis is the number of visits to the ER for asthma-related concerns. Therefore, this analysis only utilized data from participants diagnosed with asthma (n = 64).

Table 9

Results of Asthma-related ER Use by Minors with Comorbid GAD and Asthma

		Statistic		df	p
Number of ER visits	Student's t	3.27	[a]	62.0	0.002
	Welch's t	1.78		6.29	0.124

[a] Levene's test is significant ($p < .05$), suggesting a violation of the assumption of equal variances.

Note. The p-value for the Student's Independent-samples t-test shows that a significant association does exist between a diagnosis of GAD in minors with asthma and asthma-related ER utilization. The Student's Independent-samples t-test resulted in a significant Levene's test, which represent a violation of homogeneity. A more conservative Welch's t-test was performed instead to account for the significant Levene's test. The Welch's t-test corrected for the significant Levene's test. The resulting analysis met the assumption for homogeneity. The variable number of ER visits only accounts for asthma-related ER visits in the year prior to the survey. The p-value shown for Welch's t-test does not convey significance between minors with comorbid GAD and asthma compared to minors with only asthma.

Table 10

Means, Standard Deviations, and Sample Sizes for the Independent Samples t-test in Table 9

	Group	N	Mean	Median	SD	SE
Number of ER visits (both)	Asthma only	57	0.404	0.00	0.753	0.0997
	Both Asthma and GAD	7	1.57	1.00	1.72	0.649

Note. This table provides the descriptive analysis for Table 8. There is a large difference between minors with asthma compared to minors with comorbid GAD and asthma. This discrepancy contributed to the significant Levene's test shown in table 8, which was corrected with a more conservative Welch's t-test. This table shows the number of minors who attended the ER within the year prior to the study for asthma-related concerns, but does not represent the entire sample. The dependent variable in this analysis is the number of visits to the ER for asthma-related concerns. Therefore, this analysis only utilized data from participants diagnosed with asthma (n = 64).

Table 11

Regression Coefficients of GAD Diagnosis on Number of ER Visits

Model Coefficients - Number of ER Visits

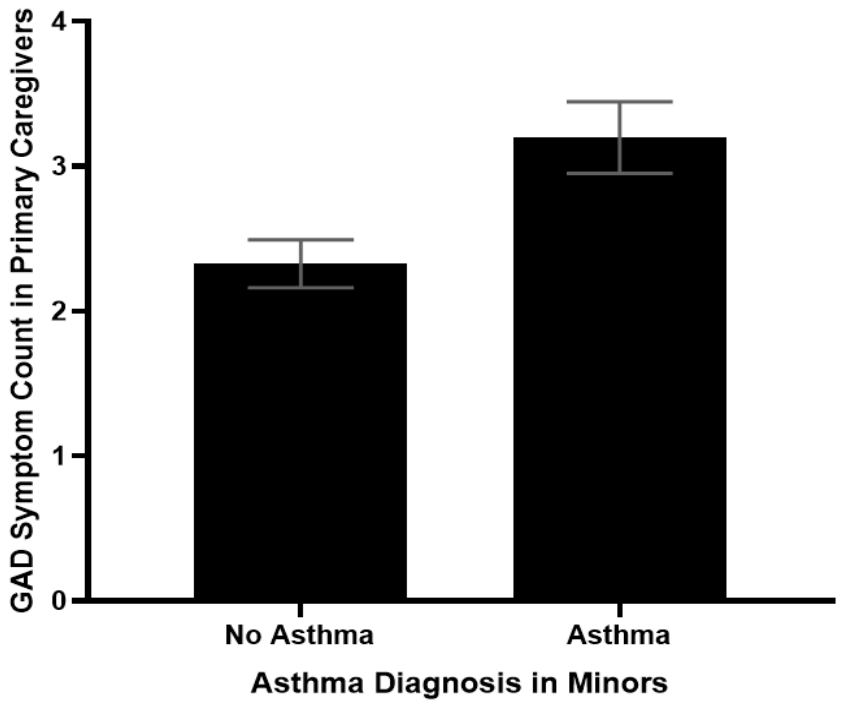
Predictor	Estimate	SE	t	p
Intercept	0.389	.130	3.001	.004
GAD Diagnosis (Caregiver)	.085	.289	.294	.770
GAD Diagnosis (Minor)	1.159	.362	3.203	.002

