Child Allergic Symptoms and Mental Well-Being: The Role of Maternal Anxiety and Depression☆

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Objective To determine whether maternal mental health mediates the relationship between eczema or asthma symptoms and mental well-being in children.

Study design Analysis of 7250 children from the Avon Longitudinal Study of Parents and Children. Child mental well-being at 8 years was measured by the Strengths and Difficulties Questionnaire. Binary outcomes were high 'internalizing' (anxious/depressive) and 'externalizing' (oppositional/hyperactive) problems (high was >90th percentile). Child rash and wheeze categories were 'none'; 'early onset transient' (infancy/preschool only); 'persistent' (infancy/preschool and at school age); and 'late onset' (school age only). Maternal anxiety and depression were reported during pregnancy and when child was 8 years old.

Results Persistent wheezing symptoms were associated with high externalizing (OR 1.74, 95% CI, 1.41-2.15) and internalizing (1.67, 1.35-2.06) problems compared with never wheeze. Maternal anxiety and depression, and disrupted child sleep, attenuated these associations. Persistent rash (externalizing: 1.74, 1.40-2.15; internalizing: 1.42, 1.16-1.74) and late onset rash (externalizing: 1.62, 1.17-2.25; internalizing: 1.46, 1.07-1.99) symptoms were associated with poorer mental well-being compared with no rash at any age. Maternal anxiety and depression, particularly when child was aged 8 years rather than during pregnancy, accounted for the association with internalizing symptoms and partly for externalizing symptoms. Sleep disruption did not mediate the association.

Conclusions Maternal anxiety and depression may mediate the association between child rash and wheeze and child mental well-being. *(J Pediatr 2014;165:592-9)*.

Children with eczema and asthma have been reported to have poorer mental well-being than healthy children; childhood asthma has been associated with anxiety, depression, emotional and behavioral problems, and treatment for a mental health problem,[1-9] and childhood eczema with increased emotional problems and a higher risk of attention deficit/hyperactivity disorder (ADHD).[10-14]

Childhood eczema and asthma are also associated with maternal anxiety and depression; mothers who are anxious or depressed during pregnancy, the postpartum period, and beyond are at increased risk of having a child with asthma or wheezing.[15-18] There is also evidence of reverse causation; caring for a child with eczema or asthma is associated with higher levels of anxiety, depression, sleep deprivation, and reduced quality of life for the child's parents and family.[19-24]

Therefore, as children with eczema and asthma are more likely to have a mother with anxiety or depression compared with healthy children, maternal mental health may be an important mediator of the association between eczema and asthma and child mental well-being. A better understanding of the role of maternal mental health could help elucidate the mechanisms that underpin the association between eczema and asthma and child mental well-being, and if causal, could aid the development of interventions to improve the mental and physical health of children affected by these conditions.[25]

Few previous studies on the mental well-being of children with eczema or asthma have considered maternal mental health. Additional limitations to the existing literature include the frequent use of small, clinic-based, convenience samples, a lack of inclusion of potentially important confounders, and few studies focusing on younger children.[11,26,27] Few studies have considered both eczema and asthma despite the frequent co-occurrence of these conditions. To address these limitations, we used data from a large, longitudinal, population-based birth cohort. We hypothesized that maternal anxiety and depression would mediate the association between rash and wheeze and child mental well-being (**Figure**; available at www.jpeds.com). Our first aim was to determine whether rash or wheeze symptoms were associated with internalizing (ie, anxious and depressive) or externalizing (ie, oppositional and hyperactive) behaviors at the age of 8 years, and whether duration of symptoms was an important factor. Our second aim was to determine whether these associations remained after adjustment for maternal anxiety and depression.

ADHD	Attention deficit/hyperactivity disorder
ALSPAC	Avon Longitudinal Study of Parents and Children
SEP	Socioeconomic position
TDS	Total difficulties score

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Methods

Subjects were participants in the Avon Longitudinal Study of Parents and Children (ALSPAC). Details on ALSPAC have been published previously,[28] and a fully searchable data dictionary is available online (www.bristol.ac.uk/alspac/). In brief, ALSPAC recruited pregnant women with expected dates of delivery between April 1, 1991 and December 31, 1992 who lived in a defined geographic area (Avon, United Kingdom). The children have been studied throughout their lives using maternal or self-report questionnaires and, from the age of 7 years, approximately annual research clinic visits. There were 14 062 live births, 13 988 children were alive at 1 year and over 7000 mothers completed the 8-year questionnaire. The study sample in this paper comprises the 7250 singletons with outcome data at 8 years of age. Ethical approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees.

