

Association between maternal occupational exposure to cleaning chemicals during pregnancy and childhood wheeze and asthma

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A thesis

submitted in partial fulfillment of the  
requirements for the degree of

Master of Public Health

University of Washington

2023

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Program Authorized to Offer Degree:  
Environmental & Occupational Health Sciences

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**Abstract**

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**Background:** Asthma is a leading cause of childhood morbidity in the U.S. and a significant public health concern. The prenatal period is a critical window during which environmental influences, including maternal occupational exposures, can shape child respiratory health. Cleaning chemicals are commonly encountered in occupational settings, yet few studies have examined the potential link between prenatal occupational exposures to cleaning chemicals and risk of childhood wheeze and asthma.

**Methods:** We evaluated the potential influence of maternal occupational exposure to cleaning chemicals during pregnancy on pediatric asthma and wheeze at child age 4–6 years in 453 mother-child pairs from two longitudinal pregnancy cohorts, TIDES and GAPPS, part of the ECHO -

PATHWAYS consortium. Maternal occupational exposure to cleaning chemicals was defined based on reported occupation and frequency of occupational use of chemicals during pregnancy. Child current wheeze and asthma outcomes were defined by parental responses to a widely-used, standardized respiratory outcomes questionnaire administered at child age 4–6 years. Multivariable Poisson regression with robust standard errors was used to estimate relative risk (RR) of asthma in models adjusted for confounders, including demographic, health, and socioeconomic factors. Effect modification by child sex was assessed using product interaction terms.

**Results:** Overall, 116 mothers (25.6%) reported occupational exposure to cleaning chemicals during pregnancy, 11.7% of children had current wheeze, and 10.2% had current asthma. We did not identify associations between prenatal exposure to cleaning chemicals and current wheeze [ $RR_{\text{adjusted}} 1.03$ , 95% confidence interval (CI): 0.56, 1.90] or current asthma ( $RR_{\text{adjusted}} 0.89$ , CI: 0.46, 1.74) in the overall sample. Analyses of effect modification suggested an adverse association among females for current wheeze (RR 1.82, CI: 0.76, 4.37), compared to males (RR 0.68, CI: 0.29, 1.58), though the interaction p-value was non-significant ( $p = 0.13$ ).

**Conclusion:** We did not observe evidence of associations between maternal prenatal occupational exposure to cleaning chemicals and childhood wheeze or asthma in the multi-site ECHO-PATHWAYS consortium. We leveraged longitudinal U.S. pregnancy cohorts with rich data characterization to expand on limited and mixed literature. Future research with more precise characterization of maternal occupational chemical exposures, including specific chemical types and timing, and larger and diverse cohorts would be most informative.

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## **Thesis Introduction**

Asthma is a complex, chronic inflammatory respiratory disease, often triggered by environmental factors. Childhood asthma affects approximately 8% of children in the U.S. and confers a significant public health burden (1,2). The prenatal period is a critical period during which interactions between genetics and environmental exposures, including environmental toxicants, influence the risk, incidence, and severity of allergic diseases and asthma through mechanisms such as modulation of fetal lung development and immunologic adaptations (3–7).

Cleaning and disinfectant products are complex mixtures of chemicals that can act as irritants and potential sensitizers (8–10). Prior investigations have found epidemiological evidence that home and occupational exposures to chemicals involved in cleaning and janitorial tasks, including disinfectants, fragrances, and solvents, increase risk for respiratory symptoms and asthma in adults (8,10–17). Additionally, evidence suggests a link between use of cleaning chemicals and sprays in the home with airway inflammation, persistent wheeze, lung function abnormalities, and increased risk of asthma in children (18–20).

Maternal environmental exposures during pregnancy and preconception, including occupational exposures to cleaning chemicals, have also been found to be associated with childhood wheeze and asthma, though mechanisms are not yet fully understood (3,9,21–23). A few prior studies have evaluated non-occupational prenatal exposures to cleaning products and respiratory health in children. These results suggest a potential link to airway health, including asthma and allergic disorders in children. Bably et. al. demonstrated an association between prenatal exposure to scented cleaning products or perfume with nocturnal cough among children, but not asthma or other asthma-related symptoms (24). Casas et al. analyzed the use of household cleaning products during pregnancy and infant wheezing and lower respiratory tract infection (LRTI) and found an association between the use of cleaning spray during pregnancy

and an elevated risk of wheezing and LRTI during the first year of infancy (25). Finally, Sherriff and colleagues reported that prenatal domestic use of cleaning products is associated with persistent wheezing in early childhood (26).

Within an occupational setting, several parental occupations are associated with higher risk of childhood respiratory outcomes, including jobs involving cleaning and chemical disinfection (21,22,27). To date, few studies have examined maternal occupational exposures to cleaning agents specifically in the prenatal period and the association with childhood asthma outcomes. Tagiyeva et al. studied 11,193 mothers and 9,473 fathers antenatally, and 4,631 mothers and 5,315 fathers postnatally, in the Avon Longitudinal Study of Parents and Children and found that maternal occupational exposure to biocides and fungicides during the postnatal period was associated with an increased likelihood of childhood wheeze (odds ratio (OR) 1.23, 95% confidence interval (CI): 1.07, 1.40) (22). However, Pape et al. studied the association between parental occupational pre-conception and pregnancy exposure and asthma in 3,985 offspring participating in the Respiratory Health in Northern Europe, Spain and Australia generation study (23). Parental occupational exposure to reactive chemicals was defined by an occupational asthma-specific job exposure matrix (JEM) into one of four major exposure groups and included any or all of the following products/compounds: high-level chemical disinfectants, isocyanates, acrylates, epoxy resins, persulfates/henna, aliphatic amines, bleach. Exposure to reactive chemicals in the pre-conception periods and pregnancy was not associated with childhood asthma (OR 1.03, CI: 0.72, 1.46). In the largest study to date, Christensen et al. investigated 78,813 mother/child pairs in the Danish National Birth Cohort and found that maternal occupational exposure during and after pregnancy to low molecular weight (LMW) agents, defined as a category of occupations with known exposures to LMW allergens and irritants that

increase the risk for occupational asthma, including cooks, cleaners, hairdressers, and/or dentistry (21). Their findings suggested an association with asthma in 7-year-old children with and without atopic dermatitis, though the results did not reach statistical significance (OR 1.17, CI: 0.95, 1.44 and OR 1.10, CI: 0.98, 1.22, respectively). Within this same study, maternal prenatal and postnatal LMW exposures were associated with childhood asthma when examined individually, but after mutual adjustments, only postnatal exposure (OR 1.13, CI: 0.99 to 1.29) and the combined effects of prenatal and postnatal exposure (OR 1.34, CI: 1.19 to 1.51) seemed to be associated with child asthma. A recent European cohort study by Tjalvin et al. found that prenatal exposure to cleaning agents was associated with childhood asthma (OR 1.56, CI: 1.05, 2.31), childhood asthma with nasal allergies (OR 1.77, CI: 1.13, 2.77), and childhood wheeze and/or asthma (OR 1.71, CI: 1.19, 2.44) (9).

Asthma is more prevalent in pre-adolescent boys and child sex has been found to modify the relationship between prenatal environmental exposures and child airway outcomes (28–30). Christensen et al. specifically focused on the modifying role of child sex in prenatal occupational exposure to cleaning chemicals and did not find effect modification by child sex in the association between occupational exposure to LMW agents and childhood asthma (21).

In this scientific context, we sought to contribute to this evidence base utilizing a large U.S. multi-site cohort study (ECHO-PATHWAYS) with data on maternal occupational exposure to cleaning chemicals in the prenatal period and longitudinal follow up to assess asthma outcome at age 4-6 years. We sought to evaluate 1. the potential influence of maternal occupational exposure to cleaning chemicals during the prenatal period on pediatric asthma and wheeze outcomes at child age 4 – 6 years and 2. whether there is evidence of modification of effects by sex. We hypothesized that maternal exposure to cleaning chemicals during pregnancy will be

associated with increased risk of asthma and wheeze at age 4 - 6 years and that a stronger adverse association will be observed in females.

## Journal Article

### **Association between maternal occupational exposure to cleaning chemicals during pregnancy and childhood wheeze and asthma**

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**Keywords: Cleaning chemicals<sup>1</sup>, Childhood wheeze<sup>2</sup>, Childhood asthma<sup>3</sup>, Occupational exposure<sup>4</sup>, Prenatal exposures<sup>5</sup>, Environmental exposure<sup>6</sup>, Respiratory outcomes<sup>7</sup>**

## **Introduction**

Childhood asthma affects approximately 8% of children in the U.S. and represents a significant public health concern (1). Asthma is a complex, chronic inflammatory respiratory disease, characterized by airway hyperresponsiveness, inflammation, and obstruction, and is often

triggered by environmental factors (2). Symptoms include episodes of breathlessness, coughing, and wheezing, and asthma that develops in childhood has a profound impact on lifelong lung health, including airway remodeling and increased risk for adult asthma (3,4). The prenatal period is a significant window during which interactions between genetics and environmental exposures, including environmental toxicants, modulate fetal lung development and immunologic responses that influence the risk, incidence, and severity of allergic diseases and asthma (3,5–8).

Cleaning and disinfectant products are complex mixtures of chemicals, including irritants and potential sensitizers (9–11). Prior investigations have found robust, consistent epidemiological evidence that both home and occupational exposures to chemicals involved in cleaning and janitorial tasks, including disinfectants, fragrances, and solvents, increase risk for respiratory symptoms and asthma in adults (9,11–18). In children, evidence also suggests a link between use of cleaning chemicals and sprays in the home with airway inflammation, persistent wheeze, lung function abnormalities, and increased risk of asthma (19–21).

By contrast, maternal environmental exposures during pregnancy and preconception, including occupational exposures to cleaning chemicals, have been found to be associated with childhood wheeze and asthma, though mechanisms are not yet fully understood (3,10,22–24). Several parental occupations are associated with higher risk of childhood respiratory outcomes, including jobs involving cleaning and chemical disinfection (22,23,25). Thus far, few studies have examined the potential link between maternal occupational exposures to cleaning agents specifically in the prenatal period and childhood asthma. A recent European cohort study found that both asthma and a related atopic condition in childhood (e.g., allergic rhinitis) were linked to prenatal exposure to cleaning agents (10). Finally, pre-adolescent boys have an increased prevalence of asthma, and child sex has been found to modify the relationship between prenatal environmental exposures and child airway outcomes (26–28), but few studies have specifically focused on the modifying role of child sex in prenatal occupational exposure to cleaning chemicals (22).

We contribute to this limited evidence base by evaluating the potential influence of maternal occupational exposure to cleaning chemicals during the prenatal period on pediatric asthma and wheeze outcomes at child age 4 – 6 years. Furthermore, we evaluate whether there is evidence of sex-specific associations. We utilize asthma and wheeze data collected in middle childhood in the ECHO prenatal and early childhood pathways to health consortium (ECHO-PATHWAYS), a multi-site longitudinal study combining three U.S. pregnancy cohorts with extensive pregnancy exposure, child outcome and covariate characterization. We hypothesize that maternal exposure to cleaning chemicals during pregnancy will be associated with increased risk of asthma and wheeze at age 4 - 6 years and that effects will vary by child sex.

## **Materials and Methods**

### **Study Setting and Population**

The study participants were mother-child pairs from two ECHO-PATHWAYS consortium pregnancy cohorts: the Global Alliance to Prevent Prematurity and Stillbirth (GAPPS) and The Infant Development and Environment Study (TIDES) (29).

GAPPS participants were enrolled between 2011 and 2014 from three hospitals in Seattle, WA and Yakima, WA. Inclusion criteria included being 18 years or older, able to speak and write English, and planning to deliver at the study hospital in which they were enrolled. Eligible mother-child dyads were recruited into ECHO-PATHWAYS when the children were 4 - 6 years old and attended clinic visits at age 4 - 6 years and age 8 - 9 years. TIDES participants were recruited during the first trimester of pregnancy from participating academic medical centers, from 2010–2012: San Francisco, CA; Minneapolis, MN; Rochester, NY; and Seattle, WA. Women were eligible if they were 18 years old or older, planning to deliver at one of the participating study hospitals, and having a low-risk singleton pregnancy at enrollment. Mother-child pairs were administered questionnaires and/or attended clinic visits at ages 4 - 5 years, 6 years and 7 years (30,31). This analysis includes participants who completed both the occupational exposure questionnaire and the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire (32,33) at child age 4 – 6 years. Because visits varied in composition and not all surveys were administered at all visits, only a subset of the participants who attended visits have both exposure and outcome data required for the main study question and are included in these analyses.

Participants provided informed consent. Data were analyzed by the University of Washington (UW) ECHO-PATHWAYS team and study protocols were approved by the UW Institutional Review Board (IRB).

