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Daycare attendance and asthma control, Asthma Call-back Survey 2012–2014

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Abstract

Objective: To examine the association between daycare attendance and asthma control among children aged 0 to 4 years with asthma

Methods: We analyzed 2012–2014 data from the Behavioral Risk Factor Surveillance System Asthma Call-back Survey on 388 children with asthma aged 0 to 4 years with information on daycare attendance in the past 12 months. We calculated weighted prevalence ratios to assess the association between daycare attendance and asthma control (categorized based on day-time and night-time asthma symptoms, activity limitation, and short-acting beta agonist use). Adjusted models controlled for parent or guardian education, household income, race, sex, cost barriers to asthma care, long-term control medication use, and the number of other children in the child's household.

Results: In this sample of children with asthma, representative of 520,400 children in 26 U.S. states, 34% attended daycare in the past 12 months. Only 32% of children who attended daycare in the past 12 months reported having an asthma action plan on file at the daycare they most recently attended. Presence of the asthma triggers of pets, mold, and smoking in a child's daycare were reported to be uncommon. Prevalence of uncontrolled asthma was 44% in children who attended daycare in the past 12 months and 68% in children who did not. The adjusted prevalence ratio between daycare attendance and uncontrolled asthma was 0.96 (95% confidence interval 0.73, 1.25).

Conclusions: When adjusting for covariates, we observed no evidence of an association between daycare attendance in early life and uncontrolled asthma.

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Introduction

Attending daycare in early life is associated with increased respiratory tract infections among young children.[1–6] Children with a family history of asthma and allergies who attend daycare have been found to be at particular risk of such infections.[1,5] Based on the hypothesis that early life exposures to greater microbial diversity in the indoor environment and some infections may prevent the development of allergic diseases,[7,8] a large body of research has assessed whether attending daycare in early life prevents later development of asthma.[6,9–11] The most recent systematic review on this topic summarized the results of 32 studies on the association between daycare attendance and asthma and wheezing in childhood.[12] It found that daycare attendance that started before 12 months of age was positively associated with wheezing by age 2 years, but was negatively associated with asthma between ages 3 and 5 years. It identified no association between daycare attendance and asthma after age 5 years.

Less research has examined asthma symptoms and control among children with asthma attending daycare. Control of asthma depends on many factors such as receiving appropriate medical care, adhering to prescribed asthma medications and avoiding asthma triggers.[13] Respiratory tract infections and other illnesses can act as asthma triggers.[14,15] Some researchers report that as much as 80% of asthma exacerbations in children can be linked to viral respiratory infections.[15,16] As such, the increased infections among children attending daycare may impact asthma control among children with asthma. If children with asthma attending daycare are found to have poorer asthma control than children not attending daycare, daycare could be an important intervention point for distribution of information and services related to asthma management.

We aimed to fill this gap in the literature by assessing the association between daycare attendance and asthma control among children with asthma in respondents aged 0 to 4 years to the Behavioral Risk Factor Surveillance System (BRFSS) Asthma Call-back Survey. The Asthma Call-back Survey provides an opportunity to compare asthma control among children with asthma living across the United States who attend and do not attend daycare.

Methods

We analyzed BRFSS Child Asthma Call-back Survey data collected from 2012 through 2014. BRFSS is an ongoing telephone survey of a representative sample of non-institutionalized U.S. adults.[17] The Asthma Call-back Survey is conducted as a follow-up survey to BRFSS and collects detailed information related to asthma in both adults and children such as asthma symptoms, medication usage, and exposures to asthma triggers.[18] Households with children who have ever been diagnosed with asthma are identified by BRFSS through the Random Child Selection module and the Child Asthma Prevalence module. Only one member of a household is eligible to participate in the Asthma Call-back Survey; information on children is collected from a parent or other caregiver. Sample weighting adjusts for unequal probability of sample selection, and differential non-response by demographic groups.[19] Between 2012 and 2014 the median response rate for BRFSS ranged from 45.2% to 47.0% and the median response rate for the Asthma Call-back Survey

child respondents (via adult proxy) ranged from 43.5% to 44.6%.[17,18] Additional information on the Asthma Call-back Survey is available in the Asthma Call-back Survey Summary Data Quality Report.[18] The Asthma Call-back Survey is exempt from Institutional Review Board (IRB) review at the Centers for Disease Control and Prevention. Participating states complete their own IRB requirements to conduct the survey.

