Journal of Adolescent Health 56 (2015) 167–173

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Original article

Secondhand Smoke Exposure Among Never-Smoking Youth in 168 Countries

Sreenivas P. Veeranki, M.B.B.S., M.P.H., Dr.P.H. [a,b,*], Hadii M. Mamudu, Ph.D. [c], Shimin Zheng, Ph.D. [d], Rijo M. John, Ph.D. [e], Yan Cao, Ph.D. [d], David Kioko, M.P.H. [c], James Anderson, M.D., Ph.D. [d], and Ahmed E. O. Ouma, Ph.D. [f]

[a] *Division of Epidemiology, Department of Preventive Medicine and Community Health, University of Texas Medical Branch, Galveston, Texas*
[b] *Division of General Pediatrics, Department of Pediatrics, Vanderbilt University School of Medicine, Nashville, Tennessee*
[c] *Department of Health Services Management and Policy, College of Public Health, East Tennessee State University, Johnson City, Tennessee*
[d] *Department of Biostatistics and Epidemiology, College of Public Health, East Tennessee State University, Johnson City, Tennessee*
[e] *Indian Institute of Technology, Jodhpur, Rajasthan, India*
[f] *Tobacco Control Programme, WHO Regional Office for Africa, Brazzaville, Congo*

Article history: Received May 15, 2014; Accepted September 24, 2014
Keywords: Never-smoking adolescent; Secondhand smoke; Global Youth Tobacco Survey; Smoke-free policy

A B S T R A C T

Purpose: To estimate the prevalence of secondhand smoke (SHS) exposure among never-smoking adolescents and identify key factors associated with such exposure.
Methods: Data were obtained from nationally representative Global Youth Tobacco Surveys conducted in 168 countries during 1999–2008. SHS exposure was ascertained in relation to the location—exposure inside home, outside home, and both inside and outside home, respectively. Independent variables included parental and/or peer smoking, knowledge about smoke harm, attitudes toward smoking ban, age, sex, and World Health Organization region. Simple and multiple logistic regression analyses were conducted.
Results: Of 356,414 never-smoking adolescents included in the study, 30.4%, 44.2%, and 23.2% were exposed to SHS inside home, outside home, and both, respectively. Parental smoking, peer smoking, knowledge about smoke harm, and positive attitudes toward smoke ban were significantly associated with increased odds of SHS exposure. Approximately 14% of adolescents had both smoking parents and peers. Compared with never-smoking adolescents who did not have both smoking parents and peers, those who had both smoking parents and peers had 19 (adjusted odds ratio [aOR], 19.0; 95% confidence interval [CI], 16.86–21.41), eight (aOR, 7.71; 95% CI, 7.05–8.43), and 23 times (aOR, 23.16; 95% CI, 20.74–25.87) higher odds of exposure to SHS inside, outside, and both inside and outcome home, respectively.
Conclusions: Approximately one third and two fifths of never-smoking adolescents were exposed to SHS inside or outside home, and smoking parents and/or peers are the key factors. Study findings highlight the need to develop and implement comprehensive smoke-free policies consistent with the World Health Organization Framework Convention on Tobacco Control.

IMPLICATIONS AND CONTRIBUTION

Harmful effects of secondhand smoke exposure are well established; however, magnitude among vulnerable populations including never-smoking adolescents still remains unknown. The study estimates prevalence and identifies factors for secondhand exposure among never-smoking adolescents in 168 countries. The findings have potential to inform development and implementation of comprehensive tobacco-free policies worldwide.

Although secondhand smoke (SHS) exposure and its harmful health effects were first reported in 1920s [1], the issue gained scientific interest in early 1980s when exposure was linked to lung cancer in healthy adults nonsmokers [2] and in late 1980s when exposure was linked to increased respiratory infections and

Conflicts of Interest: The authors have no competing interests to declare.

* Address correspondence to: Sreenivas P. Veeranki, M.B.B.S., M.P.H., Dr.P.H., Division of Epidemiology, Department of Preventive Medicine and Community Health, University of Texas Medical Branch, Galveston, TX 77555.
E-mail addresses: spveeran@utmb.edu, drveeranki@gmail.com (S.P. Veeranki).

1054-139X/
http://dx.doi.org/10.1016/j.jadohealth.2014.09.014

diminished rate of lung growth in children and adolescents [3]. The scientific consensus on the adverse health effects of SHS exposure began with earlier reports by Trichopoulos et al. [4], Hirayama et al. [5], Garfinkel et al. [6], and the U.S. Surgeon General [3]. Since then, many studies have been conducted across the world and have documented evidence about the harmful effects of SHS [7,8]. This led to the realization that smokers were not only putting their own health at risk but also the health of never smokers.