### **Occupational Prenatal Exposure to Cleaning Chemicals**

Our primary exposure of interest, maternal occupational exposure to cleaning chemicals during the prenatal period, was assessed using questionnaires administered to primary caregivers regarding job titles, occupational activities, and exposures during the prenatal period. Questionnaires were administered at the GAPPS child age 4 - 6 visit (GAPPS 4-6), GAPPS child age 8 - 9 visit (GAPPS 8-9) or TIDES child age 7 visit (TIDES 7). In both GAPPS and TIDES, prenatal exposure to cleaning chemicals was defined as meeting any of the following: (1) answered “Yes” to “*Did the biological mother work in any of the following industries during pregnancy: Janitor or house cleaner?*”; (2) answered “Yes” to “*Did the biological mother do any of the following activities at her job during pregnancy: Clean floors, sinks, or toilets?*”; (3) answered “Some days” or “Every day” to “*How often did the biological mother use janitorial chemicals or cleaners at her job during pregnancy?*”

### **Child Airway Outcomes**

We defined our primary outcomes as current wheeze and current asthma and our secondary outcome as strict asthma as reported between child ages 4 - 6 using the ISAAC questionnaire. The categorization of outcomes is similar to that used previously in ECHO-PATHWAYS consortium research (27–29,34,35). Current wheeze was defined as a positive response to “*Has the child had wheezing or whistling in the chest in the past 12 months?*” Current asthma was defined as positive responses to two of the following: current wheeze, ever asthma (defined as positive response to the question “*Has your child ever had asthma?*”), and asthma medication use (“*Does the child use any medications for treatment of recurrent cough, recurrent wheezing or asthma?*”). Strict asthma was defined as positive response to the question “*Has your child ever had asthma?*” as well as either current wheeze or asthma medication use (35,36).

## Statistical Analysis

Demographic and behavioral characteristics of mother-child pairs were summarized overall and by cohort.

Modified multivariable Poisson regression with robust standard errors was used to estimate associations (adjusted risk ratios (RR)) between exposure and outcomes. The primary analyses investigated the association between prenatal exposure to cleaning chemicals (yes/no) and primary outcomes (current wheeze and current asthma) using separate models for each outcome. Secondary analyses investigated the association between prenatal exposure to cleaning chemicals and strict asthma.

We used a staged modeling approach for covariate adjustment by fitting minimally adjusted, fully adjusted (main model), and extended models. Covariates were selected *a priori* based on a literature search to identify asthma and wheeze risk factors that may be correlated with the exposure and included maternal, child, and household demographic, health, and socioeconomic factors. Minimally adjusted models were adjusted for child age, child sex, and study site. Main models further adjusted for self-identified maternal race (White, Asian, or other) and maternal ethnicity (Hispanic/Latino or non-Hispanic/Latino), education at enrollment (less than high school, high school completion, graduated college/technical school, or any graduate school/professional), maternal history of asthma (yes/no), maternal age at delivery (years, continuous), maternal self-report of smoking status at enrollment (yes/no), household size category (<4, 4, 5, >5), region- and inflation-adjusted household income (continuous, \$USD), postnatal second-hand smoke exposure (yes/no), season of birth (warm [April through September]/cold [October through March]), and firstborn status (yes/no). Extended models additionally adjusted for two potential confounders that may also act as mediators: preterm birth at less than 37 weeks (binary) and birthweight (continuous). To evaluate whether the association between prenatal exposure to cleaning chemicals and childhood asthma is modified by child sex, we tested for a statistical interaction using multiplicative interaction terms. The primary models, effect modification analysis, and sensitivity analyses utilized multiple imputation by chained equations (MICE) to impute missing covariates (37).

We conducted multiple sensitivity analyses to assess the robustness of findings to modeling approach. In all cases, the sensitivity analyses were compared to the main model. Demographic and behavioral characteristics were also summarized for participants included in this study and those who were excluded but still attended the age 4-6 visit. To explore whether results were influenced by site- and cohort- specific associations, leave-one-out analyses were conducted in which the main analysis was repeated with one cohort or site removed in each iteration. To assess whether bias was introduced due to variation in ability to recall exposures at different child ages, we additionally adjusted for visit of exposure questionnaire completion (age 4-6 or 7/8-9 visit [binary]). We performed additional sensitivity analyses in which we adjusted for urinary cotinine (continuous) as a marker of maternal smoking and exposure to environmental tobacco smoke during pregnancy (38), measured during the second trimester visit, and whether the child had ever been diagnosed with bronchiolitis (yes/no). Maternal pregnancy tobacco smoke exposure and early childhood bronchiolitis are both associated with development of childhood asthma (1,39); however, we did not include these in the main models because they were not collected for the GAPPs participants who completed the exposure recall at age 4-6

(N=96) per study protocols. To more precisely capture clinically relevant exposure to cleaning chemicals, prenatal cleaning practices and prenatal cleaning frequency were assessed independently. Separate analyses were performed defining prenatal exposure as either (1) answered “Yes” to “*Did the biological mother do any of the following activities at her job during pregnancy - Clean floors, sinks, or toilets?*” or (2) answered “Some days” or “Every day” to “*How often did the biological mother use janitorial chemicals or cleaners at her job during pregnancy?*” Finally, we repeated the primary analysis using complete cases only.

All analyses were conducted in R version 4.2.2 and significance was assessed at an  $\alpha$  level of 0.05.

## Results

Overall, 453 pregnancy exposure and occupation recall questionnaires were completed, 239 in GAPPS and 214 in TIDES (Table 1). Of these, 116 mothers (25.6%) were classified as having been exposed to cleaning chemicals at their job during pregnancy. There was overlap among classification of exposure: ten mothers (2.2%) worked as a janitor or house cleaner, 77 (17%) cleaned floors, sinks, or toilets as part of their job, and 88 (19.4%) used janitorial chemicals or cleaners in their job some days or every day (Table 2). Mean child age at outcome assessment was 5.8 years (standard deviation (SD) 0.7) with an interquartile range (IQR) of 5.3 - 6.2 (Table 1). The child participants were 54.3% male and 45.7% female. The overall prevalences of current wheeze, current asthma, and strict asthma were 11.7% (N=53), 10.8% (N=49), and 7.7% (N=35), respectively (Table 3).

In our primary analysis, we did not observe associations between the composite measure of prenatal cleaning chemical exposure and current wheeze in the main model (RR 1.03, CI: 0.56, 1.90) or current asthma (RR 0.89, CI: 0.46, 1.74) (Table 4). Results were similar in the minimally adjusted and extended models. Similarly, our secondary analysis found no association between prenatal exposure to cleaning chemicals and strict asthma (RR 0.82, CI: 0.33, 2.02) (Table 4).

We did not observe statistical evidence of an interaction between prenatal exposure to cleaning chemicals and sex on development of current wheeze and current asthma. Results suggest an adverse association limited to females for the current wheeze outcome (RR 1.82, CI: 0.76, 4.37,  $p_{\text{interaction}} = 0.13$ ) compared to males (RR 0.68, CI: 0.29, 1.58); however, the confidence interval was wide and included the null. Effect estimates for current asthma were less than one and did not meet statistical significance in stratified analyses by child sex (Figure 1).

The participants included in our study population were similar in all characteristics except maternal education and household income, which were both somewhat higher in the analytic sample, on average, than those excluded (Supplementary Table 1). We did not observe any statistically significant associations between our primary exposure and current wheeze or current asthma in the sensitivity analyses described above (see Supplementary Material for results). Specifically, when excluding the GAPPS 4-6 exposure recalls, we observed no significant association between the exposure and current wheeze (RR 0.94, CI: 0.50, 1.79) or current asthma (RR 0.92, CI: 0.48, 1.75) (Supplementary Table 2). However, additional adjustment for cotinine and bronchiolitis in a subpopulation in which these data elements were collected led to elevated

effect estimates, though with 95% confidence intervals that included the null (RR 1.88, CI: 0.78 – 4.55) (Supplementary Table 1).

Additionally, upon disaggregation of the exposure classification by question, we did not observe a significant association between exposure and current wheeze (RR 0.81, CI: 0.42, 1.54) or current asthma (RR 0.88, CI: 0.42, 1.85) among mothers who cleaned floors, sinks, or toilets at their job during pregnancy. Similarly, there was not a significant association between exposure and current wheeze (RR 1.39, CI: 0.71, 2.73) or current asthma (RR 1.03, CI: 0.49, 2.15) among mothers who used janitorial chemicals or cleaners some days or every day at their job during pregnancy (Supplementary Table 3).

## **Discussion**

This study investigated the association between occupationally related maternal exposure to cleaning chemicals during pregnancy and childhood respiratory outcomes in a combined U.S. pregnancy cohort. We found no evidence of an association between prenatal exposure to cleaning chemicals and childhood wheeze or asthma. Our findings suggested a possible sex-specific adverse association between exposure and current wheeze in females, although this result was not statistically significant.

Prior studies have investigated the link between maternal occupational exposures to cleaning products in the prenatal period and childhood respiratory outcomes. Our findings are consistent with results reported by Pape et al., who studied the association between parental occupational pre- and post-conception exposure and asthma in 3,985 offspring participating in the Respiratory Health in Northern Europe, Spain and Australia generation study (24). The authors found that parental occupational exposure to reactive chemicals, including disinfectants and cleaning chemicals, in pre- and post-conception (including the prenatal period) was not related to offspring asthma at 0–15 years of age. While maternal exposure to reactive chemicals increased the odds for early-onset asthma (0-3 years) (odds ratio (OR) 1.65, CI: 0.98, 2.77), no association was found for maternal chemical exposures and late-onset asthma (4-15 years) (OR 1.03, CI: 0.73, 1.45). The latter corresponded to a more similar child age group to our study population. Tagiyeva et al. found that maternal prenatal occupational exposure to biocides/fungicides was associated with wheeze at medium/high intensity exposure (OR 1.23, CI: 1.07, 1.40), but not with wheeze at low exposure intensity (OR 1.06, CI: 0.93, 1.20), asthma at low exposure intensity (OR 0.96, CI 0.79, 1.17) or asthma at medium/high exposure intensity (OR 1.20, CI: 0.98 – 1.47) in 7,088 children at 7 years of age (23). Christensen et al. found that prenatal exposure to low molecular weight (LMW) agents, identified as an exposure based on job codes for cleaners, had a borderline non-significant adverse association with asthma in 7-year-old children in the Danish National Birth Cohort (22). However, both maternal postnatal exposure to LMW agents and the combined effects of prenatal and postnatal exposure were associated with asthma. In contrast, Tjalvin et al. found that maternal occupational exposure to cleaning agents starting before conception and continuing through pregnancy were associated with childhood asthma (OR 1.56, CI: 1.05, 2.31), childhood asthma with nasal allergies (OR 1.77, CI: 1.13, 2.77), and childhood wheeze and/or asthma (OR 1.71, CI: 1.19, 2.44) before 10 years of age among 3,318 children in two multi-national cohorts (10).

Previous studies investigating non-occupational exposures to cleaning products during pregnancy and childhood asthma and allergic disorders offer useful paradigms for comparison when evaluating our results. These studies also yielded mixed results. Bably et al. analyzed 400 children with a mean age of 6 years (SD 2.9) from Pakistan and demonstrated an association between prenatal exposure to scented cleaning products or perfume in the home with nocturnal cough among children, but not current asthma status or nocturnal symptoms of wheezing, shortness of breath, and chest tightness (40). In a study investigating household use of cleaning products during pregnancy, Casas et al. found that use of sprays or air fresheners was associated with higher prevalence of lower respiratory tract infections (LRTI) and use of sprays or solvents during pregnancy was associated with a higher prevalence of wheezing in the first year of life (41). Sherriff and colleagues reported a dose-dependent relationship between prenatal domestic use of chemical products, including disinfectants, cleaners, and fragrances, and persistent wheezing in the first 3.5 years of life, though significance differed by wheeze phenotype (42).

Biological mechanisms by which cleaning chemical exposure during the prenatal period affect respiratory health in children are not fully understood. Many cleaning products contain both irritants and sensitizers (9). The main sensitizers contained in cleaning products are disinfectants, quaternary ammonium compounds, amine compounds, and fragrances, whereas airway irritants in cleaning products include bleach, solvents, hydrochloric acid, alkaline agents, and phthalates all of which are commonly mixed together (9,43). Many cleaning agents are LMW chemicals and are lipophilic, so transplacental diffusion may alter fetal airway development (10,44,45). Several human studies suggest maternal cytokines, specifically cytokines released from CD4+ Th2 T helper cells and type 2 innate lymphoid cells, mediate childhood asthma risk; however, whether this association is due to maternal cytokines passing through the placenta from maternal to fetal circulation or by modulating placental cytokine release is not clear (3). Another review found that prenatal exposure to common environmental allergens and chemicals, including tobacco smoke, organic pollutants, metals and outdoor air pollutants, may alter distributions of immune system cells, immunoglobulins and cytokine patterns in neonate cord blood (8). This derangement was postulated to result in predisposition of infants to respiratory infections during the early postnatal period and potentially an increased risk of wheeze and asthma in childhood.