In the Asthma Call-back Survey, questions about daycare attendance are asked about children ages 10 years and under. When children start school around age five years, the nature of daycare changes to before or after school care. Our interest was in children attending daycare who are not yet in school, so we restricted our analysis to children with current asthma ages four years and under.

We classified a child as attending daycare in the past 12 months if they responded yes to either of the following two questions: *Does the child go to daycare outside his/her home?* and *Has the child gone to daycare in the past 12 months?* A child was classified as having a cost barrier to care if they reported cost as a barrier to visiting a primary care doctor or specialist for asthma or in purchasing medication to treat asthma. Asthma control was defined using an adapted form of a previously developed guideline-based asthma control algorithm.[20] Control was classified as “well controlled” or “uncontrolled” based on day-time symptoms, night-time symptoms, activity limitations, and short-acting beta agonist use.[21] A child was classified as having uncontrolled asthma if they had any of the following: asthma symptoms more than two times a week in the past 30 days, more than one night-time awakening due to asthma in the past 30 days, activity limitation due to asthma in the past 30 days, or short-acting beta agonist (SABA) use for symptom control more than 2 days a week in the past three months. This definition is different than the definition previously published by Zahran and colleagues[20] due to the inclusion of information on activity limitation. This component was added to the definition because starting in 2012 the Asthma Call-back Survey asked about activity limitation in the past 30 days, instead of in the past 12 months as in previous years.

We examined the potential association between daycare attendance and asthma control by calculating unadjusted and adjusted prevalence and prevalence ratios. Prevalence ratios were calculated using predicted marginal probabilities from logistic regression models.[22] Adjusted models controlled for parent or guardian education, household income, race, sex, cost barriers to asthma care, long-term control medication use in the past three months (inhaled corticosteroids, systemic corticosteroids, long-acting beta agonist, leukotriene receptor antagonists, methyl-xanthines, and immunomodulators), and number of other children in the child’s household. Control variables were selected based on their potential to confound the association between daycare attendance and asthma control. We included long-term control medication use in the past 3 months in the model because it may be one factor that determines asthma control in the past 30 days. However, it may also be a surrogate of control medication use in the future, a likely consequence of current asthma control. Due to this nuance, we completed a sensitivity analysis excluding it from the model. Health outcomes and healthcare use related to asthma control, such as asthma attacks in the past 12 months and emergency department visits, and exposure to asthma triggers at daycare, such as pets, mold, and smoking, were examined descriptively. All analyses accounted for sample

weighting and were conducted in SAS 9.4 (SAS Institute, Inc., Cary, North Carolina) and SAS-callable SUDAAN (RTI International, Research Triangle Park, North Carolina).

Results

Data on 5,613 children were available from Asthma Call-back Surveys conducted between 2012 and 2014. Of these, 399 children were aged four years and under and reported having current asthma. Eleven children were excluded from this analysis due to lack of information on daycare attendance leaving an analytic sample size of 388. This sample includes children from 26 U.S. states and due to sample weighting is representative of 520,400 children.

In this sample of children up to and including the age of four years, 34% reported attending daycare in the past 12 months (Table 1). Attending daycare was more common among male children (37%) than among female children (28%). Prevalence of daycare attendance was lowest among children whose parent or guardian graduated from high school but did not attend college (25%) and among children whose household income was less than $25,000 a year (26%).

Including children that did and did not attend daycare in the past year, prevalence of uncontrolled asthma was 60 percent (Table 1). When examining differences by education and income, uncontrolled asthma was highest among children whose parent or guardian did not graduate from high school (92%) and whose household income was less than $25,000 a year (70%). Prevalence of uncontrolled asthma was also high among children of black race (70%) and children whose race was reported as part of the other race category which included Asian, American Indian or Alaskan Native, and other racial groups (71%). Ninety-six percent of children had healthcare coverage, 17% reported cost barriers to asthma care, and 81% lived in homes with more than one child under the age of 18 years.