SHS is a common indoor air pollutant and a significant public health problem. Comprehensive assessments and reviews by scientific bodies have shown that SHS exposure has been associated with health outcomes in children and adolescents, including lower respiratory tract infections, middle ear infections, sudden infant death syndrome, asthmatic exacerbations, mental health disorders, cognitive dysfunction, sleep disorders, and metabolic syndrome [9–13]. In addition, SHS exposure has psychosocial influence on adolescents' health-seeking behaviors, especially when exposed in homes or cars, or when they observe their parents, peers, and others smoke [14]. Worldwide, it has been estimated that SHS exposure kills over 600,000 people each year [7]. Despite well-documented health effects, the increasing prevalence of smoked tobacco products use [7], particularly in low- and middle-income countries (LMICs), suggests that more never smokers, including vulnerable populations such as children and adolescents, are continuously being exposed to SHS.

The burden of SHS exposure supports the need for investigation into never-smoking youth exposure to SHS as adolescents constitute a vulnerable group in need of policy protection. This demands more attention considering the fact that only 16% of the world's population is covered by smoke-free policies (SFPs) [15]. As there is no scientific evidence for safe level of SHS exposure, the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC), the first global health treaty negotiated under the auspices of the WHO, recommended effective measures to protect never smokers from SHS exposure in its Article 8, "Protection from exposure to tobacco smoke" [16]. Effective implementation of Article 8 employs measures to eliminate/reduce exposure to SHS in indoor public places, work places, and public transport [7,16]; however, data on magnitude of SHS exposure among vulnerable populations including adolescents are limited, particularly in LMICs. Few national and global studies [17,18] have been conducted on adolescents' exposure to SHS, with minimal research on never smokers [19]. In addition, earlier studies reported only estimates and did not identify factors associated with SHS exposure. In this study, we used the Global Youth Tobacco Survey (GYTS) conducted in 168 countries, primarily in LMICs, during 1999–2008 to estimate the prevalence of SHS exposure among never-smoking youth and identify factors associated with such exposure. Given only few countries have comprehensive SFPs worldwide [7], we hypothesized that a significant proportion of never-smoking adolescents were exposed to SHS. Although it is known that SHS exposure is harmful, understanding the magnitude and correlates of never-smoking adolescents' SHS exposure will inform policymakers and public health advocates as they develop and implement SFPs and plan preventive strategies consistent with the Article 8 of the WHO FCTC [16].

Methods

Study population and Global Youth Tobacco Survey

We used the GYTS surveys conducted in 168 countries (Supplementary Appendix A) during 1999–2008 to obtain information about never-smoking adolescents' SHS exposure. Similar to earlier studies [20,21], we obtained information from the most recent surveys for countries that conducted the survey more than once. The GYTS follows a standard protocol and sampling design while selecting the samples, as previously described [22,23]. Briefly, the GYTS uses a two-stage cluster sampling design where clusters of schools proportional to the student enrollment size were selected during the first stage followed by random selection of classes during the second stage. All students in the selected classes were eligible to participate in the survey. In addition, the GYTS employs a standard methodology in survey questionnaire preparation and administration, data collection, processing and analyses, and reporting the results [22,23]. A standard and structured GYTS questionnaire consists of a "core" set of 54 questions designed to gather data on tobacco use among youth. In addition, every country has the option to add supplemental questions to obtain information on tobacco products that are relevant to specific country, region, province, city, or geographical entity. The survey questionnaires are translated to respective local or non-English language as needed and back translated to English to ensure accuracy across all GYTS survey sites [23]. The study was approved by the Institutional Review Board at the East Tennessee State University.

Study measures

The outcome variable is SHS exposure among never-smoking youth. We defined the outcome in relation to the potential location that a never-smoking adolescent could be exposed—"SHS exposure inside home" and "SHS exposure outside home." The never-smoking status of an adolescent was determined based on his/her negative response to the question, "Have you ever tried or experimented with cigarette smoking, even one or two puffs?" A never-smoking adolescent's exposure to SHS inside and/or outside home was determined if he/she responded $\geq$1 days to the questions, "During the past week, on how many days have people smoked in your home, in your presence?" and "During the past 7 days, on how many days have people smoked in your presence, in places other than in your home?," respectively. Because it is possible that an adolescent might potentially be exposed to SHS both inside and outside home, we constructed a severity variable, "SHS exposure inside and outside home," using the responses for the aforementioned two questions (Table 1).

Similar to earlier studies [20,21], we constructed seven independent variables that could potentially be associated with SHS exposure. These include (1) parental smoking behavior; (2) peer smoking behavior; (3) knowledge about harmful effects of smoking and SHS exposure; (4) attitudes toward smoking ban; (5) age; (6) sex; and (7) WHO region. During assembly of the study records, we found that the adolescents who participated in the survey had ages ranging from 11 years and younger to 17 years and older; however, we restricted our analysis to those aged 13–15 years to be consistent with the GYTS sampling frame and with earlier studies [20,21]. Complete details about GYTS survey questions, responses, and dichotomization of variables used in this study can be found in Table 1. All variables are categorical and dichotomized using previously described methods [20,21,23].

Statistical analysis

We performed descriptive analyses and reported sample (unweighted counts) and population characteristics (weighted