Sex-dependent biological mechanisms have been implicated in asthma development (26). Prior findings have been mixed regarding effect modification by sex in the relationship between prenatal environmental exposures and child airway outcomes (27,28) but few studies have specifically focused on prenatal occupational exposure to cleaning chemicals. Similar to our results, Christensen et al. did not find effect modification by child sex in the association between occupational exposure to LMW agents and childhood asthma (22). The prevalence of asthma is higher in boys than in girls in pre-adolescence, though the mechanism by which sex hormones regulate asthma pathophysiology is complex and requires further investigation (21,46).

Excluding GAPPS 4-6 recall survey data and adjusting the main model for cotinine and/or bronchiolitis altered the effect estimates from less than one to greater than one. The greatest change was in the association between exposure and current asthma; after adjusting for bronchiolitis, the estimated risk ratios approached 2, though the CIs widened significantly potentially due to reduced sample size. Acute LRTI such as bronchiolitis during infancy has been found to be a strong risk factor for childhood asthma (1,47,48). More research on the relationship

between environmental factors, including prenatal occupational cleaning product exposures, and early childhood LRTI and asthma is warranted.

Because our characterization of mothers' cleaning chemical exposure was based on a composite measure that included job category, specific task, and frequency of chemical use, we separately examined two classifications of exposure, defined by single survey questions, as a sensitivity analysis. While the questionnaire did allow for more granular and comprehensive ascertainment of mothers' exposure by including specific tasks and frequency rather than a single job title or category, mothers may have been misclassified as not exposed based on the wording of the questions. As in studies defining exposure through job exposure matrices, in which job titles constitute a proxy for exposure to specific agents and average exposures are often based on expert evaluation of job category, any exposure misclassification is likely to be non-differential, biasing the association towards the null (10,24). There were very few (N=10) respondents who worked as a janitor or house cleaner, suggesting that we were underpowered to investigate routine, intense occupational exposure. Furthermore, this group exhibited complete overlap with those who cleaned floors, sinks or toilets at her job, so they could not be disaggregated for separate analysis. While none of the associations reached significance, the effect estimates for those who cleaned floors, sinks or toilets at their job were less than one, whereas the effect estimates for those who used janitorial chemicals or cleaners at their jobs some days or every day were greater than one. This suggests that improved exposure classification that better approximates "dose" through frequency of use and more specific chemical data versus more crude measures based on job duties or job type are important considerations for future research.

Our study had several strengths. Our findings contribute to a very limited and mixed literature on maternal occupational exposures, specifically during the prenatal period, and child airway health. We were able to examine the association between prenatal exposure to occupationally associated cleaning chemicals and risk of developing childhood wheeze and asthma in a U.S. based cohort comprising several cities with robust adjustment for mother and child demographic, behavioral and socioeconomic covariates and potential confounders (29).

Several limitations should be considered. Maternal occupational exposures during pregnancy were assessed retrospectively at visits with existing knowledge about whether the respiratory outcomes had occurred, which may introduce recall bias. Despite having a robust set of covariates known to influence asthma risk, we did not have data on other chemicals and products that mothers could have been exposed to associated with occupational use of cleaning chemicals or outside of work. The specific wording of the job information could include a myriad of job tasks, and occupational cleaning tasks could also confer more or less exposure to other agents, such as dust, animal dander, microbes, indoor air pollutants, all of which may impact risk of childhood asthma. Our exposures of interest in the prenatal period were highly correlated with those in the preconception and postnatal period; however, we did not have the power in this study to differentiate exposure periods to perform separate analyses. Thus, despite inclusion of numerous covariates in our models, we cannot rule out residual confounding by other factors. Furthermore, we were unable to control for application method, dose, job duration, or use of protective equipment. The sample size and number of outcomes in our final study population limited our statistical power to detect differences among exposed compared to non-exposed. The outcomes of interest were only observed among mothers who identified as White, Asian and other race and these race categories along with median income of the overall sample (>\$100,000)

limit generalizability of this analysis, especially given that asthma has been found to be more prevalent among Black and Hispanic children and among children living in households with lower income (49). Finally, diagnosis of asthma in children can be challenging especially in younger ages, though our study population was comprised of children at or near school age where clinical history allows more confident detection despite lack of more objective measures such as spirometry. Child airway outcome definitions may be influenced by caregiver recognition of symptoms in their children, healthcare access and utilization, and accurate recall of symptoms, medications, and diagnoses at the time of ISAAC survey administration. However, any outcome misclassification would have likely been non-differential with regards to exposure. Furthermore, symptom-based history is a broadly accepted approach to childhood asthma diagnosis and our questions were derived from the validated ISAAC questionnaire (32,33) which remains the most widely used across the globe standardized survey to assess asthma in children (27,28,35,50–54).

Childhood asthma is a chronic disease and serious public health problem that can have significant lifelong health implications. The prenatal period is a crucial period during which environmental influences, including maternal occupational exposures, can shape child respiratory health. Given the widespread use of cleaning products, amplified during the COVID epidemic, research is needed to address the role of maternal occupational exposure to specific compounds found in cleaning chemicals on offspring respiratory outcomes. Future studies should investigate more diverse and representative U.S. populations and larger sample sizes to inform our understanding. Better characterization of exposure to include ingredients of cleaning products are needed, and future studies should include more quantitative assessment of exposure, including dose, timing, and duration. Such data can better inform appropriate strategies for protecting pregnant individuals from potentially hazardous occupational exposures.

In conclusion, we did not find support for our hypothesis that maternal report of occupations using cleaning chemicals or use of cleaning chemicals at work is associated with childhood wheeze or asthma in the ECHO-PATHWAYS combined cohort, nor did we find statistically significant evidence of sex-specific associations. However, our results provide support for needed further investigation in other cohorts. Our study contributes to the emerging body of literature of prenatal occupational exposures and risk of adverse child health outcomes.

**Table 1.** Descriptive characteristics of the study population by cohort.

	<b>Total<sup>b</sup></b> <b>(N=453)</b>	<b>Cohort<sup>a</sup></b>	
		<b>TIDES</b> <b>(N=214)</b>	<b>GAPPS</b> <b>(N=239)</b>
<b>Maternal race</b>			
White	346 (76.4%)	187 (87.4%)	159 (66.5%)
Black	20 (4.4%)	0 (0%)	20 (8.4%)
Asian	24 (5.3%)	15 (7.0%)	9 (3.8%)
Native Hawaiian/Other Pacific Islander	1 (0.2%)	0 (0%)	1 (0.4%)
American Indian/Alaska Native	2 (0.4%)	1 (0.5%)	1 (0.4%)
Other	26 (5.7%)	17 (7.9%)	9 (3.8%)
Multiple race	16 (3.5%)	1 (0.5%)	15 (6.3%)
Missing	18 (4.0%)	18 (8.4%)	0 (0%)
<b>Maternal ethnicity</b>			
Hispanic or Latino	38 (8.4%)	17 (7.9%)	21 (8.8%)
Not Hispanic or Latino	401 (88.5%)	197 (92.1%)	204 (85.4%)
Missing	14 (3.1%)	0 (0%)	14 (5.9%)
<b>Maternal education</b>			
Less than high school	14 (3.1%)	11 (5.1%)	3 (1.3%)
High school	79 (17.4%)	28 (13.1%)	51 (21.3%)
College/technical school	170 (37.5%)	65 (30.4%)	105 (43.9%)
Graduate or Professional degree	190 (41.9%)	110 (51.4%)	80 (33.5%)
<b>Maternal history of asthma</b>			
Yes	60 (13.2%)	24 (11.2%)	36 (15.1%)
No	365 (80.6%)	177 (82.7%)	188 (78.7%)
Missing	28 (6.2%)	13 (6.1%)	15 (6.3%)
<b>Maternal Delivery Age (years)</b>			
Mean (SD)	32.1 (5.3)	31.8 (5.4)	32.3 (5.1)
Median (IQR)	32 (29 - 36)	32 (28 - 36)	32 (29 - 36)
Missing	29 (6.4%)	0 (0%)	29 (12.1%)
<b>Child sex</b>			
Male	246 (54.3)	110 (51.4%)	136 (56.9%)
Female	207 (45.7%)	104 (48.6%)	103 (43.1%)
<b>Preterm birth</b>			
Yes	67 (14.8%)	13 (6.1%)	54 (22.6%)
No	364 (80.4%)	198 (92.5%)	166 (69.5%)
Missing	22 (4.9%)	3 (1.4%)	19 (7.9%)
<b>Season of birth</b>			
Warm	237 (52.3%)	109 (50.9%)	126 (52.7%)
Cold	216 (47.7%)	105 (49.1%)	113 (47.3%)
<b>Birthweight (grams)</b>			
Mean (SD)	3252 (705.6)	3387 (500.8)	3122 (839)
Median (IQR)	3316 (2940 - 3710)	3358 (3071 - 3700)	3274 (2755 - 3716)

Missing	120 (26.5%)	15 (7.0%)	22 (9.2%)
<b>Firstborn status</b>			
Yes	130 (28.7%)	35 (16.4%)	90 (37.7%)
No	305 (67.3%)	172 (80.4%)	138 (57.7%)
Missing	18 (4.0%)	7 (3.3%)	11 (4.6%)
<b>Ever bronchiolitis<sup>c</sup></b>			
Yes	31 (6.8%)	14 (6.5%)	17 (7.1%)
No	302 (66.7%)	185 (86.4%)	117 (49.0%)
Missing	120 (26.5%)	15 (7.0%)	105 (43.9%)
<b>Child age at 4-6 visit (years)</b>			
Mean (SD)	5.8 (0.7)	6.2 (0.4)	5.5 (0.7)
Median (IQR)	6 (5.3 – 6.2)	6.1 (6.0 – 6.2)	5.4 (5.1 – 5.9)
Missing	18 (4.0%)	7 (3.3%)	11 (4.6%)
<b>Household size</b>			
<4	80 (17.7%)	40 (18.7%)	40 (16.7%)
4	204 (45.0%)	101 (47.2%)	103 (43.1%)
5	83 (18.3%)	35 (16.4%)	48 (20.1%)
>5	50 (11.0%)	19 (8.9%)	31 (13.0%)
Missing	36 (7.9%)	19 (8.9%)	17 (7.1%)
<b>Adjusted income (\$USD)</b>			
Mean (SD)	\$114,004 (\$56,745)	\$117,237 (\$59,070)	\$111,188 (\$54,193)
Median (IQR)	\$110,813 (\$67,648 - \$172,511)	\$110,813 (\$67,676 - \$172,511)	\$105,682 (\$67,648 - \$147,955)
Missing	32 (7.1%)	18 (8.4%)	14 (5.9%)
<b>Smoking self-report</b>			
Yes	15 (3.3)	10 (4.7%)	5 (2.1%)
No	436 (96.2%)	104 (48.6%)	232 (97.1%)
Missing	2 (0.4%)	0 (0%)	2 (0.8%)
<b>Averaged cotinine<sup>d</sup></b>			
Mean (SD)	29.7 (169.2)	40.7 (206.1)	11.4 (79.2)
Median (IQR)	0.01 (0.01 – 0.06)	0.01 (0.01 – 0.07)	0.01 (0.001 – 0.02)
Missing	113 (24.9%)	2 (0.9)	111 (46.4%)
<b>Postnatal second-hand smoke exposure</b>			
Yes	127 (28.0%)	121 (56.5%)	16 (6.7%)
No	300 (66.2%)	93 (43.5%)	207 (86.6%)
Missing	16 (3.5%)	9 (4.2%)	16 (6.7%)
<b>Cohort Site</b>			
<b>GAPPS</b>			
Seattle, WA	164 (36.2%)		164 (68.6%)
Yakima, WA	75 (16.6%)		75 (31.4%)
<b>TIDES</b>			

Minneapolis, MN	56 (12.4%)	56 (26.2%)
Rochester, NY	49 (10.8%)	49 (22.9%)
San Francisco, CA	63 (12.9%)	63 (29.4%)
Seattle, WA	46 (10.2%)	46 (21.5%)

<sup>a</sup> Percentages are within cohort

<sup>b</sup> Percentages are within total group

<sup>c</sup> Bronchiolitis history was not surveyed for the subset of GAPPS participants who completed the recall survey at age 4-6. Bronchiolitis was unavailable for N=11 from the GAPPS age 8-9 recall group.

