Attention-Deficit/Hyperactivity Disorder in School-Aged Children: Association With Maternal Mental Health and Use of Health Care Resources

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Attention-Deficit/Hyperactivity Disorder in School-Aged Children: Association With Maternal Mental Health and Use of Health Care Resources

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ABSTRACT. *Objective.* **To investigate the association between the mental health status of mothers and attention-deficit/hyperactivity disorder (ADHD) in their school-aged children and to characterize the health care access and utilization of families affected by ADHD.**

Methods. **Survey logistic regression procedures were used to investigate the association between activity-limiting mental health conditions in mothers and ADHD in their school-aged children using 1998 National Health Interview Survey data. A total of 9529 mother-child dyads were included in the final analysis.**

Results. **The prevalence of ADHD among children aged 4 to 17 years was 6.3%. Survey logistic regression statistics revealed an association between an activity-limiting depression, anxiety, or emotional problem in mothers and ADHD in their children. This association persisted after controlling for the gender, age, and race of the child; household income (as a function of the 1997 poverty level); and type of family structure as reported by the mother (adjusted odds ratio [OR]: 4.2; 95% confidence interval [CI]: 2.2–8.1). Mothers of a child with ADHD were 13 times more likely to have consulted with a mental health professional about their child's health within the past year despite reporting an inability to afford prescription medications (OR: 3.3; 95% CI: 2.2–4.9) and mental health care (OR: 7.4; 95% CI: 4.6, 11.8) for the child.**

Conclusions. **Maternal mental health is significantly associated with the presence of ADHD in school-aged children. This finding further supports a link between maternal mental health and behavioral outcomes in children. Health care utilization and access findings support a family-oriented system of care.** *Pediatrics* **2003;111:1232–1237;** ***ADHD, ADD, child mental health, NHIS, maternal depression, maternal mental health.***

ABBREVIATIONS. ADHD, attention-deficit/hyperactivity disorder; NHIS, National Health Interview Survey; SES, socioeconomic status; OR, odds ratio; CI, confidence interval.

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Attention-deficit/hyperactivity disorder (ADHD) is a neurobehavioral disorder and manifests as a spectrum of impairing symptoms characterized by inattention, impulsivity/hyperactivity, or both such that daily functioning is compromised in multiple settings (see the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Text Revision Edition* for diagnostic criteria[1]). ADHD affects an estimated 3% to 7% of school-aged children in the United States; however, community-based prevalence studies continue to suggest much higher prevalence rates of ADHD than previously thought.[1–6] The genetic or environmental factors related to the onset of ADHD and the factors that exacerbate the severity of symptom expression all are unknown. Genetic and twin studies provide strong evidence for biological risk and specific genetic underpinnings, and such research continues to increase our knowledge in this area.[7–13]

Health care providers are becoming increasingly aware of the burden that ADHD places on health care systems. Health care costs for a child with ADHD may be more than twice as high as costs for children without ADHD,[14] and national estimates suggest that these costs are comparable to those for children with asthma.[15] Several studies indicate that children with ADHD are at an increased risk of unintentional injury[16] and hospitalization.[17]

To date, few studies[18,19] have investigated the association between maternal mental health and child mental health, specifically ADHD, using population-based data from the United States. However, adult and child mental health are critical aspects of the nation's well-being and health.[20] This study examines the association between ADHD among school-aged children and the presence of an activity-limiting mental health condition in their mothers using 1998 National Health Interview Survey (NHIS)[21] data. In addition, our study examines critical health care utilization and access variables to provide a fuller picture of the needs in this population and to relate these findings to potential public health responses.