Note. In this table, the predictor variables are GAD Diagnosis (Caregiver) and GAD Diagnosis (Minor). The outcome variable, or dependent variable, is Number of ER Visits. The p-value for Intercept is less than .01. This indicates that there is some collective significant effect between anxiety in primary caregivers of minors with asthma, anxiety in minors with asthma, and asthma-related ER visits. After linear regression analysis, GAD Diagnosis (Minor) was found to be a significant predictor of Number of ER Visits. GAD Diagnosis (Caregiver) was not found to be significant.

Figures

Figure 1

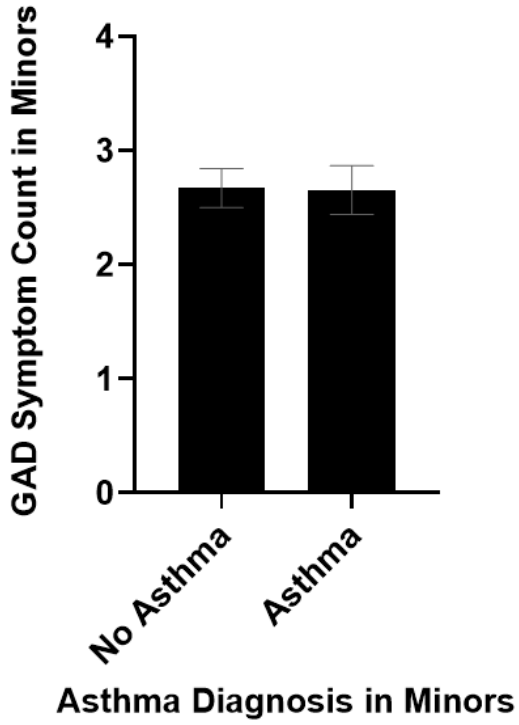
Bar Graph of GAD Symptom Counts in Caregivers of Minors with Asthma



Note. The average GAD symptom count is shown for primary caregivers of minors with and without asthma. This figure shows the significant difference in GAD symptom counts in respect to asthma diagnosis in minors. Primary caregivers of minors with asthma reported, on average, 1 more symptom of GAD compared to primary caregivers of minors without asthma. Error bars represent the standard error of the mean.

Figure 2

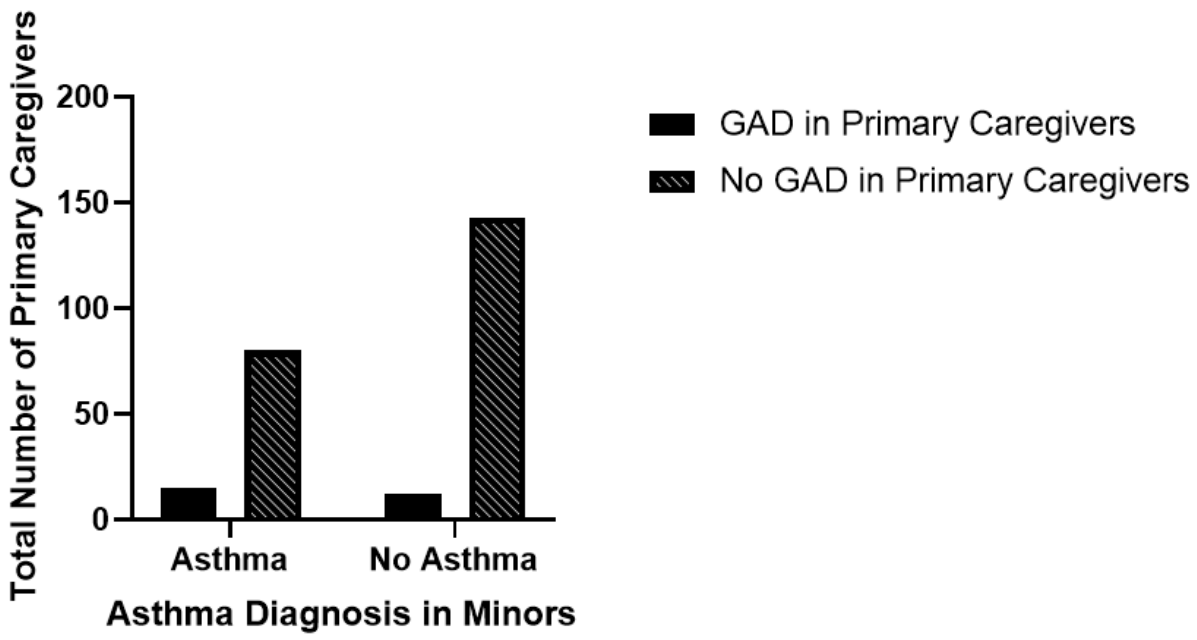
Bar Graph of GAD Symptom Counts in Minors with Asthma



