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Elevated Burden for Caregivers of Children with Persistent Asthma and a Developmental Disability

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Abstract

Objective—To evaluate how having a child with both persistent asthma and a developmental disability (DD) affects caregiver burden and quality of life (QOL).

Subjects/Setting: 3–10 yr old children with persistent asthma in urban Rochester, NY.

Design—Cross-sectional baseline survey (2006–2009).

DD Definition—Parent report of autism spectrum disorder or other behavioral disorder requiring medication.

Primary Outcome—Caregiver burden and QOL as measured by scores on previously validated depression, parenting confidence, and asthma-related quality of life scales as well as an assessment of competing demands on the caregiver.

Analyses—Bivariate and multivariate regression analyses controlling for caregiver age, education, marital status, race, ethnicity, and child asthma symptom severity.

Results—We enrolled 530 children as part of a larger study (response rate: 74%; 63% Black, 73% Medicaid). Of this sample, 70 children (13%) were defined as having a DD. There were no differences in asthma symptom severity between children with and without a DD diagnosis. However, even after adjusting for potential confounders, caregivers of children with a DD

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reported worse scores on the depression ($p = .003$), parenting confidence ($p < .001$), and competing demands ($p = .013$) scales and worse asthma-related quality of life ($p = .035$) compared to caregivers of typically developing children with asthma.

Conclusions—Despite having similar asthma symptom severity, caregivers of children with both persistent asthma and a DD diagnosis report more burden and lower QOL compared to that of caregivers of typically developing children and persistent asthma. Further attention to this subgroup is needed to promote optimal support for caregivers.

Keywords

maternal depression; parenting confidence; quality of life; developmental delay; chronic condition

Background

Developmental disability (DD) is a broad category of physical, behavioral, and learning disorders with childhood onset. Several common childhood disorders fall under the DD classification, including attention-deficit/hyperactivity disorder (ADHD), cerebral palsy, intellectual disability, muscular dystrophy, Tourette syndrome, and autism spectrum disorders (ASD). Recent data show a drastic increase in the prevalence of US children with a DD diagnosis since the new millennia. (1) Children with DD are also at greater risk of having co-morbid physical health conditions, including asthma. (2) Although rates of pediatric asthma have recently reached a plateau, asthma remains the most common chronic physical health condition in childhood, and continues to affect an estimated 9.1% of US children. (3) The reasons for elevated asthma prevalence among children diagnosed with a DD are unclear, but may be related to enhanced medical attention and diagnosis rates in children already regularly seeing a physician for one chronic condition or, potentially, a biological and environmental link between these two conditions. (4, 5)

As the prevalence of DD continues to increase and pediatric asthma prevalence remains high, there likely will be an even greater number of children with a dual DD/asthma diagnosis. Yet, the specialized healthcare and support service needs of this population are not clear. For instance, it is well-documented that caring for a child with a chronic health condition, such as asthma, is correlated with elevated caregiver anxiety and depression (6–8) and can negatively impact the caregiver's overall quality of life. (9) Similarly, there is a robust body of evidence to support that the burden of care is also elevated for parents of children with a DD. (10–12) However, relatively little is known about how caring for a child with multiple chronic conditions may affect caregivers. In a recent study of over five thousand children with physician-diagnosed ADHD, parental strain was greater for caregivers of children with ADHD and a physical health condition, such as asthma, as compared to parents of children with ADHD alone. (13)

The mental and emotional health of the caregiver can significantly impact the health of the child, (14–17) and pediatricians can play a critical role in addressing and helping to manage caregiver burden. Prior studies have found that asthmatic children with depressed caregivers report worse adherence to preventive asthma medications, less confidence and satisfaction during doctor's visits, and increased healthcare utilization, including more frequent visits to

the emergency department. (6, 18–22) This is particularly pertinent for young urban children, since they suffer the greatest burden of asthma morbidity (23) and are at high risk for inadequate preventive treatment. (24, 25)

One prospective study found a link between parental stress and the early onset of wheezing in childhood. (26) In addition to increasing asthma morbidity, elevated caregiver burden can also worsen children's cognitive, social, and behavioral problems, (27–32) which could have compounding effects on children with a DD, who often already have impairments in these areas. Further elucidating this issue is critical in order to begin to optimize care and improve outcomes for this vulnerable population. The purpose of this study is to evaluate how caring for a child with two of the most prevalent chronic conditions of childhood- asthma and a DD- impacts caregiver burden and quality of life. We focus on urban children with persistent asthma in order to capture a high-risk group of children in most need of consistent preventive care. We hypothesize that caregivers of children with a dual asthma and DD diagnosis will have a elevated burden and will report high levels of depressed mood, decreased parenting confidence, and increased competing demands. If true, a subgroup of high-risk caregivers (those with children with a chronic physical illness and a DD) would be identified, which would have important clinical applications for pediatric health care providers who could then screen for and address the caregiver's issues before they potentially interfere with the child's health management.