<sup>d</sup> Measured in nanograms per milliliter (ng/mL). Cotinine was not measured for the subset of GAPPS participants who completed the recall survey at age 4-6. Cotinine was unavailable for N=15 from the GAPPS age 8-9 recall group.

**Table 2.** Occupational exposure to cleaning chemicals<sup>a</sup> among pregnant individuals in the study population.

	Total (N=453)	Cohort	
		TIDES (N=214)	GAPPS (N=239)
<b>Exposure (composite, prenatal)</b>			
Yes	116 (25.6%)	48 (22.4%)	68 (28.5%)
No	337 (74.4%)	166 (77.6%)	171 (71.5%)
<b>Works as janitor or house cleaner</b>			
Yes	10 (2.2%)	5 (2.3%)	5 (2.1%)
No	442 (97.6%)	209 (97.7%)	233 (97.5%)
Missing	1 (0.2%)	0 (0%)	1 (0.4%)
<b>Cleans floors, sinks, or toilets at job</b>			
Yes	77 (17%)	40 (18.7%)	37 (15.5%)
No	375 (82.8%)	173 (80.8%)	202 (84.5%)
Missing	1 (0.2%)	1 (0.5%)	0 (0%)
<b>Use janitorial chemicals or cleaners at job</b>			
Some days	72 (15.9%)	22 (10.3%)	50 (20.9%)
Every day	16 (3.5%)	6 (2.8%)	10 (4.2%)
Never	362 (79.9%)	183 (85.5%)	179 (74.9%)
Missing	3 (0.7%)	3 (1.4%)	0 (0%)

<sup>a</sup> Maternal occupational exposure to cleaning chemicals during the prenatal period was assessed using questionnaires administered to primary caregivers and were completed at the GAPPS child age 4-6 visit, GAPPS child age 8-9 visit or TIDES child age 7 visit. Exposure was defined as meeting any of the following: (1) answered of “Yes” to “Did the biological mother work in any of the following industries during pregnancy: Janitor or house cleaner?”; (2) answered “Yes” to “Did the biological mother do any of the following activities at her job during pregnancy: Clean floors, sinks, or toilets?”; (3) answered “Some days” or “Every day” to “How often did the biological mother use janitorial chemicals or cleaners at her job during pregnancy?”

**Table 3.** Asthma and wheeze outcomes at age 4–6 years in the study population.

	<b>Total</b> <b>(N=453)</b>	<b>Cohort</b>	
		<b>TIDES</b> <b>(N=214)</b>	<b>GAPPS</b> <b>(N=239)</b>
<b>Current wheeze</b>			
Yes	53 (11.7%)	33 (15.4%)	20 (8.4%)
No	373 (82.3%)	174 (81.3%)	199 (83.3%)
Missing	27 (6.0%)	7 (3.3%)	20 (8.4%)
<b>Current asthma</b>			
Yes	49 (10.2%)	13 (6.1%)	36 (15.1%)
No	389 (85.9%)	183 (85.5%)	206 (86.2%)
Missing	15 (3.3%)	7 (3.3%)	8 (3.3%)
<b>Strict asthma</b>			
Yes	35 (7.7%)	14 (6.5%)	20 (8.4%)
No	392 (86.5%)	193 (90.2%)	199 (83.3%)
Missing	27 (5.8%)	7 (3.3%)	20 (8.4%)

**Table 4.** Association between maternal occupation exposure to cleaning chemicals during pregnancy and airway outcomes.

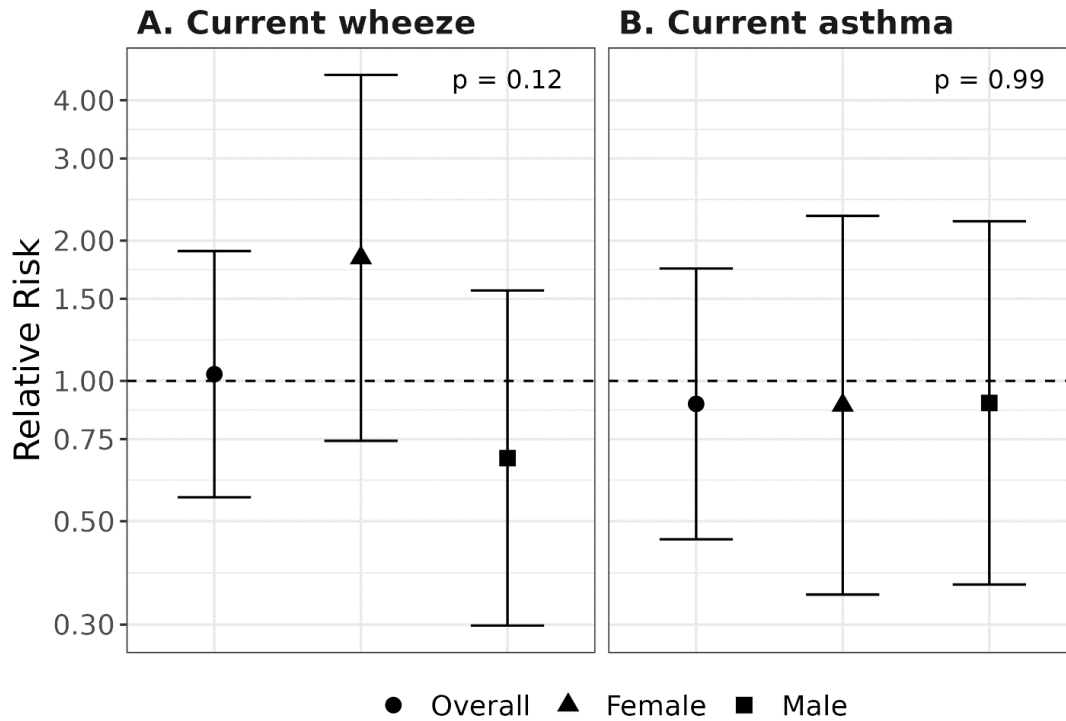
	<b>Minimally-adjusted model<sup>a</sup></b>		<b>Main model<sup>b</sup></b>		<b>Extended model<sup>c</sup></b>	
	Adjusted RR (95% CI)	p-value	Adjusted RR (95% CI)	p-value	Adjusted RR (95% CI)	p-value
<b>Primary outcomes</b>						
Current wheeze	0.90 (0.49 – 1.64)	0.72	1.03 (0.56 – 1.90)	0.92	1.03 (0.55 – 1.90)	0.65
Current asthma	0.86 (0.45 – 1.64)	0.65	0.89 (0.46 – 1.74)	0.74	0.88 (0.45 – 1.71)	0.74
<b>Secondary outcome</b>						
Strict asthma	0.70 (0.31 – 1.55)	0.38	0.82 (0.33 – 2.02)	0.67	0.80 (0.33 – 1.96)	0.63

<sup>a</sup> Minimally adjusted models were adjusted for child age, child sex, and study site.

<sup>b</sup> Main models were further adjusted for maternal race, maternal ethnicity, education at enrollment, maternal history of asthma, maternal age at delivery, and maternal self-report of smoking status at enrollment, household size category, regional- and inflation-adjusted household income, postnatal second-hand smoke exposure, season of birth, and firstborn status.

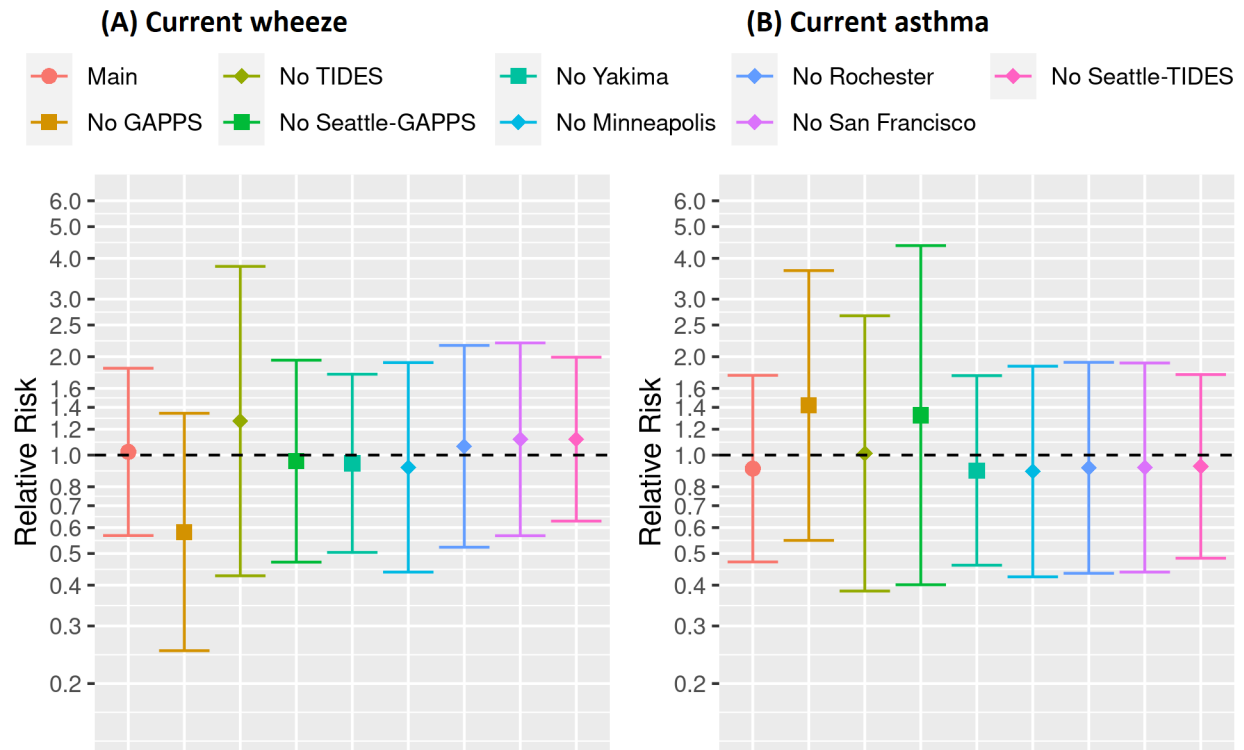
<sup>c</sup> Extended models were additionally adjusted for preterm birth and birthweight.

**Figure 1. Assessment of effect modification by child sex.**



Relative risks (95% confidence intervals) are shown for overall, male- and female-specific associations between prenatal exposure to cleaning chemicals and development of current wheeze (A) and current asthma (B) at age 4-6 years. Models were adjusted for child age, study site, maternal race, maternal ethnicity, education at enrollment, maternal history of asthma, maternal age at delivery, maternal self-report of smoking status at enrollment, household size category, region- and inflation-adjusted household income, postnatal second-hand smoke exposure, season of birth, firstborn status, child sex, and a multiplicative interaction term for exposure to cleaning chemicals by child sex.

**Supplementary Figure 1.** Association between maternal occupational exposure to cleaning chemicals during pregnancy and airway outcomes leave-one-cohort or leave-one-site out analyses.



**Supplementary Table 1.** Descriptive characteristics of the study population and larger combined cohort who attended age 4-6 study visits where airway outcomes were ascertained.