Note. The average GAD symptom count is shown for minors with and without asthma. Minors with asthma reported no significant difference in GAD symptom counts compared minors without asthma. A difference in average GAD symptoms count between minors with asthma and minors without asthma was not observed in this analysis. Error bars represent the standard error of the mean.

Figure 3

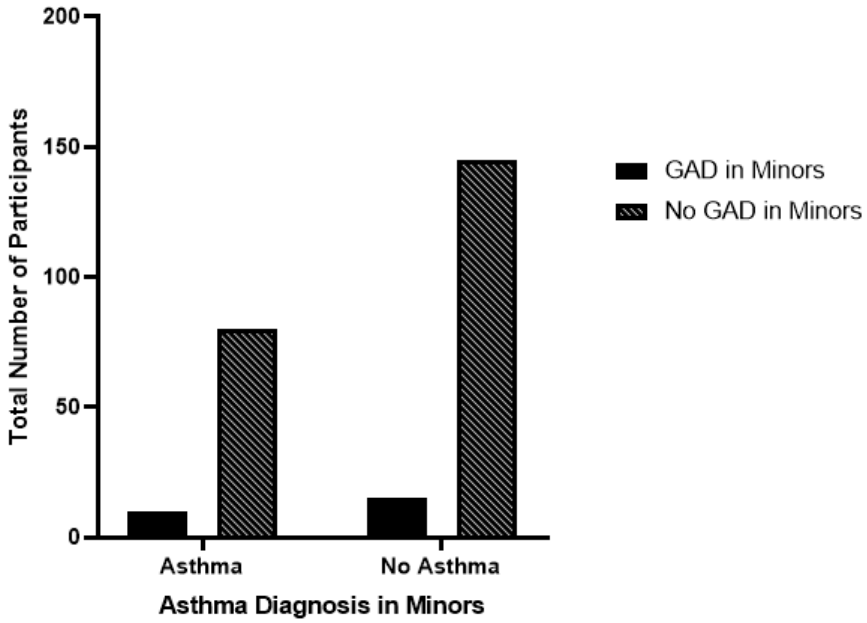
Bar Graph of Asthma Diagnosis in Minors vs GAD Diagnosis in Primary Caregivers



Note. This graphs represents the rate of GAD diagnosis among primary caregivers of minors with or without asthma. GAD means that the primary caregiver was given a positive diagnosis of GAD by the DISC-IV, parent version. No GAD means that the primary caregiver did not meet the minimum requirements for GAD, per DISC-IV, parent version guidelines. This bar graph also shows that the primary caregivers of minors with asthma are significantly more likely to be diagnosed with GAD compared to primary caregivers of minors without asthma ($p < .05$).