Among children who attended daycare in the past 12 months, 38% reported ever being given an asthma action plan by a doctor or other healthcare professional and 32% reported having a written asthma action plan or asthma management plan on file at the daycare they most recently attended. Among children who did not attend daycare, 36% reported ever being given an asthma action plan. Eight percent of children attending daycare reported pets in their daycare room (e.g., dogs, cats, hamsters, birds). Reports of mold problems in a child's daycare and smoking being allowed at daycare were rare (<1% each). On average, children attending daycare missed 3.8 days of daycare in the past 12 months due to asthma with a range of 0 to 40 days.

When examining asthma-related health outcomes and healthcare use in the past 12 months by daycare status, the most striking differences were in uncontrolled asthma and routine care visits for asthma (Table 2). Prevalence of uncontrolled asthma was higher among children who did not attend daycare in the past 12 months than among children who did attend daycare in the past 12 months (68% vs. 44%). In the past 12 months, children who attended daycare had a higher prevalence of routine care visits for asthma (84% vs. 68%), but also had a higher prevalence of an emergency department visit for asthma (40% vs. 26%). There were no differences by daycare attendance in asthma attacks, hospitalizations, or urgent care

visits for asthma, and minimal differences in medication use in the past 3 months (Table 2). Combining all children, and when stratifying by daycare attendance, children with uncontrolled asthma had more asthma-related healthcare use in the past 12 months than children with controlled asthma.

Due to the observed descriptive results, we calculated prevalence ratios examining the association between daycare attendance and uncontrolled asthma. Comparing unadjusted prevalences, children who attended daycare were less likely to have uncontrolled asthma than children who did not attend daycare (prevalence ratio [95% CI]: 0.65 [0.44, 0.94]). This association was attenuated when adjusting for parent or guardian education, household income, race, sex, cost barriers to asthma care, long-term control medication use in the past 3 months, and number of other children in the child's household (prevalence ratio [95% CI]: 0.96 [0.73, 1.25]). The adjusted results were similar in a sensitivity analysis excluding long-term control medication use in the past 3 months from the model, and also in a partially adjusted model controlling only for education, race, sex, and number of other children in a child's household (results not shown).

Discussion

In this survey of 388 children representative of 520,400 children in 26 U.S. states, we observed no evidence that attending daycare in early life was associated with an increase in the prevalence of uncontrolled asthma. Although uncontrolled asthma was not more prevalent among children attending daycare, it was still high in this group at 44%. This combined with the fact that 34% of children with asthma reported attending daycare in the past 12 months indicates that daycare could be an important place for distribution of information on asthma management to families of children with asthma. The percent of children with asthma attending daycare aligns with the estimated prevalence of nonrelative care in the general U.S. population of children under 5 years, estimated in 2011 to be 33%.[23] The asthma triggers inquired about in the Asthma Call-back Survey of pets, mold, and smoking, were all reported to be uncommon in children's daycare environments. Out of the health outcomes and healthcare use variables we examined, children attending daycare had a higher prevalence of routine care visits for asthma and emergency department visits for asthma but were no more likely than children not attending daycare to have an asthma attack, urgent care visit, or hospitalization for asthma. The results on emergency department visits warrant further understanding, but overall these findings do not raise concerns about the impact of daycare on asthma control among children ages 0 to 4 years.

The slightly lower adjusted prevalence of uncontrolled asthma we observed among children who attended daycare could be due to many factors. Prevalence of an asthma-related routine care visit in the past 12 months was higher among children who attended daycare in the past 12 months than children who had not (Table 2). This additional amount of care could be related to the improved asthma control in this group. As seen in Table 1, daycare attendance was lowest and uncontrolled asthma was highest among children born into families with the lowest household income and parent or guardian education. Although our adjusted models controlled for parent or guardian education, residual confounding by socioeconomic status could explain the differences in uncontrolled asthma prevalence in adjusted models.

