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Original article

The Peer and Family Smoking Index: A Valid Measure of Secondhand Smoke Exposure in Adolescents

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A B S T R A C T

Purpose: Nearly half of all adolescents in the United States are exposed to secondhand smoke (SHS) daily, primarily at home, resulting in respiratory infections, asthma exacerbations, and reduced lung function. A concise self-report measure is needed to identity adolescents exposed to SHS. The purpose of this study was to test whether nonsmoking adolescents who reported exposure to peer and/or family smoking on the Peer and Family Smoking Index had higher salivary cotinine levels than those reporting no exposure to either peer or family smoking.

Methods: A convenience sample of 135 English-speaking adolescents ages 15–18 years was recruited from two high schools. Those who reported use of nicotine replacement therapy, cigarette smoking (past 30 days), smokeless tobacco use (past 30 days), or who self-reported pregnancy were excluded. Salivary cotinine and self-report data from the Peer and Family Smoking Index were collected after obtaining parental consent and assent from the adolescent.

Results: Mean salivary cotinine levels differed by exposure group (none, family, peer, or family and peer), $F(3, 130) = 5.44$, $p = .001$. The post hoc analysis identified a significantly higher mean cotinine level among those exposed to SHS from both family and peers than among those with no exposure ($p = .001$).

Conclusions: Known groups validity of the index was supported. Adolescents who reported family smoking or a combination of family and peer smoking had significantly higher salivary cotinine levels than unexposed adolescents. The Peer and Family Smoking Index is a concise and valid self-report measure for SHS exposure in adolescents.

IMPLICATIONS AND CONTRIBUTION

Adolescents experience tobacco-related disparities nationwide, particularly related to secondhand smoke (SHS) exposure. Using a biomarker such as cotinine to detect SHS exposure may not be affordable or logistically possible. The Peer and Family Smoking Index is a short, valid, self-report measure to identify adolescents at risk for SHS exposure.

Approximately, 28 million adolescents (46.5%; 12–19 years) in the United States are exposed to secondhand smoke (SHS) [1]. SHS, defined as the involuntary inhalation of cigarette smoke, has no safe level of exposure and all SHS exposure has associated increased risk [2] for respiratory infections, worsening asthma symptoms, and reduced lung function [3]. Adolescents primarily experience SHS exposure in the home [4] which is an area where adolescents do not traditionally set or enforce the rules related to cigarette smoking [5].

A concise, self-report measure of SHS exposure is needed to accurately identify adolescents at risk. Although objective measurement of SHS exposure using biomarkers (e.g., cotinine) is preferred, this type of measurement is a considerable research

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expense and may not be logistically possible, particularly for studies involving large samples. Direct personal and atmospheric measurements of SHS in the places where adolescents are exposed can present researchers and clinicians with unique logistical challenges, such as the effective placement and retrieval of equipment in the home environment. Standardized self-report measures of pediatric SHS exposure are available [6]; however, a tool that comprises a cohesive set of items with established psychometrics is rare. A short, valid psychosocial measure (which assesses the perception of exposure from smokers present in an adolescent's life [7]) would allow researchers to more readily study SHS exposure in adolescents and assist clinicians in the identification of adolescents at risk for SHS exposure in the clinical setting. The five-item Peer and Family Smoking Index was originally developed to assess an adolescent's social influences by reporting the smoking status of immediate family members and friends [8]. The brevity of the measure makes it a workable option for assessing SHS exposure in the adolescent population.

The purpose of this study was to test whether nonsmoking adolescents who reported exposure to peer and/or family smoking on the Peer and Family Smoking Index had higher salivary cotinine levels than those reporting no exposure to either peer or family smoking. The hypothesis was that nonsmoking adolescents who report exposure to peer and/or family smoking would have higher salivary cotinine than those not exposed to either peer or family smoking.