Measures

Exposure - Child Rash, Wheeze, and Atopy. Child rash and wheeze symptoms were reported in mailed, self-completion questionnaires sent to the mother when her child was aged 6 months, 18 months, 2 years 6 months, 3 years 6 months, 4 years 9 months, 5 years 9 months, 6 years 9 months, and 7 years 7 months (**Table I**; available at www.jpeds.com). When questionnaires contained more than 1 question about wheeze or rash, a symptom was coded as being present if the mother reported yes to any 1 of the questions. The time periods covered by the questionnaires were categorized as infancy (up to 18 months), preschool (18 months up to 4 years 9 months), and school age (4 years 9 months up to 7 years 7 months). For each time period, symptoms were coded as being present if the mother reported that the child had the symptom in at least 1 questionnaire. For rash and wheeze separately, symptoms were categorized as 'none' (no symptoms in any time period); 'early onset, transient' (symptoms in infancy and/or preschool only); 'persistent' (symptoms in infancy and/or preschool, and at school age); and 'late onset' (symptoms at school age only). Atopy status was known for 5004 children in our sample who attended an ALSPAC clinic when aged 7.5 years; atopy was determined by skin prick testing and defined as a positive response (≥2 mm weal) to any one of *Dermatophagoides pteronyssinus*, grass, or cat allergen with a negative response to diluent solution. As previously reported, this definition identified >95% of subjects with any positive response to a wider panel of allergens.[29]

Outcome—Child Mental Well-Being. Child mental well-being at age 8 years 1 month was maternally reported using the parental version of the Goodman Strengths and Difficulties Questionnaire, a validated behavioral screening tool for children and adolescents.[30] The peer and emotion subscales can be summed to give an internalizing problems score (range 0-20), and the hyperactivity and conduct subscales summed to give an externalizing problems score (range 0-20).[31] All 4 subscales can be summed to give a total difficulties score (TDS) (range of 0-40); a higher score reflects more difficulties. For each of the TDS, externalizing and internalizing scores, children were classified as having a high score or not (high defined as >90th percentile). The cut-offs for a high score were ≥7 for internalizing, ≥10 for externalizing, and ≥15 for TDS.

Other Variables. Maternal anxiety and depression were measured in pregnancy and at the outcome time-point (when child was 8 years old). Depression was measured by the Edinburgh Postnatal Depression Scale. Although this measure was originally designed for use with postnatal women, none of the 10 items is specific to this period and it has been validated for use at other times[32]; it was chosen as it does not contain somatic items that could confound normal symptoms in pregnancy with depression. Anxiety was measured in pregnancy by the 8 items of the anxiety subscale of the Crown-Crisp Experiential Index[33] and 8 years later, by the 20-trait anxiety items of the State-Trait Anxiety Inventory.[34] Quartiles of depression and anxiety scores were calculated for use in analyses as they were not normally distributed.

A number of other child, mother, and socioeconomic variables thought to be potential confounders or mediators (based on previous literature or on theoretical grounds) were also included in analyses. Child variables were maternally reported: sex; ethnicity (White, non-White [no further disaggregation was possible due to small numbers]); age at outcome; and child wakes at night (no, once, twice or more). Socioeconomic position (SEP) was reported during pregnancy: highest maternal education (university degree, A level, O level, vocational/none); housing tenure (owned/mortgaged, privately rented, council rented, other); and financial difficulties (quartiles of score with range 0-40, where 0 is no financial difficulties). Maternal smoking (no, yes) was reported during pregnancy and at the outcome time point, and maternal insufficient sleep (no, yes) when the child was aged 7 years.

Missing Data

Multiple imputation using chained equations was used to replace missing exposure and confounder data with predictions based on information observed in the sample. The percentage of missing data was below 10% for most variables (**Table II**; available at www.jpeds.com); 47% of the children had complete data, with another 40% having between 1 and 4 missing variables. Twenty imputed datasets were created and analyzed using mi estimate commands in Stata 13 (StataCorp, College Station, Texas). Complete case analysis was also performed; results were consistent with those from the imputed data and are available from authors on request. Atopy data were not imputed; a separate complete case analysis was performed for this exposure.