Methods

Subject/Setting

As part of a larger study, we partnered with an urban school district to recruit children ages 3–10 years with physician-diagnosed persistent asthma (n = 530). (33) All study procedures for the primary study were approved by the affiliated Institutional Review Board. Data for this cross-sectional analysis were planned a priori and collected during in-home baseline assessments (2006–2009). Subjects were classified as having a developmental disability (DD) if their caregiver reported that the child had received a diagnosis of a behavioral disorder including attention-deficit disorder (ADD), attention-deficit/hyperactivity disorder (ADHD), or other conduct disorder and if the child was currently prescribed medication for that disorder. Prescription of a behavioral medication was confirmed through a combination of both parent report and a written catalogue of all prescribed medications present in the home, as recorded by the researchers, at the initial home visit. Children were also considered to have a DD if their caregiver reported a doctor diagnosis of an autism spectrum disorder (ASD) (i.e. autism, Asperger syndrome, pervasive developmental disorder not otherwise specified), regardless of whether or not the child was currently prescribed a behavioral medication (since currently pharmacological therapies are not first line treatments for ASD). (34–38)

Outcome Measures

To determine caregiver burden, we assessed depressed mood, asthma-related quality of life, parenting confidence, and competing demands. Caregiver depressed mood was measured using the validated Kessler Psychological Distress Scale (K10); (39) a ten-question survey

asking caregivers to assess how often they experienced certain emotions (e.g. hopelessness, restlessness, worthlessness) over the past four weeks. Responses to each item are scored using a five-point Likert scale (1 = “none of the time,” 5 = “all of the time”). Total scores can range from ten to fifty, with higher scores indicating more severely depressed mood. Scores above nineteen are considered clinically significant. (40)

Juniper’s Asthma-Related Quality of Life Scale (41) is a thirteen-question survey that uses a seven-point Likert scale. The first nine questions ask how often in the prior week the child’s asthma interfered with various aspects of the caregiver’s normal daily life (1 = “all of the time,” 7 = “none of the time”). Questions ten through thirteen ask the caregiver to rate how worried they felt in the past week regarding their child’s asthma-related health (1 = “very, very worried,” 7 = “not worried”). Total scores can range from thirteen to ninety-one, with lower scores reflecting worse asthma-related quality of life.

To evaluate parenting confidence, we used the Competence subscale of the Parenting Stress Index (42) with permission from the publisher, Psychological Assessment Resources, Inc. This includes five questions asking caregivers to assess their parenting confidence. Each response is scored on a five-point Likert scale (1 = “strongly agree,” 5 = “strongly disagree”), for a possible total score range of five to twenty-five. Higher scores are indicative of lower levels of parenting confidence.

We used a six-question survey to assess the additional demands that may compete for the caregiver’s attention. Caregivers were asked how often in the past two months they worried about each stressor (i.e. housing, home/neighborhood safety, a job, personal/family relationships, income/making ends meets/paying the bills, and their own health/health of another family member) and responses were scored on a five-point Likert scale (1 = “all of the time,” 5 = “none of the time”). Total scores can range between five and thirty, with lower scores representing more demands on the caregiver. (43)

Caregivers also reported behavioral scores for their child using the Behavioral Problems Inventory (BPI)- an instrument used to assess the severity of children’s negative behaviors using eight subscales: internalizing, externalizing, anxious/depressed, headstrong, antisocial, hyperactive, peer conflict, and immature. Higher scores indicate more severe behaviors and a total BPI score greater than or equal to 14 is considered clinically significant. (44)

Covariates

Since worse physical illness is often associated with elevated caregiver anxiety (45) and overall burden, (13, 46, 47) we analyzed symptom severity for all children to ensure that there were no significant group differences in asthma morbidity. Asthma symptom severity was assessed using the National Heart, Lung, and Blood Institute (NHLBI) guidelines for asthma control. (48) At the initial home visit, caregivers were asked to recall their child’s asthma symptoms over the prior two weeks. They reported the frequency of symptom-free days (defined as a twenty-four hour period in which their child had no coughing, wheezing, chest tightness, or shortness of breath and no need for rescue medications), nights with asthma symptoms, days in which their child’s activity was limited due to asthma, and days in which their child needed to use a rescue medication such as Albuterol. Days when rescue

medications were used only to prevent asthma symptoms before physical education classes were not included.

Tobacco smoke exposure was evaluated using both subjective (i.e. prevalence of primary caregiver that self-identifies as a smoker, prevalence of smokers in the home) and an objective measure (child's salivary cotinine (49)). Additional covariates included basic demographic information such as caregiver age (50–53) (<30 or ≥30 years), race (53) (White, Black or Other), ethnicity (53, 54) (Hispanic or not Hispanic), marital status (53, 55) (married/domestic partner or single), education (53) (<high school or ≥high school), and dichotomized child asthma symptom severity (13, 46, 47) (mild persistent or moderate/severe persistent symptoms).

Analyses

Statistical analyses were performed using IBM SPSS Version 20.0 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). We performed bivariate analyses including Chi-square and Mann-Whitney tests to compare characteristics of children with and without DD. We also conducted multivariate regression analyses to assess the independent relationship between having a child with DD and the outcomes of interest. A p-value <.05 was considered statistically significant.

Results

As part of the primary study, (33) we enrolled 530 children with a 74% response rate. Of this sample, 70 children (13%) were defined as having a developmental disability (DD). Figure 1 depicts the breakdown of parent-reported DD diagnoses within the asthma/DD subgroup. These are not mutually exclusive diagnoses, and those children whose parents reported several DD diagnoses are listed in multiple categories. Within this group, ADD/ADHD was the most prevalent diagnosis (80%).

