



## Original article

# Usefulness of a home affluence scale administered to urban adolescents with asthma to estimate the family's socioeconomic status



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## ARTICLE INFO

## Article history:

Received 13 January 2015

Accepted 12 July 2015

Available online 30 July 2015

## Keywords:

Social class

Asthma

Adolescents

Socioeconomic status

Income

Education

Affluence

Poverty

Census

Puff city

## ABSTRACT

**Purpose:** Measurement of socioeconomic status (SES) is traditionally based on education, income, and occupation. This information may not be readily available from adolescents participating in research.

**Methods:** Using data from school-based randomized trial of an asthma intervention targeting urban adolescents, we compared percent poverty in zip code of residence (% poverty), median housing value, and parental income and education, to teen responses on the Home Affluence Scale for Children (HASC), which included home, car, and computer ownership for the family and eligibility for free school lunch. The association of HASC with measures of asthma control was also assessed.

**Results:** Of 422 adolescents, 390 (92%) responded to HASC items (mean HASC = 2.5). HASC was associated with mother's education and household income (both  $P < .001$ ), and significantly correlated with % poverty ( $P < .0001$ ) and median home value ( $P = .003$ ). The association of HASC  $< 2.0$  to indicators of uncontrolled asthma was in the direction hypothesized, especially for nighttime symptoms, odds ratio (95% confidence interval) = 1.59 (0.95–2.66) and restricted activity, odds ratio = 1.87 (1.12–3.12).

**Conclusions:** HASC correlates well with more traditional measures of SES, and the risk estimates for HASC less than 2.0 and indicators of uncontrolled asthma were mostly in the hypothesized direction. Methods of obtaining SES indicators from youth are needed for research studies.

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## Introduction

Socioeconomic status (SES) is a dynamic concept that changes over time, both for individuals and societies at large [1]. Measurement of SES is important for research studies, as it can have an impact on health-related outcomes. Health care disparities are known to be affected by SES, through its regulation of access to health care, health behaviors, and environmental exposures [2]. Traditional measures of socioeconomic status have included education, income, and occupation, and they have been shown to correlate with outcomes for several chronic health conditions, including asthma [3]. Certain census variables such as percentage of

poverty in zip code of residence can also be used as indirect measures of SES [4].

Typically, self-report of variables, used as indicators of SES, is taken from adult respondents, but few papers describe methods for obtaining this information from youth. Obtaining accurate information from adolescent study participants about their parents' education, income, and occupation is challenging and can limit the ability of researchers to study the impact of SES on adolescent health [5]. Adolescents, however, may be able to report certain surrogate measures of familial affluence more reliably [5]. The Family Affluence Scale, developed by Currie et al. in mid-1990s [6], sought to overcome this limitation by using measures of income that adolescents are likely to report more accurately. In several analyses of the data from the multinational Health Behavior in School-aged Children study, lower affluence measured by Family Affluence Scale was associated with lower risk for sports-related injuries [7] and lower rates of participation in moderate to vigorous physical activity [8]; but higher risk for fighting injuries

The named authors have no conflicts of interest to report for this article.

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<http://dx.doi.org/10.1016/j.annepidem.2015.07.010>

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[7,9]; and consumption of soft drinks and high-sugar foods [10]. These factors are known to be associated with low SES measured by traditional methods.

In addition, neighborhood level indicators of SES are important determinants of access to health care, as well as health-related outcomes for many acute and chronic conditions [11]. Specifically for adolescents with asthma, neighborhood level low SES tends to correlate with immune dysfunction (skewed toward Th2 pathway), higher stress experiences and lower levels of belief regarding control over their health [12]. As neighborhood level indicators of SES tend to correlate with family level SES as well [13], it is important to understand how these traditional and nontraditional measures of SES can affect adolescents with asthma and their outcomes.

There is reported discrepancy between parents and adolescents regarding their reports of adolescent asthma symptoms [14]. As the adolescent report tends to correlate better with objective measures of asthma control (such as questionnaire scores or lung function) [15], it is reasonable for researchers to collect measures related to asthma outcomes from adolescents themselves. However, collection of SES data from adolescents can be challenging given the reasons cited previously, and researchers have used several surrogate measures of SES to collect SES data from adolescents. We are not aware of reports in the literature describing the usefulness of these alternative scales over the traditional measures of SES in studies involving adolescents with asthma. To address this gap, we analyzed the data collected from a school-based randomized controlled trial of self-management intervention for urban teens with asthma (Puff City; [Clinicaltrials.gov](http://Clinicaltrials.gov) identifier NCT00201058). Our aim was to compare measures of SES as reported by adolescents to parental reports of education and income, as well as census information; and to assess the association of SES indicators to selected asthma outcomes.