	Included <sup>a</sup> (N=453)	Excluded (N=782)
<b>Maternal race</b>		
White	346 (76.4%)	555 (71.0%)
Black	20 (4.4%)	60 (7.7%)
Asian	24 (5.3%)	33 (4.2%)
Native Hawaiian/Other Pacific Islander	1 (0.2%)	1 (0.1%)
American Indian/Alaska Native	2 (0.4%)	7 (0.9%)
Other	26 (5.7%)	39 (5.0%)
Multiple race	16 (3.5%)	37 (4.7%)
Missing	18 (4.0%)	50 (6.4%)
<b>Maternal ethnicity</b>		
Hispanic or Latino	38 (8.4%)	92 (11.8%)
Not Hispanic or Latino	401 (88.5%)	654 (83.6%)
Missing	14 (3.1%)	36 (4.6%)
<b>Maternal education</b>		
Less than high school	14 (3.1%)	47 (6.0%)

High school	79 (17.4%)	189 (24.2%)
College/technical school	170 (37.5%)	291 (37.2%)
Graduate or Professional degree	190 (41.9%)	247 (31.6%)
Missing	0 (0%)	8 (1.0%)
<b>Maternal history of asthma</b>		
Yes	60 (13.2%)	100 (12.8%)
No	365 (80.6%)	652 (83.4%)
Missing	28 (6.2%)	30 (3.8%)
<b>Maternal Delivery Age (years)</b>		
Mean (SD)	32.1 (5.3)	31.0 (3.5)
	32.0 (29.0 –	31.0 (27.0-
Median (IQR)	36.0)	35.0)
Missing	29 (6.4%)	27 (3.5%)
<b>Child sex</b>		
Male	246 (54.3)	372 (47.6%)
Female	207 (45.7%)	410 (52.4%)
<b>Preterm birth</b>		
Yes	67 (14.8%)	105 (13.4%)
No	364 (80.4%)	658 (84.1%)
Missing	22 (4.9%)	19 (2.4%)
<b>Season of birth</b>		
Warm	237 (52.3%)	413 (52.8%)
Cold	216 (47.7%)	369 (47.2%)
<b>Birthweight (grams)</b>		
Mean (SD)	3252 (705.6)	3295 (672.0)
	3316 (2940 -	3354 (2963-
Median (IQR)	3710)	3695)
Missing	120 (26.5%)	17 (2.2%)
<b>Firstborn status</b>		
Yes	130 (28.7%)	233 (29.8%)
No	305 (67.3%)	542 (69.3%)
Missing	18 (4.0%)	7 (0.9%)
<b>Ever bronchiolitis</b>		
Yes	31 (6.8%)	62 (7.9%)
No	302 (66.7%)	625 (79.9%)
Missing	120 (26.5%)	95 (12.1%)
<b>Child age at 4-6 visit (years)</b>		
Mean (SD)	5.8 (0.7)	5.9 (0.7)
Median (IQR)	6 (5.3 – 6.2)	6.1 (5.3-6.4)
Missing	18 (4.0%)	0 (0%)
<b>Household size</b>		
<4	80 (17.7%)	146 (18.7%)
4	204 (45.0%)	290 (37.1%)
5	83 (18.3%)	143 (18.3%)
>5	50 (11.0%)	77 (9.8%)
Missing	36 (7.9%)	126 (16.1%)

<b>Adjusted income (\$USD)</b>		
Mean (SD)	\$114,004 (\$56,745)	\$94,870 (\$59,076)
Median (IQR)	\$110,813 (\$67,648 - \$172,511)	\$82,987 (\$46,820- \$141,425)
Missing	32 (7.1%)	122 (15.6%)
<b>Smoking self-report</b>		
Yes	15 (3.3%)	31 (4.0%)
No	436 (96.2%)	737 (94.2%)
Missing	2 (0.4%)	14 (1.8%)
<b>Averaged cotinine</b>		
Mean (SD)	29.7 (169.2)	35.6 (176.6)
Median (IQR)	0.01 (0.01 – 0.06)	0.01 (0.01- 0.3)
Missing	113 (24.9%)	145 (18.5%)
<b>Postnatal second-hand smoke exposure</b>		
Yes	127 (28.0%)	221 (28.3%)
No	300 (66.2%)	482 (61.6%)
Missing	16 (3.5%)	79 (10.1%)
<b>Cohort Site</b>		
<b>GAPPS</b>		
Seattle, WA	164 (36.2%)	162 (20.7%)
Yakima, WA	75 (16.6%)	230 (29.4%)
<b>TIDES</b>		
Minneapolis, MN	56 (12.4%)	105 (13.4%)
Rochester, NY	49 (10.8%)	114 (14.6%)
San Francisco, CA	63 (12.9%)	87 (11.1%)
Seattle, WA	46 (10.2%)	84 (10.7%)

<sup>a</sup>Participants were included if they had completed both the occupational exposure questionnaire and the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire at child age 4 – 6 years.

**Supplementary Table 2.** Association between maternal occupational exposure to cleaning chemicals during pregnancy and airway outcomes additionally adjusted for cotinine or bronchiolitis after exclusion of GAPPS age 4-6 recall surveys (N=357).

	<b>Main model<sup>a</sup></b>		<b>Main model<sup>a</sup> with cotinine</b>		<b>Main model<sup>a</sup> with bronchiolitis</b>		<b>Main model<sup>a</sup> with cotinine and bronchiolitis</b>	
	Adjusted RR (95% CI)	p-value	Adjusted RR (95% CI)	p-value	Adjusted RR (95% CI)	p-value	Adjusted RR (95% CI)	p-value
Primary outcomes								
Current wheeze	0.94 (0.50 – 1.79)	0.86	1.30 (0.54 – 3.14)	0.56	1.24 (0.63 – 2.46)	0.53	1.21 (0.61 – 2.41)	0.59

Current asthma	0.92 (0.48 – 1.75)	0.79	1.31 (0.54 – 3.19)	0.55	1.85 (0.78 – 4.43)	0.17	1.88 (0.78 – 4.55)	0.16
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<sup>a</sup> Primary model was re-analyzed excluding the GAPPS 4-6 recall survey data

**Supplementary Table 3.** Association between maternal occupational exposure to cleaning chemicals during pregnancy and airway outcomes by classification of exposed status.

Primary outcomes	Cleaned floors, sinks, or toilets <sup>a</sup>		Used janitorial chemicals or cleaners some days or every day <sup>b</sup>	
	Adjusted RR (95% CI)	p-value	Adjusted RR (95% CI)	p-value
Current wheeze	0.81 (0.42 – 1.54)	0.52	1.39 (0.71 – 2.73)	0.34
Current asthma	0.88 (0.42 – 1.85)	0.74	1.03 (0.49 – 2.15)	0.95

<sup>a</sup> Association between prenatal maternal occupation exposure to cleaning chemicals and airway outcomes using the main model among those who answered “Yes” to “Did the biological mother do any of the following activities at her job during pregnancy: Clean floors, sinks, or toilets?”

<sup>b</sup> Association between prenatal maternal occupation exposure to cleaning chemicals and airway outcomes using the main model among those who answered “Some days” or “Every day” to “How often did the biological mother use janitorial chemicals or cleaners during pregnancy?”

**Supplementary Table 4.** Association between maternal occupational exposure to cleaning chemicals during pregnancy and airway outcomes adjusted by child age at recall questionnaire completion visit.

Primary outcomes	Main model adjusted by child age at recall questionnaire completion visit	
	Adjusted RR (95% CI)	p-value
Current wheeze	1.03 (0.54 – 1.97)	0.92
Current asthma	0.89 (0.43 – 1.81)	0.74

**Supplementary Table 5.** Association between maternal occupational exposure to cleaning chemicals during pregnancy and airway outcomes main model without using multiple imputation by chained equations (MICE).

Primary outcomes	Main model without MICE	
	Adjusted RR (95% CI)	p-value
Current wheeze	0.87 (0.41 – 1.85)	0.72
Current asthma	0.80 (0.36 – 1.76)	0.58

### Conflict of Interest

Adam Szpiro received funding from the National Institutes of Health (NIH) and the Health Effects Institute (HEI). Neither the NIH nor HEI were involved in the study design, collection, analysis, interpretation of data, the writing of this article, or the decision to submit it for publication.

*All other authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.*

### **Author Contributions**

ARS, CK, CL, MH, and LD contributed to conception and design of the study. ARS and LD obtained and organized the data and performed statistical analysis. MH wrote the first draft of the manuscript. AAS, ARS, CK, CL, EB, KC, LD, MA, MH, PM, and RN revised the manuscript and/or contributed critical content expertise and/or study design knowledge. All authors read and approved the final manuscript.

### **Funding**

Research reported in this publication was supported by National Institutes of Health (NIH) grants: UG3/UH3OD023271, UG3/UH3OD023305, R01ES016863, R01ES25169, UL1 TR002319, P30ES005022 and P30ES007033. Research reported in this publication was also supported by the National Institute for Occupational Safety and Health (NIOSH) under Federal Training Grant T42OH008433. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or NIOSH. This research was conducted using data collected on behalf of the Global Alliance to Prevent Prematurity and Stillbirth (GAPPS) Repository. This manuscript has been reviewed by ECHO-PATHWAYS for scientific content and consistency of data interpretation with previous ECHO-PATHWAYS publications.

### **Acknowledgments**

We acknowledge the contributions of the GAPPS and TIDES participants and families and the study research staff.

### **Abbreviations**

ECHO-PATHWAYS, ECHO prenatal and early childhood pathways to health consortium; GAPPS, Global Alliance to Prevent Prematurity and Stillbirth; IQR, interquartile range; IRB, Institutional Review Board; ISAAC, International Study of Asthma and Allergies in Childhood; LMW, low molecular weight; LRTI, lower respiratory tract infection; MICE, multiple imputation by chained equations; OR, odds ratio; RR, risk ratio; SD, standard deviation; TIDES, The Infant Development and Environment Study (TIDES); U.S., United States, UW, University of Washington

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## Conclusion

This analysis evaluated the association between maternal occupational exposure to cleaning chemicals during pregnancy and risk of asthma and wheeze in children. We did not find evidence for an association between job-related maternal exposure to cleaning chemicals in pregnancy and child wheeze or asthma, nor effects that differed by sex, in our study population. Our findings add to an emerging body of evidence that provides has yielded mixed results regarding the hypothesized relationship between these exposures in pregnancy and pediatric respiratory health. The prenatal period is an important window during which environmental influences, including maternal occupational exposures, can modify child respiratory health. We have identified several needs and potential directions for future research that would expand the literature base of this currently incompletely characterized scientific question.

First, there is a need for studies of more diverse and representative populations and larger sample sizes. The population available for this analysis yielded outcomes observed only among mothers who identified as White, Asian, and other race. Furthermore, the study population had a high median income (>\$100,000). These are important limitations on the generalizability of findings and given the recognized disparities in asthma outcomes among communities of color in the United States (31). Future studies could be conducted within the larger nationwide ECHO cohort, a very large nationwide sample of thousands of mother-child dyads, which has recently established a data platform with harmonized data on airway outcomes and prenatal exposure.

Second, given the widespread use of cleaning products in many occupations including healthcare, amplified during COVID and likely future epidemics, research should be designed to explicitly address the role of maternal occupational exposure to specific compounds found in cleaning chemicals on offspring respiratory outcomes. The source of our exposure data, the ECHO-PATHWAYS occupational exposure questionnaire, did not allow investigation or

isolation of specific chemicals. In addition, our exposure of interest was a composite measure that included job category, specific task, and frequency of cleaning chemical use. More precise characterization of exposures would be beneficial, including specific cleaning products, individual ingredients of cleaning products, and more specific quantitative assessments of exposure, including dose, timing, and duration. Duration should include more specific timing around pregnancy, if possible, including pre-conception, throughout pregnancy, and whether exposure continued postnatally.

Third, there is a need more broadly to better characterize the risk of maternal occupational exposures beyond cleaning chemicals and products and the association with childhood health, including respiratory outcomes. Within our ECHO-PATHWAYS study population, other occupations (including hair salons, construction, dry cleaning, electronics manufacturing and farms) and occupational exposures (including working with glues or adhesives, degreasers, paints, varnish, seals, or lacquers, nail polish removers, pesticides, and ethylene oxide, among others) beyond our specific exposure of interest were surveyed on the occupational exposures questionnaire. These exposures and their association with childhood respiratory outcomes could be further explored. There were very small numbers of survey respondents classifying themselves as having many of the occupations and exposures, but should the occupational exposures questionnaire continue to be administered to new cohorts, that representation could potentially expand.

Fourth, we found that the exposures within the window of interest in this analysis (prenatal) were highly correlated with those in the preconception and postnatal period, reducing opportunity to differentiate the impact of exposure in these periods on child airway outcomes. Disaggregation of prenatal and postnatal exposure periods in a larger study with more diversity

of exposure patterns would be useful to better understand relative impact of each exposure period on child airway health. Results from Tagiyeva et al. and Christensen et al. suggest that maternal exposure in the postnatal period may be more strongly associated with development of asthma in their offspring compared to exposure in the prenatal period, though prenatal and postnatal exposures are closely correlated in their study population, limiting clear interpretation of differences (21,22). Tagiyeva and colleagues have also considered the postnatal parental occupational exposure as a potential “take home” exposure pathway influencing outcomes (32). Identifying critical windows of vulnerability to cleaning chemicals and pathways of exposure that influence subsequent child health are needed to inform appropriate strategies for preventing exposures among pregnant workers.

Finally, understanding potential biases such as self-selection are important considerations for future work. Given that maternal asthma is an established risk factor for childhood wheeze and asthma (33), exploring whether women with asthma may avoid jobs with exposures that trigger symptoms would identify important considerations for analyses investigating the association between prenatal occupational exposures and childhood asthma (34,35).


Childhood asthma is a significant public health problem that can substantially influence long term respiratory health. There is increasing awareness and research investigating the role of prenatal exposures on future child health. This work suggests there is a need to further characterize conditions affecting pregnant workers to inform prevention strategies, minimize potentially hazardous maternal exposures, and protect pediatric respiratory health.