It is estimated that by 2020, depression will be the leading cause of global disease burden among females ages ≥5 years.[22] The current prevalence estimate of mental disorders in US adults is 20%[20]; however, chronic and activity-limiting mental health conditions occur less often. Prevalence estimates for impairing mental health conditions in adults range

from 0.6% to 2.4%, including anxiety disorders such as panic disorder and obsessive compulsive disorder and mood disorders such as dysthymia and bipolar disorders.[20] Already almost twice as many women face depressive disorders as men,[23] women attempt suicide up to 3 times more often than men, and more women than men are affected by anxiety disorders.[20] Risk for depression is greatest among women of lower socioeconomic status (SES).[23] Considering mental health impairments in women of childbearing age inevitably raises concern over the effect of impairing mental health conditions on mothers and, in turn, on the mental health and behavioral outcomes of their children. Previous findings suggest that maternal depression is associated with developmental and behavioral problems in children[23,24] and a lack of school readiness at 3 years of age.[25] Further explicating associations between maternal and child mental health using population-based samples is a critical step toward understanding the myriad of factors related to behavioral and emotional problems in US children.

METHODS

The NHIS is an annual survey conducted by the Centers for Disease Control and Prevention, National Center for Health Statistics on a nationally representative sample of the noninstitutionalized, civilian population residing in the United States. Within a sampled family, 1 sample child is randomly selected to receive a more in-depth interview (Sample Child questionnaire). Proxy responses are collected for the sample child from the most knowledgeable adult who resides in the sample child's household. Data from the 1998 NHIS Sample Child and Family Core questionnaires were analyzed for the present investigation.[21]

Study Variables

The primary independent variable of interest was maternal mental health status as reported by the mother or a knowledgeable family member on the Family questionnaire. Specifically, the respondent reported some form of chronic "activity-limiting physical, mental, or emotional condition" and specified that this condition was depression, anxiety, or another emotional problem. The respondent also reported whether the endorsed condition was chronic.

The dependent variables were obtained from the Sample Child database. The primary dependent variable was ADHD diagnosis as inferred from the sample child's proxy respondent having ever been told by a health care professional that the sample child had attention deficit disorder. (Although previously called attention-deficit disorder, the disorder has been renamed and is now known as ADHD. For this reason we refer to the disorder as ADHD.) Variables related to health care access, utilization, and barriers to care were also investigated to characterize better the health care experiences of children with ADHD in a family context.

Several demographic variables were investigated as potential confounding factors in the association between maternal and child mental health. These variables included the sample child's age group (4–11 and 12–17), gender, and combined race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black, non-Hispanic other). Although maternal education and maternal marital status are strong indicators of SES, these variables were highly correlated with family structure (single parent versus multiple parent) and ratio of household income to 1997 poverty level. The latter variables were thought to capture more comprehensively household SES and were therefore used as surrogates for the complex variable of household SES.

Analysis

SUDAAN was used for the analysis of all data using weights provided by the National Center for Health Statistics. Estimated rates and standard errors were generated for each of the independent and dependent variables of interest. Survey logistic regression procedures were used to model ADHD in children as a function of maternal mental health status while controlling for significant confounding factors.

Sample

Sample Child survey data were gathered for a total of 13 645 sample children during the 1998 NHIS survey year. Because the research questions of the present analysis involved factors of both maternal and child health, sample child data from the Sample Child Core and the mother's person-level data from the Family Core were merged. This merged data set was then limited to mother-child dyads in which the child was 4 to 17 years of age because ADHD is uncommonly diagnosed in children who are not yet school-age. The process of subsetting the mother-child database was performed in the analysis phase to preserve the integrity of the complex sample design and to ensure appropriate variance estimation.

After the merged database was restricted to sample children aged 4 to 17 years, the final sample consisted of 10 340 children and 9529 mothers, resulting in a final sample of 9529 mother-child dyads. All descriptive statistics were calculated for the households of all 10 340 sample children to generalize estimates from the sample to the US population, whereas modeling procedures were limited to the matched mother-child subsample of 9529.