## Materials and methods

The data used for this analysis were collected as part of a randomized controlled trial of a web-based self-management intervention called Puff City for adolescents with asthma in a school-based setting. Recruitment began in 2007 and ended in the summer of 2009. The Institutional Review Board at Henry Ford Health System approved this trial, and its details and outcomes have been described before [16,17]. Briefly, the parents of adolescents enrolled in ninth through 12th grades at six Detroit high schools were sent a letter to obtain permission for administering a lung health questionnaire to the students during English class. Among those students who opted to complete the lung health questionnaire, adolescents with asthma symptoms were considered eligible to participate (based on inclusion and exclusion criteria described before [18]). After obtaining parental informed consent and student's written assent, the adolescents were enrolled in a randomized controlled trial for an online asthma educational intervention called Puff City. The adolescents that were randomized into the treatment group received four sessions of computer-based tailored education related to asthma self-management (Puff City), whereas the control group received four computer sessions of similar duration where they accessed generic asthma education websites. All participants used computers at their respective schools to complete these educational sessions. After completion of the study intervention, the participants completed follow-up questionnaires at 6 and 12 months after enrollment. Baseline measures of asthma control were also collected from all the participants, and they included the number of days with asthma symptoms in the last 30 days, number of nights with asthma symptoms in the last 30 days, number of

school days missed in the last 30 days; and total number of days of restricted activity. For analysis, categorical variables corresponding to the cutoffs used in the Expert Panel Report 3 [19] to represent indicators of uncontrolled asthma were used.

The 6-month and 12-month follow-up included items from the Home Affluence Scale for Children (HASC). The HASC is a four-question scale that was modified by Wardle et al. [6] and includes four questions: (1) Do you own a computer at home? Yes = 1, No = 0 points. (2) Do you have a car or van at home? Yes = 1, No = 0 points. (3) Do you yourself have the option of free lunchtime meals at school? Yes = 0, No = 1 point. (4) Thinking about the house you live in at present, do your parents own it or rent it? Own = 1, Rent = 0 points. The responses for each of these four questions were added to give a total score (a range of 0 to 4). A higher score reflected higher SES. The parents of the study participants were also interviewed at baseline separately to collect information about their child's asthma, their demographic information, education, income, and home ownership. The parental education level was categorized into less than high school, high school graduate and greater than high school for any additional college education. Income was categorized into four groups—less than \$15,000; \$15,001 to \$40,000; \$40,001 to \$60,000; and greater than \$60,000 per annum. The data for percent poverty in zip code of residence and mean housing value was obtained from United States decennial census 2000 [20].

## Statistical analysis

In comparing the individual components of the HASC with the % poverty in zip code of residence and the median housing value, we used Mantel–Haenszel  $\chi^2$  tests for categorical variables. This test incorporates the fact that there is inherent ordering in both the income and education variables, and it is sometimes referred to as a test for trend [21]. For the comparison of the HASC score across the income or education categories, we used the Jonckheere–Terpstra test for trend [22]. Spearman correlation coefficients were calculated to assess the rank-order correlation between ordinal variables such as HASC and income or education categories. To describe the association between HASC and indicators of asthma morbidity and between other SES indicators and asthma morbidity, we calculated odds ratios (OR) and 95% confidence intervals. For calculation of the odds ratios, the following variables were categorized: HASC score ( $\leq 2$  vs.  $> 2$ ); mom's education ( $<$ high school, high school, and  $>$ high school) and household income ( $<$ \$15,000; \$15,001–\$40,000; \$40,001–\$60,000; and  $>$ \$60,000).

## Results

Of the 422 participants enrolled in the Puff City–2 randomized controlled trial, the questions related to HAS were answered by 390 adolescents. Subsequent analyses were done using data from these 390 participants only, and the data from remaining 32 participants were excluded for this analysis. The demographics of the study population are shown in Table 1. Most study participants were African American (90%), and nearly 40% were males. In most participants' families (83%), maternal education was at high school or greater, although the annual household income was less than \$40,000 for 85.5% of the respondents. The mean home value of the respondents by their zip code of residence (based on the 2000 US decennial Census data) was \$63976, whereas the percentage poverty in their zip code of residence was 24.5%. Among the measures used on HASC, car ownership was the highest (84.6%), followed by computer ownership (74.1%). Sixty-four percent reported eligibility for free school lunch (64.4%). Only 50.1% of youth

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