Of the entire sample, 63% of children were Black and 73% were covered by a Medicaid-managed public health insurance plan (Table 1). The majority of caregivers were Black (61%) and not Hispanic (76%), under the age of thirty (66%), single (78%), and had at least a high school education (61%). As expected, children in the DD group were more likely to be male, since developmental disabilities are significantly more prevalent amongst males. (1) These children also tended to be older, which we anticipated since presentation of developmental abnormalities often becomes more obvious as the child is given more independence and responsibility. There were no other significant differences in demographic characteristics between children with and without a DD diagnosis. We found no group differences in smoke exposure, using both subjective and objective measures. There was no difference in asthma symptom severity or preventive asthma medication use between groups (Table 2). As expected, parents of children with an asthma/DD dual diagnosis did report significantly higher BPI scores, confirming that these children had worse behavioral problems than their typically developing peers. Children with a DD had higher scores for each of the eight behavior subscales, higher total scores, and were also more likely to have a total BPI score of at least 14, indicative of clinically significant behavior problems (Table 3).

Table 4 shows outcomes related to caregiver burden for children with and without DD, controlling for pertinent confounders. Caregivers of children with a DD and persistent asthma reported significantly worse scores on the depression ($p = .003$), parenting confidence ($p < .001$), and competing demands scales ($p = .013$) as well as worse asthma-related quality of life ($p = .035$) compared to caregivers of typically developing children with persistent asthma. K10 scores also revealed that caregivers of children with a DD were more likely to report clinically significant levels of depressed mood than caregivers of typically developing children with asthma (53% vs. 38%, $p = .018$).

Discussion

The purpose of this study was to determine whether having a child with asthma and DD comorbidity was associated with greater caregiver burden than raising a typically developing child with persistent asthma. We found, despite that children had similar asthma symptom severity across groups, caregivers of children with both persistent asthma and a DD diagnosis reported greater burden. Caregivers of children with asthma who also have a DD reported significantly poorer parenting confidence, depression, and competing demands. Interestingly, these caregivers also reported a significantly lower asthma-related quality of life, regardless of the fact that there was no difference in asthma symptom severity between children with and without a parent-reported DD. This suggests that the additional stress of raising a child with two chronic conditions makes these caregivers more likely to feel the impact their child's asthma has on the family. These findings are consistent with other studies that have shown elevated caregiver burden for parents of children with ADHD and a physical illness (13) and those demonstrating lower asthma-related quality of life in caregivers that also report negative affect. (56)

Prior studies have also shown that elevated caregiver burden is correlated with poor adherence to preventive asthma medications (22) and ineffective communication between the parent and the child's PCP. (18) Although these are logical mechanisms for increased morbidity, (57, 58) recent studies have found mixed results. Several authors have reported that children with depressed caregivers are at increased risk of asthma-related hospitalization, more days with asthma symptoms, and poorer functional status. (6, 19–21) Some studies have been unable to establish a direct link between elevated caregiver burden and increased asthma symptom severity, though this may be due to the complex nature of pediatric asthma management. (18, 22) We found that caregivers of children with a DD reported worse psychological distress, however, there was no significant difference in asthma symptom severity, based on NHLBI criteria, between children with and without a DD. It is possible that our ability to detect differences in asthma severity was limited given that our sample only included children experiencing persistent symptoms.

In addition to potentially leading to an increase in asthma morbidity, elevated caregiver burden can also increase the child's risk for developing cognitive, social, and behavioral problems. A meta-analysis of 193 studies found that maternal postnatal depression was correlated with significantly higher prevalence of psychopathology and negative behavior in their children. (28) This is especially concerning for children with a DD, as they are already at increased risk of having behavior problems. In our sample, parents of children with a DD

were more likely to report child Behavioral Problems Inventory (BPI) scores above the cut-off considered clinically significant ($p < .001$), despite that the majority were currently taking a behavioral medication. These caregivers also reported worse scores on all eight BPI subscales, including the depression/anxiety subscale ($p < .001$). Caregivers of children with a dual asthma/DD diagnosis were also significantly more likely to report that their child had depression or an anxiety disorder ($p = .002$). Although we cannot infer causality due to the cross-sectional study design, it is likely that maternal psychological distress and child depression, anxiety, or severe behavioral problems negatively interact with one another and the relationship may be cyclic.

There are some potential limitations to this study. As a cross-sectional study, we cannot infer causality. We combined different categories of DD, including autism, ADHD, and behavioral disorders, and did not have adequate power to analyze these diagnoses individually. However, the heterogeneity of the sample is justified because there is substantial overlap between these diagnoses (59, 60) and thus it is common for researchers to analyze subjects with these conditions as one group with a developmental disability (61–63). We determined DD classification based on parent report rather than confirmed physician diagnosis. In an effort to limit misclassification of ADD, ADHD, and other behavioral disorders, children with a reported DD (other than ASD) must also have been prescribed a behavioral medication to be included in the DD group. It is possible that using behavioral medication prescription as an inclusion criterion for the DD group limited our sample to only those with the most severe DD. The diagnosis of persistent asthma, however, was confirmed by the child's PCP. In addition, the four scales used to evaluate caregiver burden are also based on self-report and cannot be used as a clinical diagnosis of anxiety or depression. There was an overwhelming majority of female caregivers in the overall sample, and only one male caregiver of a child with asthma/DD co-morbidity, thus limiting our ability to assess the impact of dual diagnosis on male caregivers. Similarly, we cannot infer the impact of raising a child with asthma and a DD on caregivers from rural or suburban settings, since we used an urban sample.