RESULTS

Rates of ADHD

The respondents of 626 of the 10 340 children reported being told by a health care professional that the sample child had ADHD. After the data were weighted, the prevalence of ADHD among school-aged children was 6.3%. (Prevalence is used here with the rationale that ADHD is a chronic impairment and once "diagnosed," symptoms persist throughout life.[26,27]) Statistically imposing the rate of ADHD on the 1998 population of US children, it is estimated that 3 532 549 youths aged 4 to 17 years (2 592 570 boys and 939 979 girls) had ever been identified by a health care professional as having ADHD.

The demographic characteristics of the sample children are presented in Table 1 by ADHD subgroup. Gender-specific rates support other findings of significantly higher rates of ADHD among boys (9.1%) than girls (3.4%; χ^2 [10 310] = 92.78; $P < .0001$). Age-specific rates of ADHD revealed higher rates in the older age group; 1 761 662 or 5.4% of 4- to 11-year-olds and 1 770 887 or 7.5% of 12- to 17-year-olds had ever been told that they had ADHD (χ^2 [10 310] = 12.95; $P = .0004$). The distribution of ADHD across the 4 racial groups was significantly different (χ^2 [10 310] = 50.51; $P < .0001$), with rates of ADHD highest among whites (7.4%; Table 1). When compared with children without ADHD, children with ADHD were significantly more likely to be related to their mother figure through step, adoptive, and foster relationships, although roughly 90% of mothers were biologically related to their child with ADHD.

Maternal and Family Demographics

Several significant differences in maternal and family characteristics were noted when the ADHD and non-ADHD groups were contrasted. Significantly fewer mothers in the ADHD group were married (ADHD: 70.8%; non-ADHD: 77.5%; $P < .001$), with a greater proportion of mothers in the ADHD

TABLE 1. Demographic Characteristics by ADHD Group

Variable	ADHD		Non-ADHD		Total	
	%	SE	%	SE	%	SE
Gender*						
Male	73.4	2.1	49.6	0.6	51.1	0.6
Female	26.6	—	50.4	—	48.9	—
Age group*						
4–11	49.9	2.3	58.6	0.6	58.1	0.6
12–17	50.1	—	41.4	—	41.9	—
Combined race/ethnicity*						
Hispanic	8.7	1.2	15.0	0.5	14.6	0.5
Non-Hispanic white	77.2	1.8	61.1	0.7	65.9	0.7
Non-Hispanic black	12.5	1.4	15.4	0.6	15.2	0.6
Non-Hispanic other	1.6	.5	4.5	0.3	4.3	0.3
Relationship to mother*						
Biological	89.8	1.5	97.1	0.2	96.7	0.2
Step	4.7	1.1	1.1	0.1	1.4	0.1
Adoptive	3.7	0.9	1.4	0.1	1.5	0.1
Foster	1.7	0.6	0.4	0.1	0.5	0.1
Maternal mental health condition*						
Yes	4.4	0.98	1.1	0.13	1.3	0.14
No	95.6	—	98.9	—	98.7	—

SE indicates standard error.
National Health Interview Survey, NCHS, 1998.
* $P < .0001$.

group living in single-parent households (ADHD: 20.5%; non-ADHD: 16.7%; $P < .05$). Although the household incomes of mothers of children with ADHD seemed to be slightly higher, the proportions of families at or above versus below 200% of the 1997 poverty level were not significantly different across the ADHD and non-ADHD groups. No group differences were noted in maternal educational attainment or health insurance coverage.

Rates of Maternal Mental Health Conditions

Of the 9529 mothers in the sample, 131 were reported by the respondent to have an activity-limiting depression, anxiety, or emotional problem. Of these mothers, all but 1 reported that she chronically suffered from the condition. After the data were weighted, the subpopulation of mothers with 1 of the mental health conditions of interest represented 622 717, or 1.2%, of US mothers.