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		<b>Maternal and Paternal Occupation Exposures – Recall</b> ECHO-wide Cohort Version 01.22 / July 5, 2019			<b>Form OExp-R</b> Page 1 of 15	
COHORT ID	SITE ID	PARTICIPANT ID	PIN	COHORT VISIT ID	FORM COMPLETED	
_____	_____	_____	_____	_____	____ / ____ / ____ <i>mm dd yyyy</i>	
ECHO LIFE STAGE			RESPONDENT			
<input type="checkbox"/> <sub>01</sub> Prenatal <input type="checkbox"/> <sub>03</sub> Infancy <input type="checkbox"/> <sub>05</sub> Middle Childhood		<input type="checkbox"/> <sub>02</sub> Perinatal <input type="checkbox"/> <sub>04</sub> Early Childhood <input type="checkbox"/> <sub>06</sub> Adolescence	<input type="checkbox"/> <sub>01</sub> Participant <input type="checkbox"/> <sub>03</sub> Biological Father		<input type="checkbox"/> <sub>02</sub> Biological Mother <input type="checkbox"/> <sub>04</sub> Other Respondent Code: ____	

**STUDY STAFF INSTRUCTION:** This form should be completed once by the primary caregiver of a child enrolled in an ECHO cohort until the child reaches 8 years of age, during the infancy, early childhood, or middle childhood life stages. The child’s ID should be used in the header for the participant ID. If the *Maternal and Paternal Exposures – Pre-pregnancy and Pregnancy* form was completed by the biological mother during pregnancy, the primary caregiver should only complete Section B. Otherwise, both sections of this form should be completed.

**INSTRUCTIONS**

This form has 2 sections:

- **Section A: Occupation and Exposures – Pre-pregnancy and During Pregnancy**
- **Section B: Occupation and Exposures – During Infancy**

If the biological mother previously completed the *Maternal and Paternal Occupation Exposures – Pre-pregnancy and Pregnancy* form during pregnancy, please complete only Section B; otherwise complete both sections of this form.

For each question, do the best you can to remember the details requested. If there is a question to which you do not know or cannot remember the answer, please mark “Don’t know”. If you would prefer not to answer, you can mark “Declined.”

**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy**

1. Are you able to answer questions about occupations and exposures that the biological mother and the child’s biological father might have had during the period from three months before pregnancy through the end of her pregnancy? If you have some information, but not complete information, please check ‘Yes’. Also, check ‘Yes’ if you are the biological mother.

<sub>01</sub> Yes  
<sub>02</sub> No  
<sub>-7</sub> Declined  
<sub>-8</sub> Don’t know

} **Skip to Section B**










**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

The following questions ask about occupations that the **biological mother** had during the **3 months before pregnancy** (column 1) and **during pregnancy** (column 2), and the **biological father** had during the **3 months before pregnancy** (column 3). Jobs include paid or volunteer, military service, part-time or full-time, either at home or outside the home that lasted one month or more.

	(1) <u>Biological Mother</u> During 3 Months Before Pregnancy	(2) <u>Biological Mother</u> During Pregnancy	(3) <u>Biological Father</u> During 3 Months Before Pregnancy
<p><b>2.</b> How many jobs did the biological mother and father have during the periods noted?</p>	<input type="checkbox"/> <sub>00</sub> 0 <input type="checkbox"/> <sub>01</sub> 1 <input type="checkbox"/> <sub>02</sub> 2 <input type="checkbox"/> <sub>03</sub> 3 <input type="checkbox"/> <sub>04</sub> 4 <input type="checkbox"/> <sub>05</sub> 5 or more <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>00</sub> 0 <input type="checkbox"/> <sub>01</sub> 1 <input type="checkbox"/> <sub>02</sub> 2 <input type="checkbox"/> <sub>03</sub> 3 <input type="checkbox"/> <sub>04</sub> 4 <input type="checkbox"/> <sub>05</sub> 5 or more <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>00</sub> 0 <input type="checkbox"/> <sub>01</sub> 1 <input type="checkbox"/> <sub>02</sub> 2 <input type="checkbox"/> <sub>03</sub> 3 <input type="checkbox"/> <sub>04</sub> 4 <input type="checkbox"/> <sub>05</sub> 5 or more <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<p><b><i>[If both the biological mother and father were unemployed for the entire period from 3 months before pregnancy through the child's birth, or if you marked "Don't know" or "Declined" for all time periods, skip to Section B.]</i></b></p>			
<p><b>2.a.</b> How many hours per week did the biological mother and father work on average?</p> <p><i>[If she / he did not work at all, record '0 hours/week'. If she / he worked more than one job, record the total number of hours worked at all jobs combined.]</i></p>	<input type="text"/>   <input type="text"/>   hours per week <input type="checkbox"/> <sub>-6</sub> Not applicable <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	1 <sup>st</sup> trimester: <input type="text"/>   <input type="text"/>   hours per week 2 <sup>nd</sup> trimester: <input type="text"/>   <input type="text"/>   hours per week 3 <sup>rd</sup> trimester: <input type="text"/>   <input type="text"/>   hours per week <input type="checkbox"/> <sub>-6</sub> Not applicable <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know <b>NOTE:</b> <ul style="list-style-type: none"> <li>• Trimester 1 = 0-13 weeks</li> <li>• Trimester 2 = 14-26 weeks</li> <li>• Trimester 3 = 27-40 weeks</li> </ul>	<input type="text"/>   <input type="text"/>   hours per week <input type="checkbox"/> <sub>-6</sub> Not applicable <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know









**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

3. Did the biological mother and biological father work in any of the following industries during the periods noted?

	(1) <b>Biological Mother During 3 Months Before Pregnancy</b>	(2) <b>Biological Mother During Pregnancy</b>	(3) <b>Biological Father During 3 Months Before Pregnancy</b>
<b>3.a. Janitor or house cleaner</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.b. Gas station</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.c. Hair salon</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.d. Construction</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.e. Nail Salon</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.f. Healthcare</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.g. Dry cleaning</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.h. Dentist</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.i. Car or truck repair</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know



**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

3. Did the biological mother and biological father work in any of the following industries during the periods noted?






	(1) <b>Biological Mother</b> During 3 Months Before Pregnancy	(2) <b>Biological Mother</b> During Pregnancy	(3) <b>Biological Father</b> During 3 Months Before Pregnancy
<b>3.j. Science lab</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.k. Farm</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.l. Electronics manufacturing</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.m. Plant nursery</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.n. Semiconductor manufacturing</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.o. Hazardous waste</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.p. Printing company</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.q. Plastics recycling or manufacturing</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know

**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

3. Did the biological mother and biological father work in any of the following industries during the periods noted?





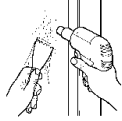
	(1) <b>Biological Mother</b> During 3 Months Before Pregnancy	(2) <b>Biological Mother</b> During Pregnancy	(3) <b>Biological Father</b> During 3 Months Before Pregnancy
<b>3.r. Chemical plant</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>3.s. Other kind of factory</b>  What kind: _____	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know

4. Did the biological mother or father do any of the following activities at her / his job during the periods noted?

	(1) <b>Biological Mother</b> During 3 Months Before Pregnancy	(2) <b>Biological Mother</b> During Pregnancy	(3) <b>Biological Father</b> During 3 Months Before Pregnancy
<b>4.a. Cleaning floors, sinks, or toilets</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.b. Lift, push, or pull heavy things</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.c. Stand for a long time</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.d. Use, make, or handle pesticides</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.e. Work with glues or adhesives</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know









**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

4. Did the biological mother or father do any of the following activities at her / his job during the periods noted?

	(1) <b>Biological Mother</b> During 3 Months Before Pregnancy	(2) <b>Biological Mother</b> During Pregnancy	(3) <b>Biological Father</b> During 3 Months Before Pregnancy
<b>4.f. Welding</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.g. Degrease tools, machines, or electronics</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.h. X-Ray, CT, radiotherapy, or nuclear medicine</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.i. Mix, thin, or apply paints, varnish, finish, seals, or lacquers</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>4.j. Remove or strip paint</b> 	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
	(1) <b>Biological Mother</b> During 3 Months Before Pregnancy	(2) <b>Biological Mother</b> During Pregnancy	(3) <b>Biological Father</b> During 3 Months Before Pregnancy
<b>5. Did the biological mother or father come into contact with any chemicals at her job during the periods noted?</b>	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>6. Did the biological mother or father smell chemicals at her job during the periods noted?</b>	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know


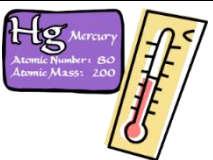


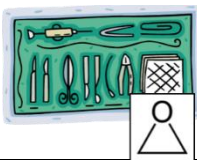



**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

7. How often did the biological mother or father use any of the following chemicals or do these activities at her / his job during the periods noted?

	(1) <b>Biological Mother</b> During 3 Months Before Pregnancy	(2) <b>Biological Mother</b> During Pregnancy	(3) <b>Biological Father</b> During 3 Months Before Pregnancy
<b>7.a. Janitorial chemicals or cleaners</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.b. Solvents</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.c. Dry cleaning chemicals</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.d. Paint</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.e. Nail polish remover</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.f. Paint stripper, remover, or thinner</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.g. Pesticides</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.h. Lead</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know


**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

7. How often did the biological mother or father use any of the following chemicals or do these activities at her / his job during the periods noted?

	(1) <b>Biological Mother During 3 Months Before Pregnancy</b>	(2) <b>Biological Mother During Pregnancy</b>	(3) <b>Biological Father During 3 Months Before Pregnancy</b>
<b>7.i. Glues or adhesives</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.j. Mercury</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.k. Degreasers</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.l. Laboratory chemicals</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.m. Ethylene oxide</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.n. X-rays</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.o. Nitrous oxide</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.p. Radioactive materials</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know

**Section A. Occupation and Exposures – Pre-Pregnancy or During Pregnancy (continued)**

7. How often did the biological mother or father use any of the following chemicals or do these activities at her / his job during the periods noted?

	(1) <b>Biological Mother During 3 Months Before Pregnancy</b>	(2) <b>Biological Mother During Pregnancy</b>	(3) <b>Biological Father During 3 Months Before Pregnancy</b>
<b>7.q. Anesthesia gas</b> 	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>7.r. Other chemical or metal?</b>  Describe: _____	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Never <input type="checkbox"/> <sub>02</sub> Some days <input type="checkbox"/> <sub>03</sub> Every day <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know
<b>8. Did the biological mother or father use safety tools at her / his job during the periods noted? [such as gloves, protective clothing, masks, lab hood, air vents or fans]</b>	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No <input type="checkbox"/> <sub>-7</sub> Declined <input type="checkbox"/> <sub>-8</sub> Don't know



**Section B. Occupation and Exposures – Infancy**

The questions below ask about occupations and exposures that the biological mother might have had during the child’s first year of life (infancy). Jobs include paid or volunteer, military service, part-time or full-time, either at home or outside the home **that lasted one month or more.**

<p>1. How many jobs did the biological mother have in the child’s first year of life?</p>	<p><input type="checkbox"/><sub>00</sub> 0 → <b>Skip to END</b>  <input type="checkbox"/><sub>01</sub> 1  <input type="checkbox"/><sub>02</sub> 2  <input type="checkbox"/><sub>03</sub> 3  <input type="checkbox"/><sub>04</sub> 4  <input type="checkbox"/><sub>05</sub> 5 or more  <input type="checkbox"/><sub>-7</sub> Declined → <b>Skip to END</b>  <input type="checkbox"/><sub>-8</sub> Don’t know → <b>Skip to END</b></p>
<p>1.a. How many hours per week did the biological mother work on average? <i>[If she did not work at all, record ‘0 hours/week’. If she worked more than one job, record the total number of hours worked at all jobs combined.]</i></p>	<p>Months 0-3:    _ _  hours per week  Months 4-6:    _ _  hours per week  Months 7-12:  _ _  hours per week  <input type="checkbox"/><sub>-8</sub> Don’t know</p>
<p><b>[If the mother worked during pregnancy ask Section B, question 1.b. below]</b></p> <p>1.b. Did the biological mother work in the same job with the same exposures while the child was an infant as she did during pregnancy?</p>	<p><input type="checkbox"/><sub>01</sub> Yes → <b>Skip to Section B, question 4</b>  <input type="checkbox"/><sub>02</sub> No  <input type="checkbox"/><sub>-8</sub> Don’t know</p>

**Section B. Occupation and Exposures – Infancy (continued)**

2. Did the biological mother work in any of the following industries in the child's first year of life?

**2.a. Janitor or house cleaner**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.g. Dry cleaning**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.m. Plant nursery**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.b. Gas station**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.h. Dentist**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.n. Semiconductor manufacturing**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.c. Hair salon**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.i. Car or truck repair**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.o. Hazardous waste**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.d. Construction**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.j. Science lab**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.p. Printing company**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.e. Nail Salon**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.k. Farm**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.q. Plastics recycling or manufacturing**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.f. Healthcare**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.l. Electronics manufacturing**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.r. Chemical plant**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**2.s. Other kind of factory**

What kind:  
\_\_\_\_\_



**Section B. Occupation and Exposures – Infancy (continued)**

**3. Did the biological mother do any of the following activities at her job in the child's first year of life?**

**3.a. Cleaning floors, sinks, or toilets**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.f. Welding**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.b. Lift, push, or pull heavy things**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.g. Degrease tools, machines, or electronics**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.c. Stand for a long time**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.h. X-Ray, CT, radiotherapy, or nuclear medicine**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.d. Use, make, or handle pesticides**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.i. Mix, thin, or apply paints, varnish, finish, seals, or lacquers**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



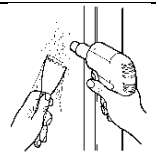
**3.e. Work with glues or adhesives**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**3.j. Remove or strip paint**

- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know



**4. Did the biological mother come into contact with any chemicals at her job in the child's first year of life?**



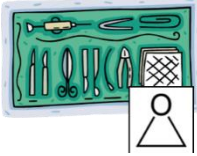







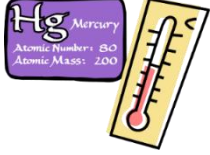






- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know

**5. Did the biological mother smell chemicals at her job in the child's first year of life?**


- <sub>01</sub> Yes
- <sub>02</sub> No
- <sub>-7</sub> Declined
- <sub>-8</sub> Don't know

**Section B. Occupation and Exposures – Infancy (continued)**

**6.** How often did the biological mother use any of the following chemicals or do these activities at her job in the child's first year of life?