Figure 4

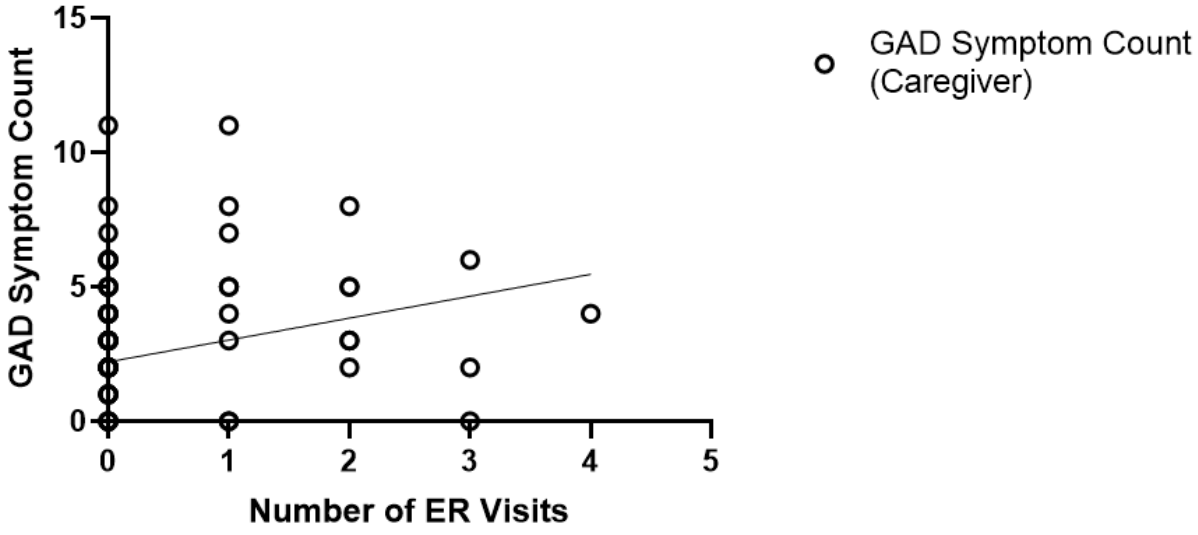
Bar Graph of Asthma Diagnosis in Minors vs GAD Diagnosis in Minors



Note. The total number of minors is shown for both asthma and GAD diagnoses. GAD in Minors means that the minor was given a positive diagnosis of GAD by the DISC-IV, child version. No GAD mean that the minor did not meet criteria for a GAD diagnosis by the DISC-IV, child version. Asthma means that the minors was previously diagnosed with asthma by a medical professional. No asthma means that the minor does not have asthma. This bar graph shows that minors with asthma are not more likely to be diagnosed with GAD ($p > .05$).

Figure 5

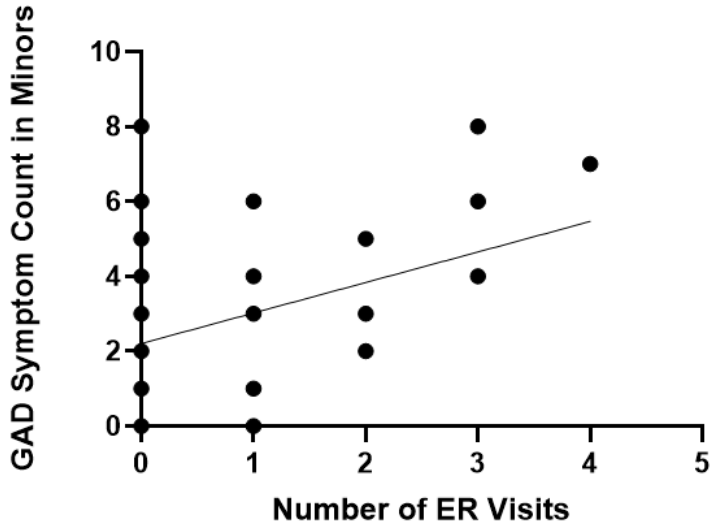
Scatterplot of GAD Symptom Count in Primary Caregivers and Number of Visits to ER



Note. This scatterplot represents GAD symptom counts in primary caregivers of minors with asthma and their corresponding number of visits to the ER within the last year. GAD symptom counts and the number of visits to the ER were tallied from survey reports. The trend line represents the trendline for GAD symptom counts in the primary caregivers in relation to how often their children have visited ER within the past year for asthma-related concerns. Although the caregiver trendline may appear slightly positive, a significant effect between the two variables was not detected ($p > .05$).