To our knowledge, this is the first study to examine the quality of life of parents caring specifically for a child with both a DD and asthma. Since asthma is the most prevalent chronic illness in childhood, it can be used as a model for other chronic physical conditions. This adds to a robust body of literature examining caregiver burden for parents of children with a single diagnosis (i.e. chronic physical health condition *or* a developmental disability.) The generalizability of our sample is another strength of the study. We had a high response rate (74%) and a large, community-based sample that is representative of our urban pediatric population.

Unfortunately, caregivers' mental health issues often go unaddressed. (64, 65) This is, in part, due to pragmatic concerns, with pediatricians citing lack of time and inadequate training in mental health treatment as major barriers to identifying and managing maternal depression. (66) Furthermore, even with adequate resources, mental health issues can be difficult for doctors to identify, and increased severity of depressive symptoms does not seem to improve recognition by the pediatrician. (67) However, prior studies have shown

that pediatricians can use a brief survey tool to reliably screen for maternal depression during the child's primary care visit. (68–71)

Pediatricians are a valuable and underused resource in addressing caregivers' mental health issues. Most parents have more consistent contact with their child's pediatrician than with their own primary care doctor, suggesting that mental health screening may need to occur outside of the caregiver's medical home. Caregiver screenings in pediatric offices can identify families in need of additional resources, and help link them to appropriate care, which may include initiating communication with the caregiver's own PCP and referral to applicable community resources. Consistent contact with the pediatrician may be even more common for families with children who have multiple chronic conditions and require frequent visits to the pediatric office. Thus, there are ample opportunities for pediatricians to screen for and monitor mental health issues in this group of high risk caregivers. Regular doctor's visits can also help the parent and pediatrician establish a trusting relationship, increasing the caregiver's willingness to discuss their mental health concerns with their child's PCP. (72) Because caregiver anxiety and depression may hamper chronic disease management, an active role by the pediatrician to help address these issues could subsequently lead to improved health outcomes for the child.

These findings may also have important implications in reducing health disparities. Underprivileged caregivers tend to report higher rates of anxiety and depression, (53) plus asthma and DD prevalence also is greater for children living below the national poverty level. (1, 3) Thus, poor caregivers, a population already at high risk for stress and depression, are at increased risk of experiencing the elevation in caregiver burden we found to be associated with caring for a child with a dual diagnosis. Additional attention to this asthma/DD subgroup and routine depression screening for high risk caregivers may help to address disparities in caregiver stress, and ultimately, pediatric health disparities.

In conclusion, our results indicate that raising a child with persistent asthma and a DD is associated with higher scores on various measures of overall caregiver burden. Thus, in addition to low socioeconomic status, caring for a child with multiple chronic health conditions is a significant risk factor for elevated caregiver burden. Pediatricians can play an important role in improving health outcomes for both the parent and the child by regularly screening these caregivers for prevalent, treatable mental health issues and facilitating the receipt of appropriate social and emotional supports.

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References

1. Boyle CA, Boulet S, Schieve LA, Cohen RA, Blumberg SJ, Yeargin-Allsopp M, et al. Trends in the Prevalence of Developmental Disabilities in US Children, 1997–2008. *Pediatrics*. 2011 Jun; 127(6): 1034–42. [PubMed: 21606152]
2. Schieve LA, Gonzalez V, Boulet SL, Visser SN, Rice CE, Van Naarden Braun K, et al. Concurrent medical conditions and health care use and needs among children with learning and behavioral