Alternatively, parents of children with severe or uncontrolled asthma may decide to use other childcare arrangements in order to decrease exposure to early life infections. It is also possible that there are characteristics of daycares that may be protective against asthma exacerbations. For example, if asthma triggers such as pets are less common in daycares than in home environments that could contribute to these observed differences in asthma control.

To our knowledge, there are no previous studies that examine daycare attendance and asthma control among children ages 0 to 4 years. Asthma is difficult to diagnose in early life due to non-specific symptoms and challenges in the use of objective testing in this age group.[13] These difficulties may prevent researchers from studying asthma control in early life. One previous study we identified examined the association between many different indicators of socioeconomic status and asthma control among African American youth (aged 8 to 21 years).[24] Among other results, it found that individuals with poor asthma control were less likely to have attended daycare than children with partial asthma control. However, given the different age distribution of this study, our results are not directly comparable.

In our sample, a low percentage of children had an asthma action plan on file with their daycare. A personalized asthma action plan is a plan a family develops with a child's healthcare provider on how to manage their child's asthma. It includes medications the child should take, a child's asthma triggers, what to do when symptoms arise, and who to call if help is needed. The National Asthma Education and Prevention Program EPR-3 guidelines recommend that all individuals with asthma have an asthma action plan.[13] This plan can be shared with all of a child's caregivers, including daycare providers. Having an asthma action plan on file is one of many steps that daycares can take to support children with asthma.[25,26] With only 38% of children in this sample reporting ever being given an asthma action plan, and 32% with their plan on file with their daycare, there is room for improvement in the use of these important health documents. Additional steps that daycares can take to support children with asthma include limiting exposure to asthma triggers such as tobacco smoke, cockroaches, mold and pets, and educating daycare staff on asthma management and control.[25] Some states have developed guidance and certification programs that help educate daycare providers on caring for children with asthma.[27,28]

There are several limitations to this study. Data collected from the Asthma Call-back Survey are cross-sectional so we were unable to assess changes in asthma control before and after starting daycare. The sample size of young children was limited which prevented us from making inferences about some of the demographic groups of interest, for example children whose parent or guardian did not graduate high school. Outcomes are self-reported and may not be reported consistently across groups. In our classification of asthma control, we were unable to incorporate all aspects of asthma control specified in the National Asthma Education and Prevention Program EPR-3 guidelines, for example lung growth status.[13] Moreover, the previously mentioned difficulties in diagnosing asthma in early life can lead to under diagnosis.[13] Further complicating diagnosing asthma in this age group, some of the symptoms of asthma, such as cough and wheeze, are often exhibited by children who do not have asthma.[29] As a result, our sample of children with diagnosed asthma may not be representative of all children in this age group who truly have asthma.

In addition to limitations related to the asthma classification and reporting, there are characteristics of daycare attendance on which we did not have information. These include the type of daycare attended (i.e., daycare center or home-based daycare), frequency and duration of daycare attendance, and the size of the daycare. Each of these factors may be important in determining exposure to infections and thus may be related to asthma control. For example, one study on infections and daycare attendance found that the proportion of days with a respiratory illness increased 7 to 12% with each additional 9 hours spent in daycare.[4] By not accounting for time spent at daycare and other important characteristics, we may have masked associations in some groups.

Although there were some key variables on which we did not have information, such as characteristics of attended daycares, the Asthma Call-back Survey does collect detailed information on a wide range of asthma-related health and healthcare variables. In examining the association between daycare attendance and asthma control we were able to adjust for a number of factors about which information is not always available. For example, cost barriers to care, which may directly impact asthma control, and number of other children in a child's home, which has been previously found to be important in determining the association between daycare attendance and respiratory illness.[4]

Conclusions/Key Findings

In this analysis using Asthma Call-back Survey data representative of 520,400 U.S. children aged 0 to 4 years in 26 U.S. states, we observed no robust evidence that children attending daycare had a meaningfully different prevalence of uncontrolled asthma than children not attending daycare when adjusting for covariates. Given the sizable proportion of children with asthma attending daycare (estimated to be roughly one third in this sample), public health programs and healthcare professionals could consider partnering with daycares to educate families on asthma self-management. Additional studies on the relationship between daycare attendance and asthma control, including emergency department visits for asthma, would increase understanding on this topic.