Methods

Design and sample

A secondary analysis of cross-sectional data from a convenience sample of 135 nonsmoking adolescents was conducted. The adolescents were recruited from two high schools located in a midwestern, rural county [9]. At the time of data collection, the county's population was 95.5% Caucasian [10]; 25% of adults were current smokers [11]; and a smoke-free state law prohibited smoking in restaurants, places of employment, and public venues but allowed smoking in bars, taverns, tobacco retail shops, and gaming facilities. The study inclusion criteria were: (1) 9th–12th grade; (2) ages 15–18 years; (3) able to understand, speak, and respond in English; (4) willing to participate; and (5) written parental consent. The target population of middle/older adolescents (ages 15–18 years) was selected due to their increasing independence, cognitive development, and potential for active smoke avoidance. Exclusion criteria were: (1) non-English-speaking adolescents or parents; (2) current cigarette smoking (past 30 days); (3) current use of smokeless tobacco (past 30 days); (4) current use of nicotine replacement therapy (past 30 days); and (5) self-reported pregnancy. Non–English-speaking adolescents/parents were excluded due to the absence of a translated informed consent form. Adolescents who self-reported being pregnant were excluded due to their potentially altered ability to metabolize nicotine which may result in less valid cotinine levels [12]. Data were collected from February to April 2013. The main findings of the primary study are reported elsewhere [9].

Measures

The five-item Peer and Family Smoking Index was used to quantify the number of immediate family members and peers who smoked and to provide a proxy measure for potential sources of SHS exposure [8]. The first three items on the Peer and Family Smoking Index require yes or no responses regarding the smoking behavior of parents, stepparents, guardians, and siblings. The final two items ask adolescents whether their friends who smoke are male and/or female and the number of each. The Peer and Family Smoking Index is scored as either SHS exposure or non-SHS exposure from family and/or peers separately [8]. A nominal variable was created to classify respondents into one of four SHS exposure categories: no exposure; exposure from family; exposure from peers; or exposure from both family and peers.

The 10-item Uptake Continuum questionnaire was used to categorize the cigarette smoking behavior of adolescents and to screen for current smokers [13]. This categorization of cigarette smoking behavior includes seven stages: (1) committed never smoker; (2) susceptible never smoker; (3) puffer; (4) noncurrent experimenter; (5) current experimenter; (6) noncurrent established smoker; and (7) current established smoker. The categorization provided by this measure acknowledges that an adolescent's transition to becoming a current established smoker is a dynamic process that may take many years [13]. Adolescents who identified themselves as committed never smokers or susceptible never smokers were categorized as nonsmokers and included in the study.

A salivary specimen was collected from each adolescent in the school setting to determine cotinine levels as a biomarker of SHS. The use of salivary specimens provides an objective, less invasive method of data collection [14] and is more appropriate for school-based data collection compared to serum or urine collection. Adolescents provided whole saliva in a collection tube by the passive drool technique [14]. Salivary specimens were collected later in the week (Thursday or Friday between 8A.M. and noon) to reflect SHS exposure during a typical school week and to avoid the variety of activities and exposures during the weekend.

The Salimetrics Cotinine enzyme immunoassay (EIA) was used to evaluate cotinine levels. It is sensitive enough to detect salivary cotinine at a level of .05 ng/mL and uses 20 μL of saliva sample per determination. It has a lower limit of sensitivity of .15 ng/mL. The performance characteristics reported for Salimetrics Cotinine EIA include an intra-assay coefficient of variation ranging from 4.5% to 8.6%. This range is acceptable as the intra-assay coefficient of variation should be below 10%. The Salimetrics Cotinine EIA interassay precision ranges from 4.21% to 9.04% with an acceptable interassay coefficient of variation being $<$15% [15].

Established salivary cotinine cutpoints for adolescents were used to quantify the extent of exposure [12]. The cutpoint of 1.0 ng/mL or less is indicative of minimal SHS exposure in adolescents [12]. Salivary cotinine levels less than 3.0 ng/mL are indicative of SHS exposure and possibly light smoking behavior in adolescents. The salivary cotinine cutpoint $\geq$3.0 ng/mL is indicative of active smoking or heavy SHS exposure in adolescents [12]. In this study, adolescents with salivary cotinine levels of less than 3.0 ng/mL were categorized as exposed to SHS.

The adolescents completed a demographic questionnaire including items that assessed age (in years), sex (female/male), race (with four possible categories, but only "Caucasian" and "multiracial" were endorsed by one or more of the participants in this study), ethnicity (Latino/non Latino), housing type (house, apartment, or mobile home), and socioeconomic status