- developmental disabilities, National Health Interview Survey, 2006–2010. Research in developmental disabilities. 2012 Mar-Apr;33(2):467–76. [PubMed: 22119694]
3. Akinbami LJ, Moorman JE, Garbe PL, Sondik EJ. Status of Childhood Asthma in the United States, 1980–2007. *Pediatrics*. 2009; 123:S131–S45. [PubMed: 19221156]
 4. Becker KG. Autism, asthma, inflammation, and the hygiene hypothesis. *Medical hypotheses*. 2007; 69(4):731–40. [PubMed: 17412520]
 5. Becker KG, Schultz ST. Similarities in features of autism and asthma and a possible link to acetaminophen use. *Medical hypotheses*. 2010 Jan; 74(1):7–11. [PubMed: 19748189]
 6. Pak L, Allen PJ. The impact of maternal depression on children with asthma. *Pediatric nursing*. 2012 Jan-Feb;38(1):11–9. 30. [PubMed: 22474854]
 7. Wade S, Weil C, Holden G, Mitchell H, Evans R 3rd, Kruszon-Moran D, et al. Psychosocial characteristics of inner-city children with asthma: a description of the NCICAS psychosocial protocol. National Cooperative Inner-City Asthma Study. *Pediatric pulmonology*. 1997 Oct; 24(4):263–76. [PubMed: 9368260]
 8. Feldman JM, Acosta Perez E, Canino G, McQuaid EL, Goodwin RD, Ortega AN. The role of caregiver major depression in the relationship between anxiety disorders and asthma attacks in island Puerto Rican youth and young adults. *The Journal of nervous and mental disease*. 2011 May; 199(5):313–8. [PubMed: 21543950]
 9. Halterman JS, Yoos HL, Conn KM, Callahan PM, Montes G, Neely TL, et al. The impact of childhood asthma on parental quality of life. *J Asthma*. 2004 Sep; 41(6):645–53. [PubMed: 15584314]
 10. Almansour MA, Alateeq MA, Alzahrani MK, Algeffari MA, Alhomaiddan HT. Depression and anxiety among parents and caregivers of autistic spectral disorder children. *Neurosciences*. 2013 Jan; 18(1):58–63. [PubMed: 23291799]
 11. Rao PA, Beidel DC. The impact of children with high-functioning autism on parental stress, sibling adjustment, and family functioning. *Behavior modification*. 2009 Jul; 33(4):437–51. Epub 2009/05/14.eng. [PubMed: 19436073]
 12. Singer GH. Meta-analysis of comparative studies of depression in mothers of children with and without developmental disabilities. *American journal of mental retardation: AJMR*. 2006 May; 111(3):155–69. [PubMed: 16597183]
 13. Hinojosa MS, Hinojosa R, Fernandez-Baca D, Knapp C, Thompson LA. Parental strain, parental health, and community characteristics among children with attention deficit-hyperactivity disorder. *Acad Pediatr*. 2012 Nov-Dec;12(6):502–8. Epub 2012/09/19.eng. [PubMed: 22985984]
 14. Zuckerman BS, Beardslee WR. Maternal depression: a concern for pediatricians. *Pediatrics*. 1987 Jan; 79(1):110–7. [PubMed: 3797157]
 15. Gump BB, Reihman J, Stewart P, Lonky E, Darvill T, Granger DA, et al. Trajectories of maternal depressive symptoms over her child's life span: relation to adrenocortical, cardiovascular, and emotional functioning in children. *Development and psychopathology*. 2009 Winter;21(1):207–25. [PubMed: 19144231]
 16. Duarte CS, Shen S, Wu P, Must A. Maternal depression and child BMI: longitudinal findings from a US sample. *Pediatric obesity*. 2012 Apr; 7(2):124–33. [PubMed: 22434752]
 17. Larson K, Russ SA, Crall JJ, Halfon N. Influence of multiple social risks on children's health. *Pediatrics*. 2008 Feb; 121(2):337–44. [PubMed: 18245425]
 18. Fagnano M, Berkman E, Wiesenthal E, Butz A, Halterman JS. Depression among caregivers of children with asthma and its impact on communication with health care providers. *Public Health*. 2012 Dec; 126(12):1051–7. Epub 2012/10/30.eng. [PubMed: 23102501]
 19. Weil CM, Wade SL, Bauman LJ, Lynn H, Mitchell H, Lavigne J. The relationship between psychosocial factors and asthma morbidity in inner-city children with asthma. *Pediatrics*. 1999 Dec; 104(6):1274–80. Epub 1999/12/10.eng. [PubMed: 10585977]
 20. Bartlett SJ, Kolodner K, Butz AM, Eggleston P, Malveaux FJ, Rand CS. Maternal depressive symptoms and emergency department use among inner-city children with asthma. *Arch Pediatr Adolesc Med*. 2001 Mar; 155(3):347–53. [PubMed: 11231800]
 21. Bender B, Zhang L. Negative affect, medication adherence, and asthma control in children. *The Journal of allergy and clinical immunology*. 2008 Sep; 122(3):490–5. [PubMed: 18602153]