Consistent with other findings, single mothers were >3 times more likely than married mothers to report having an activity-limiting depression, anxiety, or emotional problem (odds ratio [OR]: 3.19; 95% confidence interval [CI]: 2.01–5.06). Furthermore, 75.5% of the mothers in this sample with an activity-limiting mental health condition reported incomes <200% of the poverty level. Consequently, women in the lower household income group were >5 times more likely to experience 1 of the mental health outcomes of interest (OR: 5.63; 95% CI: 3.34–9.48).

Child Mental Health as a Function of Maternal Mental Health

Significantly higher rates of ADHD were found among children of mothers with an activity-limiting mental health condition (20.5% vs 5.6%; χ^2 [8921] = 11.39; $P = .0008$). After significant covariates were adjusted for, children of these mothers were still >4 times more likely to have been identified by a health care provider as having ADHD by parental report (adjusted OR: 4.23; 95% CI: 2.21–8.11).

Similarly, the likelihood that the survey respondents consulted with a mental health care professional about the sample child's health was significantly greater if the child's mother had a chronic mental health condition (22.5% vs 5.7%; χ^2 [8904] = 14.1; $P = .0002$). This association persisted after adjusting for gender, race, age group, household income, and family type (adjusted OR: 4.19; 95% CI: 2.48–7.08). Although attempted, the sample size did not allow for statistical comparisons of the health care access and utilization variables across the 4 mother-child mental health group combinations.

Health Care Utilization and Access

Family members of children with ADHD were >13 times more likely to report having consulted a mental health care professional (about the child) in the past year when compared with families without a child with ADHD. Furthermore, children with ADHD were significantly more likely to have visited a doctor in the 12 months preceding the survey and to have ever taken a prescription medication for at least 3 months (Table 2). Despite the increased health care usage noted above, the families of children with ADHD were significantly more likely to report not being able to afford prescription medications and mental health care for their child. It is notable that within the ADHD subgroup, 63% of families had not consulted with a mental health professional about their child's condition in the 12 months preceding the survey.

DISCUSSION

We found a 4-fold increase of ADHD in children among mothers with a chronic and activity-limiting mental health condition. The direction of this association can be speculated but not confirmed with these

TABLE 2. Mental Health Care Utilization and Access by ADHD Group

Variable	%	SE	OR	95% CI
Child visited doctor in past 12 mo*				
ADHD	88.0	1.5	2.4	(1.8–3.2)
Non-ADHD	75.2	0.6	1.0	—
Child ever took prescription medication for 3+ mo*				
ADHD	50.7	2.2	12.2	(10.0–14.9)
Non-ADHD	7.8	0.3	1.0	—
Caregiver consulted MH professional regarding child in past 12 mo*				
ADHD	37.3	2.2	13.3	(10.8–16.3)
Non-ADHD	4.3	0.2	1.0	—
Family can't afford prescription medication for child*				
ADHD	6.1	1.0	3.3	(2.2–4.9)
Non-ADHD	1.9	0.2	1.0	—
Family can't afford MH care for child*				
ADHD	5.5	1.0	7.4	(4.6–11.8)
Non-ADHD	0.8	0.1	1.0	—

MH indicates mental health.
National Health Interview Survey, NCHS, 1998.
* $P < .0001$.

cross-sectional data. By definition, mothers who reported having a chronic, activity-limiting mental health condition have lived with their condition over extended periods of time. Mental health conditions such as clinical depression, generalized anxiety, mood disorders, and schizophrenia that are chronic and activity-limiting start in late adolescence and early adulthood and pervasively affect the life functioning of adults with these disorders. Previous research has shown moderate to high genetic influences for psychopathology.[1,28] Assuming that a truly chronic, activity-limiting mental health problem is present in a mother, it is possible that the disorder and associated impairments would have developed before having a child and likely may have preceded having a child who received a diagnosis of ADHD. However, this temporal theory is speculative and the direction of the association found in this study cannot be determined definitively. It is also plausible that mothers of children with ADHD may be 4 times more likely to develop a chronic and activity-limiting mental health condition as a result of the stress of caring for a child with ADHD or may be 4 times more likely to have a child who receives a diagnosis of ADHD as a result of proximity to mental health care providers.