<p><b>6.a.</b> Janitorial chemicals or cleaners</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.g.</b> Pesticides</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.m.</b> Ethylene oxide</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 
<p><b>6.b.</b> Solvents</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.h.</b> Lead</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.n.</b> X-rays</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 
<p><b>6.c.</b> Dry cleaning chemicals</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.i.</b> Glues or adhesives</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.o.</b> Nitrous oxide</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 
<p><b>6.d.</b> Paint</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.j.</b> Mercury</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.p.</b> Radioactive materials</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 
<p><b>6.e.</b> Nail polish remover</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.k.</b> Degreasers</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.q.</b> Anesthesia gas</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 
<p><b>6.f.</b> Paint stripper, remover, or thinner</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.l.</b> Laboratory chemicals</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> 	<p><b>6.r.</b> Other chemical or metal?</p> <p><input type="checkbox"/><sub>01</sub> Never  <input type="checkbox"/><sub>02</sub> Some days  <input type="checkbox"/><sub>03</sub> Every day  <input type="checkbox"/><sub>-7</sub> Declined  <input type="checkbox"/><sub>-8</sub> Don't know</p> <p>Describe: _____</p>



 Environmental influences on Child Health Outcomes A program supported by the NIH		<b>Airways Questionnaire – Early Childhood</b> ECHO-wide Cohort Version 01.24 / August 14, 2019			<b>Form Air-EC</b> Page 1 of 16	
COHORT ID	SITE ID	PARTICIPANT ID	PIN	COHORT VISIT ID	FORM COMPLETED	
_____	_____	_____	_____	_____	____ / ____ / ____ <i>mm dd yyyy</i>	
ECHO LIFE STAGE			RESPONDENT			
<input type="checkbox"/> <sub>01</sub> Prenatal <input type="checkbox"/> <sub>03</sub> Infancy <input type="checkbox"/> <sub>05</sub> Middle Childhood		<input type="checkbox"/> <sub>02</sub> Perinatal <input type="checkbox"/> <sub>04</sub> Early Childhood <input type="checkbox"/> <sub>06</sub> Adolescence	<input type="checkbox"/> <sub>01</sub> Participant <input type="checkbox"/> <sub>03</sub> Biological Father		<input type="checkbox"/> <sub>02</sub> Biological Mother <input type="checkbox"/> <sub>04</sub> Other Respondent Code: ____	

**STUDY STAFF INSTRUCTION:** This form should be completed by the primary caregiver during the early childhood life stage, using the child's participant ID. Annual administration of this form is strongly encouraged. Study staff should emphasize the importance of trying to answer all questions as best the caregiver can, and if the caregiver has questions regarding medical terminology, study staff should provide answers to ensure the caregiver understands the question. If the caregiver is unsure at what age an event occurred, staff are to suggest the caregiver make his/her best guess from the age range options.

### INSTRUCTIONS

The following questions ask about symptoms and conditions related to asthma, wheezing and cough; medications for allergies, asthma, wheeze or cough; respiratory infections and related surgeries; rhinitis; eczema (atopic dermatitis); food allergy; and anaphylaxis.

### Section A. Asthma, Wheezing, and Cough

1. Has the child ever had wheezing or whistling in the chest at any time in the past?\*

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section A, Question 2**

1.a. At what age did the child first have wheezing or whistling in the chest?

\_\_\_\_| years **OR** if you aren't sure of the age, can you recall if it was...

- <sub>01</sub> Before 4 years old  
<sub>02</sub> Between about 4-5 years old

1.b. Has the child had wheezing or whistling in the chest in the past 12 months?\*

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section A, Question 2**

1.c. How many attacks of wheezing has the child had in the past 12 months?\*\*

- <sub>00</sub> None  
<sub>01</sub> 1  
<sub>02</sub> 2  
<sub>03</sub> 3  
<sub>04</sub> 4 - 12  
<sub>05</sub> More than 12

1.d. In the past 12 months, how often, on average, has the child's sleep been disturbed due to wheezing?\*

- <sub>01</sub> Never woken with wheezing  
<sub>02</sub> Less than one time per week  
<sub>03</sub> One or more times per week

**Section A. Asthma, Wheezing, and Cough (continued)**

**1.e.** In the past 12 months, has wheezing ever been severe enough to limit the child’s speech to only one or two words at a time between breaths?\*

- <sub>01</sub> Yes
- <sub>02</sub> No

**2.** Has the child ever had asthma?\*

- <sub>01</sub> Yes
- <sub>02</sub> No

**3.** In the past 12 months, has the child’s chest sounded wheezy during or after exercise?\*

- <sub>01</sub> Yes
- <sub>02</sub> No

**4.** In the past 12 months, has the child had a dry cough at night, apart from a cough associated with a cold or chest infection?\*

- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to Section A, Question 5**

**4.a.** In which of the past month(s) did this cough occur? [Check all that apply]

- |   |   |  |
|---|---|--|
| <input type="checkbox"/> <sub>01</sub> January  | <input type="checkbox"/> <sub>05</sub> May    | <input type="checkbox"/> <sub>09</sub> September |
| <input type="checkbox"/> <sub>02</sub> February | <input type="checkbox"/> <sub>06</sub> June   | <input type="checkbox"/> <sub>10</sub> October   |
| <input type="checkbox"/> <sub>03</sub> March    | <input type="checkbox"/> <sub>07</sub> July   | <input type="checkbox"/> <sub>11</sub> November  |
| <input type="checkbox"/> <sub>04</sub> April    | <input type="checkbox"/> <sub>08</sub> August | <input type="checkbox"/> <sub>12</sub> December  |

**If ‘No’ or ‘Don’t Know’ to Section A, Questions 1 and 2, SKIP to Section B**

**5.** Has a doctor or other healthcare provider ever diagnosed the child with **asthma**?

- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to Section A, Question 6**

**5.a.** At what age was the child diagnosed with asthma?

|\_\_| years **OR** if you aren’t sure of the age, can you recall if it was...

- <sub>01</sub> Before 4 years old
- <sub>02</sub> Between about 4-5 years old

**5.b.** Does the child still have asthma?

- <sub>01</sub> Yes
- <sub>02</sub> No

**Section A. Asthma, Wheezing, and Cough (continued)**

6. Has the child ever been hospitalized overnight for asthma or a severe episode of wheezing or whistling in the chest at any time in the past? [Do not include emergency room visits]

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section A, Question 7**

6.a How many times has the child been hospitalized overnight for asthma or a severe episode of wheezing or whistling in the chest? [Do not include emergency room visits]

|\_|\_|\_| times

6.b. In the past 12 months, has the child been hospitalized overnight for asthma or a severe episode of wheezing or whistling in the chest? [Do not include emergency room visits]

<sub>01</sub> Yes

<sub>02</sub> No

7. In the past 12 months, has the child had to visit an emergency room or urgent care center because of his/her asthma or a severe episode of wheezing or whistling in the chest?

<sub>01</sub> Yes

<sub>02</sub> No

8. Has the child ever been treated with an oral or injected steroid for treatment of a severe wheezing or asthma attack?

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section A, Question 9**

8.a. How many times has the child been treated with an oral or injected steroid for treatment of a severe wheezing or asthma attack?

<sub>01</sub> 1 time

<sub>02</sub> 2-4 times

<sub>03</sub> 5 or more times

8.b. In the past 12 months, has the child been treated with an oral or injected steroid for treatment of a severe wheezing or asthma attack?

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section A, Question 9**

8.b.1. In the past 12 months, how many times has the child been treated with an oral or injected steroid for treatment of a severe wheezing or asthma attack?

|\_|\_|\_| times

**Section A. Asthma, Wheezing, and Cough (continued)**

9. In the following list, what sets off or triggers any of the child's asthma or wheezing symptoms?

Possible Symptom Triggers	Yes	No	Don't know
a. Cats	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
b. Dogs	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
c. Mice	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
d. Other animals Specify: _____	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
e. Cockroaches	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
f. Dusty places	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
g. Moldy places	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
h. Cigarette or cigar smoke	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
i. Strong odors	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
j. Indoor wood smoke (e.g., fireplaces, wood stoves)	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
k. Outdoor wood smoke	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
l. Pollen/grass/trees	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
m. Weather changes	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
n. Cold air	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
o. Exercise	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
p. Common cold or sinus infection	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
q. Foods (specify): _____	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
r. Other (specify): _____	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>

10. During which months does the child get asthma, wheezing, or whistling in the chest symptoms? [Check all that apply]

- |   |   |  |
|---|---|--|
| <input type="checkbox"/> <sub>01</sub> January  | <input type="checkbox"/> <sub>05</sub> May    | <input type="checkbox"/> <sub>09</sub> September |
| <input type="checkbox"/> <sub>02</sub> February | <input type="checkbox"/> <sub>06</sub> June   | <input type="checkbox"/> <sub>10</sub> October   |
| <input type="checkbox"/> <sub>03</sub> March    | <input type="checkbox"/> <sub>07</sub> July   | <input type="checkbox"/> <sub>11</sub> November  |
| <input type="checkbox"/> <sub>04</sub> April    | <input type="checkbox"/> <sub>08</sub> August | <input type="checkbox"/> <sub>12</sub> December  |

**Section B. Medications for Hay Fever, Allergic Rhinitis, Allergies in the Nose, Asthma, Wheezing, or Cough**

1. Does the child use any medications for treatment of hay fever or allergic rhinitis or allergies in the nose?

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section B, Question 2**

1.a. Which ones?

<sub>01</sub> Oral antihistamine (e.g., Loratadine [Claritin], Cetirizine [Zyrtec], Diphenhydramine [Benadryl], Fexofenadine [Allegra])

<sub>02</sub> Nasal Steroid (e.g., Fluticasone [Flonase], Triamcinolone [Nasacort], Budesonide [Rhinocort])

<sub>03</sub> Nasal Antihistamine (e.g., Azelastine [Astelin, Astepro], Olopatadine [Patanase])

<sub>04</sub> Montelukast (e.g., Singulair)

<sub>05</sub> Other (specify): \_\_\_\_\_

2. Does the child use any medications for treatment of recurrent cough, recurrent wheezing or asthma?

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section C, Question 1**

2.a. Which ones?

<sub>01</sub> Bronchodilator (e.g., Albuterol, Proventil, Proair)

<sub>02</sub> Inhaled steroid (e.g., Flovent, Pulmicort, Asmanex)

<sub>03</sub> Combination inhaled steroid and long-acting beta agonist (e.g., Advair, Dulera, Symbicort)

<sub>04</sub> Montelukast (e.g., Singulair)

<sub>05</sub> Monoclonals or biologics (e.g., Xolair)

<sub>06</sub> Other (specify): \_\_\_\_\_

**Section C. Respiratory Infections**

1. Has the child ever been diagnosed with **bronchiolitis** (bronchiolitis is an infection in the lungs with wheezing and rapid breathing that only occurs in children under 24 months old)?

- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to Section C, Question 2**
- <sub>-8</sub> Don't know → **Skip to Section C, Question 2**

1.a. How many times has bronchiolitis been diagnosed?

- <sub>01</sub> 1 time
- <sub>02</sub> 2-4 times
- <sub>03</sub> 5 or more times

1.b. At what age was the child first diagnosed with bronchiolitis?