22. Bartlett SJ, Krishnan JA, Riekert KA, Butz AM, Malveaux FJ, Rand CS. Maternal depressive symptoms and adherence to therapy in inner-city children with asthma. *Pediatrics*. 2004 Feb; 113(2):229–37. [PubMed: 14754931]
23. Akinbami LJ, Moorman JE, Liu X. Asthma prevalence, health care use, and mortality: United States, 2005–2009. *Natl Health Stat Report*. 2011 Jan 12;32:1–14. Epub 2011/03/02.eng. [PubMed: 21355352]
24. Halterman JS, Auinger P, Conn KM, Lynch K, Yoos HL, Szilagyi PG. Inadequate therapy and poor symptom control among children with asthma: findings from a multistate sample. *Ambul Pediatr*. 2007 Mar-Apr;7(2):153–9. [PubMed: 17368410]
25. Akinbami LJ, LaFleur BJ, Schoendorf KC. Racial and income disparities in childhood asthma in the United States. *Ambul Pediatr*. 2002 Sep-Oct;2(5):382–7. [PubMed: 12241134]
26. Wright JD, Schillinger EF, Cazier F, Nouali H, Mercier A, Beaugard C. A field evaluation of a piezo-optical dosimeter for environmental monitoring of nitrogen dioxide. *J Environ Monit*. 2004 Jun; 6(6):576–82. Epub 2004/06/03.eng. [PubMed: 15173912]
27. Murray L, Arteche A, Fearon P, Halligan S, Goodyer I, Cooper P. Maternal postnatal depression and the development of depression in offspring up to 16 years of age. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2011 May; 50(5):460–70. [PubMed: 21515195]
28. Goodman SH, Rouse MH, Connell AM, Broth MR, Hall CM, Heyward D. Maternal depression and child psychopathology: a meta-analytic review. *Clinical child and family psychology review*. 2011 Mar; 14(1):1–27. [PubMed: 21052833]
29. Kersten-Alvarez LE, Hosman CM, Riksen-Walraven JM, van Doesum KT, Smeekens S, Hoefnagels C. Early school outcomes for children of postpartum depressed mothers: comparison with a community sample. *Child psychiatry and human development*. 2012 Apr; 43(2):201–18. [PubMed: 22011810]
30. Fletcher RJ, Feeman E, Garfield C, Vimpani G. The effects of early paternal depression on children's development. *The Medical journal of Australia*. 2011 Dec 19; 195(11–12):685–9. [PubMed: 22171866]
31. Galera C, Cote SM, Bouvard MP, Pingault JB, Melchior M, Michel G, et al. Early risk factors for hyperactivity-impulsivity and inattention trajectories from age 17 months to 8 years. *Archives of general psychiatry*. 2011 Dec; 68(12):1267–75. [PubMed: 22147844]
32. Korhonen M, Luoma I, Salmelin R, Tamminen T. A longitudinal study of maternal prenatal, postnatal and concurrent depressive symptoms and adolescent well-being. *Journal of affective disorders*. 2012 Feb; 136(3):680–92. [PubMed: 22036793]
33. Removed for blinding
34. Perrin JM, Coury DL, Hyman SL, Cole L, Reynolds AM, Clemons T. Complementary and alternative medicine use in a large pediatric autism sample. *Pediatrics*. 2012 Nov; 130(Suppl 2):S77–82. Epub 2012/11/09.eng. [PubMed: 23118257]
35. Hall SE, Riccio CA. Complementary and alternative treatment use for autism spectrum disorders. *Complement Ther Clin Pract*. 2012 Aug; 18(3):159–63. Epub 2012/07/14.eng. [PubMed: 22789791]
36. Anagnostou E, Hansen R. Medical treatment overview: traditional and novel psychopharmacological and complementary and alternative medications. *Curr Opin Pediatr*. 2011 Dec; 23(6):621–7. Epub 2011/10/18.eng. [PubMed: 22001766]
37. Warren, Z.; Veenstra-VanderWeele, J.; Stone, W.; Bruzek, JL.; Nahmias, AS.; Foss-Feig, JH., et al. *Therapies for Children With Autism Spectrum Disorders*. Rockville, MD: Agency for Healthcare Research and Quality (US); 2011 Apr. Report No.: Contract No.: 11-EHC029-EF
38. Hanson E, Kalish LA, Bunce E, Curtis C, McDaniel S, Ware J, et al. Use of complementary and alternative medicine among children diagnosed with autism spectrum disorder. *J Autism Dev Disord*. 2007 Apr; 37(4):628–36. Epub 2006/09/16.eng. [PubMed: 16977497]
39. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological medicine*. 2002 Aug; 32(6):959–76. [PubMed: 12214795]
40. Statistics ABo. Information Paper: Use of the Kessler Psychological Distress Scale in ABS Health Surveys, Australia, 2007–08. Apr 04.2012 Report No.: 4817.0.55.001.

41. Juniper EF, Guyatt GH, Feeny DH, Ferrie PJ, Griffith LE, Townsend M. Measuring quality of life in parents of children with asthma. *Qual Life Res.* 1996; 5(1):27–34. [PubMed: 8901364]
42. Abidin, RR. Parenting Stress Index. 3. Odessa, FL: Psychological Assessment Resources, Inc; 1995.
43. Wu AC, Smith L, Bokhour B, Hohman KH, Lieu TA. Racial/Ethnic variation in parent perceptions of asthma. *Ambul Pediatr.* 2008 Mar-Apr;8(2):89–97. Epub 2008/03/22.eng. [PubMed: 18355737]
44. Gortmaker SL, Walker DK, Weitzman M, Sobol AM. Chronic conditions, socioeconomic risks, and behavioral problems in children and adolescents. *Pediatrics.* 1990 Mar; 85(3):267–76. [PubMed: 2304779]
45. Silver EJ, Warman KL, Stein RE. The relationship of caretaker anxiety to children's asthma morbidity and acute care utilization. *The Journal of asthma: official journal of the Association for the Care of Asthma.* 2005 Jun; 42(5):379–83. Epub 2005/07/23.eng. [PubMed: 16036413]
46. Kring SR, Greenberg JS, Seltzer MM. The Impact of Health Problems on Behavior Problems in Adolescents and Adults With Autism Spectrum Disorders: Implications for Maternal Burden. *Soc Work Ment Health.* 2010 Jan; 8(1):54–71. Epub 2010/07/27.Eng. [PubMed: 20657702]
47. Anastopoulos AD, Guevremont DC, Shelton TL, DuPaul GJ. Parenting stress among families of children with attention deficit hyperactivity disorder. *J Abnorm Child Psychol.* 1992 Oct; 20(5): 503–20. Epub 1992/10/01.eng. [PubMed: 1487593]
48. NIH publication No 07-4051. Bethesda, MD: U.S. Department of Health and Human Services; National Institute of Health; National Heart, Lung, and Blood Institute; National Asthma Education and Prevention Program; 2007. Expert panel report III: guidelines for the diagnosis and management of asthma.
49. Benowitz NL. Cotinine as a biomarker of environmental tobacco smoke exposure. *Epidemiol Rev.* 1996; 18(2):188–204. [PubMed: 9021312]
50. Moffitt TE. Teen-aged mothers in contemporary Britain. *J Child Psychol Psychiatry.* 2002 Sep; 43(6):727–42. Epub 2002/09/19.eng. [PubMed: 12236608]
51. Lee Y, Fagan J, Chen WY. Do late adolescent fathers have more depressive symptoms than older fathers? *J Youth Adolesc.* 2012 Oct; 41(10):1366–81. Epub 2011/10/04.eng. [PubMed: 21965130]
52. Quinlivan JA, Tan LH, Steele A, Black K. Impact of demographic factors, early family relationships and depressive symptomatology in teenage pregnancy. *Aust N Z J Psychiatry.* 2004 Apr; 38(4):197–203. Epub 2004/03/25.eng. [PubMed: 15038797]
53. Ertel KA, Rich-Edwards JW, Koenen KC. Maternal depression in the United States: nationally representative rates and risks. *Journal of women's health.* 2011 Nov; 20(11):1609–17. Epub 2011/09/01.eng.
54. Blacher J, McIntyre LL. Syndrome specificity and behavioural disorders in young adults with intellectual disability: cultural differences in family impact. *J Intellect Disabil Res.* 2006 Mar; 50(Pt 3):184–98. Epub 2006/01/25.eng. [PubMed: 16430730]
55. Valenca MP, de Menezes TA, Calado AA, de Aguiar Cavalcanti G. Burden and quality of life among caregivers of children and adolescents with meningomyelocele: measuring the relationship to anxiety and depression. *Spinal Cord.* 2012 Jul; 50(7):553–7. Epub 2012/03/07.eng. [PubMed: 22391686]
56. Price MR, Bratton DL, Klinnert MD. Caregiver negative affect is a primary determinant of caregiver report of pediatric asthma quality of life. *Annals of allergy, asthma & immunology: official publication of the American College of Allergy, Asthma, & Immunology.* 2002 Dec; 89(6):572–7.
57. Bender BG, Bender SE. Patient-identified barriers to asthma treatment adherence: responses to interviews, focus groups, and questionnaires. *Immunol Allergy Clin North Am.* 2005 Feb; 25(1): 107–30. [PubMed: 15579367]
58. Stewart MA. Effective physician-patient communication and health outcomes: a review. *CMAJ: Canadian Medical Association journal = journal de l'Association medicale canadienne.* 1995 May 1; 152(9):1423–33. Epub 1995/05/01.eng.
59. Yuce M, Zoroglu SS, Ceylan MF, Kandemir H, Karabekiroglu K. Psychiatric comorbidity distribution and diversities in children and adolescents with attention deficit/hyperactivity