Regardless of the direction of the association, important implications to family health care should be noted. Health care providers should consider both the potential for mothers with an impairing mental health condition to have a child with ADHD or related behavioral disorders and the potential for mental health problems among mothers who have a child with ADHD. Addressing only the needs of the mother or the child individually may ignore significant risks for morbidity in the family and may compromise the benefits of treatment for either or both of the dyad.

Relative to nonaffected families, families with a child with ADHD are higher consumers of health care resources yet are significantly more likely to report not being able to afford prescription medications and mental health care services for their child. These figures are disturbing given that both medication and mental health care are the recommended and primary modalities of treating ADHD.[29] Of note, single and less affluent mothers were significantly more likely than married and affluent mothers to report a chronic, activity-limiting mental health condition. These patterns suggest that mothers with fewer resources are more affected by mental health issues. Furthermore, families that deal with ADHD report significantly more difficulty affording appropriate treatment and services. Given the strong association noted in our study between maternal mental health and childhood ADHD, single-parent families of lower income may be the most affected population. Taken together, these findings suggest that health care providers need to be aware of the potential for financial hardship in these groups and should direct affected families to local community resources offering reduced or free mental health care services. More research is necessary to understand the availability of mental health resources in communities and to identify barriers to care in families that deal with mental health problems, particularly those with limited resources.

Our findings also highlight the multifaceted nature of factors associated with child health and development. More emphasis must be placed on the family unit when considering the well-being of children, because the risk for negative developmental and behavioral outcomes may be compounded by the limitations of a parent dealing with chronic mental health problems. We already know that ADHD has a significant impact on the health care system as a whole.[14–17] To emphasize further the potential health care implications of an ADHD diagnosis, approximately half of children who have ADHD and are referred to clinics have comorbid externalizing, internalizing, and learning disorders.[1,30,31] Given these data, family health care treatment models may be the most appropriate approach when considering youths with behavioral or mental health concerns such as ADHD. By considering the mental health of the caregiver, health care providers may optimize the chance for reduced individual, familial, and social burdens associated with childhood ADHD.

There are some important limitations to this study. As previously discussed, an important limitation to our findings is that temporal relationships cannot be confirmed using these cross-sectional data, thereby limiting causal theory building. Similarly, limited information from the survey was garnered on the specific type, date of onset, and severity of the mothers' mental health condition other than its being an activity-limiting and chronic condition. The sample size of mothers with an activity-limiting mental health condition limited our ability to stratify further this group in more detailed analyses. Our sample of mothers with a mental health condition may have suffered given the possibility that women underreported their mental health condition or rated it as not activity limiting in nature. Data on child mental health disorders and behaviors should also be considered with caution because parental report of diagnosis for ADHD does not ensure a strong level of accuracy or validity in case identification[32] by health care providers. The attention-deficit disorder/ADHD question did not specifically assess ADHD diagnosis or treatment, and rates may therefore be under- or overestimates of the true prevalence. Finally, the small number of minority children with ADHD may truly reflect the burden of this disorder but did not allow us to explore whether and how maternal mental health status is related to ADHD in minority children.

Additional exploration of the association between maternal mental health and childhood ADHD is warranted. Future explorations of this association will depend largely on improvements in the quality of nationally representative data on mental health in children and adults, access to mental health care services, and health care utilization. For both maternal mental health conditions and childhood ADHD, improving identification and treatment nationally, identifying risk and protective factors, and informing the prevention of ADHD all are appropriate public health responses.[33] Identification and treatment must consider the potential for chronic mental health concerns in the family as a whole and the likelihood that the affordability of care may be a barrier to service receipt. The magnitude of the problem, the convergence of problems within families, and the promise of effective treatments reinforce the importance of a public health approach to these mental health conditions.

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