Figure 6

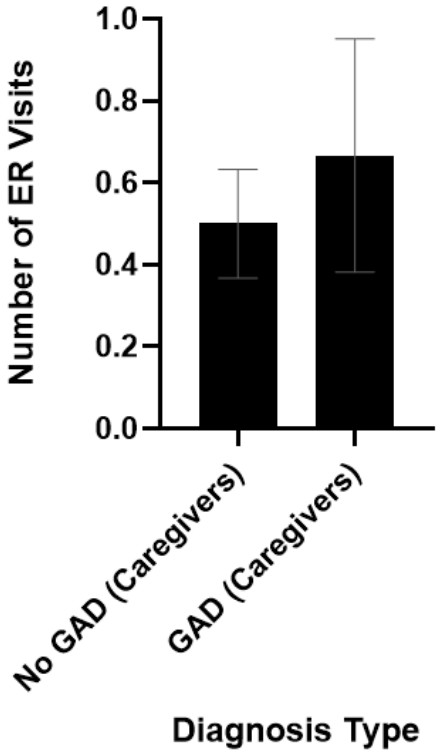
Scatterplot of GAD Symptom Count in Minors with Asthma and Number of Visits to ER



Note. This scatterplot represents GAD symptom counts in minors with asthma and their corresponding number of visits to the ER within the last year. The trend line represents the trendline for GAD symptom counts in minors with asthma in relation to how often they have been to the ER within the past year for asthma-related concerns. GAD symptom count in the minors and the number of visits to the ER were significantly related ($p < .01$).

Figure 7

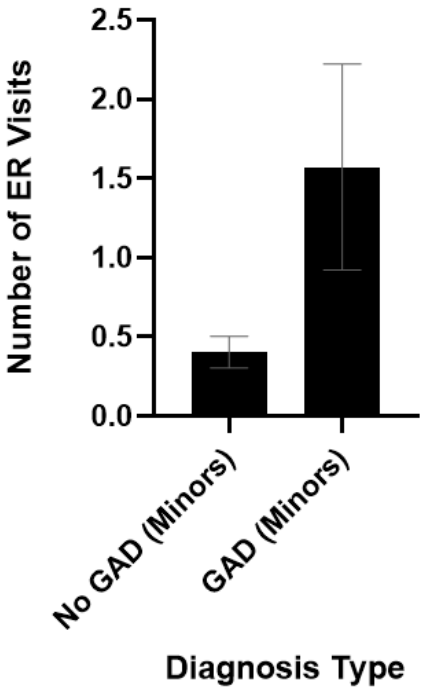
Bar graph of Number of Asthma-related ER Visits for in Primary Caregivers with GAD



Note. This bar graph represents the mean number of asthma-related ER visits is shown for primary caregivers with and without GAD. All minors in this analysis were positive for asthma diagnosis, as it is required for asthma-related ER utilization. The number of asthma-related ER visits was tallied from survey reports. Error bars show standard errors of the mean. The bar representing GAD has a larger error bar because of the difference in sample size between the two groups. The number of asthma-related ER visits reported for primary caregivers with GAD was not significantly higher than primary caregivers without GAD [$t(62) = .540$, $p = .591$].

Figure 8

Bar graph of Number of Asthma-related ER Visits for in Minors with Comorbid Asthma & GAD



Note. This bar graph represents the mean number of asthma-related ER visits is shown for minors with and without GAD. All minors in this analysis were positive for asthma diagnosis, as it is required for asthma-related ER utilization. The number of asthma-related ER visits was tallied from survey reports. Error bars show standard errors of the mean. The bar representing GAD has a larger error bar because of the difference in sample size between the two groups. The number of asthma-related ER visits reported for GAD is significantly higher than No GAD [$t(62) = 3.27$, $p = .002$]. After correcting for Levene's test by using the more conservative Welch's t-test, no significance was observed [$t(6.29) = 1.78$, $p = .124$].