- disorder: a study from Turkey. *Neuropsychiatric disease and treatment*. 2013; 9:1791–9. [PubMed: 24265552]
60. Antshel KM, Zhang-James Y, Faraone SV. The comorbidity of ADHD and autism spectrum disorder. *Expert review of neurotherapeutics*. 2013 Oct; 13(10):1117–28. [PubMed: 24117274]
 61. Janeslatt G, Granlund M, Kottorp A. Measurement of time processing ability and daily time management in children with disabilities. *Disability and health journal*. 2009 Jan; 2(1):15–9. [PubMed: 21122738]
 62. Neece CL. Mindfulness-Based Stress Reduction for Parents of Young Children with Developmental Delays: Implications for Parental Mental Health and Child Behavior Problems. *Journal of applied research in intellectual disabilities: JARID*. 2013 Jul 1.
 63. Valicenti-McDermott MR, Demb H. Clinical effects and adverse reactions of off-label use of aripiprazole in children and adolescents with developmental disabilities. *Journal of child and adolescent psychopharmacology*. 2006 Oct; 16(5):549–60. [PubMed: 17069544]
 64. Kocsis JH, Gelenberg AJ, Rothbaum B, Klein DN, Trivedi MH, Manber R, et al. Chronic forms of major depression are still undertreated in the 21st century: systematic assessment of 801 patients presenting for treatment. *Journal of affective disorders*. 2008 Sep; 110(1–2):55–61. Epub 2008/02/15.eng. [PubMed: 18272232]
 65. Young AS, Klap R, Sherbourne CD, Wells KB. The quality of care for depressive and anxiety disorders in the United States. *Archives of general psychiatry*. 2001 Jan; 58(1):55–61. Epub 2001/02/07.eng. [PubMed: 11146758]
 66. Horwitz SM, Kelleher KJ, Stein RE, Storfer-Isser A, Youngstrom EA, Park ER, et al. Barriers to the identification and management of psychosocial issues in children and maternal depression. *Pediatrics*. 2007 Jan; 119(1):e208–18. Epub 2007/01/04.eng. [PubMed: 17200245]
 67. Heneghan AM, Silver EJ, Bauman LJ, Stein RE. Do pediatricians recognize mothers with depressive symptoms? *Pediatrics*. 2000 Dec; 106(6):1367–73. Epub 2000/01/11.eng. [PubMed: 11099590]
 68. Dubowitz H, Feigelman S, Lane W, Prescott L, Blackman K, Grube L, et al. Screening for depression in an urban pediatric primary care clinic. *Pediatrics*. 2007 Mar; 119(3):435–43. [PubMed: 17332195]
 69. Freeman MP, Wright R, Watchman M, Wahl RA, Sisk DJ, Fraleigh L, et al. Postpartum depression assessments at well-baby visits: screening feasibility, prevalence, and risk factors. *Journal of women's health*. 2005 Dec; 14(10):929–35.
 70. Mishina H, Takayama JI. Screening for maternal depression in primary care pediatrics. *Curr Opin Pediatr*. 2009 Dec; 21(6):789–93. Epub 2009/09/04.eng. [PubMed: 19726991]
 71. Chaudron LH, Szilagyi PG, Kitzman HJ, Wadkins HI, Conwell Y. Detection of postpartum depressive symptoms by screening at well-child visits. *Pediatrics*. 2004 Mar; 113(3 Pt 1):551–8. [PubMed: 14993549]
 72. Heneghan AM, Mercer M, DeLeone NL. Will mothers discuss parenting stress and depressive symptoms with their child's pediatrician? *Pediatrics*. 2004 Mar; 113(3 Pt 1):460–7. Epub 2004/03/03.eng. [PubMed: 14993535]