- |\_\_| years **OR** if you aren't sure of the age, can you recall if it was...
- <sub>01</sub> 0-11 months
  - <sub>02</sub> 12-24 months

1.c. Has the child ever been hospitalized overnight for bronchiolitis? [*Do not include emergency room visits*]

- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to Section C, Question 2**
- <sub>-8</sub> Don't know → **Skip to Section C, Question 2**

1.c.1. How many times has the child been hospitalized for bronchiolitis (not including emergency room visits)?

- <sub>01</sub> 1 time
- <sub>02</sub> 2-4 times
- <sub>03</sub> 5 or more times

2. Has the child had any of the following surgeries?

	Yes	No	Don't know	(1) If yes, at what age?	
				Less than 2 years old	2-4 years old
a. Tonsils removed	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>
b. Adenoids removed	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>
c. Ear tubes placed	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>

**3. Has the child ever been diagnosed with a sinus infection?**

- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to Section C, Question 4**
- <sub>-8</sub> Don't know → **Skip to Section C, Question 4**

**3.a. How many times has a sinus infection been diagnosed?**

- <sub>01</sub> 1 time
- <sub>02</sub> 2-4 times
- <sub>03</sub> 5 or more times

**Section C. Respiratory Infections (continued)**

4. Has the child ever been diagnosed with **an ear infection** (also called otitis media)?

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section C, Question 5**  
<sub>-8</sub> Don't know → **Skip to Section C, Question 5**

4.a. How many times has an ear infection been diagnosed?

- <sub>01</sub> 1 time  
<sub>02</sub> 2-4 times  
<sub>03</sub> 5 or more times

5. Has the child ever been diagnosed with **croup**?

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section C, Question 6**  
<sub>-8</sub> Don't know → **Skip to Section C, Question 6**

5.a. How many times has croup been diagnosed?

- <sub>01</sub> 1 time  
<sub>02</sub> 2-4 times  
<sub>03</sub> 5 or more times

5.b. Has the child ever been hospitalized overnight for croup? [*Do not include emergency room visits*]

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section C, Question 6**

5.b.1. How many times has the child been hospitalized for croup?

- <sub>01</sub> 1 time  
<sub>02</sub> 2-4 times  
<sub>03</sub> 5 or more times

**Section C. Respiratory Infections (continued)**

6. Has the child ever been diagnosed with **pneumonia or bronchitis**?

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section D, Question 1**  
<sub>03</sub> Don't know → **Skip to Section D, Question 1**

6.a. How many times has pneumonia or bronchitis been diagnosed?

- <sub>01</sub> 1 time  
<sub>02</sub> 2-4 times  
<sub>03</sub> 5 or more times

6.b. Has the child ever been hospitalized overnight for pneumonia or bronchitis? [*Do not include emergency room visits.*]

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section D, Question 1**

6.b.1. How many times has the child been hospitalized for pneumonia or bronchitis?

- <sub>01</sub> 1 time  
<sub>02</sub> 2-4 times  
<sub>03</sub> 5 or more times

**Section D. Rhinitis**

The next questions are about the child's nose and about what symptoms the child may experience when he/she does not have a cold or the flu. Some of the questions will ask about whether the symptoms occur all year long, are limited to certain months, or are always there but are worse during certain months.

1. Has the child ever had a problem with sneezing or a runny or blocked (stuffy) nose, when he/she DID NOT have a cold or the flu?\*
- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to Section D, Question 3**
2. In the past 12 months, has the child had a problem with sneezing or a runny or blocked (stuffy) nose when he/she DID NOT have a cold or the flu?\*
- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to Section D, Question 3**
- 2.a. In the past 12 months, has this nose problem been accompanied by itchy-watery eyes?\*
- <sub>01</sub> Yes
- <sub>02</sub> No

The next three questions ask about specific symptoms the child may have experienced in the past year.

3. Over the past 12 months, does the child **sneeze** when he/she does not have a cold or the flu?
- <sub>01</sub> Yes
- <sub>02</sub> No
4. Over the past 12 months, does the child get a **stuffy nose** when he/she does not have a cold or the flu?
- <sub>01</sub> Yes
- <sub>02</sub> No
5. Over the past 12 months, does the child get a **runny nose** when he/she does not have a cold or the flu?
- <sub>01</sub> Yes
- <sub>02</sub> No

→ [IF A "YES" RESPONSE IS GIVEN TO ANY QUESTIONS FOR SECTION D, QUESTIONS 1-5, CONTINUE WITH SECTION D, QUESTION 6 BELOW. OTHERWISE, SKIP TO SECTION E.]

**Section D. Rhinitis (continued)**

6. Does the child have these nose and/or sinus symptoms all year round?

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section D, Question 7**

6.a. Are any months worse for the child's nose and/or sinus symptoms?

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section D, Question 8**

6.a.1. If yes, which months? [Select all that apply, then skip to Section D, Question 8]

<sub>01</sub> January

<sub>05</sub> May

<sub>09</sub> September

<sub>02</sub> February

<sub>06</sub> June

<sub>10</sub> October

<sub>03</sub> March

<sub>07</sub> July

<sub>11</sub> November

<sub>04</sub> April

<sub>08</sub> August

<sub>12</sub> December

7. During which months does the child get these nose and/or sinus symptoms? [Select all that apply.]\*\*

<sub>01</sub> January

<sub>05</sub> May

<sub>09</sub> September

<sub>02</sub> February

<sub>06</sub> June

<sub>10</sub> October

<sub>03</sub> March

<sub>07</sub> July

<sub>11</sub> November

<sub>04</sub> April

<sub>08</sub> August

<sub>12</sub> December

8. In the following list, what sets-off or triggers any of the child's nose and/or sinus symptoms reported above?

Possible Symptom Triggers	Yes	No	Don't know
a. Cats	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
b. Dogs	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
c. Mice	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
d. Other animals (specify): _____	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
e. Cockroaches	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
f. Dusty places	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
g. Moldy places	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
h. Cigarette or cigar smoke	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
i. Strong odors	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
j. Indoor wood smoke (e.g., fireplaces, wood stoves)	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
k. Outdoor wood smoke	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
l. Pollen/grass/trees	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
m. Weather changes	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
n. Cold air	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
o. Exercise	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
p. Aspirin	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
q. Foods (specify): _____	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>
r. Other (specify): _____	<input type="checkbox"/> <sub>01</sub>	<input type="checkbox"/> <sub>02</sub>	<input type="checkbox"/> <sub>-8</sub>

**Section D. Rhinitis (continued)**

9. In the past 12 months, how much did this nose problem interfere with the child's daily activities?\*

- <sub>01</sub> Not at all  
<sub>02</sub> A little  
<sub>03</sub> A moderate amount  
<sub>04</sub> A lot

10. At what age did the child first have nose problems?

|\_\_| |\_\_| years **OR** if you aren't sure of the age, can you recall if it was...

- <sub>01</sub> Before 4 years old  
<sub>02</sub> Between about 4-5 years old

11. Has the child ever had hay fever? *This can also be called allergic rhinitis or allergies in the nose.\*\**

- <sub>01</sub> Yes  
<sub>02</sub> No → **Skip to Section E, Question 1**

12. Has a doctor or health care provider ever diagnosed the child with hay fever, allergic rhinitis, or allergies in the nose?

- <sub>01</sub> Yes  
<sub>02</sub> No

**Section E. Eczema (Atopic Dermatitis)**

1. Has the child ever had an itchy rash which was coming and going for at least six months?\*

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section E, Question 8**

2. Has the child had an itchy rash at any time in the past 12 months?\*\*

<sub>01</sub> Yes

<sub>02</sub> No

3. Has this itchy rash at any time affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes?\*

<sub>01</sub> Yes

<sub>02</sub> No

4. At what age did this itchy rash first occur?\*

|\_\_| years **OR** if you aren't sure of the age, can you recall if it was...

<sub>01</sub> Before 4 years old

<sub>02</sub> Between about 4-5 years old

5. Has this itchy rash resolved?

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section E, Question 6**

5.a. At what age did this itchy rash resolve?

|\_\_| years **OR** if you aren't sure of the age, can you recall if it was...

<sub>01</sub> Before 4 years old

<sub>02</sub> Between about 4-5 years old

6. Has this rash cleared completely at any time during the past 12 months?\*

<sub>01</sub> Yes

<sub>02</sub> No

7. In the past 12 months, how often, on average, has the child been kept awake at night by this itchy rash?\*

<sub>01</sub> Never in the past 12 months

<sub>02</sub> Less than one night per week

<sub>03</sub> One or more nights per week

8. Has the child ever had **eczema** (also called **atopic dermatitis**)?\*

<sub>01</sub> Yes

<sub>02</sub> No → **Skip to Section F, Question 1**

8.a. Has a doctor or healthcare provider ever diagnosed the child with **eczema** or **atopic dermatitis**?

<sub>01</sub> Yes

<sub>02</sub> No

**Section F. Food Allergy**

1. Do you believe that the child has ever had a **food allergy**?

- <sub>01</sub> Yes  
<sub>02</sub> No

2. Has a doctor or other healthcare provider ever diagnosed the child with a **food allergy**?

- <sub>01</sub> Yes  
<sub>02</sub> No  
-8 Don't know

3. For each food listed below, indicate if the child has **ever tried** the listed food (column (1a)) and if tried, at what age (in years) the food was introduced (column (1b)), whether **you believe** the child has been allergic to the food at any point in his/her life (column (2)), whether a **doctor or other healthcare provider said** the child is allergic to the food (column (3)), the child's age in years that the allergy was first noticed (column (4)), and whether **you believe** the child is still allergic to the food item (column (5)). For each food, if either column (2) or (3) is 'Yes', respond to columns (4) and (5).

Food	(1a) Has the child ever tried the food?	(1b) If tried, at what age (in months or years) was the food introduced?	(2) Do you believe the child has been allergic to the food?	(3) Has a doctor or healthcare provider said child is allergic to food?	(4) Age (in years) allergy to food first noticed?	(5) Still allergic to food?
a. Egg	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
b. Cow's Milk	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
c. Peanut	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
d. Tree nuts (e.g., walnut, almond, hazelnut, cashew, pistachios)	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
e. Wheat	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
f. Soy	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
g. Shellfish (e.g., shrimp, lobster, crab, mussels)	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
h. Fish (e.g., salmon, tuna, cod)	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
i. Other (specify) _____	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No
j. Other (specify) _____	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No	____ mos or ____ yrs	<input type="checkbox"/> <sub>01</sub> Yes <input type="checkbox"/> <sub>02</sub> No

**Section F. Food Allergy (continued)**

4. For each food in Question 3 above where you selected **you believe** or a **doctor or healthcare provider has said** (columns (2) or (3)) the child is allergic to the food, indicate the reaction the child had to the food within 2 hours of eating it. If no food items were selected in columns (2) or (3) in Question 3, **SKIP TO Section G.**

Food	Reaction [check all that apply]								
	No Reaction	Vomiting or Stomach Pain	Diarrhea	Swelling	Hives	Worsened eczema	Cough, wheeze, or chest tightness	Loss of Consciousness	Other reaction
a. Egg	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
b. Cow's Milk	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
c. Peanut	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
d. Tree nuts (e.g., walnut, almond, hazelnut, cashew, pistachios)	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
e. Wheat	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
f. Soy	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
g. Shellfish (e.g., shrimp, lobster, crab, mussels)	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
h. Fish (e.g., salmon, tuna, cod)	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
i. Other (specify) _____	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09
j. Other (specify) _____	<input type="checkbox"/> 01	<input type="checkbox"/> 02	<input type="checkbox"/> 03	<input type="checkbox"/> 04	<input type="checkbox"/> 05	<input type="checkbox"/> 06	<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input type="checkbox"/> 09

**Section G. Anaphylaxis**

1. Does the child have a history of anaphylaxis (severe allergic reaction)? Symptoms include trouble breathing, swelling of the lips, or low blood pressure. Anaphylaxis may also require treatment with epinephrine, such as an Epinephrine Auto-Injector or EpiPen.

- <sub>01</sub> Yes
- <sub>02</sub> No → **Skip to END**

2. Has a doctor or other healthcare provider ever diagnosed the child with any of the following allergies? [Check all that apply]

- <sub>01</sub> Insect sting or bite
- <sub>02</sub> Medication
- <sub>03</sub> Latex
- <sub>04</sub> Exercise
- <sub>05</sub> Medical test
- <sub>06</sub> Other reaction (specify): \_\_\_\_\_
- <sub>08</sub> Don't know

**Setting**

**Mode**

- <sub>01</sub> Clinic or site
- <sub>02</sub> Phone
- <sub>03</sub> Other location

- <sub>01</sub> Self-administered
- <sub>02</sub> Staff-administered