

Asking the Right Questions to Ascertain Early Childhood Secondhand Smoke Exposures

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Secondhand smoke is associated with a myriad of adverse health outcomes. Therefore, it is essential for clinicians to ask precise questions about exposures, particularly for children. We present 4 questions that incorporate several locations of exposure and provide a more comprehensive account of children's smoke exposures than maternal smoking alone. (*J Pediatr* 2012; ■: ■-■)

It is estimated that 50% to 75% of children have detectable levels of serum cotinine, a nicotine metabolite specific to secondhand smoke.¹ Because secondhand smoke has many associated adverse health effects in children, it is important for clinicians to collect unbiased, precise, and accurate exposure histories. Children are exposed to secondhand smoke in a variety of locations, including their homes, friends' and relatives' homes, public places, and vehicles with disparate levels of exposure among those with lower socioeconomic status.² Questions posed to collect these histories in the clinical setting must be both comprehensive and concise to enable targeted interventions. In this study, we evaluated 4 questions for collecting secondhand smoke exposure histories in children participating in the Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS).

Methods

CCAAPS is an ongoing birth cohort of children having at least 1 parent with a positive skin prick test and allergy symptom.³ Exposure to parental reported secondhand smoke was defined at the enrollment visit (age 6-7 months) as well as exams at ages 1, 2, and 3 years. Four secondhand smoke-related exposure questions (Q) were posed: the number of cigarettes smoked daily by the mother (Q1), the number of smokers living in the child's home (Q2), the number of hours per day a child was exposed to secondhand smoke at any location (Q3), and secondhand smoke exposure in the car (yes/no) (Q4). Hair samples for cotinine analysis were collected annually by cutting 2 samples of ~20 strands from the root end in the occipital region of the scalp. Because ~20% of 1 year of age samples were of insufficient weight for analysis, samples from 2 years of age visit were adjusted for weight and analyzed for cotinine level by radioimmunoassay at the Hospital for Sick Children in Toronto, Ontario, Canada⁴; the limit of detection was 0.02 ng/mg. Therefore, the 2 years of

age questionnaire responses were used unless otherwise indicated. As an indicator of socioeconomic status, lower income was defined as <\$40 000 per year. The institutional review board at the University of Cincinnati approved the study. Written informed consent was obtained from the parents of all participating children.

The χ^2 or *t*-tests were used to compare differences for binary and continuous variables, respectively. Prior to the analysis, cotinine levels below the lower limit of detection were estimated as the lower limit of detection divided by 2.⁵ Levels were log-transformed to approximate a normal distribution as determined by the Shapiro-Wilk test. Spearman coefficients were used to determine correlations between the 4 secondhand smoke questions and hair cotinine level. Statistical analyses were conducted using SAS version 9.2 (SAS Institute, Cary, North Carolina).

Results

Overall, 55% of the 617 children in the CCAAPS cohort with available hair samples were male, 30% had lower annual household income, and 14% were African American. Cotinine was detected in 83% of the hair samples. Geometric mean hair cotinine levels (\pm SE) were higher in children with a lower family income (0.15 ± 1.12 ng/mg) compared with those with higher income (0.05 ± 1.05 ng/mg; *P* = .55).

Parents of children with lower family income were significantly more likely than those with higher income to report at age 2 that the mother smokes ≥ 1 cigarette per day (Q1, 27%

CCAAPS Cincinnati Childhood Allergy and Air Pollution Study
Q Question

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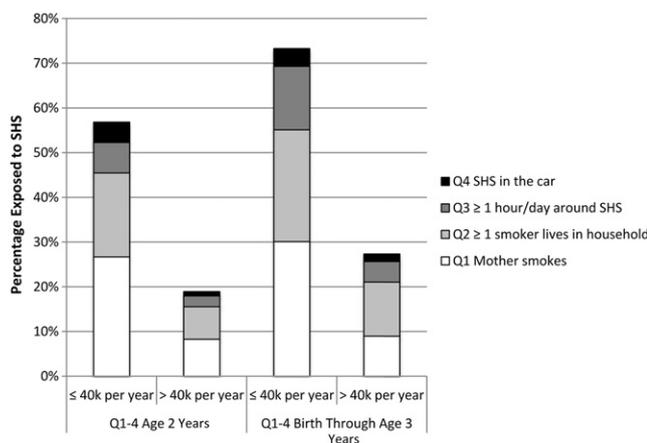


Figure. Percentage of CCAAPS children at age 2 and collectively from birth through age 3 identified as exposed to secondhand smoke by parental reported question, stratified by income level. The *stacked bars* represent the proportion of children identified as exposed to secondhand smoke by each of the 4 questions, starting with Q1 (maternal smoking). If maternal smoking is negative, Q2 (number of household smokers) is evaluated. If Q2 is 0, Q3 (number of hours a day around secondhand smoke) is then evaluated. If Q3 is 0, Q4 (secondhand smoke in the car) is evaluated. The resulting *stacked bar* represents the additional percentage of children exposed to secondhand smoke identified by Q2-4. *SHS*, secondhand smoke.

vs 8%), that there were ≥ 1 smokers living in the household (Q2, 44% vs 16%), that the child spent ≥ 1 hour around secondhand smoke per day (Q3, 32% vs 9%), and that the child was exposed to secondhand smoke in the car (Q4, 31% vs 6%) ($P < .0001$ for all comparisons).

At 2 years of age, we observed that children in lower income families were 3 times more likely to be exposed to secondhand smoke compared with children from higher income families (57% vs 19%, $P < .0001$) (Figure). Among the children exposed to secondhand smoke, 55% of lower income and 56% of higher income children would have been misclassified if Q2-4 were not asked in addition to maternal smoking (Figure). To obtain total childhood secondhand smoke exposures, we also combined positive responses from the 4 questions over all time points from birth through 3 years of age, with similar findings (73% lower income compared with 27% higher income exposed to secondhand smoke, $P < .0001$; Figure). Further, 59% of lower income and 67% of higher income children exposed to secondhand smoke would have been misclassified as unexposed if Q2-4 were not posed to the parent (Figure).

Of our 4 secondhand smoke questions, Q3 (the number of hours around secondhand smoke per day) and Q4

(secondhand smoke in the car) were the most strongly correlated with hair cotinine levels at 2 years of age among those with lower ($r = 0.49$, $P < .0001$) and higher income ($r = 0.24$, $P < .0001$), respectively, further demonstrating the importance of these additional questions.

Discussion

Families with lower socioeconomic status have disparately higher levels of parental reported secondhand smoke exposures.² By asking additional questions about the number of smokers living in the home, the number of hours per day around smoke, and whether anyone ever smokes in the car with the child, we identified that over half of the children would have been misclassified as unexposed if maternal smoking was the sole indicator. These types of questions also provide the parent(s) an opportunity to report exposures without divulging personal habits. Taken together, these results indicate that questions pertaining to secondhand smoke that do not directly target the mother are necessary when obtaining exposure histories.

Our data provide specific questions important for clinicians in order to obtain a thorough smoking history from their patients. Asking just 4 questions about maternal smoking, the number smokers living in the home, the number of hours the child spends around secondhand smoke per day, and exposures in the car will yield a comprehensive and clinically relevant smoking history. ■

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