Figure 1.
Parent-reported developmental disability diagnoses of children in the DD group

Table 1

Subject Characteristics

	Overall N = 530	DD N = 70	No DD N = 460	P-Value
Child Age, Mean (SD)	7.1 (1.9)	7.8 (1.7)	7.1 (2.0)	.003
Child Gender, No. (%)				
Female	222 (42)	19 (27)	203 (44)	.009
Child Race, No. (%)				
Black	335 (63)	42 (60)	293 (64)	
White	48 (9)	11 (16)	37 (8)	
Other	147 (28)	17 (24)	130 (28)	
Child Hispanic Ethnicity, No. (%)	151 (28)	18 (26)	133 (29)	.670
Child on Medicaid/Public Insurance, No. (%)	389 (73)	54 (77)	335 (73)	.561
Child Salivary Cotinine, Mean (SD), µg/L	1.4 (2.3)	1.6 (2.2)	1.4 (2.3)	.200
1 Smoker in the Home, No. (%)	285 (54)	40 (57)	245 (54)	.607
Primary Caregiver Smokes, No. (%)	210 (40)	31 (44)	179 (39)	.432
Caregiver Age, No. (%)				
<30 yrs	350 (66)	47 (67)	303 (66)	1.00
Caregiver Gender, No. (%)				
Female	510 (96)	69 (99)	441 (96)	.497
Caregiver Race, No. (%)				
Black	325 (61)	43 (61)	282 (61)	
White	62 (12)	11 (16)	51 (11)	
Other	143 (27)	16 (23)	127 (28)	
Caregiver Hispanic Ethnicity, No. (%)	129 (24)	13 (19)	116 (25)	.295
Caregiver Marital Status, No. (%)				
Single	412 (78)	60 (86)	352 (76)	.091
Caregiver Education, No. (%)				
< High School	205 (39)	28 (40)	177 (39)	.794

Table 2

Child Asthma Morbidity

	Overall N = 530	DD N = 70	No DD N = 460	P-Value
Child Asthma Symptom Severity/2 wks, Mean (SD)				
Symptom-Free Days	8.0 (4.8)	7.6 (5.0)	8.0 (4.8)	.530
Symptom Nights	4.1 (4.5)	4.1 (4.9)	4.0 (4.4)	.771
Days with Activity Limitation	3.0 (3.8)	3.7 (4.4)	2.8 (3.7)	.223
Days with Rescue Medication Use	4.0 (4.6)	4.2 (4.8)	3.9 (4.6)	.863
Preventive Medication Use, No. (%)				
On Daily Medication	364 (69)	48 (69)	316 (69)	1.00

Table 3

Child Behavior Measures

	Overall N = 530	DD N = 70	No DD N = 460	P-Value	Effect Size
Child Behavior Problems Inventory, Mean (SD)					
Total Score (max = 28)	11.4 (7.1)	17.3 (6.6)	10.5 (6.8)	<.001	-0.303
Internalizing Subscale Score (max = 10)	3.3 (2.7)	5.2 (2.9)	3.0 (2.6)	<.001	-0.262
Externalizing Subscale Score (max = 18)	8.2 (4.9)	12.1 (4.2)	7.6 (4.7)	<.001	-0.300
Anxious/Depressed Subscale Score (max = 5)	1.8 (1.5)	2.7 (1.6)	1.7 (1.4)	<.001	-0.228
Headstrong Subscale Score (max = 5)	2.7 (1.7)	3.8 (1.4)	2.5 (1.7)	<.001	-0.257
Antisocial Subscale Score (max = 6)	2.0 (1.7)	3.2 (1.9)	1.9 (1.6)	<.001	-0.244
Hyperactive Subscale Score (max = 5)	2.4 (1.8)	4.0 (1.2)	2.2 (1.7)	<.001	-0.353
Peer Conflict Subscale Score (max = 3)	0.7 (0.9)	1.2 (1.1)	0.6 (0.8)	<.001	-0.191
Innate Subscale Score (max = 4)	1.8 (1.4)	2.3 (1.3)	1.8 (1.4)	.001	-0.135
Score Clinical Cut-off, No. (%)	203 (38)	46 (66)	157 (34)	<.001	0.220
Parent-Reported Depression/Anxiety Disorder, No. (%)					
	43 (8.1)	17 (24)	26 (5.7)	.002	-0.135

Table 4**Caregiver Burden Measures**

Caregiver Burden Measure (Score Range)	DD N = 70 Mean (SD)	No DD N = 460 Mean (SD)	Regression Coefficient	Standard Error	Adjusted p-Value
Depression [^] (10–50)	22.6 (9.6)	19.3 (8.9)	3.4	1.1	.003
Parenting Confidence [^] (5–25)	11.1 (3.6)	9.5 (3.2)	1.6	0.4	<.001
Competing Demands [*] (6–42)	17.8 (6.6)	20.6 (6.3)	–2.7	1.1	.013
Asthma-Related QOL [*] (13–91)	5.1 (1.4)	5.4 (1.2)	–0.3	0.2	.035

[^] Higher scores = worse^{*} Lower scores = worse

Regression adjusted for caregiver age, education, marital status, race, ethnicity, and child asthma symptom severity