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Table 1.

Daycare attendance and uncontrolled asthma among Asthma Call-back Survey child respondents aged 0 to 4 years, 2012–2014

		Attended daycare in the past 12 months[1]	Uncontrolled asthma[2]
Characteristic	**Unweighted N**	**Weighted %(95% CI)**	**Weighted %(95% CI)**
All	388	33.9 (25.6, 43.4)	59.5 (49.4, 68.8)
Sex			
Male	252	37.1 (25.5, 50.4)	56.7 (43.3, 69.2)
Female	136	28.0 (17.1, 42.2)	64.7 (51.9, 75.7)
Race			
White	263	34.4 (25.3, 44.7)	50.8 (40.4, 61.1)
Black	59	37.5 (19.7, 59.5)	69.5 (46.0, 85.9)
Other race	66	29.4 (12.1, 55.8)	70.9 (45.5, 87.6)
Household income			
<$25,000	117	25.7 (11.8, 47.1)	69.5 (48.2, 84.8)
$25,000–<$50,000	71	42.5 (23.6, 63.9)	54.3 (33.5, 73.7)
≥$50,000	172	38.3 (27.5, 50.3)	56.2 (44.6, 67.2)
Parent or guardian education			
Did not graduate high school	33	_[3]	91.7 (73.4, 97.8)
Graduated high school	87	24.8 (14.0, 40.2)	68.7 (54.1, 80.3)
Attended college	118	46.9 (31.2, 63.1)	41.4 (27.2, 57.2)
Graduated college	150	42.2 (29.3, 56.2)	55.1 (41.9, 67.6)

N = sample size; CI = confidence interval

[1] Includes children who currently attend daycare and have attended daycare in the past 12 months

[2] Asthma control defined based on day-time symptoms, night-time symptoms, activity limitations, and short-acting beta agonist use

[3] Result suppressed due to unweighted sample size <50 and relative standard error >0.3

Table 2.

Asthma-related health outcomes and healthcare use among Asthma Call-back Survey child respondents aged 0 to 4 years by daycare attendance, 2012–2014

Characteristic	All children N=388 Weighted %(95% CI)	Attended daycare in past 12 months N=152 Weighted %(95% CI)	Did not attend daycare in past 12 months N=236 Weighted %(95% CI)
Asthma-related health outcomes and medication use			
Uncontrolled asthma[1]	59.5 (49.4, 68.8)	43.7 (29.8, 58.6)	67.6 (55.7, 77.6)
Asthma attack in past 12 months	61.4 (49.7, 71.8)	61.8 (46.9, 74.7)	61.1 (45.6, 74.7)
Long-term control medication use in past 3 months	45.6 (35.9, 55.7)	42.0 (28.7, 56.5)	47.5 (34.5, 60.8)
Rescue medication use in past 3 months	62.8 (51.6, 72.7)	59.6 (44.5, 73.0)	64.4 (48.2, 77.9)
Asthma-related healthcare use in past 12 months			
Routine care visit	73.4 (60.0, 83.6)	83.6 (70.5, 91.6)	68.2 (50.5, 81.8)
Urgent care visit[3]	41.6 (32.3, 51.5)	39.8 (27.5, 53.7)	42.5 (30.4, 55.6)
Emergency department visit[4]	30.7 (23.1, 39.5)	39.9 (26.8, 54.7)	26.0 (17.5, 36.7)
Hospitalization	5.4 (2.9, 9.7)	6.2 (2.4, 14.7)	5.0 (2.2, 10.7)

N = sample size; CI = confidence interval

[1] Asthma control defined based on day-time symptoms, night-time symptoms, activity limitations, and short-acting beta agonist use

[3] Defined as a visit to a doctor or other healthcare professional for urgent asthma treatment

[4] Includes emergency department and urgent care center visits due to asthma